APPENDIX K-4: Geotechnical Site Investigation Report

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION REPORT

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VA101-460/3-1
Rev 4
July 6, 2017

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2015 GEOTECHNICAL SITE INVESTIGATION REPORT
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Rev	Description	Date
0	Issued in Final	April 27, 2016
1	Minor Revisions	May 20, 2016
2	Updated Figures	May 24, 2016
3	Updated Figure	September 6, 2016
4	Updated Figures	July 6, 2017

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EXECUTIVE SUMMARY

Knight Piésold Ltd. (KP) was retained by Tintina Resources Inc. (TRI) to undertake geotechnical and hydrogeological site investigations for the Black Butte Copper Project (the Project) in 2015. This data report summarizes the work carried out and the observations made during the site investigation program. The key objectives of the site investigation were to:

- Collect geotechnical and hydrogeological information to support a feasibility level design for the construction of the Cemented Tailings Facility (CTF), Process Water Pond (PWP) and Non-Contact Water Reservoir (NCWR).
- To collect geotechnical and hydrogeological information for the conditions at the proposed plant site (to be designed by others).
- To complete test pit excavations over the project area to characterize soil depth to bedrock and suitability as potential for construction material borrow sources.

The site investigation program included the following work:

- Drilling with standard penetration testing (SPT) in overburden, Lugeon packer testing in bedrock, and detailed geotechnical logging of core or characterization of drill-cuttings.
- Installation of standpipe piezometers.
- Excavation of test pits through overburden until contact with (weathered) bedrock.
- Sample collection of soil for index testing and bedrock for strength testing.

The site investigation was conducted between March and May 2015, and included 24 drillholes and 44 test pits. It was split into two phases. Phase 1 was carried out in March 2015 and included 19 geotechnical drill holes; 4 holes had standpipe piezometers installed. The second phase was carried out in May 2015 and consisted of 5 geotechnical drillholes and 44 test pits. All Phase 1 holes were drilled with a Sandvik 710 track mounted mud rotary drill rig. Phase 2 drillholes were completed with an LF 70 track mounted mud rotary drill rig.

Results of the site investigation program indicate:

- The geology of the project area consists mainly of calcareous shale rocks of the Newland Formation (shales) and mostly low permeability rocks (diorites) of a local intrusive suite.
- Overburden typically consists of a compact, silty sand and clay matrix supporting fine gravel with rare cobbles. Overburden thickness ranges from 0.2 to 6.7 m, but is generally 1 m thick or less.
- Hydraulic conductivities for the bedrock units encountered throughout the project area ranged from 2×10^{-3} to 6×10^{-6} m/s. These values are based on passive response testing (falling head) in competent, fractured and/or weathered rock units.
- The groundwater levels in the drillholes varied from site to site but were generally in the range of 5 to 8 m below ground surface (mbgs) when observed under static conditions. One drillhole (SC15-184) exhibited artesian conditions due to its location at a topographic low on the property and with a significant thickness of confining, low permeability, till materials over the bedrock.
- Field estimates of UCS for weathered bedrock units encountered within the project area ranged from 5 to 25 MPa with competent bedrock ranging from 30 to 150 MPa. The RMR ranged from 38 to 62 indicating a rock mass designation of FAIR.

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1 – INTRODUCTION

1.1 PROJECT DESCRIPTION AND BACKGROUND

The Black Butte Copper Project (the Project) is a proposed copper/cobalt mine in the Strawberry Butte area of Montana, located approximately 32 kilometres (km) north of White Sulphur Springs and 5 km off of U.S. Highway 89. Figure 1.1 shows the location of the Project site.

Knight Piésold Ltd. (KP) was retained to produce feasibility level designs for the waste and surface water management facilities at the Project. As part of the scope of work, KP completed a geotechnical Site Investigation (SI) to collect data for the design of the waste and water management facilities.

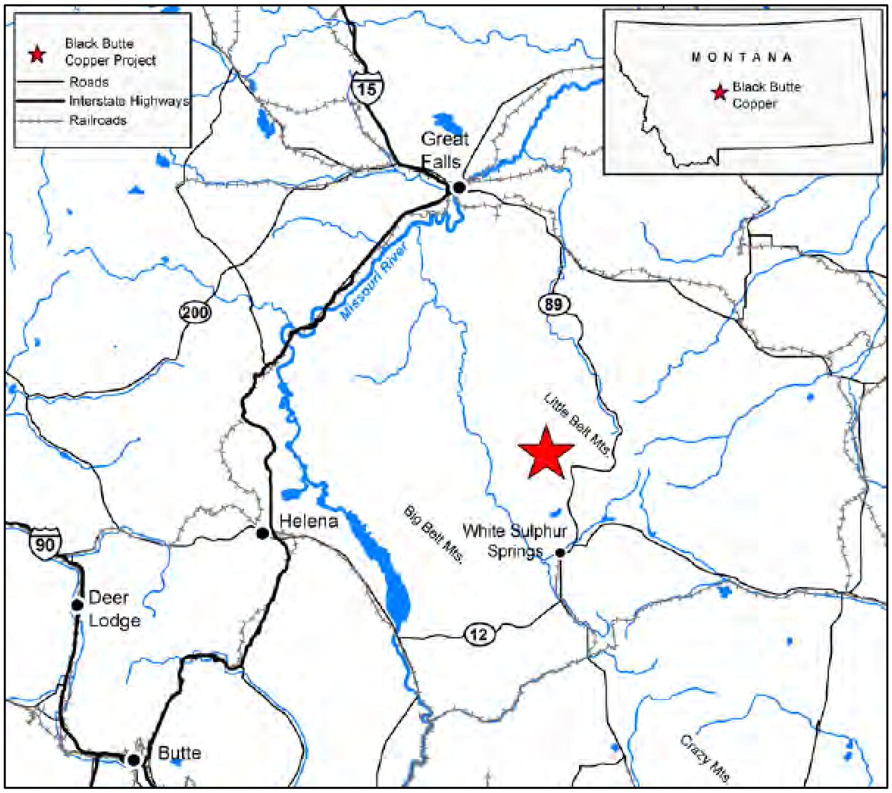


Figure 1.1 Project Location Map

1.2 SCOPE OF WORK

A geotechnical SI program was completed to collect the data required for the waste and water management systems design. The SI program scope included the following:

- Geotechnical investigation of the Cemented Tailings Facility (CTF), Process Water Pond (PWP), and Non-Contact Water Reservoir (NCWR), including previously identified alternative locations, and waste dump foundation conditions.
- Geotechnical investigation of the plant site foundations and provision of foundation design parameters to facilitate foundation designs by others.

- Identification of construction materials and borrow areas for the project facilities.
- Integration with the hydrogeological study to establish groundwater levels and hydraulic conductivity values, as appropriate.

The SI program was planned using the most current site layout available with the intent of gaining an understanding of the geology and geotechnical conditions of the project area as a whole.

The site investigation was completed in two phases. Phase 1 consisted of a geotechnical drilling program completed in March 2015. The Phase 2 program consisted of test pitting and additional geotechnical drill holes, and was conducted in May 2015 after the snowmelt and ground thaw had occurred. Figure 1.2 shows the distribution of drill holes and test pits across the Project area.

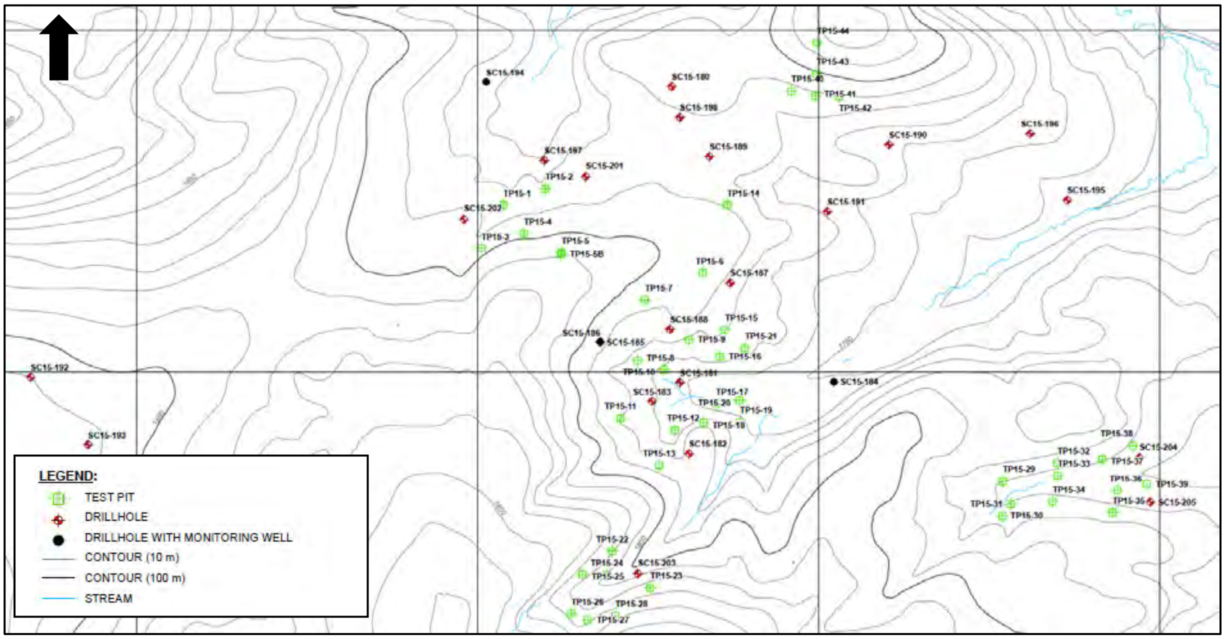


Figure 1.2 Overall Site Investigation Plan

2 – GENERAL SITE CHARACTERISTICS

2.1 PHYSIOGRAPHY AND CLIMATE

The climate is typical of uplands in central Montana with moderate summers and cold winters. The average daily minimum and maximum temperatures for White Sulphur Springs (elevation 1,609 masl) are -10°C during the winter months and up to 17°C in the summer. Temperature typically varies from -30°C in winter, up to 40°C in summer. The average annual precipitation and evaporation of the project area are approximately 416 mm and 514 mm respectively. The project lies between an elevation of 1,700 and 1,850 metres above sea level (masl), and is located in the Little Belt Mountains, resulting in cooler temperatures and higher precipitation than those recorded at White Sulphur Springs (Tintina, 2013).

2.2 REGIONAL GEOLOGY

The copper-cobalt deposits of Black Butte occur in middle Proterozoic sediments of the Belt Supergroup which are extensively exposed in an eastward protrusion of the Rocky Mountain chain called the Helena salient in central Montana (Zieg and Leitch 1993).

During formation of the Belt Basin, a deep water middle Proterozoic calcareous shale facies (Newland Formation) deposited in an embayment, known as the Helena embayment, which extended in trough-like fashion east into the craton through central Montana (Godlewski and Zieg 1984). The northern boundary of the deeper water portion of the Helena embayment lays along the southern flank of the Little Belt Mountains north of White Sulphur Springs. During the Cretaceous Laramide orogeny, renewed faulting along the ancestral northern margin of the Helena embayment formed the Volcano Valley thrust fault (Winston 1986). The bedded massive sulphides of the Black Butte are concentrated along the northern margin of the Helena embayment along the Volcano Valley Fault (VVF) zone.

2.3 SURFICIAL GEOLOGY

Newland Formation sedimentary rocks and diorite intrusive rocks occur as localized, weathered outcrops throughout the property. The overburden material varies in thickness over the property with the depth to weathered bedrock typically 1.0 m. The overburden material varies slightly around the property, but generally consists of a relatively thin cover of silty sand or sandy silt with clay and gravel (glacial till).

2.4 BEDROCK GEOLOGY

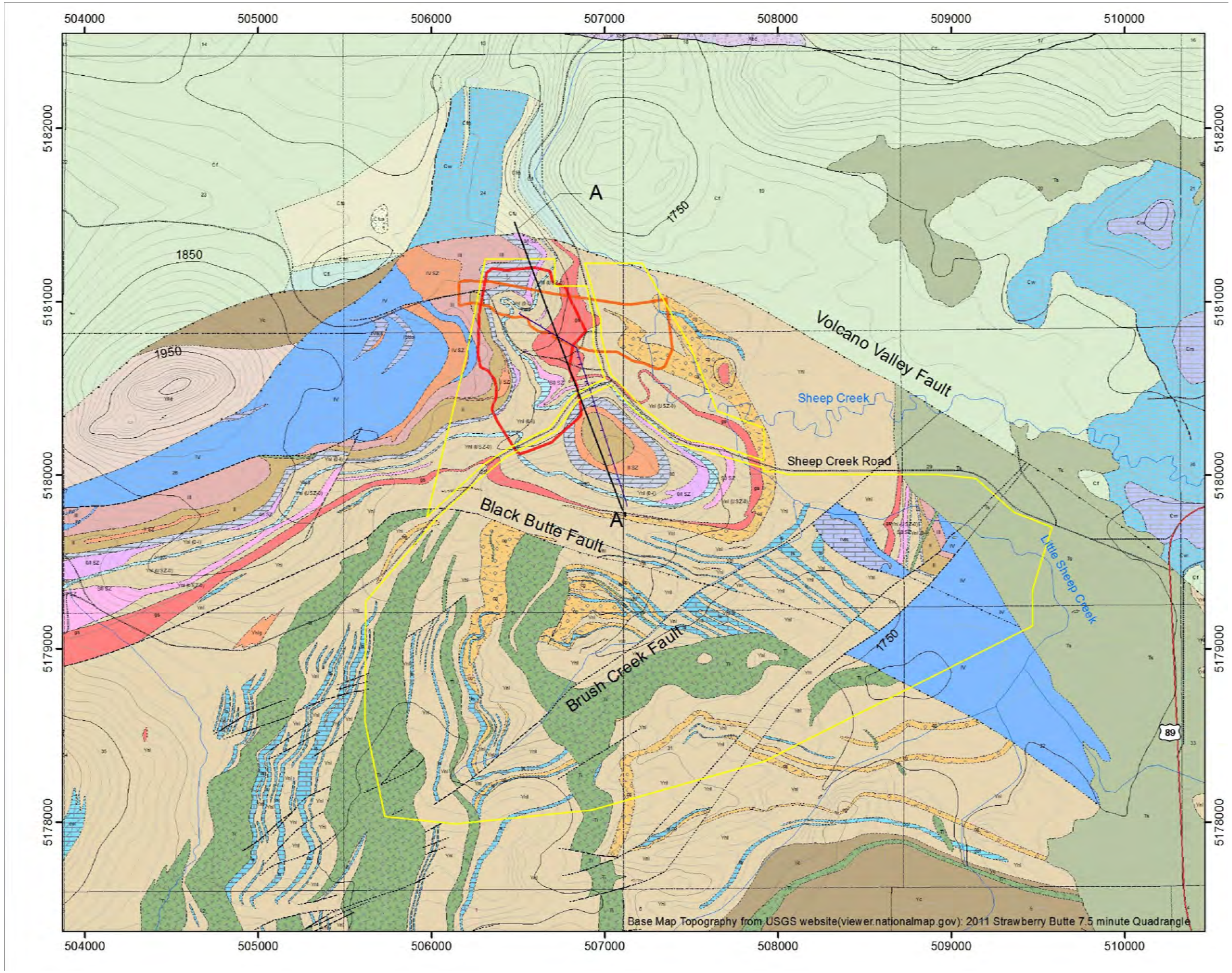
The Newland Shale consists of a lower shale-dominated part which measures approximately 760 m thick and an upper carbonate-dominated part which measures approximately 350 m thick. The shale was deposited as microturbidites in a sub-wavebase depositional setting. Debris flow conglomerates punctuate the section along the northern margin of the embayment.

Igneous rocks intrude the Newland Formation rocks throughout the property and are seen predominantly in the north and northwestern section of the property in the areas of the Process Water Pond and the south CTF impoundment. These igneous intrusive rocks consist of diorite and granodiorite and have been emplaced predominantly as sills and lesser dikes within the sedimentary package.

2.5 STRUCTURAL GEOLOGY

There are several major east trending fault systems in the region, as shown in Figure 2.1. Within the Project area the Copper Creek segment of the Volcano Valley fault (VVF) shows an orientation of roughly N80E. At Butte Creek, a N50E trending structure offsets the VVF in sinistral fashion to a point 1 km northeast of its previous location. From this point, the Black Butte segment of the VVF continues east north of Black Butte for approximately 2 km and gradually arcs toward the southeast for 7 km at a bearing of S45E toward Newlan Creek. From its entrance into the Newlan Creek valley, the Newlan Creek segment of the VVF continues with an easterly bearing for at least 16 km. The flexures in the VVF at Butte Creek and at Newlan Creek are joined by a S65E trending northeast directed reverse fault called the Black Butte Fault (BBF) which carries Chamberlain shale over Newland Shale. The area enclosed between the Black Butte segment of the VVF and the BBF contains all known copper resource at the Project (Tintina Resources Inc., 2013).

Based on the above, none of the proposed infrastructure for the project is impacted by the Volcano Valley or Black Butte fault systems. Smaller scale faults and shear zones have been observed in drill core, but were localized and over short intervals.



Base Map Topography from USGS website(viewer.nationalmap.gov): 2011 Strawberry Butte 7.5 minute Quadrangle

Legend

Contact - Defined
Contact - Approximate
Contact - Inferred
Fault - Defined
Fault - Approximate
Fault - Questionable
Fault - Inferred
Fault - Buried
Thrust - Defined
Thrust - Approximate
Thrust - Inferred
Thrust - Questionable

Mine Permit Boundary
Decline
Stream / River

Roads and Trails

Dirt
Gravel Maintained
Highway
Jeep Trail

Black Butte Lithologies

Tertiary

- Tertiary Basalt (Tb)
- Tertiary Sediments (Ts)
- Tertiary Igneous (Ti)

Paleozoic

- Lodgepole (Ml)
- Madison (Mm)
- Three Forks (MDt)
- Jefferson (Dj)
- Meagher (DCm)
- Park (Cp)
- Wolsey (Cw)
- Meagher (Cm)
- Pilgrim (Cpi)
- Up. Flathead-arkose (Cfua)
- Upper Flathead (Cfu)
- Middle Flathead (Cfm)
- Flathead Sandstone (Cf)
- Lower Flathead (Cfl)

Helena Embayment (non-Newland)

- Greyson Shale (Yg)
- Neihart Quartzite (Yne)
- Chamberlain Shale (Yc)
- Spokane Shale (Ys)

Metamorphic Basement

- Undiff. (Xbc)

Upper Newland

- Siliceous Gossan (sig)
- VII
- VI
- V
- IV Dolostone
- IV Limestone
- IV Silt
- IV
- IV SZ
- III
- II SZ
- II
- I
- Jasper (j)
- Up. Newland Undiff. (Ynu)

Lower Newland

- Ynl (0-I)
- 0/I SZ
- Ynl0
- Ynl (USZ-0)
- gs (gossan)
- Sub 0 SZ
- Low. Newland Shale (Ynl)
- Low. Newland Chert (Ynlch)
- Low. Newland Qtzt (Ynlq)
- Gossan Undiff. (Ynlg)
- Dolostone (dol)
- Limestone (ls)
- MS Conglomerate (ms-cg)
- Conglomerate (cg)

NOTE: All of the sulfide zone (SZ) lithologic units in the Newland Formation are oxidized to gossan in the near surface environment.

🟥 Johnny Lee Deposit Upper Zone (UCZ)
🟧 Johnny Lee Deposit Lower Zone (LCZ)
*boundaries projected to surface

N
W E
S

WGS 1984, UTM Zone 12N
Contour Interval 10 meters

SCALE A 250 125 0 250 500 750 1000 1250 m

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REGIONAL GEOLOGY

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	REV
FIGURE 2.1	2

2	06SEP'16	ISSUED WITH REPORT	GIM	MJC	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B08_r2, 9/6/2016 11:40:21 AM, MCOUTTS PRINTED: 9/6/2016 11:41:58 AM, Layout1, MCOUTTS
XREF FILE(S): IMAGE FILE(S): Geologic_Setting

3 – 2015 GEOTECHNICAL SITE INVESTIGATION PROGRAM

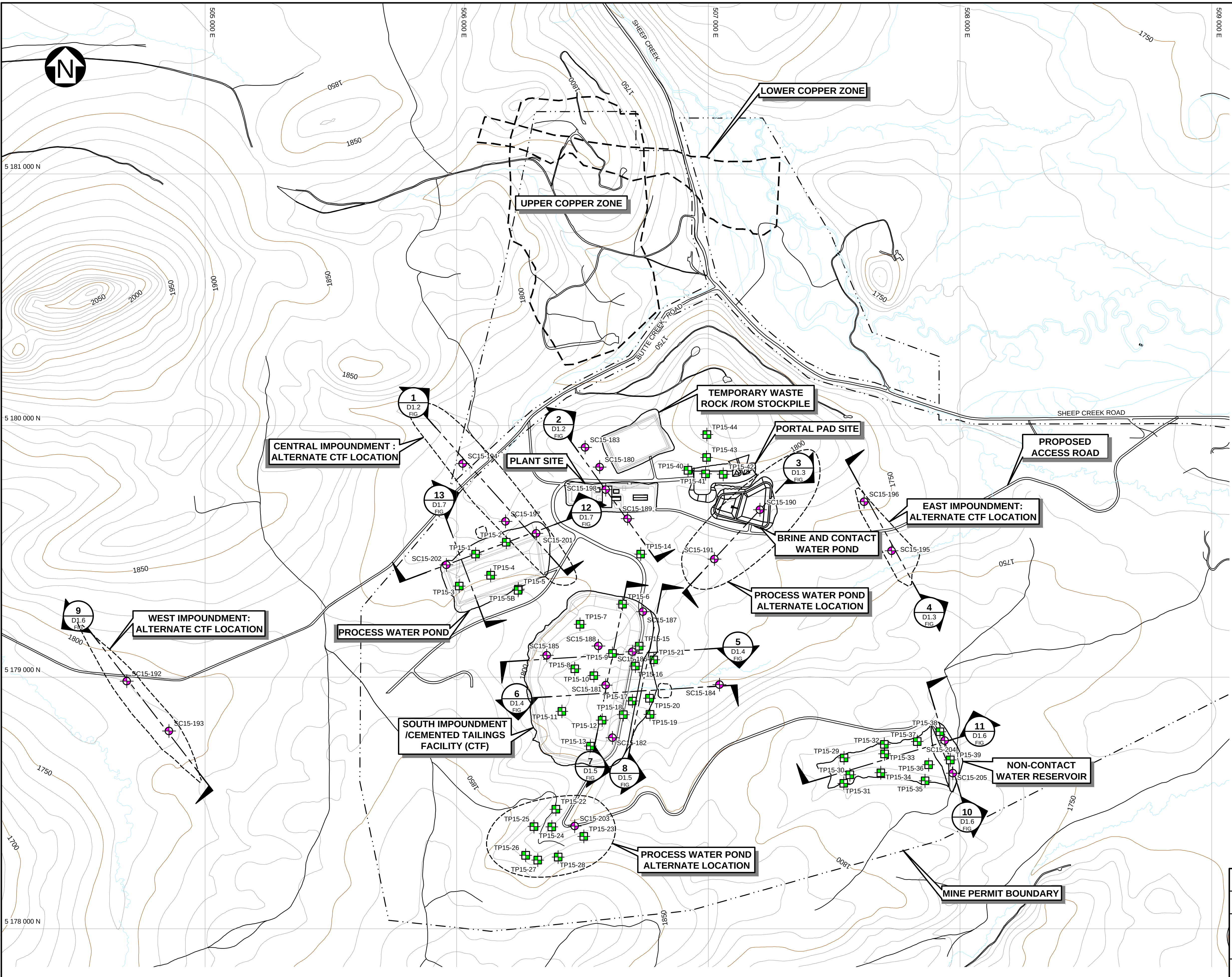
3.1 GENERAL

The 2015 geotechnical Site Investigation program was divided into two phases. Phase 1 started on March 3 and was completed on March 22, 2015. Phase 2 commenced on May 26 and completed on June 5, 2015. The primary objective of the SI program was to evaluate the geotechnical and hydrogeological conditions at the proposed Plant Site, Process Water Pond, and the proposed East, Central, West and South Tailings Impoundment locations. The data collected will support the feasibility level engineering design of the site facilities. Long-term groundwater monitoring wells were installed in order to support environmental baseline studies and ongoing groundwater monitoring.

The 2015 geotechnical SI program included the following activities:

- 724 metres drilled in 24 geotechnical drillholes using both tricone and mud rotary methods. In-situ packer testing was conducted during drilling to evaluate the hydraulic conductivity of the rock mass. The geotechnical holes were completed to assess the soil and rock foundation conditions of various proposed mine site facilities locations, primarily at the proposed CTF (the south tailings impoundment location). Geotechnical logging of drill core was carried out in all drillholes to characterize the rock mass.
- Long term monitoring wells were installed in 4 of the 24 geotechnical drillholes. Upon completion of well installations, well development and response testing was left to be carried out by Tintina Resources Inc.
- 44 test pits were excavated throughout the project area at the proposed facilities to determine overburden thickness and to characterize the overburden material.
- Drill core samples were collected for laboratory UCS testing. Laboratory testing of the rock samples was conducted by Mine Design Engineering in Kingston, Ontario, Canada.
- Samples of soil materials recovered from the geotechnical drillholes and test pits were taken for soil index testing. One triaxial test was performed on a soil sample collected downstream of the CTF embankment.

The SI plan is shown in Figure 3.1. The South Impoundment location was selected as the preferred location for the CTF prior to commencing the site investigation, and therefore has a higher density of drillhole coverage.



LEGEND:

# ### FIG	CROSS-SECTION REFERENCE
⊕	DRILL HOLE
🟩	TEST PIT
– – – –	ALTERNATE CTF AND PWP LOCATION
— · · —	MINE PERMIT BOUNDARY

NOTES:

1. TOPOGRAPHIC BASE MAP FROM 2011 AERIAL LIDAR SURVEY WITH MAP PROJECTION: UTM ZONE 12N AND MAP DATUM: NAD83.
2. CONTOUR INTERVAL IS 10 METERS.
3. ELEVATIONS ARE IN METERS, UNLESS NOTED OTHERWISE.

150 75 0 250 500 750 m
SCALE A

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GENERAL ARRANGEMENT
CTF OPTIONS AND SITE
INVESTIGATION PLAN

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P/A NO.	REF NO.
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FIGURE 3.1 REV 3

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
3	30JUN'17	ISSUED WITH REPORT	GIM	MJC	KDE

All drill collars were surveyed at the completion of drilling by KP staff using a handheld Garmin GPS Map62. All survey information uses the UTM-NAD 83 coordinate system.

Ruen Drilling Inc. completed all drilling using a Sandvik 710 drill rig capable of drilling PQ3 and HQ3 sized diamond drilling in overburden and bedrock. All drilling was completed under the supervision of KP field personnel. Detailed geotechnical logging of soil and drill core was conducted in all drillholes in order to evaluate and characterize the ground conditions. Drillholes were grouted to surface at completion by Ruen personnel, with the exception of the four monitoring well locations.

The Sandvik 710 drill rig was equipped with a hydraulic drop-hammer to perform Standard Penetration Tests (SPTs). SPT results and sample descriptions were recorded by KP field personnel. SPTs were conducted through overburden until contact with weathered bedrock and “refusal” of the sampler.

3.2 GEOTECHNICAL DRILLING

A total of 724 m of drilling was completed in 24 geotechnical drillholes during the 2015 SI program. The depth of drilling was to a minimum of 30 m with at least 6 m penetration into competent, unweathered bedrock. Geotechnical and hydrogeological data was collected for various mine facilities, primarily at the CTF and stockpile areas. Table 3.1 provides a summary of the geotechnical drillholes. The site general arrangement and SI plan are provided in Figure 3.1.

SPTs were conducted in holes SC15-181, SC15-184, SC15-192, SC15-193, SC15-195, SC15-198, and SC15-201 to SC15-205 at 1.5 m intervals. Monitoring wells were installed in holes SC15-184, SC15-185, SC15-194 and SC15-198. The monitoring well installations involved the use of 1.5-inch PVC standpipe piezometers installed at specified depths within bedrock contacts, fractured/fault zones, or highly permeable zones. The installations were conducted by Ruen Drilling Inc. under the direction and supervision of KP field personnel.

Table 3.1 Summary of Geotechnical Drillholes

Drillhole	Drillhole Location	Coordinates [1]			Total Depth	Depth to Bedrock
		Northing	Easting	Elevation		
		(m)	(m)	(m)	(m)	(m)
SC15-180	Plant Site	5,179,835	506,568	1,788	30.2	0.6
SC15-181	South Impoundment Embankment	5,178,968	506,592	1,770	30.1	6.7
SC15-182	South Impoundment Embankment	5,178,759	506,619	1,794	30.2	0.2
SC15-183	South Impoundment Embankment	5,178,913	506,510	1,779	30.2	0.6
SC15-184	Seepage Collection Pond	5,178,970	507,044	1,756	30.0	4.6
SC15-185	South Impoundment Embankment	5,179,087	506,358	1,806	30.2	0.3
SC15-186	South Impoundment Embankment	5,179,101	506,698	1,786	30.2	0.3
SC15-187	South Impoundment Embankment	5,179,260	506,740	1,786	30.2	0.3
SC15-188	South Impoundment Embankment	5,179,124	506,563	1,792	30.2	0.2
SC15-189	Plant Site	5,179,630	506,679	1,782	30.2	0.3
SC15-190	Process Water Storage Pond	5,179,665	507,205	1,761	30.2	0.5
SC15-191	Process Water Storage Pond	5,179,469	507,024	1,768	30.2	0.5
SC15-192	West Impoundment Embankment	5,178,984	504,689	1,792	30.5	2.1
SC15-193	West Impoundment Embankment	5,178,786	504,857	1,787	30.2	2.1
SC15-194	Central Impoundment Embankment	5,179,849	506,024	1,774	30.1	0.5
SC15-195	East Impoundment Embankment	5,179,502	507,728	1,736	30.1	0.2
SC15-196	East Impoundment Embankment	5,179,697	507,619	1,751	30.5	1.5
SC15-197	Central Impoundment Embankment	5,179,619	506,194	1,775	29.9	0.2
SC15-198	SAG Mill	5,179,745	506,592	1,787	30.0	1.4
SC15-201	Process Water Storage Pond	5,179,571	506,316	1,783	30.3	0.6
SC15-202	Process Water Storage Pond	5,179,446	505,959	1,795	29.8	1.4
SC15-203	Process Water Pond (Alternate)	5,178,408	506,469	1,794	30.2	1.2
SC15-204	Non-Contact Water Reservoir	5,178,748	507,939	1,761	30.2	0.3
SC15-205	Non-Contact Water Reservoir	5,178,618	507,971	1,773	29.9	0.7

NOTES:

1. Coordinates are based on final collar survey data using the NAD83 UTM Zone 12N coordinate system.

3.2.1 Overburden Drilling and Logging

Overburden drilling in the geotechnical drillholes was typically completed by Ruen Drilling Inc. using diamond drilling methods. A tricone drill bit was used on several occasions to advance the drill through unstable overburden materials or to assist with the advancement of the casing through the overburden.

SPTs were completed at selected overburden depth intervals in 11 drillholes. SPTs were not conducted where bedrock was encountered close to ground surface. SPTs were completed every 1.5 m (5 feet) and then terminated at refusal of the sampler, typically when bedrock was encountered. A 140-lb automatic hammer with a 30 inch drop setup, equipped with a 24 inch split spoon sampler was utilized for each test. Blow counts were recorded over four 15 cm (6 in) intervals for a total of 60 cm (24 in) of sampling length. The SPT ‘n’ value was determined by adding the blow counts from the second and third intervals of the test.

Soils were logged according to guidelines specified in the Canadian Foundation Engineering Manual and according to the Visual-Manual Procedure for Standard Practice for Description and Identification of Soils (ASTM D2488-06).

3.2.2 Bedrock Drilling and Logging

Bedrock coring involved the use of a diamond drill bit with a standard wireline barrel set-up and a 1.5 m core barrel. This coring method allowed for continuous core sampling as the drillhole was advanced. Twenty-one drillholes were drilled with HQ3 size equipment using a triple tube core barrel set up. Three drillholes were drilled using PQ3 size equipment.

All geotechnical drillholes were advanced using water as the main drilling fluid. Additives such as polymers and/or drill mud were used sparingly, and only as required to stabilize drillholes.

Detailed geotechnical logging of the drill core was carried out in all of the geotechnical drillholes in order to characterize the rock mass quality using Bieniawski’s Rock Mass Rating (Bieniawski, 1989) classification system. On a run-by-run basis, the following information was collected:

- Core run interval
- Core recovery
- Rock Quality Designation (RQD)
- Lithological Description
- Field estimated Unconfined Compressive Strength (UCS) of rock
- Number of discontinuities
- Discontinuity Types, and
- Joint Conditions of Discontinuities (i.e. roughness, infilling, weathering/alteration, aperture, etc.).

3.3 TEST PIT EXCAVATIONS

A total of 44 test pits were excavated in the project area during the 2015 Phase 2 Site Investigation program. Six test pits were completed in the proposed Process Water Pond area, sixteen in the South Tailings Impoundment and downstream embankment area, seven in the alternate Process Water Pond location, eleven in the Non-Contact Water Reservoir and four in the area of the Portal.

All test pits were excavated using a Komatsu 210 excavator. Test pit depths ranged from 0.2 to 3.9 m and were terminated when they could not be excavated further, typically in weathered bedrock. The test pit sites were accessed by walking the machine to each site, and care was taken to minimize environmental disturbance. Wherever possible, the surface organic material and vegetation was stripped prior to excavating the test pit and stockpiled separately. The exposed soils in the pit walls and spoil piles were logged for geotechnical characteristics and select samples were collected and sealed in heavy duty plastic sample bags for laboratory testing. All of the test pits were backfilled and the surface was re-contoured upon completion. The final activity at each site involved the replacement of the surface material and vegetation to recreate, as much as possible, the pre-investigation conditions.

A summary of the test pits, including their locations and depths, is presented in Table A1.2. The locations of the test pits for the 2015 Site Investigations are shown in Figure 3.1. Detailed logs of each test pit are presented in Appendix A4 which includes a photograph of the test pit excavation. The test pit soil results are summarized in Table C1.1 and the laboratory reports are included in Appendix C1.

3.4 ROCK MASS CLASSIFICATION

Bieniawski's Rock Mass Rating (RMR) classification system (1989) was used to describe the rock mass condition. The RMR system is based on determining values for the following five key rock mass parameters:

- Intact Rock Hardness and/or UCS – Estimated in the field and later verified with laboratory testing.
- RQD – The sum of the lengths of all intact core pieces greater than 10 cm in length, as a percentage of the drill run length.
- Fracture Spacing – The number of natural fractures encountered per drill run length.
- Fracture Condition – An evaluation of fracture persistence, roughness, infilling, aperture, and weathering determined by examination of the discontinuities. The persistence is conservatively assumed to have a rating of 0, consistent with high persistence, because delineating the actual persistence of a discontinuity is impossible due to the relatively small diameter of the drill core.
- Groundwater Condition – The groundwater rating is 15, which corresponds to dry conditions. This allows the RMR values to be consistent with geological strength index (GSI) values that can be used to estimate rock mass strength (Hoek et al. 1995).

The RMR rating and rock mass quality classification system is presented in Appendix F2. Table F2.1 shows the numerical values that were applied to each of the five parameters. The sum of these ratings defines the rock mass quality as an RMR value. This value can range from less than 20 and up to 100 and corresponds to the following rock mass quality descriptions:

- VERY GOOD: RMR 81 to 100
- GOOD: RMR 61 to 80
- FAIR: RMR 41 to 60
- POOR: RMR 21 to 40, and
- VERY POOR: RMR < 20.

Drillhole logs and detailed RMR logging spreadsheets are presented in Appendices A1 and A3, respectively. Drill core photographs are included in Appendix E1.

3.5 PACKER TESTING

Packer testing (Lugeon or Falling Head) was completed in the geotechnical drillholes to estimate the hydraulic conductivity of the rock mass. The packer testing was completed under the supervision and direction of KP field personnel using an HQ wireline nitrogen-inflated packer test assembly.

Packer tests were performed while the drillhole was being advanced and testing was conducted after encountering the first zone of bedrock that was suitable to seat the packer. The target interval for packer testing was every 7 m for tailings and water storage facility foundations, and 15 m for the plant site foundations. However, the bedrock to seat the packer requires suitable rock quality so that damage will not occur to the packer system during inflation and deflation. The packer test intervals were varied as needed based on the rock mass quality and assessment by KP field personnel.

General methodology for the packer tests included the following:

- Flushing the drillhole until the drill return was clear of cuttings.
- Calculating how many rods needed to pull out of the drillhole to expose the test zone and calculation of the required nitrogen inflation pressure and Lugeon test pressures for each packer test depth.
- Pulling the drill rods out of the hole to expose the desired test section.
- Lowering the packer equipment with a pressure transducer enclosed in a housing unit below the packer to the drill bit with the wireline and nitrogen line.
- Inflating the packer bladder with nitrogen to isolate the test interval.
- Establishing a stable water level in the drillhole.
- Completing the test. The following tests were conducted based on groundwater conditions:
    - Response testing was conducted in select intervals which involved filling up the rods with a known quantity of water after the packer was inflated and allowing the static groundwater level to recover. These tests were conducted in zones that were fully submerged beneath the groundwater level.
    - Lugeon testing which involved pumping water into the isolated test interval at three ascending and two descending water pressure stages and recording the flow rate of water into the rock mass. These tests were conducted in zones that were partially or fully above the groundwater level. Leakage was measured for each pressure stage and the values were recorded.
- Measurements were collected with a mechanical flowmeter measuring in gallons and a water pressure gauge in pounds per square inch (psi). The pressure transducer monitored the water pressures throughout the testing stages.
- Any observations about the testing were noted where appropriate.

Individual packer test analysis sheets are provided in Appendix B1. Hydraulic conductivity results based on the packer testing are summarized in Table A1.1 in Appendix A1.

3.6 MONITORING WELL INSTALLATION

Groundwater monitoring wells were installed in four of the completed geotechnical drillholes during the 2015 SI program. All monitoring wells were drilled and installed by Ruen Drilling Inc. with the supervision of KP field personnel.

The wells were installed at four of the proposed mine facilities, SAG Mill (Plant Site), Seepage Collection Pond (for the South Tailings Impoundment), Central Tailings Impoundment and South Tailings Impoundment, in order to monitor baseline groundwater quality conditions. A single well was installed at each location in bedrock below the water table. Table 3.2 provides a summary of the monitoring wells and their locations can be seen in Figure 1.2.

Table 3.2 Summary of Monitoring Well Installation and Hydrogeological Testing

Drillhole	Piezometer Information [1]				
	Completion Zone		Stick Up Height	Static Water Level	Hydraulic Conductivity (Falling Head) [2,]
	From (m)	To (m)	(m)	(mbgs)	(m/sec)
SC15-184	14.9	27.5	1.60	Artesian flow ~10 gal/min	-
SC15-185	17.2	25.9	3.05	7.0	5×10^{-6}
SC15-194	21.6	28.8	0.6	N/A	6×10^{-6}
SC15-198	15.8	22.9	0.6	N/A	7×10^{-7}

NOTES:
1. All monitoring wells were installed with 1.5” diameter PVC.
2. Values reported are pre-installation over the same interval as completion zone.

The wells were installed at specified depths in areas of interest such as fractured/fault zones or highly permeable zones as identified by geotechnical logging and packer testing results. The purpose of the installation is to be able to measure the groundwater level, conduct falling/rising head response tests in the isolated completion zone and collect samples for environmental baseline water quality data.

The piezometers were constructed with 1.75-inch diameter, decontaminated, flush-threaded, Schedule 40 polyvinyl chloride (PVC) riser pipes. The screened completion zones are 1.75-inch Schedule 40, Slot 20 PVC threaded installed across the zone of interest, and 1.75-inch Schedule 40 PVC threaded blank pipe was installed to the surface. Bentonite pellets were used to backfill the drillhole, if it was not desirable to set the completion zone at the bottom of the hole. The annular space around the completion zone was backfilled with 10/20 silica filter sand. The completion zone was sealed at either end with hydrated bentonite chips or pellets. A cement/grout mix was used to backfill the drillhole to surface above the top bentonite seal. Monuments were installed to protect and prevent tampering to the PVC pipe, which extends above the ground surface. The monitoring well completion details are presented in Appendix A1.

3.7 LABORATORY TESTWORK

Selected bedrock and soil samples from the drillholes were collected for laboratory strength testing and material characterization. Detailed summaries of the results from all soil and rock laboratory testing are provided in Appendix C.

3.7.1 Soil Testing

SPT soil samples and grab samples from test pit excavations were selected for laboratory testing in order to characterize the types of materials found at the drillhole locations. Particle Size Analysis (PSA), moisture content and Atterberg limits testing were completed.

PSAs were conducted in accordance with ASTM D-422 procedures using both conventional screen and hydrometer methods, in order to assess the particle distribution and grading characteristics of the material deposits on site. A hydrometer analysis was used to determine the silt and clay fraction particle sizes for material with a fine fraction exceeding 15% of the total sample.

Soil testing results and PSA summaries for the various mine site facilities are presented in Appendix C1. Table 3.3 summarizes the number of tests and test types performed. A summary of the soil laboratory test results is presented in Appendix C1.

Table 3.3 Soil Laboratory Testing Summary

Test Type	Number of Tests
Particle Size Distribution	29
Moisture Content	16
Atterberg Limits	29
Multi-stage Triaxial	1

3.7.2 Rock Testing

Seventeen rock core samples were collected during Phase 1 of the 2015 SI program, of which twelve were subject to unconfined compressive strength (UCS) testing and five (being too short to test for UCS) were tested to point load failure. Testing was carried out at Mine Design Engineering in Kingston, Ontario, Canada. Representative samples of the rock types on site without pre-existing planes of weakness were collected when possible.

No additional rock core samples were collected for testing during the Phase 2 SI program.

A summary of the lab results is presented below in Table 3.4 with the complete results in Appendix C2.

Table 3.4 Summary of Rock Mass Strength Properties

Sample	Mean Rock Strength (MPa)		Density (g/cm^3)	Young's Modulus (GPa) [2]	Poisson's Ratio [2]	Point Load Index (MPa)
	UCS					
	Foliation Break	Intact				
SC15-181-UCS#1	50.9 (pf)	---	2.68	11.560	0.14	---
SC15-182-UCS#1		170.6	2.66	24.173	0.30	---
SC15-183-UCS#1	---	---	---	---	---	0.21
SC15-183-UCS#2	2.2 (f)	---	2.30	0.179	---	---
SC15-187-UCS#1	---	124.3	2.60	19.273	0.15	---
SC15-187-UCS#2	---	56.8	2.67	20.782	0.22	---
SC15-188	---	76.3	2.59	10.025	0.37	---
SC15-189-UCS#1	---	---	---	---	---	0.32
SC15-190-UCS#1	---	---	---	---	---	1.38
SC15-191-UCS#1	36.1 (pf)	---	2.69	12.050	0.14	---
SC15-193-UCS#1	---	106.7	2.74	16.537	0.17	---
SC15-197-UCS#1	---	---	---	---	---	0.41
SC15-197-UCS#2	---	76.8	2.60	17.186	0.23	---
SC15-198-UCS#1	---	42.9	2.69	16.049	0.24	---
SC15-198-UCS#2	14.3 (f)	---	2.70	8.773	0.27	---
SC15-198-UCS#3	1.8 (f)	---	2.62	0.592	---	---
SC15-198-UCS#4	---	---	---	---	---	0.33

NOTES:

1. Data is based on 2015 geotechnical holes.
2. Sample failure occurring along pre-existing foliation surface denoted with (f).
3. Sample failure partially occurring along pre-existing failure surface denoted with (pf).

4 – MATERIAL CHARACTERIZATION

4.1 GENERAL

Three primary geotechnical units were observed during the 2015 SI program, overburden, weathered bedrock, and competent bedrock.

4.2 OVERBURDEN

Overburden ranges in thickness from 0 to 6.7 m in the project area with the thickest overburden cover observed in the proposed East and West Tailings Impoundment areas. Overburden mainly consists of sandy silt or silty sand and gravel, with trace to some cobbles and boulders, and trace clay. Moisture content ranged from 14% to 25%, with an average of 19%. The overburden is typically loose to compact, dry to moist, with sub-angular to sub-rounded particles. The gravel particles are typically sub-angular to sub-rounded and poorly graded. Localized variation in overburden composition is discussed in the following sub-sections.

A topsoil veneer covers the Black Butte project area, consisting of dry to moist, spongy, fibrous, dark brown silt and sand with organics. The topsoil layer typically ranges in thickness from 0.1 to 0.3 m.

4.3 WEATHERED BEDROCK

Two main rock types of bedrock were encountered during the 2015 SI; intrusive and sedimentary. The intrusive rocks predominantly comprise granodiorite whereas the sedimentary package consisted mostly of shale punctuated by localized intervals of related calcareous sediments and debris flow conglomerates.

Weathered bedrock is characterized by an orangey brown discoloration or staining of the rock mass, joints and fractures, by iron oxide. The rock typically has a high degree of fracturing and may be rubbleized or, in some cases, completely decomposed to a saprolitic material.

Weathered bedrock is between 0.2 and 6.7 mbgs with an average overburden / weathered bedrock contact at 1.1 mbgs. The weathered bedrock thickness varies between 0.3 to 17.5 m.

4.4 COMPETENT BEDROCK

Bedrock across the project site consists predominantly of rock of the Newland Formation; calcareous and dolomitic shales and debris flow conglomerates. In the areas of the Process Water Pond and the South Tailings Impoundment, intrusive diorite rocks were encountered in some drill core and test pit excavations. These rocks have likely been emplaced as sills and vary in thickness and occurrence throughout this area of the property.

4.5 ROCK MASS PERMEABILITY

Hydrogeological testing was conducted to assess the hydraulic conductivity of the rock mass at various intervals. Two testing methods were adopted: Lugeon (Single Packer) Permeability testing and Falling Head Response tests. A total of 59 Lugeon tests were conducted in all geotechnical drillholes of which 12 were completed in zones of weathered bedrock and the remaining 47 in unweathered bedrock.

The test results indicate that the weathered bedrock across the project area typically has a moderate permeability with hydraulic conductivities in the order of 2 x 10^{-9} to 1 x 10^{-5} m/sec. Competent bedrock across the project area typically has a low to moderate permeability with hydraulic conductivities in the order of 1 x 10^{-9} to 1 x 10^{-6} m/sec.

The individual packer hydraulic conductivity test sheets are presented in Appendix B1 and are summarized in Table A1.1 in Appendix A1.

5 – GEOTECHNICAL CONDITIONS

5.1 GENERAL

The geotechnical conditions of the overburden and bedrock for the proposed facility locations were assessed using the information collected during the 2015 SI program and previous exploration resource drilling. Geotechnical cross sections through the proposed infrastructure are provided in Appendix D.

5.2 TAILINGS IMPOUNDMENT AREAS

Four impoundment areas were initially proposed for the storage of tailings at the project site; identified as the Central, West, East and South Impoundments. Thirteen geotechnical drillholes were completed over these areas. An alternatives assessment of the impoundment options deemed the South Impoundment the preferred option for the CTF; however two drillholes were completed along the embankments for each of the Central, West and East Impoundments.

The geotechnical characteristics of the proposed impoundment areas are summarized as follows:

- **Central Impoundment:** 2 geotechnical holes (SC15-194 and SC15-197) were completed along the embankment centerline during the 2015 SI program. The overburden is characterized as loose, silty sand with clay with a thickness from 0.2 to 0.5 m. Bedrock underlying the overburden was identified as shale with weathering of this unit pervasive for 8 to 10 mbgs. The average field estimated UCS of the shale was approximately 50 MPa and the average RMR was 44 indicating a rock mass designation of FAIR (Bieniawski, 1989). Five falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 2.5 x10^{-6} m/s. This is based on testing in all types of shale encountered during drilling, including competent and highly fractured and/or weathered sections.
- **West Impoundment:** 2 geotechnical holes (SC15-192 and SC15-193) were completed along the embankment centerline. The overburden is characterized as compact, silty sand and sandy clay with sub-angular to sub-rounded gravel (till). The overburden thickness was approximately 2.1 m. Bedrock underlying the overburden was predominantly shale with minor granodiorite intrusion near surface. Weathering of this unit was pervasive for 7 to 10 mbgs. The average field estimated UCS of the shale was approximately 40 MPa and the average RMR was 47 indicating a rock mass designation of FAIR (Bieniawski, 1989). Four falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 6 x10^{-7} m/s. This is based on testing in all types of shale encountered during drilling, including competent and highly fractured and/or weathered sections.
- **East Impoundment:** 2 geotechnical holes (SC15-195 and SC15-196) were completed along the embankment centerline. The overburden is characterized as clayey sand with sub-angular to sub-rounded gravel (till). The overburden thickness varies in thickness from 0.2 to 1.5 m. Bedrock underlying the overburden was predominantly shale with associated sedimentary rocks. Weathering of this unit was pervasive for 2 to 7 mbgs. The average field estimated UCS of the shale was approximately 35 MPa and the average RMR was 42 indicating a rock mass designation of FAIR (Bieniawski, 1989). Four falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 1 x10^{-6} m/s. This is based on testing in all types of shale encountered during drilling, including competent and highly fractured and/or weathered sections.

- **South Impoundment:** 7 geotechnical holes (SC15-181 to SC15-183 and SC15-185 to SC15-188) were completed along the embankment centerline and within the impoundment area. The overburden is characterized as compact, silty sand with sub-angular to sub-rounded gravel and some clay (till). The overburden thickness varies from 0.2 to 6.7 m. Bedrock underlying the overburden was predominantly granodiorite with shale, limestone and conglomerate. Weathering was evident for up to 13.4 mbgs although in the majority of the drillholes the weathering only persisted for 1 to 2 mbgs. The average field estimated UCS of the granodiorite and shale in the South Impoundment drillholes was approximately 100 MPa and 30 MPa, respectively. The average RMR across the embankment centreline was 55 indicating a rock mass designation of FAIR (Bieniawski, 1989). Thirteen falling head tests were completed for the 4 drillholes along the embankment centreline with an average hydraulic conductivity of 1 x10^{-6} m/s. This is based on testing in all types of granodiorite and shale encountered during drilling, including competent and highly fractured and/or weathered sections.

5.3 PROCESS WATER STORAGE POND

Two geotechnical drillholes (SC15-190 and SC15-191) were completed along the initially proposed embankment area of the Process Water Pond (PWP). The overburden mainly consists of dense, moist, sandy silt with clay and gravels. The gravel is sub-angular to sub-rounded and poorly graded. The overburden contains some roots and organics and is roughly 0.5 m thick. Bedrock underlying the overburden was predominantly shale and limestone. Weathering of this unit was pervasive up to 7 mbgs. The average field estimated UCS of the shale and limestone was approximately 35 MPa and the average RMR was 41 indicating a rock mass designation of FAIR (Bieniawski, 1989). Five falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 5 x10^{-6} m/s. This is based on testing in all types of shale and limestone encountered during drilling, including competent and highly fractured and/or weathered sections.

The PWP was relocated east of the plant site prior to the Phase 2 site investigation, and 2 geotechnical drillholes (SC15-201 and SC15-202) were completed along the main embankment of the new location. The overburden at the relocated PWP consists of compact to stiff, silty sand with trace clay and gravel. The gravel is composed of shale clasts and is sub-angular, poorly graded and up to 1.5 m thick. Bedrock underlying the overburden was predominantly shale with some granodiorite intrusive rocks (less than 3 m). Weathering of this unit continued for up to 13.4 mbgs in SC15-202. The average field estimated UCS of the shale was approximately 50 MPa and the average RMR was 48 indicating a rock mass designation of FAIR (Bieniawski, 1989). Seven falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 4 x10^{-6} m/s. The first falling head test for SC15-202 reported a hydraulic conductivity of 2 x 10^{-3} m/s through highly weathered granodiorite near surface.

An alternative PWP location was also identified south of the South Impoundment, and one geotechnical drillhole (SC15-203) was completed within that area. The overburden at the alternate Process Water Pond was similar to the primary PWP foundation area and consisted of a loose to compact silty sand with trace clay and fine gravel. The gravel component is sub-angular, poorly graded shale. The bedrock at this drillhole was shale with a field estimated UCS of approximately 60 MPa and an RMR of 54 indicating a rock mass designation of FAIR (Bieniawski, 1989). The average hydraulic conductivity from three falling head tests was 2 x 10^{-7} m/s through mostly competent shale.

5.4 PLANT SITE

Three geotechnical drillholes (SC15-180, SC15-189 and SC15-198) were completed within the proposed plant site area. The overburden consists mainly of firm to compact, moist, sandy silt and clayey sand with some gravel. The gravel is sub-angular to sub-rounded and poorly graded. The overburden contains some roots and organics and. The thickness varies from 0.3 to 1.4 m. Bedrock underlying the overburden was predominantly shale with associated sedimentary rocks. Weathering of this unit was pervasive for 16.5 mbgs in SC15-180 but significantly less in the other 2 drillholes The average field estimated UCS of the shale was approximately 35 MPa and the average RMR was 42 indicating a rock mass designation of FAIR (Bieniawski, 1989). Nine falling head tests were completed for the 3 drillholes with an average hydraulic conductivity of 3 $x10^{-7}$ m/s.

5.5 NON-CONTACT WATER RESERVOIR

Two geotechnical drillholes (SC15-204 and SC15-205) were completed along the main embankment of the proposed Non-Contact Water Reservoir location during the Phase 2 SI. The overburden consists mainly of firm to compact, moist, sandy silt and clayey sand with some gravel. The gravel is sub-angular to sub-rounded and poorly graded. The overburden contains some roots and organics and. The thickness varies from 0.3 to 1.4 m. Bedrock underlying the overburden was predominantly shale and conglomerate. Weathering of this unit was pervasive for 4 to 8 mbgs. The average field estimated UCS of the shale was approximately 50 MPa and the average RMR was 53 indicating a rock mass designation of FAIR (Bieniawski, 1989). Six falling head tests were completed for the 2 drillholes with an average hydraulic conductivity of 2 $x10^{-6}$ m/s. This is based on testing in all types of shale and conglomerate encountered during drilling, including competent and highly fractured and/or weathered sections.

7 – SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY OF 2015 SI PROGRAM

The 2015 geotechnical and hydrogeological site investigation program was performed to support a feasibility level design of the site facilities. Twenty-four geotechnical drillholes were completed over the property at the proposed infrastructure sites with 4 piezometers installed, and 44 test pits were excavated.

Results of the investigation program indicate the following:

- The geology within the Project area is comprised of two major rock types; shales and associated sedimentary rocks of the Newland Formation and igneous intrusive rocks composed mainly of diorite.
- The South Impoundment centerline overlies both Newland Formation (shales) and granodiorite intrusive rocks.
- Hydraulic conductivities ranged from 1 x 10^{-4} to 1 x 10^{-9} m/s for the bedrock units encountered along the South Impoundment centerline. These values are based on Falling Head testing in competent, fractured and/or weathered rock units.
- The Process Water Pond also overlies Newland Formation (shales) and granodiorite intrusive rocks. Hydraulic conductivities ranged from 2 x 10^{-3} to 8 x 10^{-8} m/s for the bedrock units encountered along the Process Water Pond embankment. These values are based on Falling Head testing in competent, fractured and/or weathered rock units.
- The Non-Contact Water Reservoir overlies Newland Formation (shales and conglomerates) Hydraulic conductivities ranged from 9 x 10^{-6} to 8 x 10^{-8} m/s for the bedrock units encountered along the reservoir embankment centerline. These values are based on Falling Head testing in competent, fractured and/or weathered rock units.
- Test pit investigations in the overburden material throughout the project area have indicated that the material consists of silty sand or sandy silt with clay and gravel, covered by a thin topsoil veneer. Test pitting and sampling were conducted in shallow depths as the depth to weathered bedrock through the overburden was generally quite shallow (less than 1.5 metres), with a maximum depth of 7 m.
- Field estimates of UCS for weathered bedrock units encountered within the Project area ranged from 5 to 25 MPa, with competent bedrock ranging from 30 to 150 MPa The RMR ranged from 38 to 62 indicating a rock mass designation of FAIR within the Project area.
- The geology and geotechnical conditions for the proposed plant site / mill area have been forwarded to the designers for inclusion in their work on these facilities.

7.2 RECOMMENDATIONS FOR FUTURE WORK

As the Project moves onto the detailed design phase it is recommended that additional site work be conducted to build on the current geotechnical and hydrogeological database. The next phase of site investigations for detailed design will be developed based on comments and recommendations made by the Project Independent Review Panel, and will consider comments from the Project's Mine Operating Permit Application. This work may include:

- Additional geotechnical drilling and test pitting to better delineate overburden, weathered bedrock, and competent bedrock profiles.

- Installation of additional monitoring wells within the facility footprints more accurately define the groundwater table elevation.
- Additional rock and soil laboratory testing to establish suitability of available construction materials, including slake testing of bedrock to determine the potential of long term strength degradation, and testing for potential acid generation of the bedrock.

This data will be used to refine KP’s understanding of the foundation conditions for the various facilities and better define construction material quantities.

8 – REFERENCES

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9 – CERTIFICATION

This report was prepared and reviewed by the undersigned.

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APPENDIX A

GEOTECHNICAL DRILLHOLE DATA

Appendix A1	Geotechnical Drillhole and Test Pit Summary Tables
Appendix A2	Geotechnical Drillhole Logs
Appendix A3	Geotechnical Drillhole Logging Records
Appendix A4	Test Pit Logs

APPENDIX A1

GEOTECHNICAL DRILLHOLE AND TEST PIT SUMMARY TABLES

(Page A1-1 to A1-4)

TABLE A1.1

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION
DRILLHOLE SUMMMARY

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Drillhole #	Pre-Drill Designation	Rig #	Drillhole Location	NAD83 UTM Coordinates$^{(1)}$			Azimuth	Inclination	Hole Size	Total Depth	Depth to Weathered Bedrock	Depth to Competent Bedrock	Packer Test Hydraulic Conductivity Testing				Installation Information						Drillhole Notes (artesian conditions, fault zones, zones with circulation loss, etc.)
				Easting	Northing	Elevation							Packer Test Zone		Constant Head Test Results	Falling Head Test Results	Completion Zone		Piezometer Diameter	Stickup Height	Static Water Level	Date and Time of Measurement	
				(m)	(m)	(m)	(˚)	(˚)	Nominal	(m)	(m)	(m)	From (m)	To (m)	(m/s)	(m/s)	From (m)	To (m)	(mm)	(m)	(mbgs)		
SC15-180	DH15-19	Sandvik 710	Plant Site	506,568	5,179,835	1,788	0	90	HQ3	30.2	0.6	16.5	8.1	19.5	n/a	6.E-07	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 1.52 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													18.7	30.2	n/a	1.E-08							
SC15-181	DH15-8	Sandvik 710	South Impoundment Embankment	506,592	5,178,968	1,770	0	90	HQ3	30.1	6.7	13.4	9.6	14.9	n/a	1.E-06	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 6.71 m and continued with HQ3 coring until end of hole 30.1 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													12.6	21.0	n/a	2.E-07							
													20.3	30.1	n/a	1.E-09							
SC15-182	DH15-7	Sandvik 710	South Impoundment Embankment	506,619	5,178,759	1,794	0	90	HQ3	30.2	0.2	1.2	2.0	7.3	1E-06	n/a	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.2 m. Loss of circulation at 6.8 m, drillers add shredded paper to improve circulation after packer test (#1). Loss of circulation observed at 8.2 to 9.4 m and then again at 11.5 to 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													6.6	13.4	1E-06	n/a							
													12.6	19.5	n/a	6.E-06							
													18.7	19.5	3E-07	n/a							
													24.8	30.2	n/a	3.E-06							
SC15-183	DH15-6	Sandvik 710	South Impoundment Embankment	506,510	5,178,913	1,779	0	90	HQ3	30.2	0.6	17.6	5.0	11.9	n/a	4.E-08	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 1.52 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Slight loss of circulation at about 28.2 m noted by the driller but regained it shortly.
													11.1	18.0	n/a	5.E-08							
													17.2	24.1	n/a	2.E-07							
													23.3	30.2	n/a	2.E-06							
SC15-184	DH15-11	Sandvik 710	Seepage Collection Pond	507,044	5,178,970	1,756	0	90	PQ3	30.0	4.6	5.9	6.6	13.4	n/a	3.E-06	14.9	27.5	44.45	1.60	Artesian flow at approx. 10 gal/min	10/03/2015 2:00	PWT casing advanced to 4.57 m and continued with PQ3 coring until end of hole 30.0 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Slight loss of circulation from 10.06 to 10.36 m. Artesian condition observed at around 69 ft (see packer testing results).
													14.2	21.0	n/a	4.E-06							
													20.3	30.0	Artesian (see test notes)								
SC15-185	DH15-5	Sandvik 710	South Impoundment Embankment	506,358	5,179,087	1,806	0	90	PQ3	30.2	0.3	1.1	5.6	11.9	n/a	1.E-07	17.2	25.9	44.45	3.05	7.0	11/03/2015 5:00	PWT casing advanced to 4.42 m and continued with PQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Loss of cirulation (remained 20 to 30 %) starting at 16.76 m until end of hole.
													12.6	18.0	n/a	1.E-05							
													17.2	24.1	n/a	5.E-06							
													23.3	30.2	n/a	1.E-05							
SC15-186	DH15-10	Sandvik 710	South Impoundment Embankment	506,698	5,179,101	1,786	0	90	HQ3	30.2	0.3	4.7	5.0	11.9	n/a	6.E-08	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													12.6	18.0	n/a	1.E-07							
													17.2	24.1	n/a	8.E-08							
													23.3	30.2	n/a	1.E-08							
SC15-187	DH15-13	Sandvik 710	South Impoundment Embankment	506,740	5,179,260	1,786	0	90	HQ3	30.2	0.3	6.1	2.7	8.8	n/a	2.E-06	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Lugeon test performed at 2.7 m, all other packing tests were falling head response tests.
													9.6	14.9	n/a	2.E-06							
													15.7	22.6	n/a	3.E-08							
													23.3	30.2	n/a	6.E-07							
SC15-188	DH15-9	Sandvik 710	South Impoundment Embankment	506,563	5,179,124	1,792	0	90	HQ3	30.2	0.2	10.4	3.5	8.8	n/a	2.E-07	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Artesian zone encounterd after 79ft to 84 ft drill run. Stopped flowing after approximately 3 minutes. Measured water flow of 3 L in 2.5 minutes before flow stopped.
													8.1	14.9	n/a	1.E-07							
													15.7	22.6	n/a	1.E-07							
													23.3	30.2	n/a	1.E-08							
SC15-189	DH15-17	Sandvik 710	Plant Site	506,679	5,179,630	1,782	0	90	HQ3	30.2	0.3	5.8	5.0	11.9	n/a	4.E-07	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													11.1	18.0	n/a	2.E-07							
													17.2	24.1	n/a	4.E-08							
													24.8	30.2	n/a	1.E-07							
SC15-190	DH15-14	Sandvik 710	Process Water Storage Pond	507,205	5,179,665	1,761	0	90	HQ3	30.2	0.5	7.5	8.1	14.8	n/a	3.E-07	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 2.13 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													15.7	22.1	n/a	3.E-07							
													21.8	30.2	n/a	2.E-06							
SC15-191	DH15-12	Sandvik 710	Process Water Storage Pond	507,024	5,179,469	1,768	0	90	HQ3	30.2	0.5	2.7	8.1	14.9	n/a	2.E-05	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 1.52 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Loss of circulation (90% loss) starting at 10.76 m to 12.01 m.
													15.7	22.6	n/a	3.E-07							
													21.8	30.2	n/a	1.E-07							
SC15-192	DH15-2	Sandvik 710	West Impoundment Embankment	504,689	5,178,984	1,792	0	90	HQ3	30.5	2.1	9.8	9.6	19.8	n/a	4.E-07	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 5.2 m and continued with HQ3 coring until end of hole 30.5 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													20.6	30.5	n/a	2.E-06							
SC15-193	DH15-1	Sandvik 710	West Impoundment Embankment	504,857	5,178,786	1,787	0	90	HQ3	30.2	2.1	7.5	8.1	18.0	n/a	1.E-07	No installation. Drillhole backfilled with grout to surface.						HWT casing advanced to 3.66 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													17.2	30.2	n/a	6.E-08							

				NAD83 UTM Coordinates(1)									Packer Test Hydraulic Conductivity Testing				Installation Information						
Drillhole #	Pre-Drill Designation	Rig #	Drillhole Location	Easting	Northing	Elevation	Azimuth	Inclination	Hole Size	Total Depth	Depth to Weathered Bedrock	Depth to Competent Bedrock	Packer Test Zone		Constant Head Test Results	Falling Head Test Results	Completion Zone		Piezometer Diameter	Stickup Height	Static Water Level	Date and Time of Measurement	Drillhole Notes (artesian conditions, fault zones, zones with circulation loss, etc.)
				(m)	(m)	(m)	(˚)	(˚)	Nominal	(m)	(m)	(m)	From (m)	To (m)	(m/s)	(m/s)	From (m)	To (m)	(mm)	(m)	(mbgs)		
SC15-194	DH15-3	Sandvik 710	Central Impoundment Embankment	506,024	5,179,849	1,774	0	90	PQ3	30.1	0.5	10.4	12.6	17.7	n/a	5.E-07	21.6	28.8	44.45	0.6	N/A	N/A	PWT casing advanced to 4.57 m and continued with PQ3 coring until end of hole 30.1 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. Water level meter was covered in grease, so did not measure static water level in well to avoid contamination.
													17.2	23.8	n/a	7.E-08							
													23.3	30.1	n/a	6.E-06							
SC15-195	DH15-15	Sandvik 710	East Impoundment Embankment	507,728	5,179,502	1,736	0	90	HQ3	30.1	0.2	2.0	9.6	19.5	n/a	5.E-06	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 30.1 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													18.7	30.1	n/a	1.E-08							
SC15-196	DH15-16	Sandvik 710	East Impoundment Embankment	507,619	5,179,697	1,751	0	90	HQ3	30.5	1.5	7.2	13.6	22.9	n/a	3.E-07	No installation. Drillhole backfilled with grout to surface.						Triconed to 2.43 m but no casing was advanced. Continued with HQ3 coring until end of hole 30.5 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													22.1	30.5	n/a	4.E-08							
SC15-197	DH15-4	Sandvik 710	Central Impoundment Embankment	506,194	5,179,619	1,775	0	90	HQ3	29.9	0.2	8.2	9.6	19.4	n/a	4.E-06	No installation. Drillhole backfilled with grout to surface.						No casing advanced as bedrock is near surface, HQ3 coring until end of hole 29.9 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													18.7	29.9	n/a	1.E-06							
SC15-198	DH15-18	Sandvik 710	SAG Mill	506,592	5,179,745	1,787	0	90	HQ3	30.0	1.4	1.4	9.6	16.3	n/a	2.E-07	15.8	22.9	44.45	0.6	N/A	N/A	No casing advanced as bedrock is near surface. HQ3 coring until end of hole 30.0 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water. A HWT casing advancer (tricone) was used to drill to 17.4 m to facilitate the installation of the monitoring well. Water level meter was covered with grease, so no water level measurement was made at the end of the well installation in order to avoid contamination.
													15.7	22.6	n/a	7.E-07							
													21.8	30.0	n/a	1.E-07							
SC15-201	DH15-21	LF 70	Process Water Storage Pond	506,316	5,179,571	1,783	0	90	HQ3	30.3	0.6	4.1	5.6	12.0	n/a	2.E-06	No installation. Drillhole backfilled with bentonite to surface.						HWT casing advanced to 3.0 m and continued with HQ3 coring until end of hole 30.3 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													11.4	24.2	n/a	2.E-07							
													22.1	30.3	n/a	8.E-08							
SC15-202	DH15-20	LF 70	Process Water Storage Pond	505,959	5,179,446	1,795	0	90	HQ3	29.8	1.5	13.4	2.4	10.4	n/a	2.E-03	No installation. Drillhole backfilled with bentonite to surface.						HWT casing advanced to 3.2 m and continued with HQ3 coring until end of hole 29.8 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													6.7	14.6	n/a	2.E-05							
													14.3	20.7	n/a	5.E-08							
													20.1	29.8	n/a	3.E-06							
SC15-203	DH15-22	LF 70	Process Water Pond (Alternate)	506,469	5,178,408	1,794	0	90	HQ3	30.2	1.2	8.2	8.5	14.9	n/a	6.E-07	No installation. Drillhole backfilled with bentonite to surface.						Casing advanced to 3.7 m. Lost return at 11.3 m.
													14.0	22.5	n/a	2.E-09							
													21.6	30.2	n/a	6.E-08							
SC15-204	DH15-23	LF 70	Non Contact Water Reservoir	507,939	5,178,748	1,761	0	90	HQ3	30.2	0.3	8.6	7.9	14.9	n/a	2.E-08	No installation. Drillhole backfilled with bentonite to surface.						HWT casing advanced to 3.0 m and continued with HQ3 coring until end of hole 30.2 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													12.5	22.6	n/a	8.E-08							
													21.6	30.2	n/a	2.E-06							
SC15-205	DH15-24	LF 70	Non Contact Water Reservoir	507,971	5,178,618	1,773	0	90	PQ3	29.9	0.7	8.5	4.6	11.6	n/a	5.E-07	No installation. Drillhole backfilled with bentonite to surface.						HWT casing advanced to 3.0 m and continued with HQ3 coring until end of hole 29.9 m. Drilled with a mixture of light polymer (Poly-Plus RD) and water.
													10.7	22.2	n/a	2.E-07							
													19.8	29.9	n/a	9.E-06							

\\KPL\VA-Prj$\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Rev 0\Appendices\A1 - Geotechnical Drillhole Summary Table\[Table A1.1 - Drillhole Summary.xlsx]Table 1 Drillhole Summary

NOTES:

1. COORDINATES ARE NAD83 UTM. COORDINATES WERE SURVEYED BY KP USING A HANDHELD GARMIN GPS MAP62 WITH AN ACCURACY OF ±3 METRES.

0	26APR'16	ISSUED WITH REPORT VA101-460/3-1	JDC	GIM
REV	DATE	DESCRIPTION	PREP'D	REV'D

TABLE A1.2

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION
TEST PIT SUMMARY

Print Apr/26/16 16:23:41

Test Pit ID	Test Pit Location	GPS UTM Coordinates NAD 83			Depth of Excavation	Ground-water	Reason For Termination	Samples Collected	KP Field Description of Main Soil Type	Comments
		Easting (m)	Northing (m)	Elevation (m)	(m)	(m)				
TP15-1	Process Water Storage Pond	506,075	5,179,489	1780	1.1	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-2	Process Water Storage Pond	506,197	5,179,536	1785	1.0	-	Sufficient excavation into weathered bedrock	0.3 - 0.5 m	silty SAND	Easy excavation
TP15-3	Process Water Storage Pond	506,010	5,179,362	1797	0.6	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-4	Process Water Storage Pond	506,135	5,179,405	1796	0.8	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-5	Process Water Storage Pond	506,245	5,179,350	1804	0.6	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-5B	Process Water Storage Pond	506,244	5,179,345	1806	0.5		Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-6	South Impoundment	506,659	5,179,290	1794	0.2	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-7	South Impoundment	506,490	5,179,210	1795	0.7	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-8	South Impoundment	506,469	5,179,033	1778	1.7	-	Sufficient excavation into weathered bedrock	0.3 - 0.6 m	silty SAND	Easy excavation
TP15-9	South Impoundment	506,619	5,179,094	1781	1.7	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-10	South Impoundment	506,545	5,179,006	1770	0.6	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-11	South Impoundment	506,418	5,178,864	1782	1.6	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-12	South Impoundment	506,578	5,178,829	1767	1.8	-	Sufficient excavation into weathered bedrock	0.4 - 0.6 m	silty SAND	Easy excavation
TP15-13	South Impoundment	506,531	5,178,726	1782	1.4	-	Sufficient excavation into weathered bedrock	0.4 - 0.5 m	silty SAND	Easy excavation
TP15-14	South Impoundment	506,731	5,179,489	1782	1.4	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-15	South Impoundment	506,725	5,179,123	1782	1.5	-	Sufficient excavation into weathered bedrock	0.74 - 1.0 m	silty SAND	Easy excavation
TP15-16	South Impoundment	506,710	5,179,044	1773	0.8	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-17	South Impoundment	506,698	5,178,905	1757	3.9	-	Sufficient excavation into weathered bedrock	1.9 - 2.0 m	silty SAND	Easy excavation
TP15-18	South Impoundment	506,662	5,178,851	1764	0.9	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-19	South Impoundment	506,768	5,178,852	1762	0.8	-	Sufficient excavation into weathered bedrock	3.2 - 3.3 m	silty SAND	Easy excavation
TP15-20	South Impoundment	506,766	5,178,916	1756	2.6	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-21	South Impoundment	506,783	5,179,069	1775	0.6	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-22	Process Water Pond (Alternate)	506,394	5,178,475	1818	1.1	-	Sufficient excavation into weathered bedrock	3.6 - 3.7 m	sandy SILT	Easy excavation
TP15-23	Process Water Pond (Alternate)	506,505	5,178,367	1818	1.5	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-24	Process Water Pond (Alternate)	506,378	5,178,405	1809	2.1	-	Sufficient excavation into weathered bedrock	0.3 - 0.5 m	sandy SILT	Easy excavation
TP15-25	Process Water Pond (Alternate)	506,307	5,178,406	1821	2.1	-	Sufficient excavation into weathered bedrock	0.4 - 0.6 m	silty SAND	Easy excavation

TABLE A1.2

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION
TEST PIT SUMMARY

Print Apr/26/16 16:23:41

Test Pit ID	Test Pit Location	GPS UTM Coordinates NAD 83			Depth of Excavation	Ground-water	Reason For Termination	Samples Collected	KP Field Description of Main Soil Type	Comments
		Easting (m)	Northing (m)	Elevation (m)	(m)	(m)				
TP15-26	Process Water Pond (Alternate)	506,274	5,178,292	1823	1.2	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-27	Process Water Pond (Alternate)	506,322	5,178,273	1822	1.3	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-28	Process Water Pond (Alternate)	506,403	5,178,285	1830	1.4	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-29	Non Contact Water Reservoir	507,539	5,178,679	1774	1.7	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-30	Non Contact Water Reservoir	507,562	5,178,612	1773	2.3	-	Sufficient excavation into weathered bedrock	0.2 - 0.3 m 0.3 - 0.6 m	silty SAND	Easy excavation
TP15-31	Non Contact Water Reservoir	507,538	5,178,578	1776	2.1	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-32	Non Contact Water Reservoir	507,699	5,178,733	1774	1.8	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-33	Non Contact Water Reservoir	507,700	5,178,695	1769	1.9	-	Sufficient excavation into weathered bedrock	-	sandy SILT	Easy excavation
TP15-34	Non Contact Water Reservoir	507,685	5,178,620	1772	1.2	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-35	Non Contact Water Reservoir	507,861	5,178,588	1773	1.1	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-36	Non Contact Water Reservoir	507,875	5,178,652	1764	1.0	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-37	Non Contact Water Reservoir	507,830	5,178,744	1775	1.0	-	Sufficient excavation into weathered bedrock	0.2 - 0.5 m	silty SAND	Easy excavation
TP15-38	Non Contact Water Reservoir	507,920	5,178,783	1768	0.8	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-39	Non Contact Water Reservoir	507,961	5,178,671	1760	1.2	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-40	Proposed Portal	506,919	5,179,822	1787	1.2	-	Sufficient excavation into weathered bedrock	0.1 - 0.2 m	silty SAND	Easy excavation
TP15-41	Proposed Portal	506,989	5,179,808	1790	2.4	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-42	Proposed Portal	507,059	5,179,806	1791	1.6	-	Sufficient excavation into weathered bedrock	0.45 - 0.65 m	silty SAND	Easy excavation
TP15-43	Proposed Portal	506,993	5,179,873	1797	1.9	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation
TP15-44	Proposed Portal	506,994	5,179,964	1785	0.8	-	Sufficient excavation into weathered bedrock	-	silty SAND	Easy excavation

\\KPL\VA-Prj$\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Rev 0\Appendices\A1 - Geotechnical Drillhole Summary Table\[Table A1.2 - Test Pit Summary Table.xlsx]Table A1.2 Test Pit Summary

0	15JUN'15	ISSUED WITH REPORT VA101-460/3-1	JDC	GIM
REV	DATE	DESCRIPTION	PREP'D	REV'D

APPENDIX A2

GEOTECHNICAL DRILLHOLE LOGS

(Page A2-1 to A2-28)

Contractor: Ruen Drilling Inc.
Location: Plant Site
Coordinates: 506,568 E , 5,174,835 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-180
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1788 m
Inclination: -90

Page: 1 of 4
Date Started: Mar 4, 15
Date Completed: Mar 5, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)
1	1787
2	1786
3	1785
4	1784
5	1783
6	1782
7	1781
8	1780
9	1779

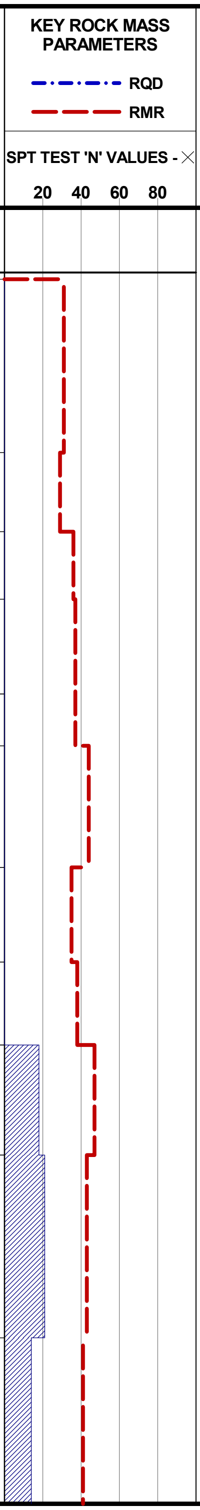
MATERIAL DESCRIPTION

SANDY SILT
(0 to 0.6 m)
Sandy SILT with trace clay; some coarse grained sand, low plasticity, brown, trace organics.

SHALE
(0.6 to 1.9 m)
Medium grey shale and rubble.

WEATHERED SHALE
(1.9 to 16.5 m)
Medium to dark grey, fine grained, very thinly laminated to very thinly bedded, weak, moderately weathered with FeO staining along joints; some calcite veinlets.

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
70				5	
100				2.5	
100				20	
96				50	
100				40	
64				50	
100				35	
78				50	
98				35	
96				40	
98				40	



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

8.1 m to 19.5 m - Lugeon Packer Test #1 - k = 6E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-1

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

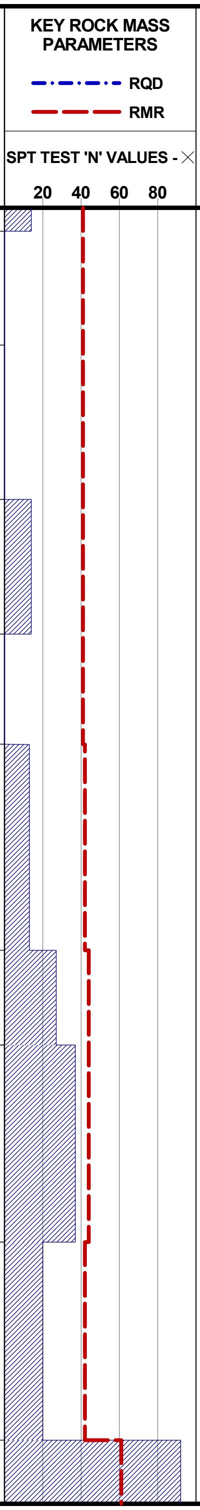
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: Plant Site
Coordinates: 506,568 E , 5,174,835 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-180
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1788 m
Inclination: -90

Page: 2 of 4
Date Started: Mar 4, 15
Date Completed: Mar 5, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
			WEATHERED SHALE (1.9 to 16.5 m) Medium to dark grey, fine grained, very thinly laminated to very thinly bedded, weak, moderately weathered with FeO staining along joints; some calcite veinlets.	100				50				
11	1777											
				93				35				
12	1776											
				96				35				
13	1775											
				100				50				
14	1774											
				98				40				
15	1773											
16	1772			96				40				
			SHALE (16.5 to 30.2 m) Medium to light grey, fine grained, very thinly laminated to very thinly bedded, medium strong to strong with occasional rubbly zones, mostly fresh and unweathered with some clay infilling along joints; trace calcite veins and veinlets.	100				40				
17	1771											
18	1770											
				100				50				18.7 m to 30.2 m - Lugeon Packer Test #2 - k = 1E-08 m/s
19	1769											



GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-1

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

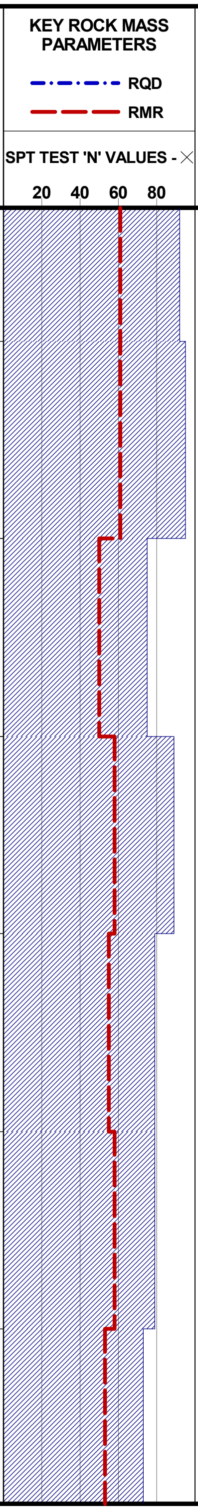
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: Plant Site
Coordinates: 506,568 E , 5,174,835 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-180
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1788 m
Inclination: -90

Page: 3 of 4
Date Started: Mar 4, 15
Date Completed: Mar 5, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
			SHALE (16.5 to 30.2 m) Medium to light grey, fine grained, very thinly laminated to very thinly bedded, medium strong to strong with occasional rubbly zones, mostly fresh and unweathered with some clay infilling along joints; trace calcite veins and veinlets.	100				50				
21	1767											
				100				50				
22	1766											
23	1765											
				100				40				
24	1764											
				97				50				
25	1763											
26	1762											
				100				50				
27	1761											
				100				50				
28	1760											
29	1759											
				100				50				



GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-1

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Plant Site
Coordinates: 506,568 E , 5,174,835 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-180
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1788 m
Inclination: -90

Page: 4 of 4
Date Started: Mar 4, 15
Date Completed: Mar 5, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS RQD RMR SPT TEST 'N' VALUES - × 20 40 60 80	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
			End of Drillhole: 30.2 m									
31	1757											
32	1756											
33	1755											
34	1754											
35	1753											
36	1752											
37	1751											
38	1750											
39	1749											

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

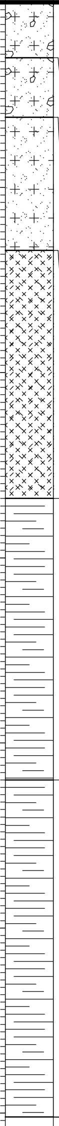
FIGURE A2-1

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

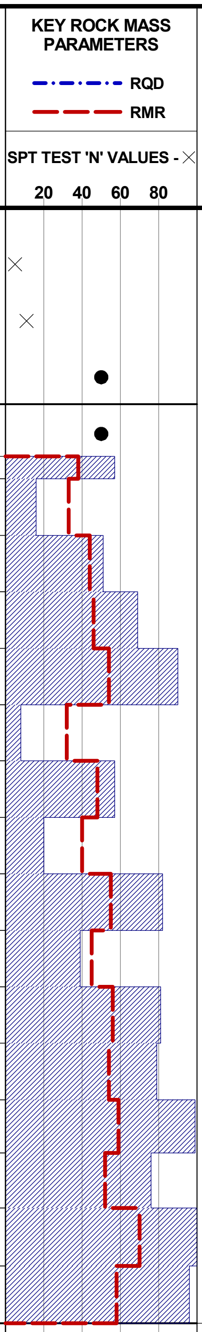
Contractor: Ruen Drilling Inc.	**Drillhole No.:** SC15-181	**Page:** 1 of 1
Location: South Impoundment Embankment	Drill Type: Sandvik 710	Date Started: Mar 5, 15
Coordinates: 506,592 E , 5,178,968 N	Total Length: 30.1m	Date Completed: Mar 5, 15
Coordinate System: NAD83	Elevation: 1770 m	Logged by: GM/JBC
Hole Size HQ3	Inclination: -90	Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	MATERIAL DESCRIPTION
		SILTY SAND (0 to 1.5 m) Silty SAND, subangular, fine to coarse grained, subangular, no plasticity, light brown, frozen with no visible ice; trace gravel; trace organics near surface.
		SAND WITH SILT AND GRAVEL (1.5 to 3.1 m) SAND with trace silt and trace angular gravel, sand is medium to coarse grained, poorly graded, low plasticity, brown.
5	1765	**SAND WITH SILT** (3.1 to 6.7 m) SAND with trace silt, subangular, fine to medium grained, poorly graded, non-plastic, orange/brown, moist.
10	1760	**WEATHERED BEDROCK** (6.7 to 13.4 m) GRANODIORITE, fine to coarse grained, inequigranular, light grey to grey with orange oxide staining throughout, very weak to weak, highly weathered, massive.
15	1755	**MUDSTONE/SHALE** (13.4 to 21 m) MUDSTONE/SHALE. fine grained, equigranular, grey to light grey, medium strong, highly fractured with some rubbleized sections, slightly to moderately weathered with FeO and calcite infilling along fractures and joints, thinly laminated, intermittent calcite veinlets throughout.
20	1750	
25	1745	**SHALE** (21 to 30.1 m) SHALE, fine grained, equigranular, grey to light grey, medium strong, moderately fractured, fresh and unweathered, thinly laminated, occasional calcite veins and veinlets.
30	1740	End of Drillhole: 30.11 m



RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6")	SPT 'N' VALUE
	SPT01	46		2/2/3	5
	SPT02	42		3/4/7	11
	SPT03	42		16/26/50+	R
	SHELBY01	100			
	SPT04	100		50+	R
100				10	
91				5	
82				20	
93				20	
100				40	
72				10	
100				50	
100				40	
100				50	
98				40	
100	UCS-01			50	
88				40	
100				50	
100				40	
100				40	
99				40	

UCS



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

9.6 m to 14.9 m - Lugeon Packer Test #1 - k = 1E-06 m/s

12.6 m to 21.0 m - Lugeon Packer Test #2 - k = 2E-07 m/s

20.3 m to 30.1 m - Lugeon Packer Test #3 - k = 1E-09 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-2

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
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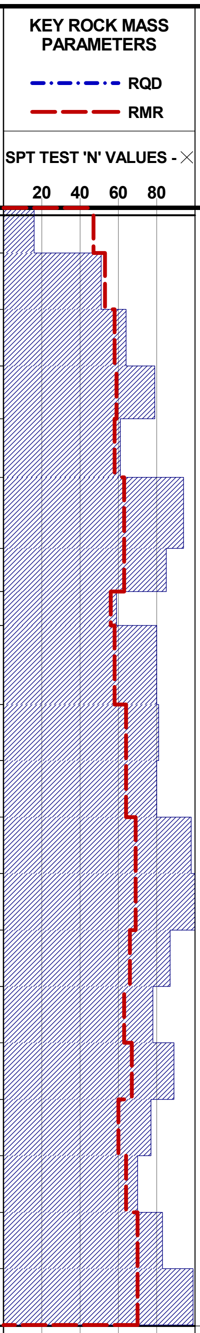
Contractor: Ruen Drilling Inc.
Location: South Impoundment Embankment
Coordinates: 506,619 E , 5,178,759 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-182
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1794 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 6, 15
Date Completed: Mar 7, 15
Logged by: GM/JBC
Reviewed by: GM



DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
			SILTY SAND (0 to 0.2 m) Silty SAND, brown, dry with some organics.	98				120				
			WEATHERED BEDROCK (0.2 to 1.2 m) GRANODIORITE, medium to coarse grained, inequigranular, light grey, strong, moderately weathered, some FeO staining throughout rock and along joints, some soil infilling along joints and fractures, massive.	100				120				2.0 m to 7.3 m - Lugeon Packer Test #1 - k = 1E-06 m/s
	1790			93				120				
5				100	UCS-01			120				
			GRANODIORITE (1.2 to 30.2 m) GRANODIORITE, medium to coarse grained, inequigranular, light grey, strong, slightly weathered to fresh, some calcite infilling along joints and fractures, minor clay alteration along some joint and fracture surfaces, massive.	96				120				6.6 m to 13.4 m - Lugeon Packer Test #2 - k = 1E-04 m/s
				99				100				
10	1785			99				100				
				98				100				
				100				100				12.6 m to 19.5 m - Lugeon Packer Test #3 - k = 6E-06 m/s
	1780			100				125				
15				95				125				
				98				125				
	1775			100				125				18.7 m to 25.6 m - Lugeon Packer Test #4 - k = 3E-07 m/s
20				100				125				
				100				125				
	1770			100				125				
25				98				100				24.8 m to 30.2 m - Lugeon Packer Test #5 - k = 3E-06 m/s
				100				120				
				95				120				
	1765			100				120				
30			End of Drillhole: 30.2 m									
	1760											

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-3

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

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Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: South Impoundment Embankment
Coordinates: 506,510 E , 5,178,913 N
Coordinate System: NAD83
Hole Size HQ3

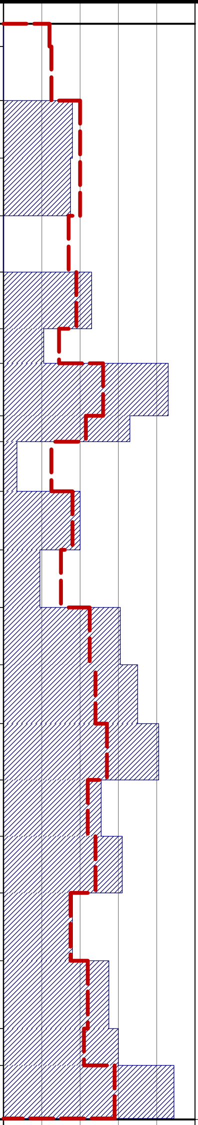
Drillhole No.: SC15-183
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1779 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 7, 15
Date Completed: Mar 8, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	MATERIAL DESCRIPTION
		SILTY SAND (0 to 0.6 m) Silty SAND, fine grained, non plastic, brown, moist with some organics.
		WEATHERED BEDROCK (0.6 to 1.5 m) GRANODIORITE, inequigranular, brownish orange, friable, completely weathered.
	1775	
5		**WEATHERED BEDROCK** (1.5 to 17.6 m) GRANODIORITE, medium grained, inequigranular, brownish grey, very weak to weak, highly weathered with localized intervals of complete weathering, massive.
	1770	**SHEAR ZONE** (9.2 to 9.9 m) Strong clay and yellow FeO staining with structural shear fabrics.
10		
	1765	
15		
		GRANODIORITE (17.6 to 21.1 m) GRANODIORITE, medium grained, inequigranular, light grey to pale grey, medium strong to strong, slightly to moderately weathered with some FeO staining along joint surfaces and fractures, massive.
	1760	
20		
		INTERBEDDED SHALE (21.1 to 30.2 m) SILTY SHALE, fine grained, grey and light grey sub horizontal beds, weak with occasional fractured zones and claye rubble, slightly weathered becoming mostly fresh towards bottom of hole, very thin to thickly laminated, sporadic calcite veins and veinlets.
	1755	
25		
	1750	
30		End of Drillhole: 30.2 m
	1745	

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
66				0.5	
96				1	
94				5	
100				10	
100				5	
100				7	
95				1	
100	UCS-02			10	
100				15	
92				1	
95				5	
100				1	
98				10	
100				20	
100				50	
98				10	
98				25	
88				1	
100				25	
99				10	
100	UCS-01			50	

KEY ROCK MASS PARAMETERS



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES
5.0 m to 11.9 m - Lugeon Packer Test #1 - k = 4E-08 m/s
11.1 m to 18.0 m - Lugeon Packer Test #2 - k = 5E-08 m/s
17.2 m to 24.1 m - Lugeon Packer Test #3 - k = 2E-07 m/s
23.3 m to 30.2 m - Lugeon Packer Test #4 - k = 2E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-4

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
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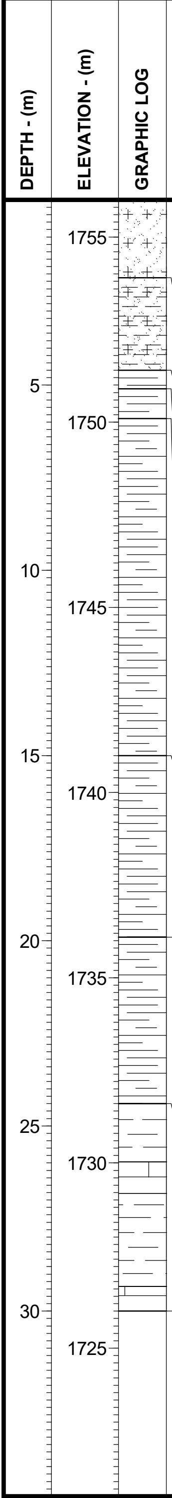
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Appendix: A2

Contractor: Ruen Drilling Inc.
Location: Seepage Collection Pond
Coordinates: 507,044 E , 5,178,970 N
Coordinate System: NAD83
Hole Size PQ3

Drillhole No.: SC15-184
Drill Type: Sandvik 710
Total Length: 30.0m
Elevation: 1756 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 8, 15
Date Completed: Mar 9, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILTY SAND
(0 to 2.1 m)
Silty SAND, angular to subangular, fine to coarse grained, porrly graded, low to no plasticity, dark brown, loose.

SANDY, CLAYEY SILT
(2.1 to 4.6 m)
Clayey SILT with sand, poorly graded, high plasticity, light brown, wet.

WEATHERED BEDROCK
(4.6 to 5.1 m)
Highly weathered silty and carboncaeous SHALE with FeO staining along fractures.

WEATHERED BEDROCK
(5.1 to 5.9 m)
SHALE, fine grained, grey to black, weak to very weak, highly fractured and oxidized, moderately to heavily weathered, discontinuous laminations.

INTERBEDDED CONGLOMERATES AND SHALES
(5.9 to 15 m)
Interbedded SHALES with heterolithic CONGLOMERATES, fine grained, light grey to black, weak with sections of highly fractured and rubbleized clayey rock (<5cm thick), moderately to slightly weathered with FeO along some joint surfaces, chaotic bedding.

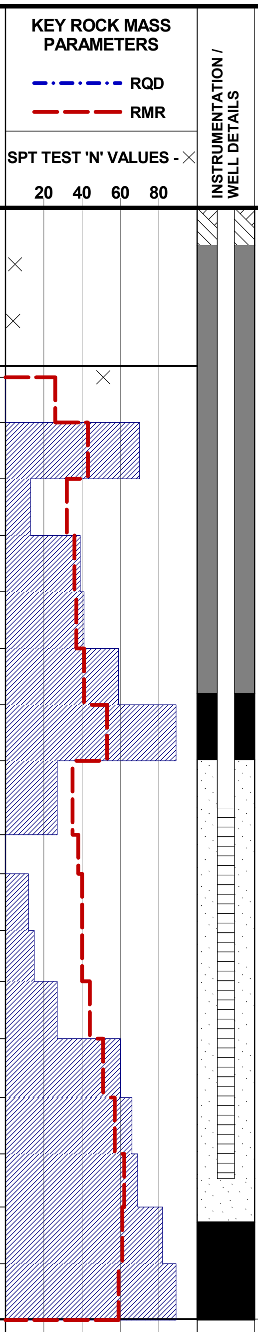
SHALE
(15 to 19.9 m)
SHALE, fine grained, grey to black, weak to medium strong with several highly fractured/rubble zones throughout interval, slightly to moderately weathered, very thinly to thickly laminated with subhorizontal bedding; some calcite veins and veinlets.

INTERBEDDED CONGLOMERATES AND SHALES
(19.9 to 24.4 m)
Interbedded SHALES with heterolithic CONGLOMERATES, fine grained, light grey to black, weak with sections of highly fractured and rubbleized clayey rock (<5cm thick), moderately to slightly weathered with FeO along some joint surfaces, chaotic bedding.

SHALE AND LIMESTONE
(24.4 to 30 m)
Interbedded SHALE and LIMESTONE, fine grained, light to dark grey, strong, mostly fresh and unweathered with trace FeO infilling along some fractures and joints, thin laminations and bedding.

End of Drillhole: 30 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6") / UCS	SPT 'N' VALUE
	SPT01	75		2/2/3	5
	SPT02	29		1/1/3	4
	SHELBY01	31			
	SPT03	80		~~14/19/32~~	~~51~~
90				1	
93				10	
98				0 5	
100				5	
98				5	
100				15	
100				50	
100				20	
98				35	
100				40	
95				40	
100				75	
95				100	
100				70	
100				70	
100				50	
98				50	



DRILLING NOTES

6.6 m to 13.4 m - Lugeon Packer Test #1 - k = 3E-06 m/s

14.2 m to 21.0 m - Lugeon Packer Test #2 - k = 4E-06 m/s

20.3 m to 30.0 m - Lugeon Packer Test #3 - Artesian conditions encountered

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-5

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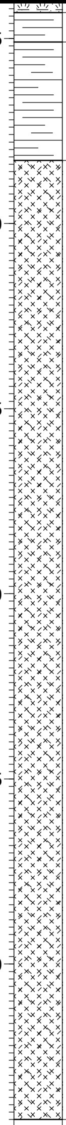
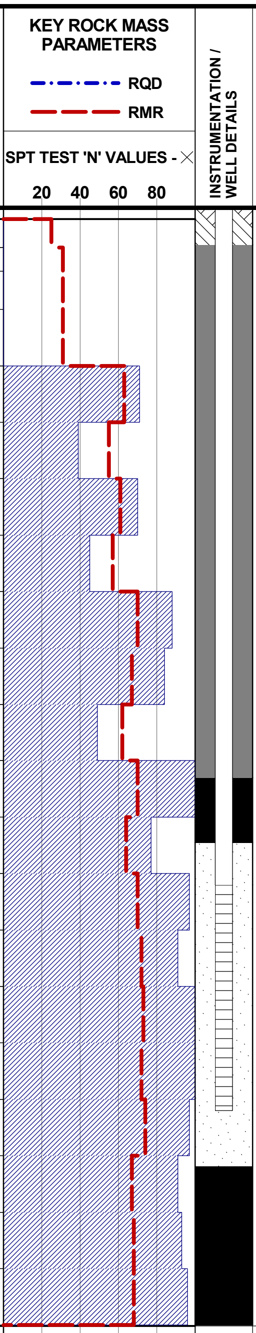
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.	**Drillhole No.:** SC15-185	**Page:** 1 of 1
Location: South Impoundment Embankment	Drill Type: Sandvik 710	Date Started: Mar 10, 15
Coordinates: 506,358 E , 5,179,087 N	Total Length: 30.2m	Date Completed: Mar 11, 15
Coordinate System: NAD83	Elevation: 1806 m	Logged by: GM/JBC
Hole Size PQ3	Inclination: -90	Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	MATERIAL DESCRIPTION
	1805	**SILTY SAND** (0 to 0.3 m) Silty SAND, medium brown with some organics.
		WEATHERED BEDROCK (0.3 to 1.1 m) Completely to highly weathered SHALE.
5	1800	**SHALE** (1.1 to 4.3 m) SHALE, fine grained, medium to dark grey, very weak; highly fractured over entire interval with some rubble zones and clay infilling in some fractures, moderately weathered, very thin to thinly laminated.
10	1795	**GRANODIORITE** (4.3 to 30.2 m) GRANODIORITE, medium grained, inequigranular with white feldspar phenocrysts (1-2 mm), light grey to grey, very strong, moderately fractured with some subvertical fracturing, slightly weathered to fresh and unweathered (at ~10.1 mbgs) with minor FeO staining along joints and fractures, massive.
15	1790	
20	1785	
25	1780	
30	1775	End of Drillhole: 30.2 m



RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
45				1	
94				10	
100				10	
79				10	
100				120	
89				120	
100				120	
100				120	
100				120	
97				120	
100				120	
100				120	
97				120	
97				120	
98				150	
100				150	
100				150	
97				150	
97				150	
100				150	
97				150	



DRILLING NOTES

5.6 m to 11.9 m - Lugeon Packer Test #1 - k = 1E-07 m/s

12.6 m to 18.0 m - Lugeon Packer Test #2 - k = 1E-05 m/s

17.2 m to 24.1 m - Lugeon Packer Test #3 - k = 5E-06 m/s

23.3 m to 30.2 m - Lugeon Packer Test #4 - k = 1E-05 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-6

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: South Impoundment Embankment
Coordinates: 506,698 E , 5,179,101 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-186
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1786 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 11, 15
Date Completed: Mar 12, 15
Logged by: GM/JBC
Reviewed by: GM

MATERIAL DESCRIPTION

TOPSOIL
(0 to 0.3 m)
No recovery.

WEATHERED BEDROCK
(0.3 to 3.2 m)
SHALE, fine grained, equigranular with heterolithic angular to subangular CONGLOMERATE, medium grey, weak with several (up to 10cm) rubble zones, highly to completely weathered with FeO and clay infill along joints and fractures, thinly to thickly laminated with clasts.
Contact with intrusive unit at 3.2 mbgs.

WEATHERED BEDROCK
(3.2 to 4.7 m)
GRANODIORITE, medium grained with white feldspar phenocrysts, inequigranular, brownish grey, very weak to weak, completely to highly weathered with FeO staining along joints and fractures.

GRANODIORITE
(4.7 to 14.9 m)
GRANODIORITE, medium grained with white feldspar phenocrysts, inequigranular, grey to medium grey, strong to very strong with moderate fracturing, small, localized rubble zones throughout interval, moderately to slightly weathered with FeO staining along joints and fractures.

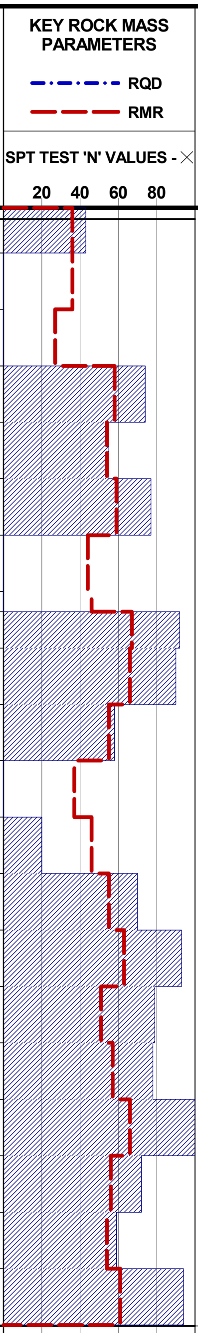
SHALE
(14.9 to 17.8 m)
SHALE, fine grained, black and dark blue, weak, highly fractured, moderately weathered with FeO infill along fractures and joints and FeO stained bedding, thickly laminated.

DEBRIS FLOW CONGLOMERATE
(17.8 to 26.9 m)
CONGLOMERATE, fine grained matrix with sub angular to angular heterolithic clasts, grey, medium strong with moderate fracturing becoming more intact downhole, moderately weathered, joints infilled with FeO, clay and calcite.

SHALE
(26.9 to 30.2 m)
SHALE, fine grained, light to dark grey, medium strong, moderately weathered with minor FeO infill along joints, very thinly to thinly laminated, calcite veins up to 1 mm thick throughout, calcite infilling along some joints.
DEBRIS FLOW CONGLOMERATE from 28.65 - 29.25 m.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	UCS
88		10
92		10
66		3
100		90
100		90
100		90
0		90
73		90
92		90
98		120
98		120
100		40
100		50
100		50
98		50
97		40
98		50
100		60
100		50
100		50
100	UCS-01	50



DRILLING NOTES

5.0 m to 11.9 m - Lugeon Packer Test #1 - k = 6E-08 m/s

12.6 m to 18.0 m - Lugeon Packer Test #2 - k = 1E-07 m/s

17.2 m to 24.1 m - Lugeon Packer Test #3 - k = 8E-08 m/s

23.3 m to 30.2 m - Lugeon Packer Test #4 - k = 1E-08 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-7

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

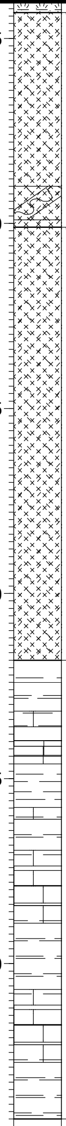
Contractor: Ruen Drilling Inc.
Location: South Impoundment Embankment
Coordinates: 506,740 E , 5,179,260 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-187
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1786 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 12, 15
Date Completed: Mar 12, 15
Logged by: GM/JBC
Reviewed by: GM

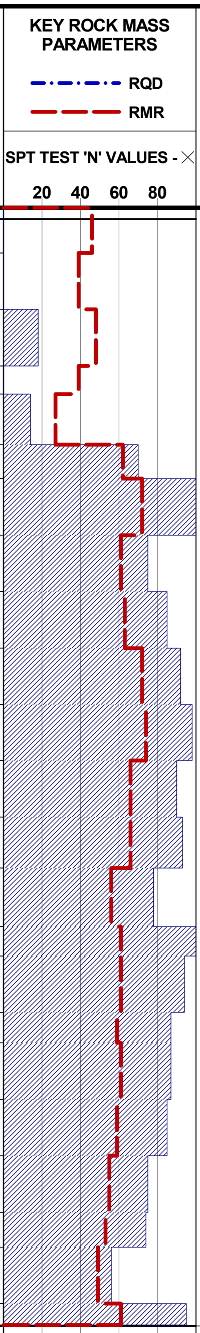
DEPTH - (m)	ELEVATION - (m)	MATERIAL DESCRIPTION
	1785	**TOSPOIL** (0 to 0.3 m) No recovery.
		WEATHERED BEDROCK (0.3 to 6.1 m) GRANODIORITE, medium grained, inequigranular, light grey to greenish grey, very strong to strong with moderate fracturing, slightly to moderately weathered; FeO staining along joints and fractures, massive.
5	1780	**SHEAR ZONE** (5 to 5.9 m) SHALE, orangey brown, strongly weathered, FeO stained, sheared and disintegrated.
10	1775	**GRANODIORITE** (6.1 to 17.8 m) GRANODIORITE, medium grained, inequigranular, light grey to greenish grey, very strong, slightly weathered; FeO staining along some joints and fractures with trace FeO stained blebs throughout interval, massive.
15	1770	
20	1765	**SHALEY LIMESTONE** (17.8 to 30.2 m) SHALE, fine grained, medium grey, medium strong, slightly weathered, mostly massive except for 17.83 - 18.41 m interval which is thick to very thickly bedded (up to 1.2 cm). **CLAST SUPPORTED CONGLOMERATE** (18.4 to 20.4 m) CONGLOMERATE, poorly sorted, heterolithic, clast supported, angular to subangular limestone clasts.
25	1760	**SHALEY LIMESTONE** (20.4 to 22.1 m) SHALE with DEBRIS FLOW CONGLOMERATES, fine grained matrix, blue to blue grey, medium strong, slightly weathered, strongly deformed. **SHALEY LIMESTONE** (22.1 to 30.2 m) SHALE, SHALEY LIMESTONE and DEBRIS FLOW CONGLOMERATES, strongly disrupted, moderately weathered with FeO staining along joints and fractures, mostly massive with thin bedding towards end of interval.
30	1755	End of Drillhole: 30.2 m

GRAPHIC LOG



RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
96				120	
96				50	
100				120	
88				50	
85				1	
100	UCS-01			120	
100				120	
98				120	
100				120	
100				120	
98				120	
97				120	
100				120	
91	UCS-02			40	
100				40	
100				40	
100				40	
100				40	
100				50	
100				40	
100				40	
100				40	
95				40	

KEY ROCK MASS PARAMETERS



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

2.7 m to 8.8 m - Lugeon Packer Test #1 - k = 2E-06 m/s

9.6 m to 14.9 m - Lugeon Packer Test #2 - k = 2E-06 m/s

15.7 m to 22.6 m - Lugeon Packer Test #3 - k = 3E-08 m/s

23.3 m to 30.2 m - Lugeon Packer Test #4 - k = 6E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-8

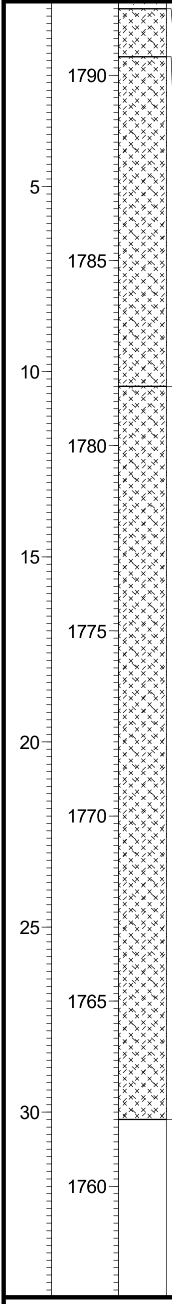
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: South Impoundment Embankment
Coordinates: 506,563 E , 5,179,124 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-188
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1792 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 12, 15
Date Completed: Mar 13, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SANDY SILT WITH CLAY
(0 to 0.2 m)
Sandy SILT with some clay and trace organics.

WEATHERED BEDROCK
(0.2 to 1.5 m)
GRANODIORITE, medium grained, inequigranular, light grey, highly weathered with lenses of extremely weak orangey brown soil material (up to 10 cm).

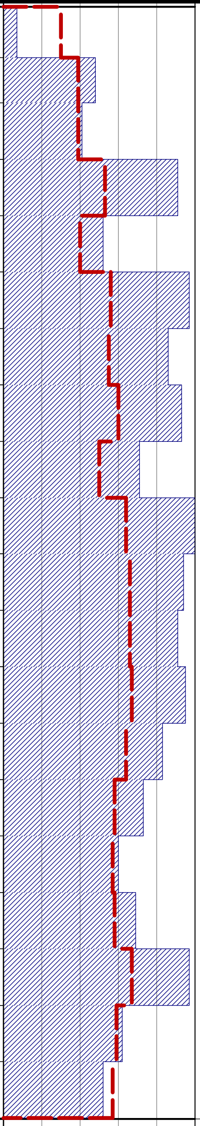
WEATHERED BEDROCK
(1.5 to 10.4 m)
GRANODIORITE, medium grained, inequigranular, light grey / orangey grey, medium strong, moderately weathered with pervasive FeO staining throughout groundmass, FeO infilling along joints, massive.

GRANODIORITE
(10.4 to 30.2 m)
GRANODIORITE, medium grained, inequigranular, light grey to grey, medium strong, slightly weathered with occasional locally oxidized zones, FeO infilling along many joints with a weak chlorite alteration observed along joints towards bottom of hole, massive.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
100				1			
96				10			
100				20			3.5 m to 8.8 m - Lugeon Packer Test #1 - k = 2E-07 m/s
98	UCS-01			30			
98				10			
100				40			8.1 m to 14.9 m - Lugeon Packer Test #2 - k = 1E-07 m/s
100				50			
100				75			
100				75			
100				100			
100				120			15.7 m to 22.6 m - Lugeon Packer Test #3 - k =1E-07 m/s
96				120			
100				120			
98				120			
96				120			
97				120			23.3 m to 30.2 m - Lugeon Packer Test #4 - k = 1E-08 m/s
100				120			
100				120			
100				120			
100				120			

KEY ROCK MASS PARAMETERS



GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-9

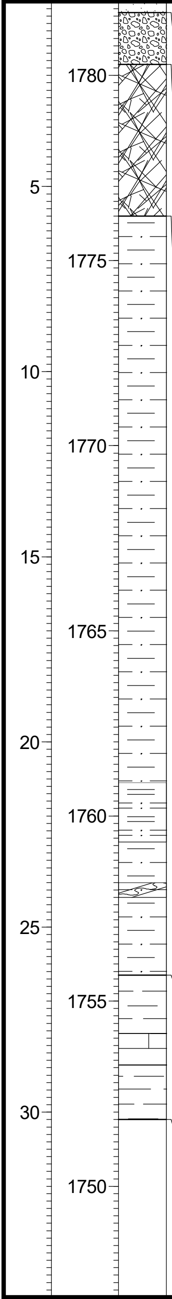
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: Plant Site
Coordinates: 506,679 E , 5,179,630 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-189
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1782 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 13, 15
Date Completed: Mar 14, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILTY SAND
(0 to 0.3 m)
Brown silty SAND.

WEATHERED BEDROCK
(0.3 to 1.7 m)
SHALE, fine grained, grey, weak, highly to completely weathered with FeO staining throughout. Interval is highly fractured and mostly rubbleized.

WEATHERED BEDROCK
(1.7 to 5.8 m)
SHALE, fine grained, grey to dark grey, weak, highly fractured with multiple sections of rubbly oxidized material (up to 5 cm), moderately weathered with FeO staining along joints and fractures, very thin to thinly laminated. Numerous subvertical fractures parallel to deformed bedding throughout interval.

SILTY SHALE
(5.8 to 26.3 m)
SHALE, fine grained, grey to light grey, medium strong, moderately fractured with some sections of rubbly material, slightly weathered, some FeO and clay infill along joints and fractures, very thin to thinly laminated. Numerous subvertical fractures parallel to deformed bedding throughout interval.

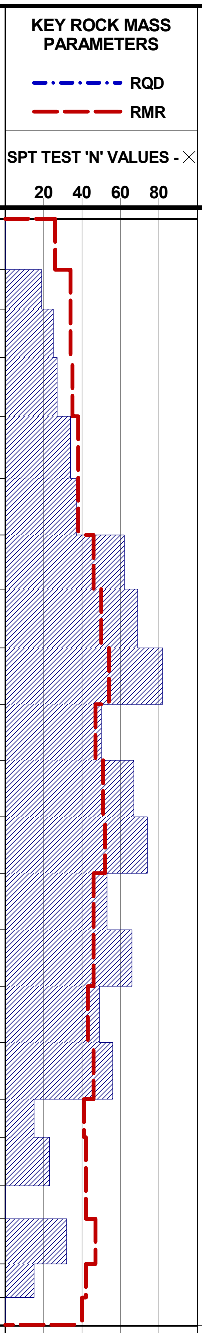
SHALE / CONGLOMERATE
(21.1 to 22.7 m)
SHALE / CONGLOMERATE, grey, weak, slightly weathered, mostly shale clasts (up to 2 cm diameter), very fine grained matrix, trace calcite veinlets.

SHEAR ZONE
(23.8 to 24.2 m)
Highly fractured with fine gravel sized clasts and thick clay.

SHALE
(26.3 to 30.2 m)
SHALE, fine grained, grey to light grey, medium strong, mostly fresh and unweathered, moderately to highly fractured with occasional rubble zones (up to 10 cm) throughout interval, very thin laminations and bedding.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
100				1	
94				5	
99				5	
96				5	
95				15	
98				10	
100				25	
96				25	
98				40	
100				40	
100				40	
98				40	
100				25	
100				25	
100				25	
98				25	
100				25	
89				40	
100				50	
92	UCS-01			50	
98				50	
100				50	



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

5.0 m to 11.9 m - Lugeon Packer Test #1 - k = 4E-07 m/s

11.1 m to 18.0 m - Lugeon Packer Test #2 - k = 2E-07 m/s

17.2 m to 24.1 m - Lugeon Packer Test #3 - k = 4E-08 m/s

24.8 m to 30.2 m - Lugeon Packer Test #4 - k = 1E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

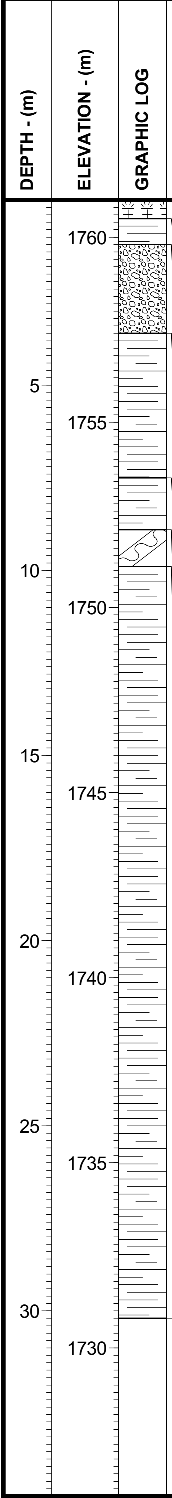
FIGURE A2-10

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Process Water Storage Pond
Coordinates: 507,205 E , 5,179,665 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-190
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1761 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 14, 15
Date Completed: Mar 15, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILT
(0 to 0.5 m)
SILT with some clay, brown, some roots.

WEATHERED BEDROCK
(0.5 to 1.2 m)
SHALE, tan and grey, fine grained, highly to completely weathered.

WEATHERED BEDROCK
(1.2 to 3.6 m)
SHALE, fine grained, tan and medium grey, highly broken and rubbleized, completely weathered.

WEATHERED BEDROCK
(3.6 to 7.5 m)
SHALE, fine grained, medium grey and tan bedding, highly fractured with rubble and clay filled zones, medium strength for intact rock, moderately weathered, very thin laminations and bedding.

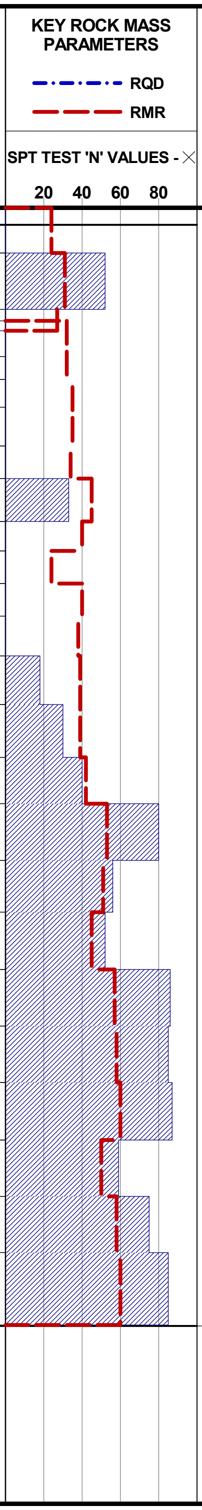
SHALE
(7.5 to 8.9 m)
SHALE, fine grained, grey to medium grey, highly fractured with rubble and clay filled zones, medium strength for intact rock, moderately weathered, very thin laminations and bedding.

SHEAR ZONE
(8.9 to 9.9 m)
Cohesive shear with large clay fraction.

SHALE
(9.9 to 30.2 m)
SHALE, fine grained, light to medium grey, moderately fractured with some rubble zones (up to 20cm), medium strength, moderately weathered to fresh and unweathered, very thin laminations and bedding.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
80				0.5	
52				0.5	
86				0.5	
62				30	
90				30	
92				30	
94				30	
85				30	
101				35	
98				30	
94				0.5	
100				30	
100				30	
92				30	
96	UCS-01			30	
100				30	
98				30	
100				30	
98				30	
100				40	
100				50	
100				50	
100				40	
100				50	
100				50	



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

8.1 m to 14.8 m - Lugeon Packer Test #1 - k = 3E-07 m/s

15.7 m to 22.1 m - Lugeon Packer Test #2 - k = 2E-06 m/s

21.8 m to 30.2 m - Lugeon Packer Test #3 - k = 3E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-11

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

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Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.	**Drillhole No.:** SC15-191	**Page:** 1 of 1
Location: Process Water Storage Pond	Drill Type: Sandvik 710	Date Started: Mar 15, 15
Coordinates: 507,024 E , 5,179,469 N	Total Length: 30.2m	Date Completed: Mar 15, 15
Coordinate System: NAD83	Elevation: 1768 m	Logged by: GM/JBC
Hole Size HQ3	Inclination: -90	Reviewed by: GM

MATERIAL DESCRIPTION

SANDY SILT WITH CLAY
(0 to 0.5 m)
Sandy SILT with some clay, medium to light brown, trace roots and organics.

WEATHERED BEDROCK
(0.5 to 2.7 m)
Light brown / tan, highly weathered and disintegrated shale, some pebble sized fragments of shaley limestone, heavily infilled with clay, some FeO staining throughout interval.

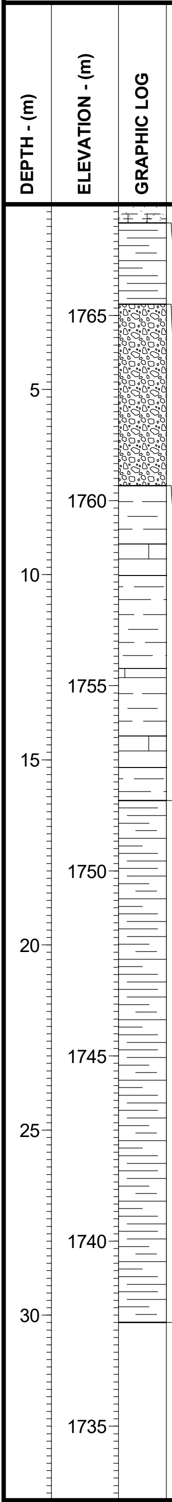
LIMESTONE AND SHALE
(2.7 to 7.6 m)
LIMESTONE and SHALE, fine grained, beige and grey, very weak, highly fractured and rubbleized, highly to moderately weathered with FeO staining along joints and fractures, very thinly to thickly laminated.

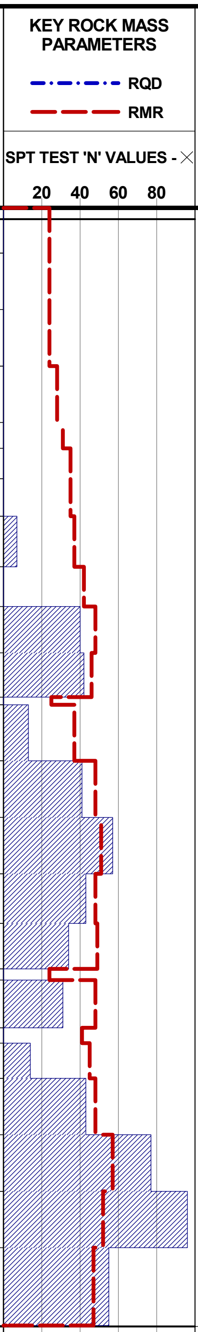
LIMESTONE AND SHALE
(7.6 to 16.1 m)
LIMESTONE and SHALE, fine grained, grey to medium grey, very weak, highly fractured and rubbleized, highly to moderately weathered with FeO staining along joints and fractures, very thinly to thickly laminated, multiple calcite veins, veinlets and stringers cross-cutting bedding over enitre interval.

SHALE
(16.1 to 30.2 m)
SHALE, fine grained, grey, medium strong, moderately fractured, mostly fresh and unweathered, very thin to thickly laminated, multiple calcite veins and veinlets cross-cutting bedding.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	BLOW COUNTS (PER 6")
82			0.5
72			0.5
66		0.21	0.5
39			1
74			1
97			10
89			10
90			25
84			30
100			35
91			35
100			1
98			35
92			40
98			40
100			40
98			35
98			1
86			35
98			35
99			35
100			40
98	UCS-01		40
100			10
96			20





DRILLING NOTES

8.1 m to 14.9 m - Lugeon Packer Test #1 - k = 2E-05 m/s

15.7 m to 22.6 m - Lugeon Packer Test #2 - k = 3E-07 m/s

21.8 m to 30.2 m - Lugeon Packer Test #4 - k = 1E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-12

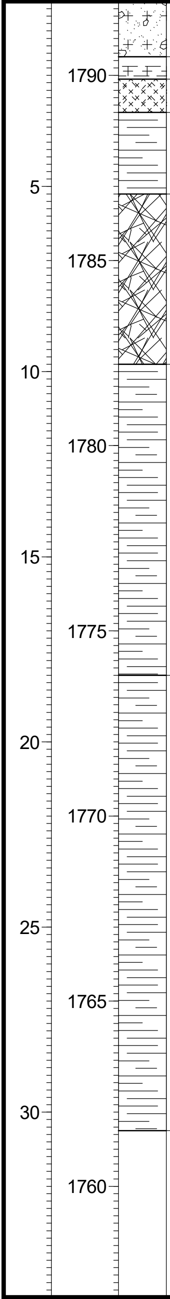
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: West Impoundment Embankment
Coordinates: 504,689 E , 5,178,984 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-192
Drill Type: Sandvik 710
Total Length: 30.5m
Elevation: 1792 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 15, 15
Date Completed: Mar 16, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILTY SAND
(0 to 1.5 m)
Silty SAND, subangular to subrounded, fine to coarse grained, some angular gravel, poorly graded, dry, trace clay.

SILTY CLAY
(1.5 to 2.1 m)
Silty CLAY, medium plasticity, brown to orangey brown, compact, massive, moist; some sand, coarse grained, some gravel, subangular to angular, fine to coarse grained, well graded.

WEATHERED BEDROCK
(2.1 to 3 m)
GRANODIORITE, completely weathered, fine to coarse grained, poorly graded, non plastic, greyish brown, moist to wet.

WEATHERED BEDROCK
(3 to 5.2 m)
SHALE, completely weathered, oxidized, some clay sections.

WEATHERED BEDROCK
(5.2 to 9.8 m)
SHALE, fine grained, medium grey, weak to medium strong, highly fractured and rubbleized in sections, moderately weathered with some FeO staining and some clayey gouge infilling along joints, very thinly laminated and bedded.

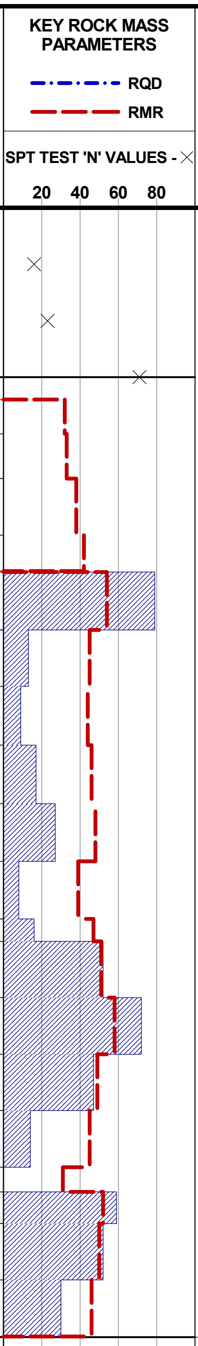
SHALE
(9.8 to 18.2 m)
SHALE, fine grained, grey to medium grey, medium strong, moderately fractured with some minor rubbleized sections (less than 10 cm), slightly weathered to fresh and unweathered,some clayey gouge infilling along joints, very thinly laminated and bedded.

SHALE
(18.2 to 30.5 m)
SHALE, fine grained, medium grey and light grey, medium strong, moderately to highly fractured, fresh to slightly weathered, very thinly to thickly laminated and very thinly bedded, calcite veins and veinlets throughout interval, minor FeO staining along some fractures.

End of Drillhole: 30.5 m

SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6")	SPT 'N' VALUE
SPT01	75		6/9/7	16
SPT02	71		9/10/13	23
SPT03	51		2/31/40	71

RUN RECOVERY (%)	UCS
68	25
86	25
84	25
90	35
100	40
102	40
98	40
95	40
100	50
98	40
100	40
100	40
100	40
100	40
100	40
75	1
100	40
98	40
100	40



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

9.6 m to 19.8 m - Lugeon Packer Test #1 - k = 4E-07 m/s

20.6 to 30.5 m - Lugeon Packer Test #2 - k = 2E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-13

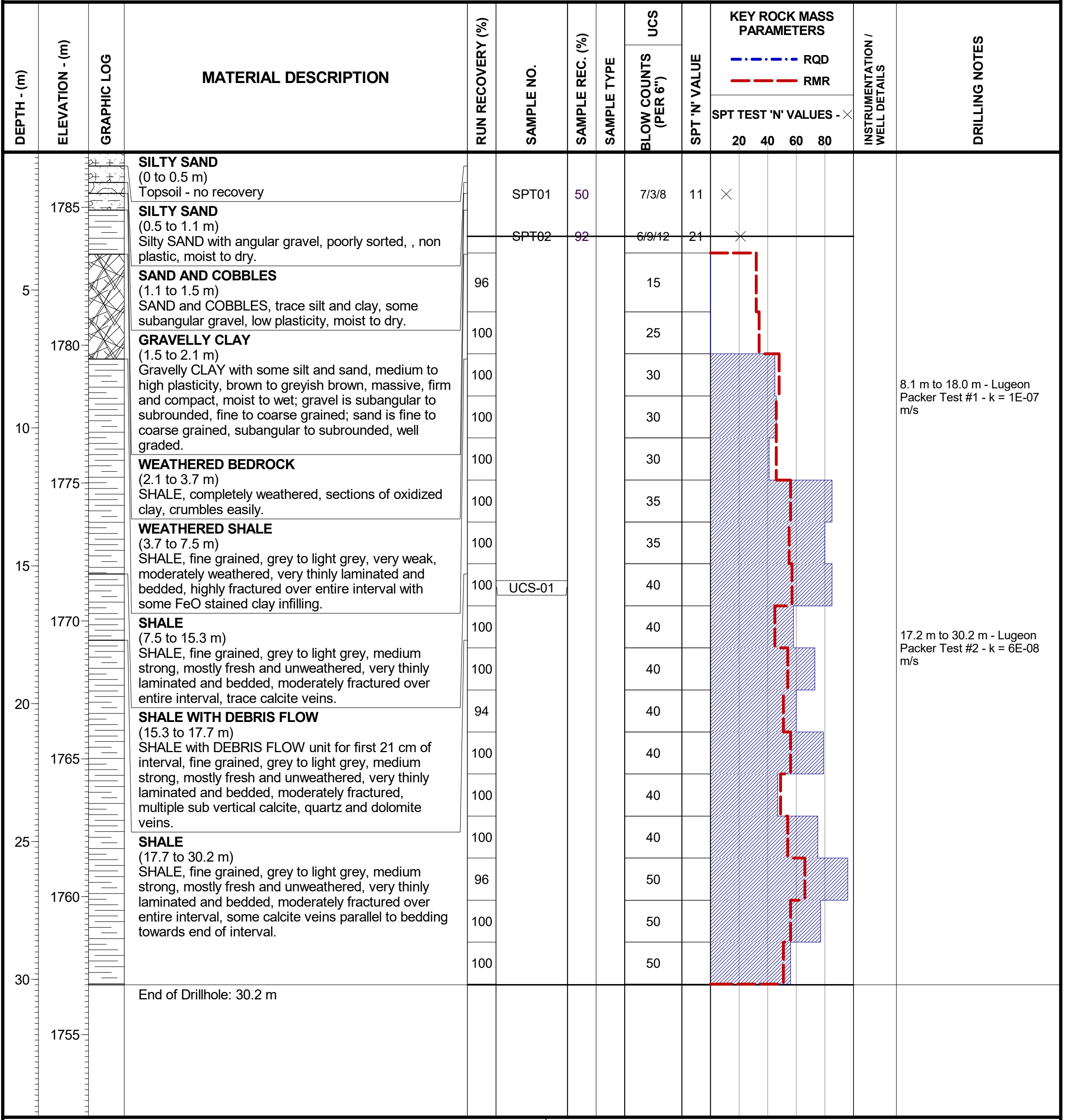
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: West Impoundment Embankment
Coordinates: 504,857 E , 5,178,786 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-193
Drill Type: Sandvik 710
Total Length: 30.2m
Elevation: 1787 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 16, 15
Date Completed: Mar 17, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILTY SAND
(0 to 0.5 m)
Topsoil - no recovery

SILTY SAND
(0.5 to 1.1 m)
Silty SAND with angular gravel, poorly sorted, , non plastic, moist to dry.

SAND AND COBBLES
(1.1 to 1.5 m)
SAND and COBBLES, trace silt and clay, some subangular gravel, low plasticity, moist to dry.

GRAVELLY CLAY
(1.5 to 2.1 m)
Gravelly CLAY with some silt and sand, medium to high plasticity, brown to greyish brown, massive, firm and compact, moist to wet; gravel is subangular to subrounded, fine to coarse grained; sand is fine to coarse grained, subangular to subrounded, well graded.

WEATHERED BEDROCK
(2.1 to 3.7 m)
SHALE, completely weathered, sections of oxidized clay, crumbles easily.

WEATHERED SHALE
(3.7 to 7.5 m)
SHALE, fine grained, grey to light grey, very weak, moderately weathered, very thinly laminated and bedded, highly fractured over entire interval with some FeO stained clay infilling.

SHALE
(7.5 to 15.3 m)
SHALE, fine grained, grey to light grey, medium strong, mostly fresh and unweathered, very thinly laminated and bedded, moderately fractured over entire interval, trace calcite veins.

SHALE WITH DEBRIS FLOW
(15.3 to 17.7 m)
SHALE with DEBRIS FLOW unit for first 21 cm of interval, fine grained, grey to light grey, medium strong, mostly fresh and unweathered, very thinly laminated and bedded, moderately fractured, multiple sub vertical calcite, quartz and dolomite veins.

SHALE
(17.7 to 30.2 m)
SHALE, fine grained, grey to light grey, medium strong, mostly fresh and unweathered, very thinly laminated and bedded, moderately fractured over entire interval, some calcite veins parallel to bedding towards end of interval.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6") / UCS	SPT 'N' VALUE
	SPT01	50		7/3/8	11
	~~SPT02~~	~~92~~		~~6/9/12~~	~~21~~
96				15	
100				25	
100				30	
100				30	
100				30	
100				35	
100				35	
100	UCS-01			40	
100				40	
100				40	
94				40	
100				40	
100				40	
100				40	
96				50	
100				50	
100				50	

DRILLING NOTES

8.1 m to 18.0 m - Lugeon Packer Test #1 - k = 1E-07 m/s

17.2 m to 30.2 m - Lugeon Packer Test #2 - k = 6E-08 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-14

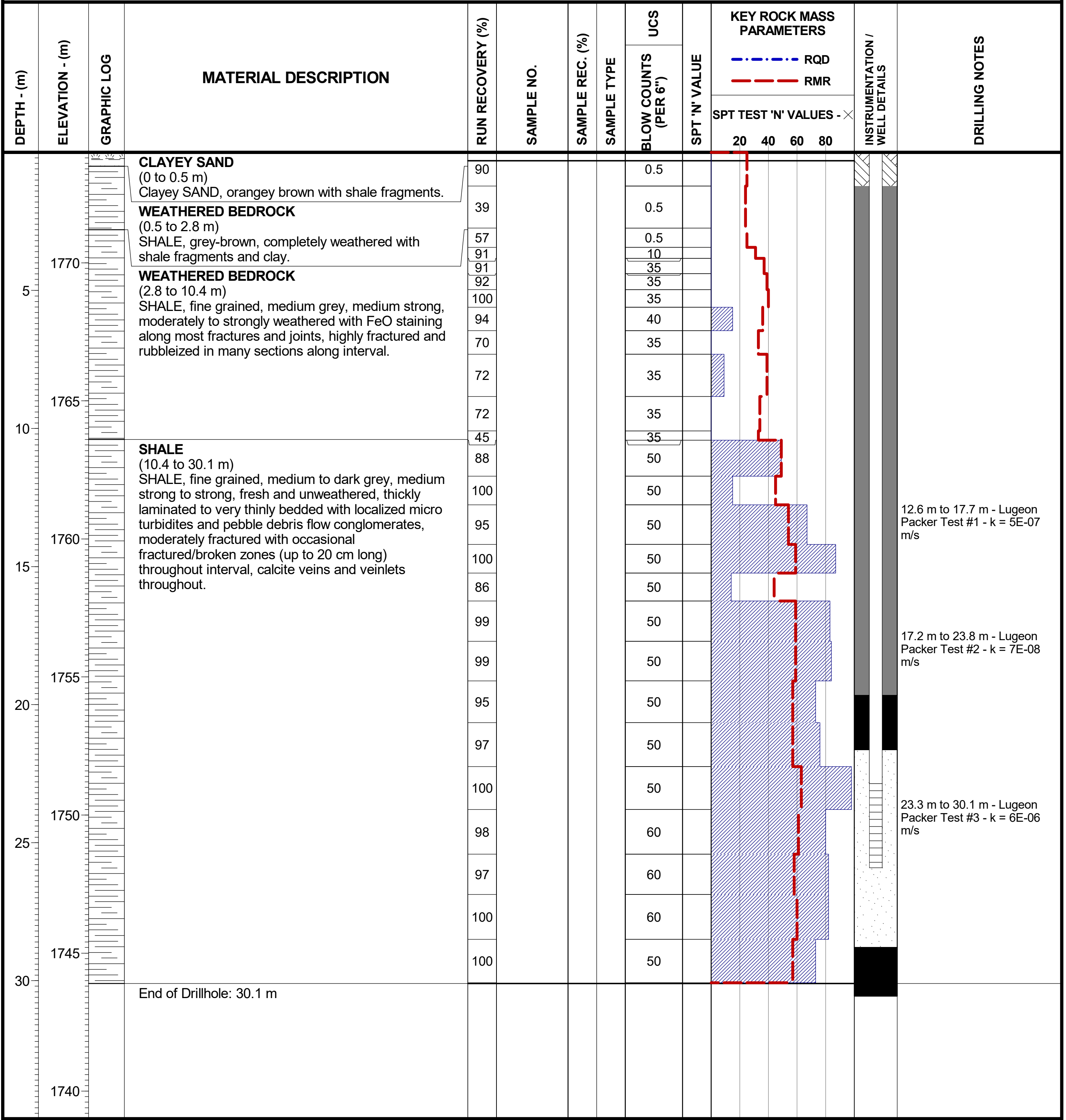
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Central Impoundment Embankment
Coordinates: 506,024 E , 5,179,849 N
Coordinate System: NAD83
Hole Size PQ3

Drillhole No.: SC15-194
Drill Type: Sandvik 710
Total Length: 30.1m
Elevation: 1774 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 17, 15
Date Completed: Mar 18, 15
Logged by: GM/JBC
Reviewed by: GM



CLAYEY SAND
(0 to 0.5 m)
Clayey SAND, orangey brown with shale fragments.

WEATHERED BEDROCK
(0.5 to 2.8 m)
SHALE, grey-brown, completely weathered with shale fragments and clay.

WEATHERED BEDROCK
(2.8 to 10.4 m)
SHALE, fine grained, medium grey, medium strong, moderately to strongly weathered with FeO staining along most fractures and joints, highly fractured and rubbleized in many sections along interval.

SHALE
(10.4 to 30.1 m)
SHALE, fine grained, medium to dark grey, medium strong to strong, fresh and unweathered, thickly laminated to very thinly bedded with localized micro turbidites and pebble debris flow conglomerates, moderately fractured with occasional fractured/broken zones (up to 20 cm long) throughout interval, calcite veins and veinlets throughout.

End of Drillhole: 30.1 m

RUN RECOVERY (%)	UCS
90	0.5
39	0.5
57	0.5
91	10
91	35
92	35
100	35
94	40
70	35
72	35
72	35
45	35
88	50
100	50
95	50
100	50
86	50
99	50
99	50
95	50
97	50
100	50
98	60
97	60
100	60
100	50

12.6 m to 17.7 m - Lugeon Packer Test #1 - k = 5E-07 m/s

17.2 m to 23.8 m - Lugeon Packer Test #2 - k = 7E-08 m/s

23.3 m to 30.1 m - Lugeon Packer Test #3 - k = 6E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-15

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: East Impoundment Embankment
Coordinates: 507,728 E , 5,179,502 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-195
Drill Type: Sandvik 710
Total Length: 30.1m
Elevation: 1736 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 18, 15
Date Completed: Mar 19, 15
Logged by: GM/JBC
Reviewed by: GM

MATERIAL DESCRIPTION

TOPSOIL
(0 to 0.2 m)
No recovery.

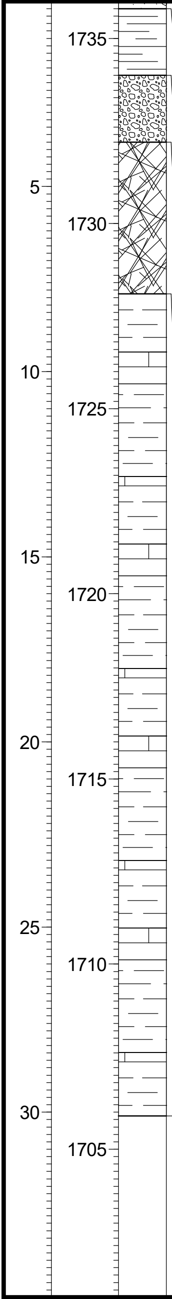
WEATHERED BEDROCK
(0.2 to 2 m)
SHALE, completely weathered, brown-grey silty clay with shale fragments, some relict bedding,

SHALE
(2 to 3.8 m)
SHALE, highly fractured, mainly rubble with angular fragments up to 4 cm in diameter.

SHALE
(3.8 to 7.9 m)
SHALE, fine grained, grey to light grey, weak becoming medium strong as rock becomes more intact, highly to moderately fractured, thinly laminated and very thinly bedded with interbedded very thin to thin limestone beds every 1 - 2 m, calcite veins, veinlets and stringers throughout.

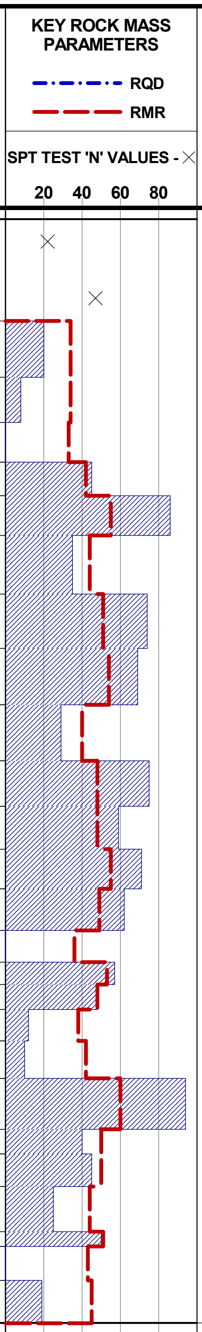
SHALE
(7.9 to 30.1 m)
SHALE, fine grained, grey to light grey, medium strong, moderately fractured, thinly laminated and very thinly bedded with interbedded very thin to thin limestone beds every 1 - 2 m, intermittent zones of gouge and rubble over entire interval, calcite veins, veinlets and stringers throughout.

End of Drillhole: 30.1 m



SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6")	SPT 'N' VALUE
SPT01	75		9/11/11	22
SPT02	75		11/18/29	47

RUN RECOVERY (%)	UCS
92	5
90	10
94	10
100	20
102	40
88	40
100	40
90	40
90	30
100	30
95	40
94	40
100	40
68	35
92	40
84	35
66	35
79	35
100	35
82	35
96	35
94	35
101	35
98	35
65	35



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

9.6 m to 19.5 m - Lugeon Packer Test #1 - k = 5E-06 m/s

18.7 m to 30.1 m - Lugeon Packer Test #2 - k = 1E-08 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

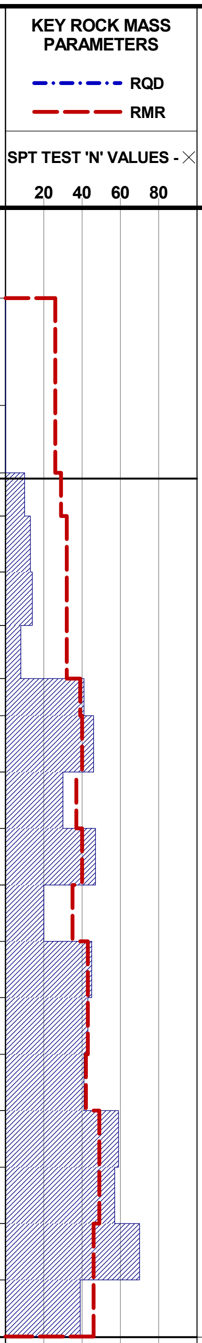
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: East Impoundment Embankment
Coordinates: 507,619 E , 5,179,697 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-196
Drill Type: Sandvik 710
Total Length: 30.5m
Elevation: 1751 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 19, 15
Date Completed: Mar 20, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
	1750		**TOPSOIL** (0 to 0.3 m) No recovery.									
			CLAYEY SAND WITH GRAVEL (0.3 to 0.6 m) Clayey SAND with angular, poorly sorted gravel, reddish brown, medium plasticity, moist to dry.	78				0.5				
5	1745		**GRAVELLY SAND** (0.6 to 1.5 m) SAND with some gravel, dry. Relict texture may indicate completely weathered bedrock material.	77				0.5				
			WEATHERED BEDROCK (1.5 to 7.2 m) Completely weathered bedrock, orangey brown to greyish brown, clay rich, highly oxidized, dense, moist; protolith most likely granodiorite, weathered shale and granodiorite clasts throughout.	100				1				
				89				1				
10	1740		**DEBRIS FLOW CONGLOMERATE** (7.2 to 30.5 m) Very poorly sorted, clast supported, heterolithic DEBRIS FLOW CONGLOMERATE, fine grained, grey with orangey brown FeO staining throughout, very weak, highly weathered, highly fractured becoming more competent by end of hole, massive.	90				1				
				61				10				
				100				20				
15				100				20				13.6 m to 22.9 m - Lugeon Packer Test #1 - k = 3E-07 m/s
	1735			100				15				
				100				20				
				98				15				
20	1730			100				25				
				99				25				22.1 m to 30.5 m - Lugeon Packer Test #2 - k - 4E-08 m/s
				100				25				
25				98				30				
	1725			100				30				
				98				30				
30				100				30				
	1720		End of Drillhole: 30.5 m									



GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-17

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Appendix: A2

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

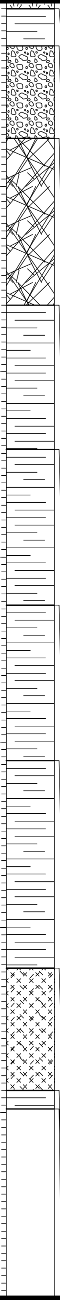
Contractor: Ruen Drilling Inc.
Location: Central Impoundment Embankment
Coordinates: 506,194 E , 5,179,619 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-197
Drill Type: Sandvik 710
Total Length: 29.9m
Elevation: 1775 m
Inclination: -90

Page: 1 of 2
Date Started: Mar 20, 15
Date Completed: Mar 21, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)
5	1770
10	1765
15	1760
20	1755
25	1750
30	1745

GRAPHIC LOG



MATERIAL DESCRIPTION

TOPSOIL
(0 to 0.2 m)
Brownish grey silty SAND.

WEATHERED BEDROCK
(0.2 to 1.2 m)
SHALE, fine grained, grey to light grey, fractured and microfractured, very weak, highly weathered with some FeO infilling along joints, some rubbleized material at end of interval.

WEATHERED SHALE
(1.2 to 3.7 m)
SHALE, fine grained, grey, highly fractured and rubbleized, very weak, highly to moderately weathered with some FeO infilling along joints, some rubbleized material at end of interval, intact rock is very thinly to thickly laminated.

WEATHERED SHALE
(3.7 to 8.2 m)
SHALE, fine grained, grey, highly fractured and rubbleized, very weak to weak, moderately weathered with some FeO infilling along joints, some rubbleized material at end of interval, intact rock is very thinly to thickly laminated, some local shearing parallel to bedding.

SHALE
(8.2 to 12.1 m)
SHALE, fine grained, grey, moderately fractured, medium strong, moderately weathered with some minor rubble and clay infilling, very thickly to thinly laminated, calcite veins and veinlets throughout.

SHALE
(12.1 to 16.3 m)
SHALE, fine grained, grey to white, highly to moderately fractured, medium strong, moderately weathered with some rubbleized zones and minor gouge, very thickly to thinly laminated, thick quartz-dolomite vein with shale clasts for majority of this interval.

SHALE
(16.3 to 20.5 m)
SHALE, fine grained, grey, highly fractured with rubbleized zones throughout interval, medium strong, moderately weathered to unweathered, intact rock is very thinly to thickly laminated. some local shearing parallel to bedding, calcite veins and veinlets throughout.

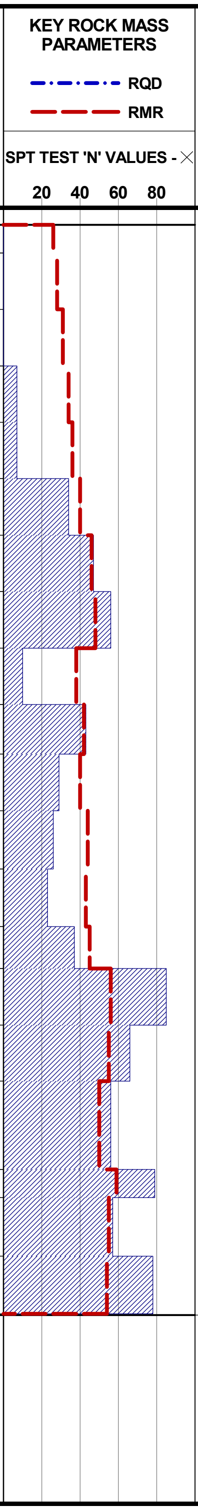
SHALE
(20.5 to 26.1 m)
SHALE, fine grained, grey, moderately fractured, medium strong, moderately weathered with some minor rubble and clay infilling, very thickly to thinly laminated, calcite veins and veinlets throughout, some dolomite-quartz veins with depth.

GRANODIORITE
(26.1 to 29.4 m)
GRANODIORITE, fine to coarse grained, inequigranular, light grey to grey with white phenocrysts, strong, fresh and unweathered with some hematite and calcite infilling along joints and fractures, massive.

DEBRIS FLOW CONGLOMERATE

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
100				1	
93				1	
94				5	
95				15	
94				15	
95				15	
100				40	
99				40	
66				40	
100				40	
98				40	
95				40	
96	UCS-02			35	
100				35	
100				50	
100	UCS-01			50	
100				50	
98				60	
98				60	
100				50	

KEY ROCK MASS PARAMETERS



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

9.6 m to 19.4 m - Lugeon Packer Test #1 - k = 4E-06 m/s

18.7 m to 29.9 m - Lugeon Packer Test #2 - k = 1E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-18

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: Central Impoundment Embankment
Coordinates: 506,194 E , 5,179,619 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-197
Drill Type: Sandvik 710
Total Length: 29.9m
Elevation: 1775 m
Inclination: -90

Page: 2 of 2
Date Started: Mar 20, 15
Date Completed: Mar 21, 15
Logged by: GM/JBC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE	KEY ROCK MASS PARAMETERS RQD RMR SPT TEST 'N' VALUES - × 20 40 60 80	INSTRUMENTATION / WELL DETAILS	DRILLING NOTES
			(29.4 to 29.9 m) DEBRIS FLOW CONGLOMERATE, heterolithic, clast supported with subangular pebble-cobble clasts, fine grained, medium grey, highly to moderately fractured, medium strong, unweathered with some rubbleized zones and minor gouge at the start of interval, massive, calcite veinlets throughout. End of Drillhole: 29.9 m									
40	1735											
45	1730											
50	1725											
55	1720											
60	1715											
65	1710											

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-18

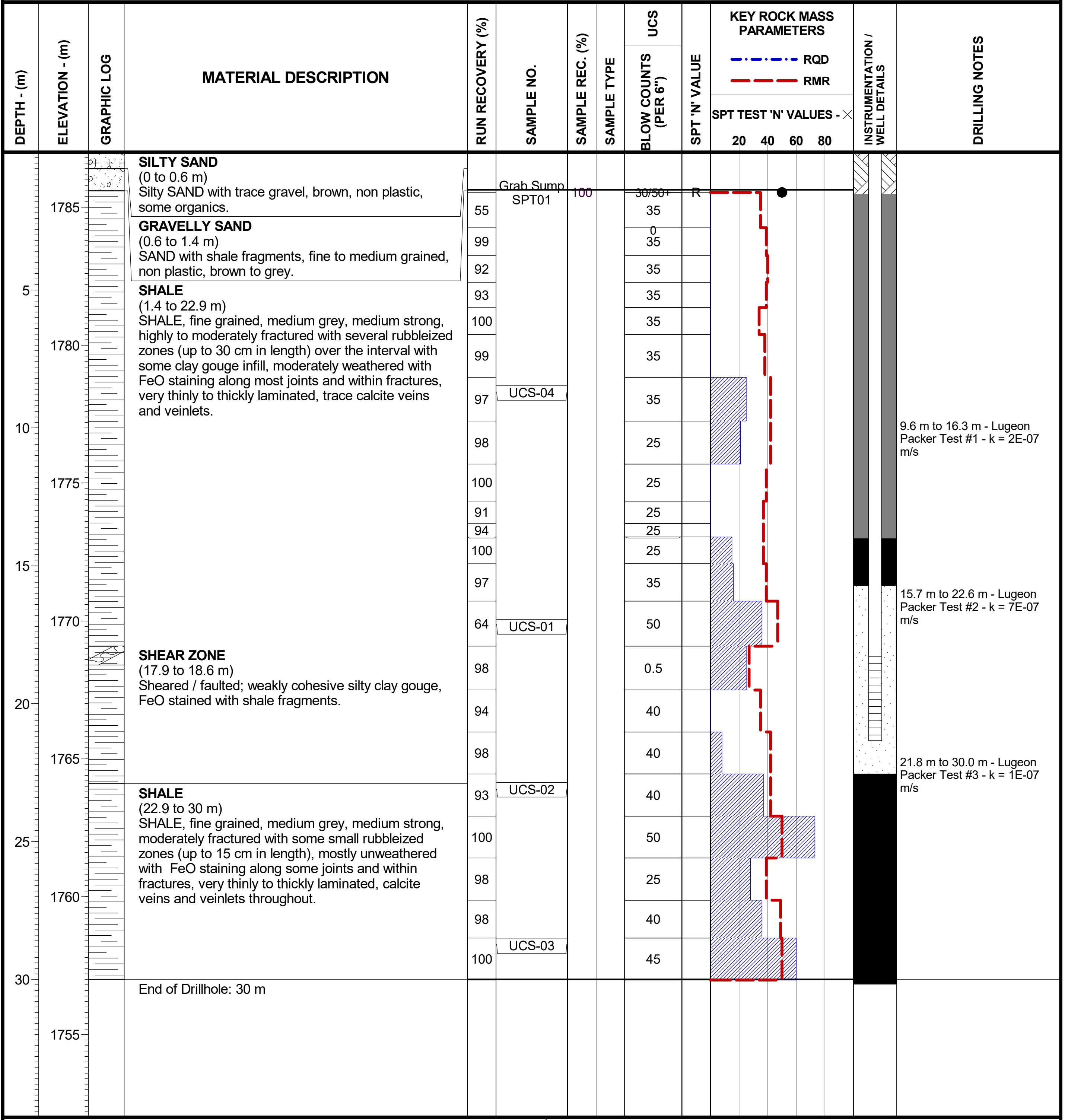
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Ruen Drilling Inc.
Location: SAG Mill
Coordinates: 506,592 E , 5,179,745 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-198
Drill Type: Sandvik 710
Total Length: 30.0m
Elevation: 1787 m
Inclination: -90

Page: 1 of 1
Date Started: Mar 21, 15
Date Completed: Mar 22, 15
Logged by: GM/JBC
Reviewed by: GM



MATERIAL DESCRIPTION

SILTY SAND
(0 to 0.6 m)
Silty SAND with trace gravel, brown, non plastic, some organics.

GRAVELLY SAND
(0.6 to 1.4 m)
SAND with shale fragments, fine to medium grained, non plastic, brown to grey.

SHALE
(1.4 to 22.9 m)
SHALE, fine grained, medium grey, medium strong, highly to moderately fractured with several rubbleized zones (up to 30 cm in length) over the interval with some clay gouge infill, moderately weathered with FeO staining along most joints and within fractures, very thinly to thickly laminated, trace calcite veins and veinlets.

SHEAR ZONE
(17.9 to 18.6 m)
Sheared / faulted; weakly cohesive silty clay gouge, FeO stained with shale fragments.

SHALE
(22.9 to 30 m)
SHALE, fine grained, medium grey, medium strong, moderately fractured with some small rubbleized zones (up to 15 cm in length), mostly unweathered with FeO staining along some joints and within fractures, very thinly to thickly laminated, calcite veins and veinlets throughout.

End of Drillhole: 30 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
	Grab Sump SPT01	100		30/50+	R
55				35	
99				0 35	
92				35	
93				35	
100				35	
99				35	
97	UCS-04			35	
98				25	
100				25	
91				25	
94				25	
100				25	
97				35	
64	UCS-01			50	
98				0.5	
94				40	
98				40	
93	UCS-02			40	
100				50	
98				25	
98				40	
100	UCS-03			45	

DRILLING NOTES

9.6 m to 16.3 m - Lugeon Packer Test #1 - k = 2E-07 m/s

15.7 m to 22.6 m - Lugeon Packer Test #2 - k = 7E-07 m/s

21.8 m to 30.0 m - Lugeon Packer Test #3 - k = 1E-07 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-19

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

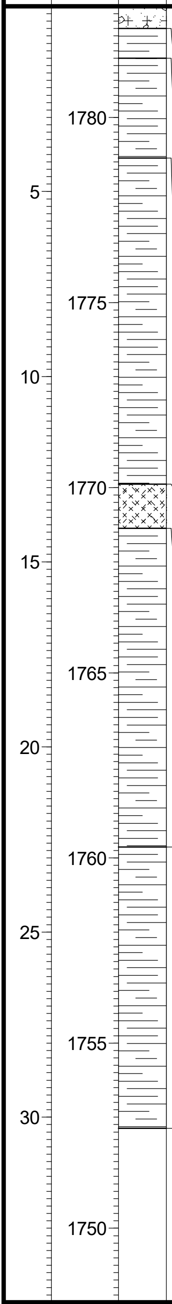
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Process Water Storage Pond
Coordinates: 506,316 E , 5,179,571 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-201
Drill Type: LF 70
Total Length: 30.3m
Elevation: 1783 m
Inclination: -90

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 30, 15
Logged by: JDC
Reviewed by: GM

DEPTH - (m) | **ELEVATION - (m)** | **GRAPHIC LOG**



MATERIAL DESCRIPTION

SILTY SAND
(0 to 0.6 m)
Silty SAND with trace gravel, medium brown, non plastic, some organics and roots.

WEATHERED BEDROCK
(0.6 to 1.4 m)
SHALE, dark grey, highly fractured and rubbleized with coarse silty sand infill.

WEATHERED BEDROCK
(1.4 to 4.1 m)
SHALE, fine grained, very thickly bedded, dark grey, highly fractured with several rubbleized zones over the interval, highly weathered with FeO staining along most joints and within fractures, weak.

DEBRIS FLOW CONGLOMERATE
(4.1 to 12.9 m)
DEBRIS FLOW CONGLOMERATE, fine grained matrix, very thickly bedded, heterolithic, clast supported, dark to medium grey, moderately fractured with some heavily fractured zones, moderately weathered with FeO staining along most joints and within fractures, some calcite infilling along joints, medium strong; microfractures throughout.

GRANODIORITE
(12.9 to 14.1 m)
GRANODIORITE, medium grained, inequigranular, grey to greenish grey, strong, slightly weathered with some FeO staining along joints, massive.

SHALE
(14.1 to 22.7 m)
SHALE, fine grained, very thickly bedded, dark to medium grey, moderately fractured, moderately weathered with FeO staining along joints only and within fractures, some calcite infilling along joints, medium strong; microfractures throughout.

SHALE
(22.7 to 30.3 m)
SHALE, fine grained, thinly bedded, dark grey, moderately fractured, unweathered, some calcite veinlets and infilling along joints, medium strong; trace localized sulphides.

End of Drillhole: 30.3 m

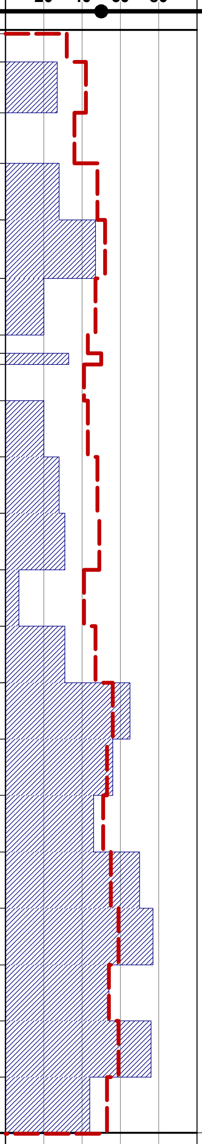
RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
0	1	100		8/50+	R
59				5	
98				25	
62				15	
100				50	
96				60	
100				60	
68				40	
105				60	
100				40	
100				40	
100				40	
100				70	
100				35	
100				40	
100				50	
100				50	
100				50	
100				50	
100				60	
100				60	
100				70	
100				60	

KEY ROCK MASS PARAMETERS

RQD

RMR

SPT TEST 'N' VALUES - ×



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

5.49 m to 12.04 m - Lugeon Packer Test #1 - k = 2E-06 m/s

11.43 m to 24.23 m - Lugeon Packer Test #2 - k = 2E-07 m/s

22.10 m to 30.33 m - Lugeon Packer Test #3 - k = 8E-08 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-20

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

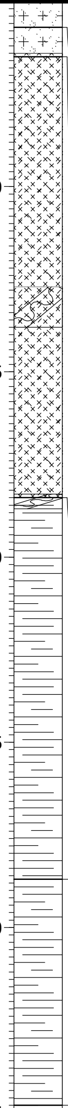
Contractor: Ruen Drilling Inc.
Location: Process Water Storage Pond
Coordinates: 505,959 E , 5,179,446 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-202
Drill Type: LF 70
Total Length: 29.8m
Elevation: 1795 m
Inclination: -90

Page: 1 of 1
Date Started: May 30, 15
Date Completed: May 31, 15
Logged by: JDC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)
5	1790
10	1785
15	1780
20	1775
25	1770
30	1765

GRAPHIC LOG



MATERIAL DESCRIPTION

SILTY SAND
(0 to 0.7 m)
Silty SAND, medium brown, fine to medium grained, trace roots, low plasticity, massive, compact to stiff, moist.

SANDY SILT
(0.7 to 1.5 m)
Sandy SILT, light brown, fine grained, no plasticity, massive, firm, dry.

WEATHERED BEDROCK
(1.4 to 13.4 m)
GRANODIORITE, medium grained, inequigranular, porphyritic, grey to greenish grey, medium strong, slightly to moderately weathered with some FeO staining along joints and fractures, some dissolution weathering towards end of interval, massive.

SHEAR ZONE
(7.7 to 8.8 m)
SHEAR ZONE, moderately fractured rock with silt/clay gouge infilling, FeO staining along fractures.

SHEAR ZONE
(13.3 to 13.7 m)
SHEAR ZONE, highly fractured rock with clay gouge infilling.

SHALE
(13.4 to 23.7 m)
SHALE, fine grained, thinly to thickly bedded, medium grey and tan, heavily fractured with some rubbleized zones, highly weathered with FeO staining throughout rock and along most joints and within fractures, some dissolution weathering in calcite veins, some calcite veinlets and infilling along healed fratures, weak rock.

SHALE
(23.7 to 29.8 m)
SHALE, fine grained, thinly to very thinly bedded, medium grey, moderately fractured, moderately weathered with FeO staining along joints and fractures, some microfractures, medium strong.

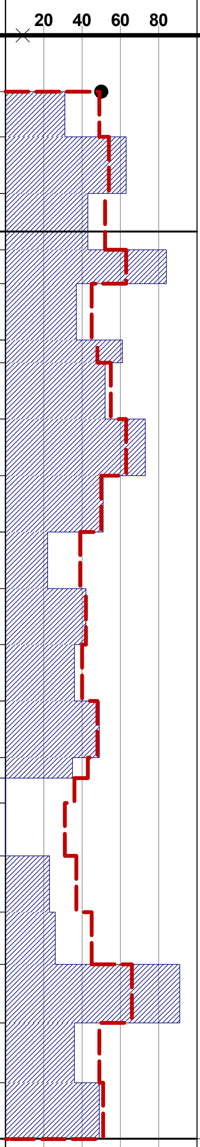
End of Drillhole: 29.8 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
0	1	100		2/3/6	9
	2	100		28/50+	R
84				75	
100				31 75	
100				70	
98				80	
100				60	
98				60	
100				75	
100				100	
100				70	
100				25	
100				30	
100				30	
100				30	
84				30	
98				25	
71				10	
100				40	
96				40	
96				50	
94				35	
100				45	

KEY ROCK MASS PARAMETERS

RQD
RMR

SPT TEST 'N' VALUES - ×



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

2.44 m to 10.36 m - Lugeon Packer Test #1 - k = 2E-03 m/s

6.71 m to 14.94 m - Lugeon Packer Test #2 - k = 2E-05 m/s

14.33 m to 20.73 m - Lugeon Packer Test #3 - k = 5E-08 m/s

20.12 m to 29.81 m - Lugeon Packer Test #4 - k = 3E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-21

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

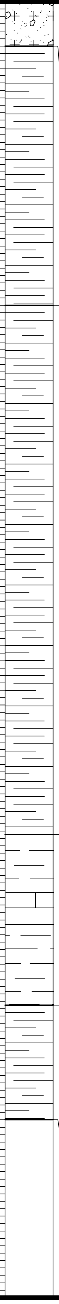
Contractor: Ruen Drilling Inc.
Location: Process Water Pond (Alternate)
Coordinates: 506,469 E , 5,178,408 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-203
Drill Type: LF 70
Total Length: 30.2m
Elevation: 1794 m
Inclination: -90

Page: 1 of 1
Date Started: May 31, 15
Date Completed: Jun 1, 15
Logged by: JDC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6")	SPT 'N' VALUE
		1	85		2/3/2	5

Depth scale (m): 5, 10, 15, 20, 25, 30
Elevation scale (m): 1790, 1785, 1780, 1775, 1770, 1765, 1760



MATERIAL DESCRIPTION

SILTY SAND
(0 to 1.2 m)
Silty SAND, medium brown, fine grained with some fine shale gravel, trace clay, trace roots, low plasticity, massive, loose to compact, moist.

WEATHERED BEDROCK
(1.2 to 8.2 m)
SHALE, fine grained, thinly to very thinly bedded, medium to dark grey, weak, highly weathered, highly jointed and fractured with vertical and subvertical fracturing throughout with some FeO staining along joints, some localized rubble zones, some calcite veins and veinlets, trace dissolution weathering.

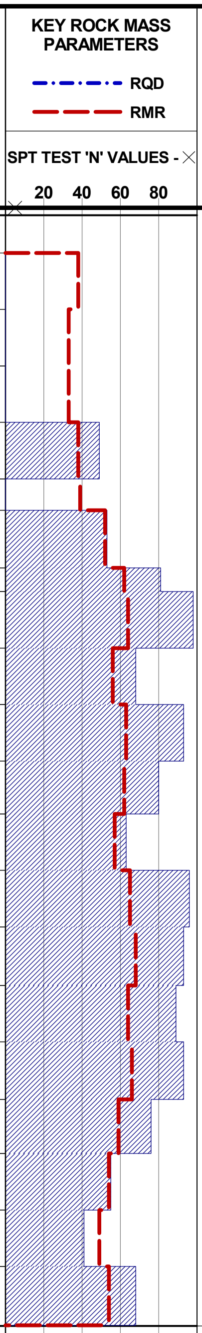
SHALE
(8.2 to 22.5 m)
SHALE, fine grained, thinly bedded, light to medium grey, medium strong, moderately weathered to unweathered, mostly competent with some moderately fractured zones, some FeO staining along joints only, trace calcite veinlets and infilling along joints.

SHALE/LIMESTONE
(22.5 to 27.1 m)
INTERBEDDED SHALE AND LIMESTONE, fine grained, thinly to very thinly bedded, medium to dark grey, strong, mostly fresh and unweathered, some calcite veinlets and infilling along joints, joint sets and conjugate joints oriented subvertically to core axis.

SHALE
(27.1 to 30.2 m)
SHALE, fine grained, thinly to very thinly bedded, dark to medium grey, medium strong, moderately weathered to unweathered, moderately fractured, some FeO staining along joints, some calcite infilling along joints and healed fractures.

End of Drillhole: 30.2 m

RUN RECOVERY (%)	UCS
0	
28	5
100	10
100	15
49	10
95	25
98	50
100	50
100	60
100	60
100	60
98	70
100	50
100	70
96	70
100	70
98	70
100	70
100	60
100	60
96	60



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

8.53 m to 14.94 m - Lugeon Packer Test #1 - k = 6E-07 m/s

14.02 m to 22.52 m - Lugeon Packer Test #2 - k = 2E-09 m/s

21.64 m to 30.18 m - Lugeon Packer Test #3 - k = 6E-08 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-22

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Non Contact Water Reservoir
Coordinates: 507,939 E , 5,178,748 N
Coordinate System: NAD83
Hole Size HQ3

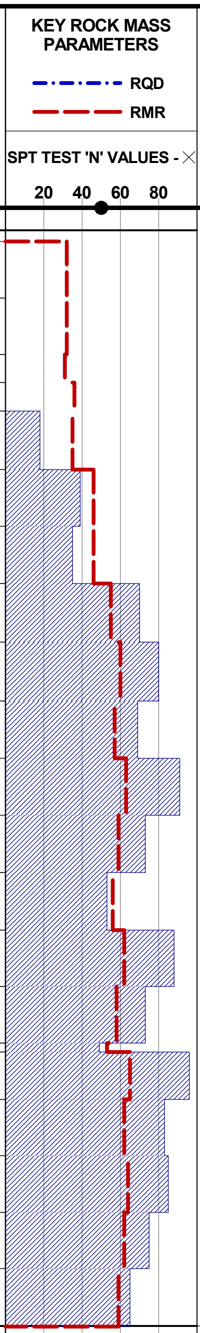
Drillhole No.: SC15-204
Drill Type: LF 70
Total Length: 30.2m
Elevation: 1761 m
Inclination: -90

Page: 1 of 1
Date Started: Jun 1, 15
Date Completed: Jun 2, 15
Logged by: JDC
Reviewed by: GM

DEPTH - (m)	ELEVATION - (m)	MATERIAL DESCRIPTION
		TOPSOIL (0 to 0.1 m) TOPSOIL, dark brown, organics and roots.
	1760	**SILTY SAND** (0.1 to 0.3 m) Silty SAND, dark to medium brown with some FeO staining throughout, trace shale gravel, trace roots, low plasticity, massive, loose, moist.
5	1755	**WEATHERED BEDROCK** (0.3 to 4 m) SHALE, fine grained, very thinly bedded, medium to dark grey, weak, highly weathered, highly fractured, FeO staining throughout rock and along joints, some localized rubble zones, some calcite infilling along joints and fractures.
10	1750	**SHALE** (4 to 5.9 m) SHALE, highly fractured and rubbleized, highly weathered, very weak.
		WEATHERED BEDROCK (5.9 to 8.6 m) SHALE, fine grained, very thinly bedded, medium to dark grey, weak, highly weathered, highly fractured, FeO staining throughout rock and along joints, some localized rubble zones, some calcite infilling along joints and fractures.
15	1745	**SHALE** (8.6 to 30.2 m) SHALE, fine grained, thinly bedded, dark to medium grey, medium strong, mostly unweathered, moderately fractured with some subvertical fracturing, some calcite infilling along joints and poorly healed fractures, some localized stockwork calcite veining near the end of the interval.
20	1740	
25	1735	
30	1730	End of Drillhole: 30.2 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	UCS BLOW COUNTS (PER 6")	SPT 'N' VALUE
35	1	100		2/3/23	R
62				10	
80				10	
59				10	
89				5	
76				20	
100				40	
98				40	
96				50	
96				50	
98				60	
100				70	
98				70	
98				65	
100				70	
100				60	
62				70	
102				70	
100				65	
100				65	
83				60	
82				60	

KEY ROCK MASS PARAMETERS



INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

7.92 m to 13.32 m - Lugeon Packer Test #1 - k = 2E-08 m/s

12.5 m to 22.56 m - Lugeon Packer Test #2 - k = 8E-08 m/s

21.64 m to 30.21 m - Lugeon Packer Test #3 - k = 2E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-23

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Ruen Drilling Inc.
Location: Non Contact Water Reservoir
Coordinates: 507,971 E , 5,178,618 N
Coordinate System: NAD83
Hole Size HQ3

Drillhole No.: SC15-205
Drill Type: LF 70
Total Length: 29.9m
Elevation: 1773 m
Inclination: -90

Page: 1 of 1
Date Started: Jun 3, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GM

MATERIAL DESCRIPTION

TOPSOIL
(0 to 0.1 m)
TOPSOIL, dark brown, organics and roots.

SILTY SAND
(0.1 to 0.7 m)
Silty SAND, medium brown, trace shale gravel, trace roots, low plasticity, massive, loose, moist.

WEATHERED BEDROCK
(0.7 to 8.5 m)
SHALE, fine grained, thinly bedded, medium grey and tan, very weak to weak, highly weathered with FeO staining throughout rock and along joints, highly jointed and fractured with some calcite infilling and veinlets throughout.

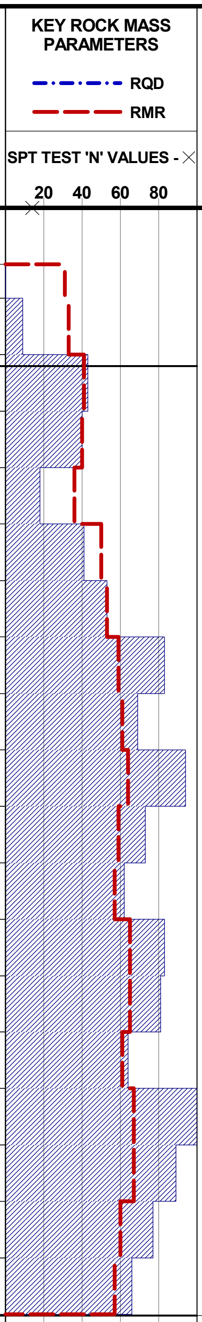
SHALE
(8.5 to 16.7 m)
SHALE, fine grained, very thinly to thinly bedded, medium to dark grey, medium strong, moderately weathered, moderately fractured, some FeO staining along joints until ~25.6 mbgs becoming fresh and unweathered, some calcite infilling along joints and fractures, trace calcite veinlets and infilling cross-cutting bedding, jointing parallel with bedding.

DEBRIS FLOW CONGLOMERATE
(16.7 to 26.5 m)
DEBRIS FLOW CONGLOMERATE, fine grained matrix with shale clasts up to 30 mm, medium to dark grey, medium strong, mostly fresh and unweathered with localized dissolution weathering of calcite infill at beginning of interval, some deformed bedding throughout interval, occasional localized minor (< 5 cm) shear zones, trace calcite veins and veinlets throughout.

SHALE
(26.5 to 29.9 m)
SHALE, fine grained, very thickly to thinly bedded, medium grey, medium strong, moderately fractured, fresh and unweathered, trace calcite veinlets and infilling along healed fractures and joints.

End of Drillhole: 29.9 m

RUN RECOVERY (%)	SAMPLE NO.	SAMPLE REC. (%)	SAMPLE TYPE	BLOW COUNTS (PER 6") / UCS	SPT 'N' VALUE
0	1	100		1/4/10	14
79				5	
100				10	
100				20	
100				20	
100				15	
100				40	
100				50	
100				60	
100				60	
100				65	
100				55	
100				40	
100				60	
100				60	
100				50	
100				70	
100				70	
100				60	
100				50	



DEPTH - (m): 5, 10, 15, 20, 25, 30
ELEVATION - (m): 1770, 1765, 1760, 1755, 1750, 1745, 1740

INSTRUMENTATION / WELL DETAILS

DRILLING NOTES

4.57 m to 11.58 m - Lugeon Packer Test #1 - k = 5E-07 m/s

10.67 m to 22.25 m - Lugeon Packer Test #2 - k = 2E-07 m/s

19.81 m to 29.87 m - Lugeon Packer Test #3 - k = 9E-06 m/s

GENERAL REMARKS:

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-00460/03	1	0

FIGURE A2-24

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BLACK BUTTE COPPER PROJECT.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, GEOTECHNICAL DRILLHOLE LOG, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

APPENDIX A3

RMR LOGGING SHEETS

(Pages A3-1 to A3-43)

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-180

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.8	0.55	1.80												Brown, sandy silt with trace clay and some organics. Sand fraction is predominantly coarse (50+%), no medium grained sand visible, trace to some fine grained sand. Ground is frozen. Logged in sump.	OB													GIM							
1.8	0.55	6.20	1.89	4.40	0.94	70	0.00	0	max	5	5	R2	Med Grey	Very fine grained,		Shale, extremely weathered and rubbly, several zones of decomposed or ground core presents similar to clay. Intact rock fragments can be cipped easily with the point of a hammer.	Ynl	0	0	3	2	1	6	15			cc	ox		GIM	1.5	3.0	5.0	6.0	15	**31**	**31**
6.2	1.89	8.20	2.50	2.00	0.62	100	0.00	0	20	30	2.5	R1	Med Grey	Very fine grained.	Laminated with calcite veining at ~40-50° TCA.	Shale, very weathered with gouge zone at upper 10-15 cm of run. Rubble between joints, could scraped or peel with knife.	Ynl	0	0	1	2	1	4	15			cc	ox		GIM	1.3	3.0	5.4	4.0	15	**29**	**29**
8.2	2.50	9.90	3.02	1.70	0.53	100	0.00	0	20	25	20	R2	Med Grey	Very fine grained.	Laminated with carbonate veing 1-3 mm thick at ~40-50° TCA.	Shale, moderately weathered with carbonate veins 1-3 mm thick every 0.5-2 cm.	Ynl	0	4	1	2	3	10	15			cc	ox		GIM	3.0	3.0	5.3	10.0	15	**36**	**36**
9.9	3.02	12.30	3.75	2.40	0.70	96	0.00	0	14	47	50	R4	Med Grey	Very fine grained.	Laminated with carbonate veing 1-3 mm thick at ~40-50° TCA.	Shale, moderately weathered with carbonate veins 1-3 mm thick every 0.5-2 cm. 2-3 blows with a hammer to chip.	Ynl	0	1	1	2	4	8	15			cc	ox		GIM	5.7	3.0	5.6	8.0	15	**37**	**37**
12.3	3.75	13.60	4.15	1.30	0.58	100	0.00	0	9	58	40	R3	Med Grey	Very fine grained.	Laminated with carbonate veing 1-3 mm thick at ~40-50° TCA.	Shale, moderately weathered with carbonate veins 1-3 mm thick every 0.5-2 cm. 2-3 blows with a hammer to fracture.	Ynl	0	1	1	2	4	8	15			cc	ox		GIM	4.8	3.0	5.8	8.0	15	**37**	**37**
13.6	4.15	16.70	5.09	3.10	0.60	64	0.00	0	7	75	50	R4	Med Grey	Very fine grained.	Carbonate veinlets cross cut 5-10 mm thick carbonate veins at 40-50° TCA	Shale. Several blows to fracture sample with hammer. Carbonate infilling is beige/pale brown and "hard" infilling. Trace oxide on fracture surfaces.	Ynl	0	4	1	4	5	14	15			carb	ox		GIM	5.7	3.0	6.0	14.0	15	**44**	**44**
16.7	5.09	19.10	5.82	2.40	0.84	100	0.00	0	12	65	35	R3	Med Grey	Very fine grained.	Carbonate veinlets cross cut 5-10 mm thick carbonate veins at 40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Carbonate infilling is beige/pale brown and "hard" infilling. Trace oxide on fracture surfaces. Rubbly/clayey infilling in fractures near bottom of run, 1-6 mm thick.	Ynl	0	1	1	0	5	7	15			carb	ox		GIM	4.4	3.0	5.9	7.0	15	**35**	**35**
19.1	5.82	21.20	6.46	2.10	0.50	78	0.00	0	12	38	50	R4	Med Grey	Very fine grained.	Carbonate veinlets cross cut 5-10 mm thick carbonate veins at 40-50° TCA	Shale. Several firm blows to fracture sample with hammer. Carbonate infilling is beige/pale brown and "hard" infilling. Trace oxide on fracture surfaces. Rubbly/clayey infilling in fractures near top of run, 1-2 mm thick.	Ynl	0	1	1	2	5	9	15			carb	ox		GIM	5.7	3.0	5.5	9.0	15	**38**	**38**
21.2	6.46	24.00	7.31	2.80	0.84	98	0.15	18	9	84	35	R3	Med Grey	Very fine grained.	Carbonate veinlets cross cut 5-10 mm thick carbonate veins at 40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Carbonate infilling is beige/pale brown and "hard" infilling. Trace oxide on fracture surfaces. 5 cm rubble zone at top of run.	Ynl	0	4	3	4	5	16	15			carb	ox		GIM	4.4	5.1	6.1	16.0	15	**47**	**47**
24.0	7.31	28.60	8.72	4.60	1.34	96	0.29	21	18	71	40	R3	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Carbonate present as alteration halos around sealed fractures, and as vein filling. Trace oxide on fracture surfaces. Calcite veinlets present. Rubbly calcite vein ~1-2 mm thick 20 cm from bottom of run.	Ynl	0	2	3	2	5	12	15			cc	ox		GIM	4.8	5.5	6.0	12.0	15	**43**	**43**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA							RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
28.6	8.72	33.40	10.18	4.80	1.44	98	0.20	14	17	80	40	R3	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Carbonate present as alteration halos around sealed fractures, and as vein filling. Trace oxide on fracture surfaces. Calcite veinlets present. 1 mm calcite veins appear periodically throughout run.	Ynl	0	1	3	2	5	11	15			cc	ox		GIM	4.8	4.6	6.1	11.0	15	**41**	**41**
33.4	10.18	36.30	11.06	2.90	0.94	100	0.00	0	13	67	50	R4	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Several firm blows to fracture sample with hammer. Carbonate present as alteration halos around sealed fractures, and as vein filling 1-7 mm thick. Trace oxide on fracture surfaces. Calcite veinlets and fracture coating present. 1 mm calcite veins appear periodically throughout run.	Ynl	0	1	3	2	5	11	15			cc	ox		GIM	5.7	3.0	5.9	11.0	15	**41**	**41**
36.3	11.06	40.20	12.25	3.90	1.10	93	0.00	0	16	65	35	R3	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Carbonate present as alteration halos around sealed fractures, and as vein filling. Trace oxide on fracture surfaces. Calcite veinlets present. 1 mm calcite veins appear periodically throughout run.	Ynl	0	4	2	2	5	13	15			cc	ox		GIM	4.4	3.0	5.9	13.0	15	**41**	**41**
40.2	12.25	43.60	13.29	3.40	1.00	96	0.14	14	16	59	35	R3	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Several firm blows to fracture sample with hammer. Beige carbonate present as alteration halos and veins 1-5 mm thick. Trace oxide on fracture surfaces. Calcite veinlets present. 1 mm calcite veins appear periodically throughout run.	Ynl	0	1	3	2	5	11	15			Rub	cc		GIM	4.4	4.6	5.8	11.0	15	**41**	**41**
43.6	13.29	46.40	14.14	2.80	0.90	100	0.00	0	15	56	50	R4	Med Grey	Very fine grained.	Calcite veinlets throughout run, Carbonate veins and alteration halos ~40-50° TCA	Shale. Single firm blow to fracture sample with hammer. Beige carbonate present as alteration halos and veins 1-5 mm thick. Trace oxide on fracture surfaces. Calcite veinlets present. 1 mm calcite veins appear periodically throughout run. Some rubbly infilling on fractures in upper 30 cm of run, 1-2 mm thick.	Ynl	0	4	1	2	5	12	15			cc	ox		GIM	5.7	3.0	5.8	12.0	15	**41**	**41**
46.40	14.14	51.60	15.73	5.20	1.56	98	0.20	13	19	78	40	R3	Med and Light grey	Very fine grained.	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present.	Ynl	0	4	1	2	5	12	15			cc			GIM	4.8	4.5	6.1	12.0	15	**42**	**42**
51.6	15.73	54.00	16.46	2.40	0.70	96	0.20	27	8	78	40	R3	Med and Light grey	Very fine grained.	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present.	Ynl	0	4	1	2	5	12	15			cc			GIM	4.8	6.4	6.1	12.0	15	**44**	**44**
54.0	16.46	59.00	17.98	5.00	1.52	100	0.56	37	12	117	40	R3	Med and Light grey	Very fine grained.	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present.	Ynl	0	1	1	2	6	10	15			cc			GIM	4.8	7.8	6.6	10.0	15	**44**	**44**
59.0	17.98	64.00	19.51	5.00	1.52	100	0.30	20	15	95	50	R4	Med and Light grey	Very fine grained.	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present.	Ynl	0	1	1	2	6	10	15						GIM	5.7	5.4	6.3	10.0	15	**42**	**42**
64.0	19.51	69.00	21.03	5.00	1.52	100	1.40	92	8	169	50	R4	Med grey to grey	Fine grained	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present. Fresh	Ynl	0	4	3	2	6	15	15			cly	cc		JBC	5.7	18.3	7.2	15.0	15	**61**	**61**
69.0	21.03	74.00	22.55	5.00	1.52	100	1.45	95	6	217	50	R4	Med grey to grey	Fine grained	Bedded at ~65-70° TCA, medium and light grey bands 2-5 mm thick.	Bedded shale. Some calcite veinlets present. Fresh	Ynl	0	4	1	2	6	13	15			cly			JBC	5.7	19.1	7.8	13.0	15	**61**	**61**
74.0	22.55	79.00	24.08	5.00	1.52	100	1.15	75	15	95	40	R3	Med grey to grey	Fine grained	Discontinuities occurring along bedding (40 to 50° TCA),	Bedded shale, medium strong to strong, slightly weathered to fresh, clay rich infilling, some rubble towards the end (~2 cm thick)	Ynl	0	1	3	0	5	9	15			cly	Rub		JBC	4.8	14.8	6.3	9.0	15	**50**	**50**
79.0	24.08	84.00	25.60	5.00	1.48	97	1.35	89	6	211	50	R4	Med grey to grey	Fine grained	Bedded at ~20 to 40 ° TCA, grey bands up to 5 mm	Medium strong to strong, slightly weathered to fresh, rubbly clay rich zone (~1 cm thick) at 81 ft.	Ynl	0	1	3	2	6	12	15			cly	Rub		JBC	5.7	17.6	7.7	12.0	15	**58**	**58**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
84.0	25.60	89.00	27.13	5.00	1.52	100	1.20	79	10	138	50	R4	Med grey to grey	Fine grained	Bedded at ~20 to 40 ° TCA, grey bands up to 5 mm	Medium strong, fresh to slightly weathered, trace calcite veinlets, subvertical discontinuities along bedding	Ynl	0	1	3	2	6	12	15			cly			JBC	5.7	15.5	6.8	12.0	15	**55**	**55**
89.0	27.13	94.00	28.65	5.00	1.52	100	1.20	79	8	169	50	R4	Med grey to grey	Fine grained	Bedded at ~10 to 30 ° TCA, grey bands up to 5 mm	Medium strong, fresh to slightly weathered, some calcite veinlets, subvertical discontinuities along bedding	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	15.5	7.2	15.0	15	**58**	**58**
94.0	28.65	99.00	30.17	5.00	1.52	100	1.12	73	15	95	50	R4	Med grey to grey	Fine grained	Bedded at ~40 to 60 ° TCA, grey bands up to 1 cm	Medium strong, clay infilling, trace calcite veinlets, slightly weathered to fresh	Ynl	0	1	3	2	6	12	15			cly			JBC	5.7	14.4	6.3	12.0	15	**53**	**53**
																	EOH																				

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-181

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	17.5	5.33	17.50		0										Pale brown, sand, some silt, and trace organics. Logged in sump	OB													GIM							
17.5	5.33	22.00	6.71	4.50		0							Orange to brown	Coarse grained		Highly weathered bedrock	YnIII													JBC							
22.0	6.71	24.00	7.31	2.00	0.61	100	0.35	57	10	55	10	R2	Light grey to grey	Fine to coarse grained, inequigranular	Porphyrthic	Weak, some intact core pieces, easily crumbled by hand	YnIII	0	0	3	0	1	4	15			FeO	cly		JBC	2.0	11.3	5.8	4.0	15	**38**	**38**
24.0	7.31	29.00	8.84	5.00	1.38	91	0.25	16	22	60	5	R2	Light to orangey grey	Fine to coarse grained, inequigranular	Porphyrthic	Weak, highly oxidized	YnIII	0	0	3	0	3	6	15			FeO	cly		JBC	1.5	4.9	5.8	6.0	15	**33**	**33**
29.0	8.84	34.00	10.36	5.00	1.25	82	0.78	51	10	114	20	R2	Light to orangey grey	Fine to coarse grained, inequigranular	Porphyrthic	Weak, highly oxidized	YnIII	0	1	3	2	3	9	15			FeO	cly		JBC	3.0	10.2	6.5	9.0	15	**44**	**44**
34.0	10.36	39.00	11.89	5.00	1.42	93	1.05	69	20	68	20	R2	Grey to pale grey	Fine to medium grained, inequigranular	Porphyrthic, chert phenocrysts?up to 2 mm diameter	Highly weathered zone (~20 cm thick) at 37 ft, easily crumbled and weak	YnIII	0	1	3	2	3	9	15			FeO	cly		JBC	3.0	13.5	5.9	9.0	15	**46**	**46**
39.0	11.89	44.00	13.41	5.00	1.52	100	1.37	90	7	190	40	R3	Grey to pale grey	Fine to medium grained, inequigranular	Porphyrthic, chert phenocrysts?up to 2 mm diameter	Highly weathered section (~5 cm thick) at 40 ft.	YnIII	0	1	3	2	3	9	15			FeO	rub		JBC	4.8	17.9	7.5	9.0	15	**54**	**54**
44.0	13.41	49.00	14.93	5.00	1.10	72	0.12	8	Max	5	10	R2	Grey to light grey	Fine grained, equigranular	Highly fractured	Low recovery, weak, rubbly and highly oxidized	YnIII	0	0	3	0	3	6	15			rub	cly		JBC	2.0	3.9	5.0	6.0	15	**32**	**32**
49.0	14.93	54.00	16.46	5.00	1.52	100	0.87	57	9	152	50	R4	Grey to medium grey	Fine grained, equigranular	Bedded, 75 to 85 degree TCA	Shale, strong to medium strong, calcite veinlets, slightly to moderately weathered, iron oxide and calcite infilling	Ynl	0	1	3	2	3	9	15			FeO	cc		JBC	5.7	11.3	7.0	9.0	15	**48**	**48**
54.0	16.46	59.00	17.98	5.00	1.52	100	0.30	20	15	95	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, 75 to 85 degree TCA	Shale, subvertical calcite veins, iron oxide and calcite infilling	Ynl	0	1	3	2	3	9	15			cc	FeO		JBC	4.8	5.4	6.3	9.0	15	**40**	**40**
59.0	17.98	64.00	19.51	5.00	1.52	100	1.25	82	8	169	50	R4	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal	Shale, medium strong, chaotic calcite veinlets, slightly weathered to fresh, iron oxide and calcite infilling	Ynl	0	1	3	2	5	11	15			FeO	cc		JBC	5.7	16.2	7.2	11.0	15	**55**	**55**
64.0	19.51	69.00	21.03	5.00	1.50	98	0.60	39	18	79	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal	Shale, medium strong, chaotic calcite veinlets, slightly weathered to fresh, iron oxide and calcite infilling	Ynl	0	1	3	2	5	11	15			cc	FeO		JBC	4.8	8.2	6.1	11.0	15	**45**	**45**
69.0	21.03	74.00	22.55	5.00	1.52	100	1.23	81	7	190	50	R4	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 2-3 firms blows with hammer to fracture. Calcite veins 1-2 mm thick every 5-10 cm, calcite veinlets sporadically throughout.	Ynl	0	1	3	2	6	12	15			cc			GIM	5.7	15.9	7.5	12.0	15	**56**	**56**
74.0	22.55	79.00	24.08	5.00	1.34	88	1.20	79	5	223	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 1-2 firms blows with hammer to fracture. Calcite veins 1-2 mm thick every 5-10 cm, calcite veinlets sporadically throughout.	Ynl	0	1	3	2	5	11	15			cc	FeO		GIM	4.8	15.5	7.9	11.0	15	**54**	**54**
79.0	24.08	83.70	25.51	4.70	1.43	100	1.42	99	5	238	50	R4	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 2-3 firms blows with hammer to fracture. Irregular, discontinuous, calcite veinlets sporadically throughout.	Ynl	0	1	1	2	6	10	15			cc			GIM	5.7	20.0	8.0	10.0	15	**59**	**59**
83.7	25.51	88.60	27.00	4.90	1.50	100	1.13	76	6	214	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 1-2 firms blows with hammer to fracture. Irregular, discontinuous, calcite veinlets sporadically throughout.	Ynl	0	1	1	2	6	10	15			cc			GIM	4.8	14.8	7.8	10.0	15	**52**	**52**
88.60	27.00	93.70	28.56	5.10	1.55	100	1.55	100	1	775	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 1-2 firms blows with hammer to fracture. Irregular, discontinuous, calcite veinlets sporadically throughout.	Ynl	0	4	1	6	6	17	15						GIM	4.8	20.1	13.1	17.0	15	**70**	**70**
93.7	28.56	98.80	30.11	5.10	1.54	99	1.49	96	4	308	40	R3	Grey to medium grey	Fine grained, equigranular	Bedded, horizontal to sub-horizontal, 1-10 mm beds.	Shale, 1-2 firms blows with hammer to fracture. Irregular, discontinuous, calcite veinlets sporadically throughout. 5 mm thick calcite veins spaced 0.7 m apart throughout run.	Ynl	0	1	1	2	6	10	15			cc			GIM	4.8	19.2	8.8	10.0	15	**58**	**58**
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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	0.8	0.23	0.75		0											OB																				
0.0	0.00	4.00	1.22	4.00	1.20	98	0.20	16	12	92	120	R5	Grey	Inequigranular. Medium grained grey matrix with 1-2 mm white phenocrysts.	Massive	Granodiorite, trace amount of fine grained pyroxene. White phenocrysts make up ~20-30% of rock mass. Matrix is medium grained.	IG	0	1	4	2	3	10	15			soil				10.6	4.9	6.2	10.0	15	**47**	**47**
4.0	1.22	9.00	2.74	5.00	1.55	102	0.78	51	15	97	120	R5	Grey	Inequigranular. Medium grained grey matrix with 1-2 mm white phenocrysts.	Massive	Granodiorite, trace amount of fine grained pyroxene. White phenocrysts make up ~20-30% of rock mass. Matrix is medium grained. Some soil is present within fractures.	IG	0	1	3	2	5	11	15			soil				10.6	10.2	6.3	11.0	15	**53**	**53**
9.0	2.74	14.00	4.27	5.00	1.42	93	0.98	64	10	129	120	R5	Grey	Inequigranular. Medium grained grey matrix with 1-2 mm white phenocrysts.	Massive	Granodiorite, trace amount of fine grained pyroxene. White phenocrysts make up ~20-30% of rock mass. Matrix is medium grained. Calcite fracture filling and hematite coating on some fractures.	IG	0	1	3	4	5	13	15			Hem	cc			10.6	12.6	6.7	13.0	15	**58**	**58**
14.0	4.27	18.70	5.70	4.70	1.46	102	1.13	79	8	162	120	R5	Grey	Inequigranular. Medium grained grey matrix with 1-2 mm white phenocrysts.	Massive	Granodiorite, trace amount of fine grained pyroxene. White phenocrysts make up ~20-30% of rock mass. Matrix is medium grained. Calcite fracture filling on some fractures.	IG	0	1	3	2	5	11	15			cc				10.6	15.5	7.1	11.0	15	**59**	**59**
18.7	5.70	23.90	7.28	5.20	1.52	96	0.96	61	6	217	120	R5	Grey	Inequigranular. Medium grained grey matrix with 1-2 mm white phenocrysts.	Massive	Granodiorite, trace amount of fine grained pyroxene. White phenocrysts make up ~20-30% of rock mass. Matrix is medium grained. Hematite staining on some fractures. Low RQD due to high angled joints in run.	IG	0	1	3	4	5	13	15			Hem				10.6	11.9	7.8	13.0	15	**58**	**58**
23.9	7.28	30.20	9.20	6.30	1.90	99	1.80	94	7	238	100	R5	Grey to light grey	Medium grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	1	3	2	6	12	15			cc	hem		JBC	9.4	18.8	8.0	12.0	15	**63**	**63**
30.2	9.20	34.00	10.36	3.80	1.15	99	0.99	85	8	128	100	R5	Grey to light grey	Medium grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	4	3	2	6	15	15			cc	hem		JBC	9.4	16.9	6.7	15.0	15	**63**	**63**
34.0	10.36	37.00	11.28	3.00	0.90	98	0.54	59	8	100	100	R5	Grey to light grey	Medium grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	4	3	2	5	14	15			cc	hem		JBC	9.4	11.6	6.3	14.0	15	**56**	**56**
37.0	11.28	44.00	13.41	7.00	2.13	100	1.70	80	12	164	100	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	1	3	2	5	11	15			cc	hem		JBC	9.4	15.7	7.1	11.0	15	**58**	**58**
44.0	13.41	49.00	14.93	5.00	1.52	100	1.24	81	10	138	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	4	3	2	6	15	15			cc	hem		JBC	10.9	16.0	6.8	15.0	15	**64**	**64**
49.0	14.93	54.00	16.46	5.00	1.45	95	1.22	80	6	207	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface discoloration possible hematite?	IG	0	4	3	2	6	15	15			cc	hem		JBC	10.9	15.8	7.7	15.0	15	**64**	**64**
54.0	16.46	59.00	17.98	5.00	1.49	98	1.49	98	4	298	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface staining, calcite veinlets up to 1 mm thick,	IG	0	4	3	2	6	15	15			cc	hem		JBC	10.9	19.7	8.7	15.0	15	**69**	**69**
59.0	17.98	64.00	19.51	5.00	1.52	100	1.52	100	5	253	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface staining, calcite veinlets up to 1 mm thick,	IG	0	4	3	2	6	15	15			cc	hem		JBC	10.9	20.1	8.2	15.0	15	**69**	**69**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
64.0	19.51	69.00	21.03	5.00	1.52	100	1.32	87	6	217	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface staining, calcite veinlets up to 1 mm thick,	IG	0	4	3	2	6	15	15			cc			JBC	10.9	17.2	7.8	15.0	15	**66**	**66**
69.0	21.03	74.00	22.55	5.00	1.52	100	1.19	78	11	127	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slightly weathered to fresh, joint filled with calcite, joint surface staining, calcite veinlets up to 1 mm thick,	IG	0	4	3	2	6	15	15			cc			JBC	10.9	15.3	6.7	15.0	15	**63**	**63**
74.00	22.55	79.00	24.08	5.00	1.52	100	1.35	89	5	253	125	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slighly weathered to fresh, calcite infilling and veinlets, competent	IG	0	4	3	2	6	15	15			cc			JBC	10.9	17.6	8.2	15.0	15	**67**	**67**
79.0	24.08	84.00	25.60	5.00	1.50	98	1.18	77	13	107	100	R5	Grey to light grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, strong, slighly weathered to fresh, calcite infilling and veinlets, slight discoloration on joint surfaces	IG	0	4	3	2	5	14	15			cc	hem		JBC	9.4	15.2	6.4	14.0	15	**60**	**60**
84.0	25.60	89.00	27.13	5.00	1.55	102	1.07	70	9	155	120	R5	Grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, some (~10%)medium grained pyroxene, 25-35% 1-2 mm white phenocrysts. Some hematite staining on fractures.	IG	0	4	3	6	5	18	15			hem			GIM	10.6	13.7	7.0	18.0	15	**64**	**64**
89.0	27.13	94.00	28.65	5.00	1.45	95	1.26	83	4	290	120	R5	Grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, some (~10%)medium grained pyroxene, 25-35% 1-2 mm white phenocrysts.	IG	0	4	3	6	6	19	15						GIM	10.6	16.3	8.6	19.0	15	**70**	**70**
94.0	28.65	99.00	30.17	5.00	1.55	102	1.51	99	3	388	120	R5	Grey	Medium grained, to coarse grained, inequigranular, porphyritic	Massive	Granodiorite, some (~10%)medium grained pyroxene, 25-35% 1-2 mm white phenocrysts. <1 mm calcite veins/fracture coating present.	IG	0	4	3	2	6	15	15						GIM	10.6	20.0	9.7	15.0	15	**70**	**70**
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GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-183

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	RMR-89 Total Min. Joint	RMR-89 Total Run Average
0.0	0.00	2.0	0.61	2.00		0										Topsoil. Brown, silty fine sand with some organics. Poorly graded, non-plastic.	OB													GIM							
2.0	0.61	4.00	1.22	2.00	0.40	66	0.00	0	max	5	0.5	R0	Orange Brown	Inequigranular, medium grained	Massive	Extremely weathered granodiorite. Friable.	IG	0	0	0	0	0	0	15						GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
4.0	1.22	8.80	2.68	4.80	1.40	96	0.00	0	max	5	1	R1	Brownish grey	Inequigranular, medium grained	Massive	Weathered granodiorite, slightly stronger than previous run, but can be pulled apart with some effort or peeled easily.	IG	0	0	0	0	1	1	15						GIM	1.1	3.0	5.0	1.0	15	**25**	**25**
8.8	2.68	13.90	4.24	5.10	1.46	94	0.56	36	6	209	5	R2	Brownish grey	Inequigranular, medium grained	Massive	Weathered granodiorite, slightly stronger than previous run, but can be peeled easily with knife. Extremely weathered joint at 0.5 m.	IG	0	1	4	2	1	8	15			FeO			GIM	1.5	7.7	7.7	8.0	15	**40**	**40**
13.9	4.24	19.00	5.79	5.10	1.56	100	0.55	35	9	156	10	R2	Grey	Inequigranular, medium grained	Massive	Weathered granodiorite, slightly stronger than previous run, but can be peeled with difficulty with knife. Extremely weathered joint at 0.7 m.	IG	0	1	3	2	2	8	15			FeO			GIM	2.0	7.6	7.0	8.0	15	**40**	**40**
19.0	5.79	24.00	7.31	5.00	1.53	100	0.00	0	11	128	5	R2	Brownish grey	Inequigranular, medium grained	Massive	Weathered granodiorite, 25-35% white phenocrysts, can be peeled with slight difficulty with knife. Weathering of rock is more intense around joints.	IG	0	1	3	2	2	8	15			FeO			GIM	1.5	3.0	6.7	8.0	15	**34**	**34**
24.0	7.31	29.00	8.84	5.00	1.52	100	0.70	46	9	152	7	R2	Brownish grey	Inequigranular, medium grained	Massive	Weathered granodiorite, 25-35% white phenocrysts, can be peeled with slight difficulty with knife. Weathering of rock is more intense around joints.	IG	0	1	1	2	1	5	15			FeO			GIM	1.7	9.3	7.0	5.0	15	**38**	**38**
29.0	8.84	32.10	9.78	3.10	0.90	95	0.20	21	4	180	1	R1	Orange/Umber	Inequigranular, medium grained	Massive	Upper 0.45 m is weathered granodiorite, as described above. Lower 0.45 m is extremely weathered/clayey, with relic texture remaining. Very friable.	IG	0	0	0	0	0	0	15			FeO			GIM	1.1	5.6	7.3	0.0	15	**29**	**29**
32.1	9.78	36.70	11.19	4.60	1.40	100	1.20	86	5	233	10	R2	Brownish orange	Inequigranular, medium grained	Massive	Weathered granodiorite, 25-35% white phenocrysts, can be peeled with difficulty with knife, with some localized weakened zones near fractures. Weathering of rock is more intense around joints.	IG	0	4	3	2	1	10	15			FeO	cly		GIM	2.0	16.9	8.0	10.0	15	**52**	**52**
36.7	11.19	39.00	11.89	2.30	0.77	100	0.46	66	3	193	15	R2	Brownish orange	Inequigranular, medium grained	Massive	Weathered granodiorite, 25-35% white phenocrysts, can be dented with firm blow from hammer point, with some localized weakened zones near fractures. Weathering of rock is more intense around joints.	IG	0	1	1	2	1	5	15			FeO	cly		GIM	2.5	12.8	7.5	5.0	15	**43**	**43**
39.0	11.89	43.40	13.23	4.40	1.23	92	0.10	7	max	5	1	R1	Brownish orange	Inequigranular, medium grained	Massive	Weathered granodiorite, 25-35% white phenocrysts. Upper 0.5 m can be scraped or penetrated with a knife. The rest of the run is completely weathered.	IG	0	0	0	0	0	0	15			FeO	cly		GIM	1.1	3.8	5.0	0.0	15	**25**	**25**
43.4	13.23	48.60	14.81	5.20	1.51	95	0.64	40	8	168	5	R2	Brownish orange	Inequigranular, medium grained	Massive	Upper 1.04 m is weathered granodiorite, brownish orange and easily scraped with a knife. The rest of the run is moderately weathered granodiorite, greenish grey. 1-5 mm calcite veins are present throughout the run.	IG	0	0	3	0	1	4	15			cc	FeO		GIM	1.5	8.4	7.2	4.0	15	**36**	**36**
48.6	14.81	53.70	16.37	5.10	1.56	100	0.30	19	max	5	1	R1	Brownish orange	Inequigranular, medium grained	Massive	Upper 0.3 m is moderately weathered)as described above). From 0.3 to 1.3 m the run is strongly weathered (can be easily scraped with knife. The lower 0.2 m is completely weathered to residual soil.	IG	0	0	3	0	1	4	15			cc	cly		GIM	1.1	5.3	5.0	4.0	15	**30**	**30**

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
53.7	16.37	58.80	17.92	5.10	1.53	98	0.95	61	8	170	10	R2	Brownish orange	Inequigranular, medium grained	Massive	10-20 cm interlayered sequences of moderately to strongly weathered granodiorite.	IG	0	1	3	2	3	9	15			cly	FeO		GIM	2.0	12.0	7.2	9.0	15	**45**	**45**
58.8	17.92	64.00	19.51	5.20	1.59	100	1.11	70	10	145	20	R2	Brownish orange, light grey to pale grey	Medium grained, inequigranular, porphyritic	Massive	Medium strong, rock looks altered/weathered - easily scratched, lots of calcite phenocrysts, oxidized joint surfaces, vuggy calcite veins, moderately weathered	IG	0	1	3	2	3	9	15			cc	FeO		JBC	3.0	13.7	6.9	9.0	15	**48**	**48**
64.0	19.51	69.00	21.03	5.00	1.52	100	1.24	81	11	127	50	R4	Light grey to pale grey	Medium grained, inequigranular, porphyritic	Massive	Calcite, hornblende and quartz phenocrysts (up to 1 mm), medium strong to strong, calcite infilling, oxidized joint surfaces, slightly to moderately weathered	IG	0	1	3	2	5	11	15			FeO	cc		JBC	5.7	16.0	6.7	11.0	15	**54**	**54**
69.0	21.03	74.00	22.55	5.00	1.50	98	0.78	51	16	88	10	R2	Light grey to grey	Fine grained	Bedded	Transition to interbedded shale, subhorizontal bedding, chaotic and sporadic calcite veinlets, weak, slightly weathered	Ynl	0	1	3	2	5	11	15			cc	cly		JBC	2.0	10.2	6.2	11.0	15	**44**	**44**
74.0	22.55	79.00	24.08	5.00	1.49	98	0.94	62	10	135	25	R3	Light grey to grey	Fine grained	Bedded	Interbedded shale, subhorizontal beds of grey to light grey (up to 1 cm), medium strong, calcite veinlets	Ynl	0	1	3	2	5	11	15			cc			JBC	3.4	12.1	6.8	11.0	15	**48**	**48**
79.0	24.08	85.00	25.91	6.00	1.61	88	0.66	36	max	5	1	R1	Light grey to grey	Fine grained	Bedded	Interbedded shale, subhorizontal beds of grey to light grey (up to 1 cm), medium strong, calcite veinlets. Highly fractured with 10 cm clayey rubble zone at the top of run. Very weak and can be dented with a fingernail.	Ynl	0	0	3	0	3	6	15			cly	rub		JBC	1.1	7.7	5.0	6.0	15	**35**	**35**
85.0	25.91	91.00	27.74	6.00	1.85	101	1.01	55	35	51	25	R3	Light grey to grey	Fine grained	Bedded	Interbedded shale, subhorizontal beds of grey to light grey (up to 1 cm), medium strong, calcite veinlets	Ynl	0	1	3	0	5	9	15			cly	cc	py	JBC	3.4	10.9	5.7	9.0	15	**44**	**44**
91.0	27.74	94.30	28.74	3.30	1.00	99	0.60	60	20	48	10	R2	Light grey to grey	Fine grained	Bedded	Interbedded shale, subhorizontal beds of grey to light grey (up to 1 cm), medium strong, calcite veinlets. 5 cm zones of clayey rubble present throughout run.	Ynl	0	0	3	0	5	8	15			rub	rub		JBC	2.0	11.7	5.7	8.0	15	**42**	**42**
94.3	28.74	99.00	30.17	4.70	1.43	100	1.27	89	8	159	50	R4	Light grey to grey	Fine grained	Bedded	Interbedded shale, subhorizontal beds of grey to light grey (up to 1 cm), strong, calcite veinlets.	Ynl	0	4	1	2	6	13	15			py	cc		JBC	5.7	17.6	7.1	13.0	15	**58**	**58**
																EOH																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-184

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	RMR-89 Total Min. Joint	RMR-89 Total Run Average
0.0	0.00	14.0	4.27	14.00		0										Dark to light brown sandy silt and clay	OB													GIM							
14.0	4.27	15.00	4.57	1.00		0										Weathered shale, oxidized, easily dented by fingernail, logged from SPT sample #3	Ynl						0	15						JBC							
15.0	4.57	19.00	5.79	4.00	1.10	90	0.00	0	Max	5	1	R1	Grey to black	Fine grained	Chaotic and microfractured	Shale, highly fractured and oxidized, very weak, moderately weathered to heavily weathered, easily crumbled	Ynl	0	0	1	0	1	2	15			hem	rub	cly	JBC	1.1	3.0	5.0	2.0	15	26	26
19.0	5.79	24.00	7.31	5.00	1.42	93	1.07	70	15	89	10	R2	Grey to light grey	Fine grained	Chaotic and microfractured	Shale, weak, moderately weathered	Ynl	0	0	3	0	3	6	15			cly	rub		JBC	2.0	13.7	6.2	6.0	15	43	43
24.0	7.31	29.00	8.84	5.00	1.50	98	0.20	13	Max	5	5	R2	Grey to light grey	Fine grained	Chaotic and microfractured	Shale, weak, moderately weathered, sections (5 to 10 cm thick) of highly fractured rubble, oxidized joint surfaces	Ynl	0	0	3	0	3	6	15			rub	cly		JBC	1.5	4.5	5.0	6.0	15	32	32
29.0	8.84	34.00	10.36	5.00	1.52	100	0.60	39	Max	5	5	R2	Grey to light grey	Fine grained	Chaotic and microfractured	Shale, sections fo competent and rubble/clay (up to 5 cm thick)	Ynl	0	0	3	0	3	6	15			rub	cly		JBC	1.5	8.2	5.0	6.0	15	36	36
34.0	10.36	39.00	11.89	5.00	1.50	98	0.62	41	30	48	5	R2	Grey to black	Fine grained	Microfractured, bedded, sub-horizontal	Shale, highly fractured sections (up to 5 cm thick) filled with rubble and clay, moderately weathered, oxidized joint surfaces	Ynl	0	0	3	0	3	6	15			rub	cly		JBC	1.5	8.5	5.7	6.0	15	37	37
39.0	11.89	44.00	13.41	5.00	1.54	101	0.90	59	15	96	15	R2	Grey to black	Fine grained	Microfractured, bedded, sub-horizontal	Shale, highly fractured sections (up to 2 cm thick) filled with rubble and clay, moderately weathered, oxidized joint surfaces	Ynl	0	0	3	0	3	6	15			rub	cly		JBC	2.5	11.6	6.3	6.0	15	41	41
44.0	13.41	49.00	14.93	5.00	1.52	100	1.35	89	9	152	50	R4	Grey to black	Fine grained	Bedded, sub-horizontal	Shale, mostly intact with a 10 cm rubble zone at 46 ft	Ynl	0	0	3	0	5	8	15			rub			JBC	5.7	17.6	7.0	8.0	15	53	53
49.0	14.93	55.50	16.92	6.50	1.99	100	0.53	27	Max	5	20	R2	Grey to black	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale, highly fractured and rubble rich throughout, oxidized joint surfaces	Ynl	0	0	3	0	3	6	15			rub	hem		JBC	3.0	6.3	5.0	6.0	15	35	35
55.5	16.92	59.00	17.98	3.50	1.05	98	0.00	0	10	95	35	R3	Medium grey	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale with calcite veinlets spaced ~10 cm apart. 1-2 firm blows with hammer to fracture.	Ynl	0	1	1	2	5	9	15			FeO	cc		GIM	4.4	3.0	6.3	9.0	15	38	38
59.0	17.98	64.00	19.51	5.00	1.52	100	0.18	12	13	109	40	R3	Medium grey	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale with calcite veinlets spaced ~10 cm apart. 2-3 firm blows with hammer to fracture. 6 cm thick strongly weathered joint (clayey infilling) at 0.3 m.	Ynl	0	1	1	2	5	9	15			FeO	cc		GIM	4.8	4.4	6.5	9.0	15	40	40
64.0	19.51	68.50	20.88	4.50	1.30	95	0.20	15	12	100	40	R3	Medium grey	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale with calcite veinlets spaced ~10 cm apart. 2-3 firm blows with hammer to fracture. 4 mm thixk calcite vein near lower 15 cm of run.	Ynl	0	1	1	2	5	9	15			cc	FeO		GIM	4.8	4.7	6.3	9.0	15	40	40
68.5	20.88	73.60	22.43	5.10	1.60	100	0.42	27	11	133	75	R4	Medium grey	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale. From 0.5 m to end of run the rock is strongly fractured and re-sealed with quartz and calcite. 2-3 cm thick gouge filled shear zones are at 0.6 m and 1.06 m.	Ynl	0	0	3	0	5	8	15			gg	FeO	cc	GIM	7.7	6.4	6.8	8.0	15	44	44
73.6	22.43	78.80	24.02	5.20	1.50	95	0.95	60	8	167	100	R5	Light to medium grey	Fine grained	Mottled and fractured	Upper 0.5 m is shale, as described above. From 0.6 to 0.6 is a rubbly gouge zone of angualr fractured rock and clay. From 0.6 to 1.1 the shale transitions to a conglomerate or breccia, with 1-4 cm rounded light grey clasts in a fine grained medium gray matrix.	Ynl	0	0	3	0	5	8	15			gg	FeO	cc	GIM	9.4	11.8	7.2	8.0	15	51	51
78.8	24.02	83.80	25.54	5.00	1.52	100	1.00	66	6	217	70	R4	Light to medium grey	Fine grained	Conglomerate	Upper o.4 m is a fractured and reselaed shale/conglomerate, terminating in a 3 cm rubble zone at 0.4 m (FeO staining on fracture). The next 30 cm of the run is light grey, fine grained with up to 10 cm rounded clasts. The rest f the run is light grey, massive textured with no visible clasts.	Ynl	0	1	1	6	6	14	15			rub			GIM	7.3	12.8	7.8	14.0	15	57	57

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
83.80	25.54	88.50	26.97	4.70	1.52	100	0.99	69	8	169	70	R4	Medium grey	Fine grained	Bedded, sub-horizontal (70 to 80 ° TCA)	Shale, calcite stringers/veinlets throughout run. A 6 cm rubble zone is at 0.7 m.	Ynl	0	4	3	6	6	19	15						GIM	7.3	13.5	7.2	19.0	15	**62**	**62**
88.5	26.97	93.50	28.50	5.00	1.55	102	1.25	82	8	172	50	R4	Light to medium grey	Fine grained	Conglomerate	Upper 0.4 m and lower 0.3 m are shale (medium grey, sub-horizontal bedding with cc veinlets). From 0.4 to 1.2 m is conglomerate (light grey, with 5-20 cm clasts, fine grained matrix)	Ynl	0	4	1	6	6	17	15						GIM	5.7	16.2	7.2	17.0	15	**61**	**61**
93.5	28.50	98.50	30.02	5.00	1.50	98	1.35	89	9	150	50	R4	Light to medium grey	Fine grained	Conglomerate	Veinlets throughout	Ynl	0	4	1	4	5	14	15			FeO			GIM	5.7	17.6	7.0	14.0	15	**59**	**59**
																EOH																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-185

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00												Topsoil. Brown silty sand with some organics, non-plastic, dry, poorly graded.	OB													GIM							
1.0	0.30	3.50	1.07	2.50	0.34	45	0.00	0	max	5	1	R1	Grey	Fine grained.	Fractured.	Upper 12 cm of run is topsoil. The rest of the run is strongly weathered shale, decomposed with fragments of intact rock.	Ynl	0	0	0	0	1	1	15						GIM	1.1	3.0	5.0	1.0	15	**25**	**25**
3.5	1.07	5.60	1.71	2.10	0.60	94	0.00	0	max	5	10	R2	Medium grey	Fine grained.	Fractured.	Shale, upper 0.4 m is rubbly and fractured, rest of run is cored but strongly fractured. Fines and clyaye material likely washed out during drilling.	Ynl	0	0	3	0	3	6	15			cly	FeO		GIM	2.0	3.0	5.0	6.0	15	**31**	**31**
5.6	1.71	9.00	2.74	3.40	1.05	101	0.00	0	max	5	10	R2	Medium grey	Fine grained.	Fractured.	Shale, extremely fractured with rubble and clay fracture infilling, up to 5-6 cm thick.	Ynl	0	0	3	0	3	6	15			cly	Rub		GIM	2.0	3.0	5.0	6.0	15	**31**	**31**
9.0	2.74	14.00	4.27	5.00	1.20	79	0.00	0	max	5	10	R2	Medium grey	Fine grained.	Fractured.	Shale, extremely fractured with rubble and clay fracture infilling, up to 5-6 cm thick.	Ynl	0	0	3	0	3	6	15			Rub	cly		GIM	2.0	3.0	5.0	6.0	15	**31**	**31**
14.0	4.27	19.00	5.79	5.00	1.52	100	1.08	71	9	152	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm white phenocrysts, trace fine grained biotite	IG	0	4	3	4	5	16	15			FeO			GIM	10.6	13.9	7.0	16.0	15	**63**	**63**
19.0	5.79	24.00	7.31	5.00	1.35	89	0.60	39	10	123	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm white phenocrysts, trace fine grained biotite	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	8.2	6.6	14.0	15	**55**	**55**
24.0	7.31	29.00	8.84	5.00	1.55	102	1.07	70	8	172	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm white phenocrysts, trace fine grained biotite	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	13.7	7.2	14.0	15	**61**	**61**
29.0	8.84	34.00	10.36	5.00	1.52	100	0.69	45	6	217	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm white phenocrysts, trace fine grained biotite. One low angle (20-30° TCA) running through run.	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	9.2	7.8	14.0	15	**57**	**57**
34.0	10.36	39.00	11.89	5.00	1.52	100	1.34	88	6	217	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics.	IG	0	4	3	6	6	19	15			FeO			GIM	10.6	17.5	7.8	19.0	15	**70**	**70**
39.0	11.89	44.00	13.41	5.00	1.48	97	1.28	84	4	296	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics.	IG	0	4	4	2	6	16	15			cc			GIM	10.6	16.6	8.7	16.0	15	**67**	**67**
44.0	13.41	49.00	14.93	5.00	1.52	100	0.75	49	2	507	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics. Low-angle (20-25° TCA) joint running through core from 0-0.7 m.	IG	0	4	4	2	6	16	15			cc			GIM	10.6	9.9	10.8	16.0	15	**62**	**62**
49.0	14.93	54.00	16.46	5.00	1.52	100	1.52	100	4	304	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics.	IG	0	4	3	2	6	15	15			cc			GIM	10.6	20.1	8.8	15.0	15	**70**	**70**
54.0	16.46	59.00	17.98	5.00	1.48	97	1.18	77	5	247	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics.	IG	0	4	3	2	6	15	15			cc			GIM	10.6	15.2	8.1	15.0	15	**64**	**64**
59.0	17.98	64.00	19.51	5.00	1.48	97	1.48	97	3	370	120	R5	Light grey	Medium grained, mottled, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics.	IG	0	4	3	2	6	15	15			cc			GIM	10.6	19.5	9.5	15.0	15	**70**	**70**
64.0	19.51	69.00	21.03	5.00	1.49	98	1.38	91	5	248	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, trace calcite on discontinuites	IG	0	4	3	6	6	19	15				cc		JBC	12.2	18.0	8.1	19.0	15	**72**	**72**
69.00	21.03	74.00	22.55	5.00	1.52	100	1.52	100	4	304	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, trace calcite on discontinuites, hard calcite vein (up to 1 mm) at 71 ft.	IG	0	4	3	4	6	17	15			cc			JBC	12.2	20.1	8.8	17.0	15	**73**	**73**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
74.0	22.55	79.00	24.08	5.00	1.52	100	1.52	100	3	380	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, competent, joints filled with calcite and a slimy green mineral (posibble olivine?)	IG	0	4	3	2	6	15	15			cc		oliv	JBC	12.2	20.1	9.6	15.0	15	**72**	**72**
79.0	24.08	84.00	25.60	5.00	1.48	97	1.48	97	5	247	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, competent	IG	0	4	3	6	6	19	15						JBC	12.2	19.5	8.1	19.0	15	**74**	**74**
84.0	25.60	89.00	27.13	5.00	1.48	97	1.38	91	5	247	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, competent, surface staining	IG	0	4	3	2	5	14	15			cc	hem		JBC	12.2	18.0	8.1	14.0	15	**67**	**67**
89.0	27.13	94.00	28.65	5.00	1.52	100	1.42	93	5	253	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, competent, surface staining	IG	0	4	3	2	5	14	15			cc	hem		JBC	12.2	18.6	8.2	14.0	15	**68**	**68**
94.0	28.65	99.00	30.17	5.00	1.48	97	1.46	96	6	211	150	R5	Grey to light grey	Medium grained, porphyritic, inequigranular	Massive	Granodiorite, 25-35% 1-2 mm white phenocrysts, trace fine grained biotite and medium grained mafics, very strong, competent, surface staining	IG	0	4	3	2	5	14	15			cc	hem		JBC	12.2	19.2	7.7	14.0	15	**68**	**68**
EOH																																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-186

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00		0											OB													GIM							
0.0	0.00	4.00	1.22	4.00	1.07	88	0.52	43	11	89	10	R2	Medium Grey	Fine grained, equigranular.	Bedded	Shale, strongly weathered, 20 cm rubbly clayey zones at top and bottom of run.	Ynl	0	0	3	0	1	4	15			cly	FeO		GIM	2.0	8.8	6.2	4.0	15	**36**	**36**
4.0	1.22	9.00	2.74	5.00	1.40	92	0.00	0	15	88	10	R2	Medium Grey	Fine grained, equigranular.	Bedded	Shale, strongly weathered, heavy oxidation with some clay infilling on fractures. Rubbly at top and botom 10 cm.	Ynl	0	4	3	2	1	10	15			FeO	cly		GIM	2.0	3.0	6.2	10.0	15	**36**	**36**
9.0	2.74	14.00	4.27	5.00	1.00	66	0.00	0	max	5	3	R1	Pale Green/Brown	Medium grained, inequigranular	Massive	0-20 cm - Strongly weathered shale. 20-30 cm - Strongly weathered and oxidized transition zone, very soft. 30-60 cm - Completely weathered granodiorite, very soft, original texture intact. 60-150 cm - Strongly weathered granodiorite, easily fractured with point of hammer.	IG	0	0	3	0	0	3	15			FeO	cly		GIM	1.3	3.0	5.0	3.0	15	**27**	**27**
14.0	4.27	19.00	5.79	5.00	1.55	102	1.13	74	8	172	90	R4	Light Greenish Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained.	IG	0	4	3	2	3	12	15			cc	FeO		GIM	8.7	14.5	7.2	12.0	15	**58**	**58**
19.0	5.79	24.00	7.31	5.00	1.52	100	0.84	55	8	169	90	R4	Light Greenish Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained.	IG	0	4	3	2	3	12	15			FeO	cc		GIM	8.7	10.9	7.2	12.0	15	**54**	**54**
24.0	7.31	29.00	8.84	5.00	1.57	100	1.18	77	5	262	90	R4	Light Greenish Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained. Rubbly joint at 0.4 cm ~1 cm thick.	IG	0	4	3	2	3	12	15			cc	FeO		GIM	8.7	15.2	8.3	12.0	15	**59**	**59**
29.0	8.84	34.00	10.36	5.00		0		0	11	0	90	R4	Light Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained.	IG	0	4	3	2	3	12	15			FeO	cc		GIM	8.7	3.0	5.0	12.0	15	**44**	**44**
34.0	10.36	35.80	10.91	1.80	0.40	73	0.00	0	max	5	90	R4	Light Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained. Lower 0.2 m is completely crushed.	IG	0	4	3	2	5	14	15			FeO	cc		GIM	8.7	3.0	5.0	14.0	15	**46**	**46**
35.8	10.91	39.00	11.89	3.20	0.90	92	0.90	92	1	450	90	R4	Light Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. Caclite veinlets present intermitantly. Phenocrysts are FeO stained.	IG	0	1	5	4	5	15	15			FeO			GIM	8.7	18.4	10.3	15.0	15	**67**	**67**
39.0	11.89	44.00	13.41	5.00	1.50	98	1.37	90	4	300	120	R5	Light Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. 1-2 mm thick caclite veins and veinlets present intermitantly. Phenocrysts and calcite veins are FeO stained.	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	17.9	8.7	14.0	15	**66**	**66**
44.0	13.41	49.00	14.93	5.00	1.50	98	0.89	58	10	136	120	R5	Light Grey	Medium grained, inequigranular	Massive	Granodiorite, 20-30% 1-2 mm phenocrysts. 1-2 mm thick caclite veins and veinlets present intermitantly. Upper 0.5 m of run is fractured with rubbly joints. Lower 0.1 m of run is crushed/weak rock (transition zone).	IG	0	1	3	2	5	11	15			Rub	cc		GIM	10.6	11.5	6.8	11.0	15	**55**	**55**
49.0	14.93	54.00	16.46	5.00	1.55	102	0.00	0	28	53	40	R3	Medium Grey	Fine grained, equigranular.	Bedded, sub-horizontal (70-80°TCA)	Shale, moderately weathered, calcite veinlets throughout run, strongly FeO stained. Lower half of run is altered to a dark to medium tan colour.	Ynl	0	0	3	2	3	8	15			FeO	cc		GIM	4.8	3.0	5.7	8.0	15	**37**	**37**
54.0	16.46	59.00	17.98	5.00	1.52	100	0.31	20	22	66	50	R4	Medium Grey	Fine grained, equigranular.	Bedded, sub-horizontal (70-80°TCA)	Shale, FeO staining on fractures, but not staining calcite veins as with previous run. Rubbly zones at 0.8 and 1.3 m	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	5.7	5.5	5.9	14.0	15	**46**	**46**

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
59.0	17.98	64.00	19.51	5.00	1.53	100	1.06	70	9	153	50	R4	Grey to medium grey	Fine grained with some angular clasts	Bedded, sub-horizontal	Conglomerate/shale, some veinlets, medium strong, joints filled with calcite, clay and iron oxide	Ynl	0	4	3	2	5	14	15			cc	FeO		JBC	5.7	13.6	7.0	14.0	15	**55**	**55**
64.0	19.51	69.00	21.03	5.00	1.50	98	1.41	93	3	375	50	R4	Grey to medium grey	Fine grained with some angular clasts	Bedded, sub-horizontal	Conglomerate/shale, some veinlets, medium strong, joints filled with calcite, clay and iron oxide, more intact run	Ynl	0	4	3	2	5	14	15			cc			JBC	5.7	18.5	9.5	14.0	15	**63**	**63**
69.00	21.03	74.00	22.55	5.00	1.48	97	1.21	79	12	114	40	R3	Grey to medium grey	Fine grained with some angular clasts (up to 1 cm)	Bedded, sub-horizontal	Conglomerate/shale, a 5 cm rubble zone near the end of the run at 73 ft	Ynl	0	1	3	0	5	9	15			Rub	FeO		JBC	4.8	15.6	6.5	9.0	15	**51**	**51**
74.0	22.55	79.00	24.08	5.00	1.50	98	1.19	78	10	136	50	R4	Grey to medium grey	Fine grained with some angular clasts (up to 1 cm)	Bedded, sub-horizontal	Conglomerate/shale, some veinlets, medium strong	Ynl	0	4	3	2	5	14	15			cc	FeO		JBC	5.7	15.3	6.8	14.0	15	**57**	**57**
79.0	24.08	84.00	25.60	5.00	1.52	100	1.52	100	3	380	60	R4	Grey	Fine grained	Bedded, sub-horizontal, bands of light and dark grey (2 mm thick)	Shale, calcite veinlets along bedding	Ynl	0	4	3	2	6	15	15			cc			JBC	6.5	20.1	9.6	15.0	15	**66**	**66**
84.0	25.60	89.00	27.13	5.00	1.52	100	1.09	72	7	190	50	R4	Grey	Fine grained	Bedded, sub-horizontal, bands of light and dark grey (2 mm thick)	Shale, medium strong, calcite veinlets, some congromerate sections	Ynl	0	4	3	2	5	14	15			FeO	cc		JBC	5.7	14.0	7.5	14.0	15	**56**	**56**
89.0	27.13	94.00	28.65	5.00	1.52	100	0.90	59	15	95	50	R4	Grey	Fine grained	Bedded, sub-horizontal (75-85°TCA)	Shale, joints along bedding, calcite veinlets (up to a 1 mm thick)	Ynl	0	4	3	2	6	15	15			cly	cc		JBC	5.7	11.6	6.3	15.0	15	**54**	**54**
94.0	28.65	99.00	30.17	5.00	1.52	100	1.43	94	8	169	50	R4	Grey	Fine grained with some angular clasts (up to 1 cm)	Bedded, sub-horizontal (75-85°TCA)	Shale , slight surface staining, subhorizontal bedding	Ynl	0	4	3	2	5	14	15			FeO	cc		JBC	5.7	18.8	7.2	14.0	15	**61**	**61**
																EOH																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-187

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00		0											OB													GIM							
0.0	0.00	4.00	1.22	4.00	1.17	96	0.00	0	12	90	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite	IG	0	1	3	2	5	11	15		FeO	cly			GIM	10.6	3.0	6.2	11.0	15	**46**	**46**
4.0	1.22	9.00	2.74	5.00	1.46	96	0.00	0	20	70	50	R4	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. Zones of weathered, weakened rock throughout run.	IG	0	1	3	2	3	9	15		FeO	cly			GIM	5.7	3.0	5.9	9.0	15	**39**	**39**
9.0	2.74	14.00	4.27	5.00	1.53	100	0.27	18	25	59	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite.	IG	0	1	3	2	5	11	15		FeO	cly			GIM	10.6	5.1	5.8	11.0	15	**48**	**48**
14.0	4.27	16.50	5.03	2.50	0.67	88	0.00	0	9	67	50	R4	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. Lower 10 cm of run is clay.	IG	0	1	3	2	3	9	15		FeO	cly			GIM	5.7	3.0	5.9	9.0	15	**39**	**39**
16.5	5.03	21.00	6.40	4.50	1.17	85	0.19	14	Max	5	1	R1	Orange/brown	fine grained	bedded	Upper 0.7 m is extremely weathered shale with some decomposed zones near top fo run. Lower 0.37 m is slightly weathered granodiorite.	Ynl	0	0	0	0	1	1	15		cly	FeO			GIM	1.1	4.6	5.0	1.0	15	**27**	**27**
21.0	6.40	24.00	7.31	3.00	0.92	100	0.64	70	6	131	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite.	IG	0	4	3	4	5	16	15		FeO				GIM	10.6	13.7	6.7	16.0	15	**62**	**62**
24.0	7.31	29.00	8.84	5.00	1.52	100	1.52	100	3	380	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. ~5% FeO stained plagioclase grains.	IG	0	4	3	4	6	17	15		FeO				GIM	10.6	20.1	9.6	17.0	15	**72**	**72**
29.0	8.84	34.00	10.36	5.00	1.50	98	1.15	75	3	375	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. ~5% FeO stained plagioclase grains.	IG	0	1	3	2	5	11	15		FeO	cly			GIM	10.6	14.8	9.5	11.0	15	**61**	**61**
34.0	10.36	39.00	11.89	5.00	1.52	100	1.30	85	3	380	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. ~5% FeO stained plagioclase grains.	IG	0	1	3	2	5	11	15		FeO	cly			GIM	10.6	16.9	9.6	11.0	15	**63**	**63**
39.0	11.89	44.00	13.41	5.00	1.52	100	1.40	92	4	304	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite.	IG	0	4	3	6	6	19	15						GIM	10.6	18.3	8.8	19.0	15	**72**	**72**
44.0	13.41	49.00	14.93	5.00	1.49	98	1.49	98	3	373	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 25-35% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite.	IG	0	4	3	6	6	19	15						GIM	10.6	19.7	9.5	19.0	15	**74**	**74**
49.0	14.93	54.00	16.46	5.00	1.48	97	1.37	90	4	296	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 20-30% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite. ~5% FeO stained plagioclase grains and on calcite vein filling.	IG	0	4	3	2	5	14	15		cc	FeO			GIM	10.6	17.9	8.7	14.0	15	**66**	**66**
54.0	16.46	58.50	17.83	4.50	1.37	100	1.28	93	6	196	120	R5	Light Grey	Medium grained, inequigranular.	Massive	Granodiorite. 20-30% 1-2 mm white phenocrysts, trace amounts of fine to medium grained biotite.	IG	0	4	3	2	5	14	15		cc	FeO			GIM	10.6	18.7	7.5	14.0	15	**66**	**66**
58.5	17.83	63.70	19.41	5.20	1.45	91	1.23	78	7	181	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal (70-80° TCA)	Shale with trace calcite veinlets. Lower half of run is conglomerate with 1-10 cm clasts.	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	4.8	15.2	7.4	14.0	15	**56**	**56**
63.7	19.41	66.30	20.21	2.60	0.80	100	0.82	100	3	199	40	R3	Medium Grey	Fine grained	Massive	Conglomerate. 1-10 cm light grey clasts.	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	4.8	20.0	7.6	14.0	15	**61**	**61**
66.30	20.21	71.30	21.73	5.00	1.52	100	1.44	94	6	217	40	R3	Medium Grey	Fine grained	Massive	Inter-bedded conglomerate and shale (~30 cm zones throughout run)	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	4.8	18.9	7.8	14.0	15	**61**	**61**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
71.3	21.73	74.00	22.55	2.70	0.82	100	0.72	87	3	205	40	R3	Medium Grey	Fine grained	Massive	Inter-bedded conglomerate and shale (~30 cm zones throughout run)	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	4.8	17.4	7.6	14.0	15	**59**	**59**
74.0	22.55	79.00	24.08	5.00	1.52	100	1.33	87	5	253	40	R3	Medium Grey	Fine grained	Massive	Conglomerate. 1-4 cm light grey clasts. Irregular calcite veining (<1-1 mm) throughout run.		0	4	5	2	5	16	15		cc	FeO			GIM	4.8	17.3	8.2	16.0	15	**61**	**61**
79.0	24.08	84.00	25.60	5.00	1.52	100	1.30	85	9	152	50	R4	Medium Grey	Fine grained	Massive	Shale with trace calcite veinlets. Upper 0.4 m of run transitions from conglomerate.	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	5.7	16.9	7.0	14.0	15	**59**	**59**
84.0	25.60	89.00	27.13	5.00	1.52	100	1.15	75	11	127	40	R3	Medium Grey	Fine grained	Bedded (40-60°TCA)	Shale with trace calcite veinlets.	Ynl	0	4	3	2	5	14	15		cc	FeO			GIM	4.8	14.8	6.7	14.0	15	**55**	**55**
89.0	27.13	92.10	28.07	3.10	0.95	100	0.70	74	4	189	40	R3	Medium Grey	Fine grained	Bedded (40-60°TCA)	Shale with trace calcite veinlets.	Ynl	0	1	3	2	5	11	15		Rub	cc			GIM	4.8	14.5	7.5	11.0	15	**53**	**53**
92.1	28.07	97.10	29.59	5.00	1.52	100	0.86	56	11	127	40	R3	Medium Grey	Fine grained	Bedded (horizontal)	Conglomerate with ~10% 1-4 cm clasts throughout run.	Ynl	0	1	3	2	5	11	15		FeO	cc			GIM	4.8	11.1	6.7	11.0	15	**49**	**49**
97.1	29.59	99.00	30.17	1.90	0.55	95	0.55	95	1	275	40	R3	Medium Grey	Fine grained	Bedded (horizontal)	Conglomerate with ~10% 1-4 cm clasts throughout run.	Ynl	0	4	3	2	5	14	15		FeO	cc			GIM	4.8	19.0	8.4	14.0	15	**61**	**61**
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GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-188

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	0.5	0.15	0.50		0										Topsoil, mainly roots, silt with some clay and sand	OB													JBC							
0.5	0.15	5.00	1.52	4.50	1.37	100	0.10	7	15	86	1	R1	Grey, orangey brown weathering	Medium grained, porphyritic	Massive	Granodiorite, highly weathered lenses (up to 10 cm) of extremely weak material, easily indented by finger	IG	0	0	3	0	1	4	15			FeO	cly		JBC	1.1	3.8	6.2	4.0	15	**30**	**30**
5.0	1.52	9.00	2.74	4.00	1.17	96	0.59	48	12	90	10	R2	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, more intact than previous, 2 cm rubbly weak section, oxidized	IG	0	0	3	0	3	6	15			FeO	cly		JBC	2.0	9.7	6.2	6.0	15	**39**	**39**
9.0	2.74	14.00	4.27	5.00	1.52	100	0.62	41	18	80	20	R2	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, highly weathered, some sections easily crumbled by finger	IG	0	0	3	0	3	6	15			FeO	cly		JBC	3.0	8.5	6.1	6.0	15	**39**	**39**
14.0	4.27	19.00	5.79	5.00	1.49	98	1.38	91	8	166	30	R3	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, medium strong, oxidized joint surfaces	IG	0	1	3	2	3	9	15			FeO	cly		JBC	3.9	18.0	7.2	9.0	15	**53**	**53**
19.0	5.79	24.00	7.31	5.00	1.50	98	0.80	52	15	94	10	R2	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, medium strong, highly oxidized, orangey brown weak sections	IG	0	0	3	0	3	6	15			FeO	cly		JBC	2.0	10.4	6.3	6.0	15	**40**	**40**
24.0	7.31	29.00	8.84	5.00	1.52	100	1.48	97	6	217	40	R3	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, medium strong, oxidized joint surfaces	IG	0	1	3	2	3	9	15			FeO	cly		JBC	4.8	19.5	7.8	9.0	15	**56**	**56**
29.0	8.84	34.00	10.36	5.00	1.52	100	1.31	86	5	253	50	R4	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, 20% phenocrysts (up to 1 mm thickness), sections have been oxidized and weathered	IG	0	1	3	2	3	9	15			FeO	cly		JBC	5.7	17.0	8.2	9.0	15	**55**	**55**
34.0	10.36	39.00	11.89	5.00	1.52	100	1.41	93	7	190	75	R4	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, 20% phenocrysts (up to 1 mm thickness), slightly weathered run	IG	0	1	3	2	5	11	15			FeO			JBC	7.7	18.5	7.5	11.0	15	**60**	**60**
39.0	11.89	44.00	13.41	5.00	1.52	100	1.08	71	10	138	75	R4	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, 20% phenocrysts (up to 1 mm thickness), some oxidized sections up to 1 cm thick	IG	0	1	3	0	3	7	15			FeO	cly		JBC	7.7	13.9	6.8	7.0	15	**50**	**50**
44.0	13.41	49.00	14.93	5.00	1.52	100	1.52	100	4	304	100	R5	Light grey to grey	Medium grained, porphyritic	Massive	Granodiorite, 20% phenocrysts (up to 1 mm thickness), more competent run, slightly weathered to fresh	IG	0	1	3	2	5	11	15			FeO			JBC	9.4	20.1	8.8	11.0	15	**64**	**64**
49.0	14.93	54.00	16.46	5.00	1.52	100	1.43	94	4	304	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene)	IG	0	1	3	4	5	13	15			FeO			GIM	10.6	18.8	8.8	13.0	15	**66**	**66**
54.0	16.46	59.00	17.98	5.00	1.46	96	1.38	91	5	243	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene)	IG	0	4	3	2	5	14	15			FeO	cc		GIM	10.6	18.0	8.1	14.0	15	**66**	**66**
59.0	17.98	64.00	19.51	5.00	1.54	101	1.45	95	5	257	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene)	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	19.1	8.2	14.0	15	**67**	**67**
64.0	19.51	69.00	21.03	5.00	1.50	98	1.27	83	5	250	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene)	IG	0	4	3	2	5	14	15			FeO	cc		GIM	10.6	16.5	8.2	14.0	15	**64**	**64**
69.0	21.03	74.00	22.55	5.00	1.47	96	1.12	73	8	163	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). FeO staining/halos present around calcite veins and veinlets.	IG	0	1	3	2	5	11	15			FeO	cc		GIM	10.6	14.4	7.1	11.0	15	**58**	**58**
74.00	22.55	79.00	24.08	5.00	1.48	97	0.92	60	4	296	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). <1-2 mm calcite veins at low angles every 40-50 cm (~20-30°TCA). Upper 10 cm is strongly oxidized and moderately rubbly.	IG	0	1	3	2	5	11	15			cc	FeO		GIM	10.6	11.9	8.7	11.0	15	**57**	**57**
79.0	24.08	84.00	25.60	5.00	1.58	100	1.05	69	7	198	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). <1-2 mm calcite veins at low angles throughout run (~20-30°TCA).	IG	0	1	3	2	5	11	15			cc	FeO		GIM	10.6	13.5	7.6	11.0	15	**58**	**58**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
84.0	25.60	89.00	27.13	5.00	1.56	100	1.48	97	5	260	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). <1-2 mm calcite veins at low angles throughout run (~20-30°TCA).	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	19.5	8.3	14.0	15	**67**	**67**
89.0	27.13	94.00	28.65	5.00	1.52	100	0.95	62	10	138	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). <1-2 mm calcite veins at low angles throughout run (~20-30°TCA).	IG	0	4	3	2	5	14	15			cc	FeO		GIM	10.6	12.2	6.8	14.0	15	**59**	**59**
94.0	28.65	99.00	30.17	5.00	1.55	102	0.80	52	9	155	120	R5	Light grey to grey	Medium grained, inequigranular, porphyritic	Massive	Granodioirte, 20-30% white phenocrysts. Trace amounts of fine to medium grained mafic mineral (biotite/pyroxene). <1-2 mm calcite veins throughout run.	IG	0	4	3	2	5	14	15			cc			GIM	10.6	10.4	7.0	14.0	15	**57**	**57**
EOH																																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-189

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00		0										Topsoil	OB													JBC							
1.0	0.30	5.50	1.68	4.50	1.40	102	0.00	0	Max	5	1	R1	Grey, some brownish grey sections	Fine grained	Completely weathered, lenses of weak soil-like material	Shale, mostly rubble, highly oxidized	Ynl	0	0	1	0	1	2	15			Rub	cly		JBC	1.1	3.0	5.0	2.0	15	**26**	**26**
5.5	1.68	9.00	2.74	3.50	1.00	94	0.20	19	15	63	5	R2	Grey	Fine grained	Thinly bedded (1 mm)	Shale, highly fractured, sections (<5 cm) of rubble and oxidized material	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.5	5.3	5.9	6.0	15	**34**	**34**
9.0	2.74	13.30	4.05	4.30	1.30	99	0.33	25	20	62	5	R2	Grey	Fine grained	Thinly bedded (1 mm)	Shale, fractured, sections (<5 cm) of rubble and oxidized material	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.5	6.1	5.8	6.0	15	**34**	**34**
13.3	4.05	18.50	5.64	5.20	1.52	96	0.43	27	20	72	5	R2	Grey	Fine grained	Thinly bedded (1 mm)	Shale, fractured, sections (<5 cm) of rubble and oxidized material	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.5	6.4	6.0	6.0	15	**35**	**35**
18.5	5.64	24.00	7.31	5.50	1.60	95	0.57	34	14	107	15	R2	Grey	Fine grained	Thinly bedded (1 mm)	Shale, fractured, sections (<5 cm) of rubble and oxidized material	Ynl	0	1	3	0	3	7	15			cly	FeO		JBC	2.5	7.4	6.4	7.0	15	**38**	**38**
24.0	7.31	29.00	8.84	5.00	1.50	98	0.56	37	19	75	10	R2	Grey	Fine grained	Thinly bedded (1 mm)	Shale, fractured, sections (<5 cm) of rubble and oxidized material	Ynl	0	1	3	0	3	7	15			cly	FeO		JBC	2.0	7.8	6.0	7.0	15	**38**	**38**
29.0	8.84	33.80	10.30	4.80	1.47	100	0.90	62	15	92	25	R3	Grey	Fine grained	Thinly bedded (1 mm), subvertical	Shale, fractured, oxidized joint surfaces	Ynl	0	1	3	2	3	9	15			cly	FeO		JBC	3.4	12.1	6.2	9.0	15	**46**	**46**
33.8	10.30	39.00	11.89	5.20	1.52	96	1.10	69	12	117	25	R3	Grey	Fine grained	Thinly bedded (1 mm), subvertical	Shale, fractured, oxidized joint surfaces	Ynl	0	1	3	2	5	11	15			FeO	cly		JBC	3.4	13.6	6.6	11.0	15	**50**	**50**
39.0	11.89	44.00	13.41	5.00	1.50	98	1.25	82	10	136	40	R3	Grey to light grey	Fine grained	Bedded (up to 1 cm thick), sub-vertical	Shale, medium strong, some clay and iron oxide on joint surfaces, slightly weathered	Ynl	0	1	3	2	5	11	15			FeO	cly		JBC	4.8	16.2	6.8	11.0	15	**54**	**54**
44.0	13.41	49.00	14.93	5.00	1.52	100	0.76	50	15	95	40	R3	Grey to light grey	Fine grained	Bedded (up to 1 cm thick), sub-vertical	Shale, medium strong, some clay and iron oxide on joint surfaces, slightly weathered, trace calcite veinlets	Ynl	0	1	3	2	5	11	15			FeO	cly		JBC	4.8	10.0	6.3	11.0	15	**47**	**47**
49.0	14.93	54.00	16.46	5.00	1.52	100	1.02	67	10	138	40	R3	Grey to light grey	Fine grained	Bedded (up to 1 cm thick), sub-vertical	Shale, disturbed bedding, possible conglomerate with shale clasts, fine matrix, cannibalized?	Ynl	0	1	3	2	5	11	15			cly			JBC	4.8	13.1	6.8	11.0	15	**51**	**51**
54.0	16.46	59.00	17.98	5.00	1.49	98	1.13	74	10	135	40	R3	Grey to light grey	Fine grained	Bedded (up to 1 cm thick), sub-vertical	Shale, disturbed bedding, possible conglomerate with shale clasts, fine matrix, cannibalized?	Ynl	0	1	3	2	5	11	15			cc	cly		JBC	4.8	14.5	6.8	11.0	15	**52**	**52**
59.0	17.98	64.00	19.51	5.00	1.52	100	0.81	53	15	95	25	R3	Grey to light grey	Fine grained	Bedded, cannibalized texture?	Shale, disturbed bedding, calcite veinlets, medium strong to weak, easily fractured and crumbled	Ynl	0	1	3	2	5	11	15			cly	cc		JBC	3.4	10.6	6.3	11.0	15	**46**	**46**
64.0	19.51	69.00	21.03	5.00	1.52	100	1.01	66	9	152	25	R3	Grey to light grey	Fine grained	Bedded, cannibalized texture?	Shale, rubble and clay section (about 2 m thick) at 68 ft	Ynl	0	0	3	0	5	8	15			Rub	cly		JBC	3.4	13.0	7.0	8.0	15	**46**	**46**
69.0	21.03	74.00	22.55	5.00	1.52	100	0.75	49	12	117	25	R3	Grey to light grey	Fine grained	Thinly bedded shale, conglomerate sections	Shale/conglomerate, very fine grained matrix with clasts up to 2 cm diameter (mostly shale clasts) , rubble zone at 71 ft (about 10 cm thick), trace calcite veinlets, weak, slightly weathered	Ynl	0	0	3	0	5	8	15			Rub	cly		JBC	3.4	9.9	6.6	8.0	15	**43**	**43**
74.00	22.55	79.00	24.08	5.00	1.50	98	0.85	56	20	71	25	R3	Grey to light grey	Fine grained	Thinly bedded shale, conglomerate sections	Shale/conglomerate, very fine grained matrix with clasts up to 2 cm diameter (mostly shale clasts) , trace calcite veinlets, weak and easily fractured, slightly weathered	Ynl	0	1	3	2	5	11	15			cly			JBC	3.4	11.0	6.0	11.0	15	**46**	**46**
79.0	24.08	82.40	25.11	3.40	1.06	102	0.16	15	14	71	25	R3	Medium grey	Fine grained	Thinly bedded shale, conglomerate sections	Shale/conglomerate, very fine grained matrix with angular clasts up to 2 cm diameter (mostly shale clasts) , trace calcite veinlets, weak and easily fractured, slightly weathered.	Ynl	0	4	1	2	5	12	15			cc				3.4	4.8	6.0	12.0	15	**41**	**41**
82.4	25.11	86.70	26.42	4.30	1.17	89	0.30	23	10	106	40	R3	Medium grey	Fine grained	Thinly bedded shale, conglomerate sections	Shale/conglomerate, very fine grained matrix with angular clasts up to 2 cm diameter (mostly shale clasts) , trace calcite veinlets.	Ynl	0	1	1	2	6	10	15			cc				4.8	5.8	6.4	10.0	15	**42**	**42**
86.7	26.42	89.60	27.31	2.90	0.90	102	0.00	0	17	50	50	R4	Medium grey	Fine grained	Bedded, sub-horizontal (70-80° TCA)	Shale. Trace calcite veinlets throughout run. Upper 10 cm is rubble/gouge (shear zone).	Ynl	0	4	1	2	6	13	15			cc	rub			5.7	3.0	5.7	13.0	15	**42**	**42**

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
89.6	27.31	93.60	28.53	4.00	1.12	92	0.39	32	12	86	50	R4	Medium grey	Fine grained	Bedded, sub-horizontal (70-80° TCA)	Shale. Trace calcite veinlets throughout run.	Ynl	0	4	1	2	6	13	15			cc				5.7	7.1	6.2	13.0	15	**47**	**47**
93.6	28.53	96.60	29.44	3.00	0.90	98	0.14	15	10	82	50	R4	Medium grey	Fine grained	Bedded, sub-horizontal (70-80° TCA)	Shale. Calcite veinlets and 1mm veins throughout run. Center 10 cm is rubble/gouge (shear zone).	Ynl	0	1	1	2	6	10	15			cc	rub			5.7	4.8	6.1	10.0	15	**42**	**42**
96.6	29.44	99.00	30.17	2.40	0.74	101	0.00	0	10	67	50	R4	Medium grey	Fine grained	Bedded 40-50° TCA	Shale. Calcite veinlets and 1mm veins throughout run.	Ynl	0	1	1	2	6	10	15			cc				5.7	3.0	5.9	10.0	15	**40**	**40**

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GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-190

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00		0											OB													GIM							
0.0	0.00	4.00	1.22	4.00	0.97	80	0.00	0	max	5	0.5	R0	Beige/brown			Completely weathered shale, very soft, can be penetrated with finger easily. Lower 0.17 m has intact fragemtns of moderately weathered shale.	Ynl	0	0	0	0	0	0	15			cly			GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
4.0	1.22	9.00	2.74	5.00	0.80	52	0.80	52	max	5	0.5	R0	Beige/brown	Fine grained	Bedded	Interbedded beige and medium grey shale fragments intermixed with completely weathered shale.	Ynl	0	0	0	0	0	0	15			cly			GIM	1.1	10.4	5.0	0.0	15	**31**	**31**
9.0	2.74	10.90	3.32	1.90	0.50	86	0.00	0	max	5	0.5	R0	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Interbedded beige and medium grey shale fragments intermixed with completely weathered shale. Run is predominantly rock fragments over weathered clay.	Ynl	0	0	3	0	0	3	15			cly			GIM	1.1	3.0	5.0	3.0	15	**27**	**27**
10.0	3.05	13.20	4.02	3.20	0.60	62	0.00	0	8	67	30	R3	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Shale, 0.5-1 cm thick clay and rubble infilling on some fractures.	Ynl	0	0	1	0	3	4	15			cly	rub		GIM	3.9	3.0	5.9	4.0	15	**32**	**32**
13.2	4.02	15.20	4.63	2.00	0.55	90	0.00	0	10	50	30	R3	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Shale, 0.5-1 cm thick clay and rubble infilling on some fractures.	Ynl	0	0	1	0	3	4	15			rub	cly		GIM	3.9	3.0	5.7	4.0	15	**32**	**32**
15.2	4.63	17.70	5.39	2.50	0.70	92	0.00	0	14	47	30	R3	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Shale, <0.5 cm thick clay and rubble infilling on some fractures.	Ynl	0	1	1	2	3	7	15			cly	rub		GIM	3.9	3.0	5.6	7.0	15	**35**	**35**
17.7	5.39	21.10	6.43	3.40	0.97	94	0.00	0	20	46	30	R3	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Shale, <0.5 cm thick clay and rubble infilling on some fractures. Calcite veining visible throughout run.	Ynl	0	1	1	2	3	7	15			cc	rub		GIM	3.9	3.0	5.6	7.0	15	**35**	**35**
21.1	6.43	24.00	7.31	2.90	0.75	85	0.00	0	30	24	30	R3	Beige/brown	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~30-40° TCA.	Shale, <0.5 cm thick clay and rubble infilling on some fractures. Calcite veining visible throughout run.	Ynl	0	1	1	2	3	7	15			rub	cly		GIM	3.9	3.0	5.3	7.0	15	**34**	**34**
24.0	7.31	27.80	8.47	3.80	1.17	101	0.38	33	16	69	35	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Upper 0.2 m is weathered shale as described above, terminating in a rubbly clayey fracture. Rest of run is unweathered shale, with some calcite veinings.	Ynl	0	4	1	2	5	12	15			cc			GIM	4.4	7.2	5.9	12.0	15	**45**	**45**
27.8	8.47	30.40	9.27	2.60	0.78	98	0.00	0	11	65	30	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, with some calcite veining. Extrememly fractured and lower 10 cm is weak and friable.	Ynl	0	4	1	2	5	12	15			cc			GIM	3.9	3.0	5.9	12.0	15	**40**	**40**
30.4	9.27	33.30	10.15	2.90	0.83	94	0.00	0	max	5	0.5	R0	Medium Grey	Fine grained	Fault zone	Fault zone, grey gouge, can easily penetrate with knife. Lower 0.3 m is fractured but unfaulted shale.	flt	0	0	0	0	0	0	15			gg			GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
33.3	10.15	36.20	11.03	2.90	0.88	100	0.00	0	20	42	30	R3	Medium Grey	Fine grained	Bedded, layers up to 2 cm thick of medium grey and light beige rock. ~40-50° TCA.	Shale, calcite veinlets present throughout run, very fractured. Fractured with single firm blow from hammer.	Ynl	0	4	1	2	6	13	15			cc			GIM	3.9	3.0	5.6	13.0	15	**40**	**40**
36.2	11.03	39.70	12.10	3.50	1.07	100	0.00	0	15	67	30	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, calcite veinlets present throughout run, very fractured. Fractured with single firm blow from hammer. <1 cm rubble and clayey fractures throughout run.	Ynl	0	1	1	2	6	10	15			rub	cly		GIM	3.9	3.0	5.9	10.0	15	**38**	**38**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
39.7	12.10	44.00	13.41	4.30	1.20	92	0.24	18	14	80	30	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, calcite veinlets present throughout run, very fractured. Fractured with single firm blow from hammer. 10 cm rubble zone at .5 m, and 5 cm rubble zone at 0.7 m.	Ynl	0	0	1	2	6	9	15			rub			GIM	3.9	5.2	6.1	9.0	15	**39**	**39**
44.0	13.41	48.70	14.84	4.70	1.37	96	0.43	30	21	62	30	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, calcite veinlets present throughout run, very fractured. Fractured with single firm blow from hammer. From 0.8 to 1.1 m there is a zone of medium grey and beige interbedded shale (as decribed at top of hole, with 2-4 cm fault gouge at contacts.	Ynl	0	0	1	0	6	7	15			gg	rub		GIM	3.9	6.8	5.8	7.0	15	**39**	**39**
48.70	14.84	52.80	16.09	4.10	1.25	100	0.50	40	15	78	30	R3	Medium to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, sections (up to 1 cm thick) of clayey rubble present throughout run, slightly weathered, weak	Ynl	0	1	3	0	5	9	15			rub	cly		JBC	3.9	8.3	6.1	9.0	15	**42**	**42**
52.8	16.09	57.80	17.62	5.00	1.49	98	1.22	80	13	106	30	R3	Grey to light grey	Fine grained	Bedded, layers up to 1 cm thick, sub-vertical	Shale, weak to medium strength, slightly weathered to fresh, joints filled with clay	Ynl	0	1	3	2	6	12	15			cly			JBC	3.9	15.8	6.4	12.0	15	**53**	**53**
57.8	17.62	62.40	19.02	4.60	1.40	100	0.79	56	15	88	30	R3	Grey to light grey	Fine grained	Bedded, layers up to 1 cm thick, 45 to 50 degree TCA	Shale, weak to medium strength, slightly weathered to fresh, joints filled with clay	Ynl	0	4	3	2	6	15	15			cly	cc		JBC	3.9	11.1	6.2	15.0	15	**51**	**51**
62.4	19.02	67.50	20.57	5.10	1.52	98	0.81	52	20	72	30	R3	Grey to light grey	Fine grained	Bedded, layers up to 1 cm thick, 45 to 50 degree TCA	Shale, weak to medium strength, slightly weathered to fresh, a 2 cm thick rubble section at 66 ft	Ynl	0	1	3	0	6	10	15			rub			JBC	3.9	10.4	6.0	10.0	15	**45**	**45**
67.5	20.57	72.50	22.10	5.00	1.52	100	1.31	86	10	138	40	R3	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 50 degree TCA	Shale, medium strong, calcite infilling	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	17.0	6.8	13.0	15	**57**	**57**
72.5	22.10	77.50	23.62	5.00	1.52	100	1.30	85	8	169	50	R4	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 50 degree TCA	Shale, medium strong, calcite infilling	Ynl	0	4	1	2	6	13	15			cc			JBC	5.7	16.9	7.2	13.0	15	**58**	**58**
77.5	23.62	82.60	25.18	5.10	1.55	100	1.35	87	7	194	50	R4	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 50 degree TCA	Shale, medium strong, calcite infilling	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	17.2	7.5	15.0	15	**60**	**60**
82.6	25.18	87.60	26.70	5.00	1.52	100	0.90	59	15	95	40	R3	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 50 degree TCA	Shale, medium strong to weak, calcite veinlets throughout	Ynl	0	1	3	2	6	12	15			cc	cly		JBC	4.8	11.6	6.3	12.0	15	**50**	**50**
87.6	26.70	92.60	28.22	5.00	1.52	100	1.14	75	8	169	50	R4	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 50 degree TCA	Shale, medium strong to weak, calcite veinlets throughout	Ynl	0	4	3	2	6	15	15			cly			JBC	5.7	14.7	7.2	15.0	15	**58**	**58**
92.6	28.22	99.00	30.17	6.40	1.96	100	1.66	85	10	178	50	R4	Grey to light grey	Fine grained	Bedded, layers up to 2 cm thick, 45 to 55 degree TCA	Shale, medium strong, calcite veinlets throughout	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	16.8	7.3	15.0	15	**60**	**60**
EOH																																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-191

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	1.0	0.30	1.00		0											OB													GIM							
0.0	0.00	4.00	1.22	4.00	1.00	82	0.00	0	max	5	0.5	R0	Beige brown	Fine grained	Decomposed bedrock	Upper 0.3 m is topsoil, transitioning into completely decomposed bedrock, can be penetrated with hammer point easily. Lower 0.2 m shows fragements of medium grey shale.	Ynl	0	0	0	0	0	0	15			cly			GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
4.0	1.22	9.00	2.74	5.00	1.10	72	0.00	0	max	5	0.5	R0	Beige brown	Fine grained	Decomposed bedrock	Fragments, 1-4 cm, of beige and medium grey shale held together by decomposed rock.	Ynl	0	0	0	0	0	0	15			cly	Rub		GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
9.0	2.74	14.00	4.27	5.00	1.00	66	0.00	0	max	5	0.5	R0	Beige brown	Fine grained	Decomposed bedrock	Fragments, 1-4 cm, of beige and medium grey shale held together by decomposed rock.	Ynl	0	0	0	0	0	0	15			cly	Rub		GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
14.0	4.27	19.00	5.79	5.00	0.60	39	0.00	0	max	5	1	R1	Beige brown & medium grey	Fine grained	Fragmented bedrock	Extremely fractured beige and medium grey shale with ~40% of run as decomposed bedrock and rubble.	Ynl	0	0	3	0	1	4	15			cly	Rub		GIM	1.1	3.0	5.0	4.0	15	**28**	**28**
19.0	5.79	21.30	6.49	2.30	0.52	74	0.00	0	max	5	1	R1	Beige brown & medium grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Extremely fractured shale with rubble, clay, and FeO infilling on fractures. Rock fragments are held together enough to show bedding orientation.		0	1	3	2	1	7	15			Rub	cly	FeO	GIM	1.1	3.0	5.0	7.0	15	**31**	**31**
21.3	6.49	24.00	7.31	2.70	0.80	97	0.00	0	12	62	10	R2	Beige brown & medium grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Fractured shale with rubble, clay, and FeO infilling on fractures. Core is more competent than previous run.		0	1	3	2	3	9	15			Rub	cly	FeO	GIM	2.0	3.0	5.8	9.0	15	**35**	**35**
24.0	7.31	27.30	8.32	3.30	0.90	89	0.00	0	14	60	10	R2	Beige brown & medium grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Upper 0.4 m is beige and medium grey shale with rubbly fractures. Rest of run is medium grey, unweathered shale with calcite veins and veinlets throughout run.	Ynl	0	1	3	2	3	9	15			Rub	cc		GIM	2.0	3.0	5.8	9.0	15	**35**	**35**
27.3	8.32	31.80	9.69	4.50	1.24	90	0.10	7	19	62	25	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale with calcite veins ~1 mm thick throughout run. Zone of weathered shale (beige) at 0.7-0.9 m.	Ynl	0	1	3	2	3	9	15			cc	Rub		GIM	3.4	3.8	5.8	9.0	15	**37**	**37**
31.8	9.69	35.30	10.76	3.50	0.90	84	0.00	0	12	69	30	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale. Discontinuous calcite veinlets throughout run.	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	3.9	3.0	5.9	14.0	15	**42**	**42**
35.3	10.76	39.40	12.01	4.10	1.25	100	0.50	40	13	89	35	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale. Discontinuous calcite veinlets throughout run. Lower half of run features 1-3 cm thick light grey beds spaced 10 cm apart. Lost 90% of water return during this run.	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	4.4	8.3	6.2	14.0	15	**48**	**48**
39.4	12.01	43.35	13.21	3.95	1.10	91	0.50	42	8	122	35	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale. Discontinuous calcite veinlets throughout run.	Ynl	0	1	3	2	5	11	15			cc	Rub		GIM	4.4	8.6	6.6	11.0	15	**46**	**46**
43.4	13.21	44.00	13.41	0.65	0.20	100	0.00	0	max	5	1	R1	Beige	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Very soft, strongly weathered shale. Can be dented or penetrated with firm blow of hammer. Friable.	Ynl	0	0	0	0	1	1	15			gg			GIM	1.1	3.0	5.0	1.0	15	**25**	**25**
44.0	13.41	49.00	14.93	5.00	1.50	98	0.20	13	max	5	35	R3	Medium Grey	Fine grained	Disturbed bedding, 40-50° TCA, 1-10 mm thick layers	Shale. Bedding is discontinuous/disturbed with fragments of light grey layers throughout run. Discontinuous calcite veinlets throughout run. Old fault structure indicated by disturbed bedding.	Ynl	0	0	3	0	5	8	15			Rub	cc		GIM	4.4	4.5	5.0	8.0	15	**37**	**37**
49.0	14.93	54.00	16.46	5.00	1.40	92	0.63	41	12	108	40	R3	Medium Grey	Fine grained	Disturbed bedding, 40-50° TCA, 1-10 mm thick layers	Shale. Bedding is discontinuous/disturbed with fragments of light grey layers throughout run. Discontinuous calcite veinlets throughout run. Old fault structure indicated by disturbed bedding	Ynl	0	4	1	2	6	13	15			cc			GIM	4.8	8.6	6.4	13.0	15	**48**	**48**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger g.)	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
54.0	16.46	59.00	17.98	5.00	1.50	98	0.87	57	12	115	40	R3	Medium Grey	Fine grained	Disturbed bedding, 40-50° TCA, 1-10 mm thick layers	Shale. Bedding is discontinuous/disturbed with fragments of light grey layers throughout run. Discontinuous calcite veinlets throughout run. Old fault structure indicated by disturbed bedding	Ynl	0	4	1	2	6	13	15			cc			GIM	4.8	11.3	6.5	13.0	15	**51**	**51**
59.00	17.98	63.40	19.32	4.40	1.34	100	0.58	43	13	96	40	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale with dsicontinuous calcite veinlets and veins (1-2 mm) throughout run. Bedding is mostly intact, with minor localized disturbance.	Ynl	0	4	1	2	6	13	15			cc			GIM	4.8	8.9	6.3	13.0	15	**48**	**48**
63.4	19.32	67.40	20.54	4.00	1.19	98	0.42	34	8	132	35	R3	Medium Grey	Fine grained	Bedded, 40-50° TCA, 1-10 mm thick layers	Shale with dsicontinuous calcite veinlets and veins (1-2 mm) throughout run. Bedding is mostly intact, with minor localized disturbance.	Ynl	0	4	3	2	6	15	15			cc			GIM	4.4	7.5	6.8	15.0	15	**49**	**49**
67.4	20.54	68.40	20.85	1.00	0.30	98	0.00	0	max	5	1	R1	Medium Grey	Fine grained	Fault zone	Fractured with intense calcite veining. Gouge ~1-2 cm thick at ~45° TCA.	flt	0	0	0	0	0	0	15			gg			GIM	1.1	3.0	5.0	0.0	15	**24**	**24**
68.4	20.85	72.60	22.13	4.20	1.10	86	0.40	31	9	110	35	R3	Medium Grey	Fine grained	Bedded, Sub-horizontal at 70-80° TCA, 1-10 mm thick layers	Shale with dsicontinuous calcite veinlets and veins (1-2 mm) throughout run. Bedding is mostly intact, with minor localized disturbance.	Ynl	0	4	3	2	6	15	15			cc			GIM	4.4	7.0	6.5	15.0	15	**48**	**48**
72.6	22.13	74.00	22.55	1.40	0.42	98	0.00	0	6	60	35	R3	Medium Grey	Fine grained	Bedded, Sub-horizontal at 70-80° TCA, 1-10 mm thick layers	Shale with dsicontinuous calcite veinlets and veins (1-2 mm) throughout run. Bedding is mostly intact, with minor localized disturbance.	Ynl	0	4	1	2	6	13	15			cc			GIM	4.4	3.0	5.8	13.0	15	**41**	**41**
74.0	22.55	77.10	23.50	3.10	0.94	99	0.13	14	14	63	35	R3	Medium Grey	Fine grained	Bedded, Sub-horizontal at 70-80° TCA, 1-10 mm thick layers	Shale. Irregular/discontinuous calcite veinlets and 1-2 mm veins.	Ynl	0	4	3	2	6	15	15			cc			GIM	4.4	4.6	5.9	15.0	15	**45**	**45**
77.1	23.50	82.10	25.02	5.00	1.52	100	0.66	43	20	72	40	R3	Medium Grey	Fine grained	Bedded, Sub-horizontal at 70-80° TCA, 1-10 mm thick layers	Shale. Irregular/discontinuous calcite veinlets and 1-2 mm veins.	Ynl	0	4	1	2	6	13	15			cc			GIM	4.8	8.9	6.0	13.0	15	**48**	**48**
82.1	25.02	87.10	26.55	5.00	1.49	98	1.18	77	10	135	40	R3	Grey to medium grey	Fine grained	Bedded, up to 10 mm thick beds, various orientations	Shale, calcite veinlets, fresh, medium strong, calcite infilling	Ynl	0	4	3	2	6	15	15			cc			JBC	4.8	15.2	6.8	15.0	15	**57**	**57**
87.1	26.55	92.10	28.07	5.00	1.52	100	1.46	96	8	169	10	R2	Grey to medium grey	Fine grained	Bedded, up to 10 mm thick beds, various orientations	Shale, discontinuous and chaotic calcite veinlets, a 3 cm thick gougey clay zone with angular fragments (up to 2 cm diameter) at 92 ft	Ynl	0	1	3	0	5	9	15			gg	cly		JBC	2.0	19.2	7.2	9.0	15	**52**	**52**
92.1	28.07	99.00	30.17	6.90	2.02	96	1.15	55	32	61	20	R2	Grey to medium grey	Fine grained	Bedded, up to 1 cm thick beds, various orientations	Shale, discontinuous and chaotic calcite veinlets, run is more fractured	Ynl	0	1	3	2	6	12	15			cc	cly		JBC	3.0	10.8	5.8	12.0	15	**47**	**47**
																EOH																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	15.0	4.57	15.00		0											OB													JBC							
17.0	5.18	20.00	6.10	3.00	0.62	68	0.00	0	max	5	25	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale, calcite veinlets throughout intact rock fragements. Fractured with rubble and clay zones.	Ynl	0	0	3	0	3	6	15			Rub	cly		GIM	3.4	3.0	5.0	6.0	15	**32**	**32**
20.0	6.10	24.00	7.31	4.00	1.05	86	0.00	0	21	48	25	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale, calcite veinlets throughout intact rock fragements. Fractured with rubble and clay zones near top and bottom of run. Some bedding layers are brown/beige in colour.	Ynl	0	0	3	0	3	6	15			Rub	cly		GIM	3.4	3.0	5.7	6.0	15	**33**	**33**
24.0	7.31	29.00	8.84	5.00	1.28	84	0.00	0	27	46	25	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale. Calcite veinlets throughout run. Fractured with rubble and clay ~1 cm thick near top and bottom of run.	Ynl	0	1	3	2	5	11	15			Rub	cly	FeO	GIM	3.4	3.0	5.6	11.0	15	**38**	**38**
29.0	8.84	32.20	9.81	3.20	0.88	90	0.00	0	20	42	35	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale. Calcite veinlets throughout run. Very fractured with minimal occurances of rubble and clay in some fractures.	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	4.4	3.0	5.6	14.0	15	**42**	**42**
32.3	9.84	37.40	11.40	5.10	1.52	98	1.23	79	25	58	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale. 1-2 mm calcite veins and veinlets throughout run. Some ~5 mm rubbly fractures present every 0.4-0.6 m.	Ynl	0	4	1	2	6	13	15			cc	Rub		GIM	4.8	15.6	5.8	13.0	15	**54**	**54**
37.4	11.40	42.40	12.92	5.00	1.55	102	0.20	13	21	70	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale. 1-2 mm calcite veins and veinlets throughout run. Upper 0.2 m is rubbly with some clay gouge. 5 cm rubble joint at 1.0 m. Pyrite in bedding in lower 0.3 m.	Ynl	0	4	3	2	6	15	15			cc			GIM	4.8	4.5	6.0	15.0	15	**45**	**45**
42.4	12.92	47.60	14.51	5.20	1.55	98	0.14	9	18	82	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale. Calcite veinlets throughout run. Pyrite in bedding in upper 0.3 m.	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	4.8	4.0	6.1	14.0	15	**44**	**44**
47.6	14.51	52.80	16.09	5.20	1.50	95	0.27	17	14	100	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale. 1-2 mm calcite veins and veinlets throughout run.	Ynl	0	4	3	2	6	15	15			cc			GIM	4.8	5.0	6.3	15.0	15	**46**	**46**
52.8	16.09	57.90	17.65	5.10	1.55	100	0.42	27	29	52	50	R4	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale. 1-2 mm calcite veins and veinlets throughout run. 1 cm thick gouge zone at 1.35 m, followed by heavily fractured rock.	Ynl	0	4	3	2	6	15	15			cc	gg		GIM	5.7	6.4	5.7	15.0	15	**48**	**48**
57.9	17.65	63.00	19.20	5.10	1.53	98	0.12	8	22	67	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale, upper 0.6 is weathered/altered to a beige and grey colour, strongly fractured. Rest of run is shale as described above.	Ynl	0	1	3	2	3	9	15			cc	Rub		GIM	4.8	3.9	5.9	9.0	15	**39**	**39**
63.0	19.20	65.00	19.81	2.00	0.63	100	0.10	16	8	70	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale, trace calcite veinlets throughout run	Ynl	0	4	3	4	5	16	15			FeO			GIM	4.8	4.9	6.0	16.0	15	**47**	**47**
65.0	19.81	70.00	21.33	5.00	1.53	100	0.80	52	9	153	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale, trace calcite veinlets throughout run	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	4.8	10.4	7.0	14.0	15	**51**	**51**
70.0	21.33	75.00	22.86	5.00	1.54	100	1.09	72	10	140	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale, trace calcite veinlets present.	Ynl	0	4	1	6	6	17	15						GIM	4.8	14.0	6.9	17.0	15	**58**	**58**
75.0	22.86	80.00	24.38	5.00	1.57	100	0.72	47	14	105	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale, with light grey beds throughout. Trace calcite veinlets present and 2-3 mm thick calcite vein runs sub-parallel to core axis.	Ynl	0	4	1	2	6	13	15			cc			GIM	4.8	9.5	6.4	13.0	15	**49**	**49**
80.0	24.38	85.00	25.91	5.00	1.55	100	0.22	14	16	91	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shale, with light grey beds throughout. Discontinuous calcite veinlets present as well as 1-3 mm thick calcite veins.	Ynl	0	4	3	2	5	14	15			cc	FeO		GIM	4.8	4.7	6.2	14.0	15	**45**	**45**
85.00	25.91	87.20	26.58	2.20	0.50	75	0.00	0	8	56	1	R1	Medium Grey	Fine grained	Bedded, sub-horizontal, 60-75° TCA	Shear zone. Upper half of run is rubbly shale. Lower half of run features a 1-2 cm beige clay gouge shear at ~20-30° TCA with rubble below.	FLT	0	0	1	0	5	6	15			gg	Rub		GIM	1.1	3.0	5.8	6.0	15	**31**	**31**

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
87.2	26.58	90.00	27.43	2.80	0.86	100	0.50	59	2	287	40	R3	Medium Grey	Fine grained	Disturbed bedding	Shale. Upper 0.15 m is continuation of shear. Rest of run is disturbed shale with discontinuous bedding and calcite veins and veinlets.	Ynl	0	4	1	2	5	12	15			cc	FeO		GIM	4.8	11.5	8.6	12.0	15	**52**	**52**
90.0	27.43	95.00	28.95	5.00	1.50	98	0.79	52	12	115	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale with trace calcite and quartz veinlets throughout the run. Some minor rubbly fractures in upper half of run.	Ynl	0	4	1	2	6	13	15			cc	qtz		GIM	4.8	10.3	6.5	13.0	15	**50**	**50**
95.0	28.95	100.00	30.48	5.00	1.53	100	0.46	30	15	96	40	R3	Medium Grey	Fine grained	Bedded, sub-horizontal, 70-80° TCA	Shale with trace calcite and quartz veinlets throughout the run. Some minor rubbly fractures at 0.7 to 0.9 m. Pyrite present in bedding in upp34 0.3 m of run.	Ynl	0	4	1	2	6	13	15			Rub	gg		GIM	4.8	6.8	6.3	13.0	15	**46**	**46**
																	EOH																				

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-193

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	10.0	3.05	10.00													OB	0												JBC							
10.0	3.05	12.00	3.66	2.00												Completely weathered Shale	Ynl	0					0	15						JBC	1.0	3.0	5.0	0.0	15	**24**	**24**
12.0	3.66	19.00	5.79	7.00	2.04	96	0.00	0	Max	5	15	R2	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal (75 to 85 degrees TCA)	Shale, very weak and easily crumbled, joints along bedding, orangey brown oxidized and clayey sections (up to 2 cm thick)	Ynl	0	1	3	0	3	7	15			cly	FeO		JBC	2.5	3.0	5.0	7.0	15	**32**	**32**
19.0	5.79	24.00	7.31	5.00	1.52	100	0.00	0	50	30	25	R3	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal (75 to 85 degrees TCA)	Shale, very weak and easily crumbled, joints along bedding	Ynl	0	1	3	0	3	7	15			cly			JBC	3.4	3.0	5.4	7.0	15	**34**	**34**
24.0	7.31	29.00	8.84	5.00	1.57	100	0.68	45	18	83	30	R3	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal	Shale, weak, clay and calcite infilling	Ynl	0	4	3	2	5	14	15			cc	cly		JBC	3.9	9.1	6.1	14.0	15	**48**	**48**
29.0	8.84	34.00	10.36	5.00	1.52	100	0.70	46	20	72	30	R3	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal	Shale, weak, clay and calcite infilling	Ynl	0	4	1	2	5	12	15			cc	cly		JBC	3.9	9.3	6.0	12.0	15	**46**	**46**
34.0	10.36	39.00	11.89	5.00	1.52	100	0.62	41	21	69	30	R3	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal	Shale, weak, joints along bedding, fresh	Ynl	0	4	1	2	6	13	15			cc	cly		JBC	3.9	8.5	5.9	13.0	15	**46**	**46**
39.0	11.89	44.00	13.41	5.00	1.54	100	1.30	85	12	118	35	R3	Grey to light grey	Fine grained	Bedded, beds up to 5 mm, sub-horizontal	Shale, weak, joints along bedding, fresh, some calcite veinlets	Ynl	0	4	1	2	6	13	15			cc			JBC	4.4	16.9	6.6	13.0	15	**56**	**56**
44.0	13.41	49.00	14.93	5.00	1.55	100	1.22	80	12	119	35	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh	Ynl	0	4	1	2	6	13	15			cc			JBC	4.4	15.8	6.6	13.0	15	**55**	**55**
49.0	14.93	54.00	16.46	5.00	1.58	100	1.30	85	8	176	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh, calcite veinlets throughout	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	16.9	7.3	13.0	15	**57**	**57**
54.0	16.46	59.00	17.98	5.00	1.60	100	0.88	58	16	94	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh, calcite veinlets throughout (up to 3 cm thick), an 8 cm thick gougey clay section with angular fragments (up to 0.5 cm diameter) at 55 ft	Ynl	0	0	3	0	5	8	15			Rub	gg	cly	JBC	4.8	11.4	6.3	8.0	15	**45**	**45**
59.0	17.98	64.00	19.51	5.00	1.57	100	1.12	73	10	143	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh, calcite veinlets throughout	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	14.4	6.9	13.0	15	**54**	**54**
64.0	19.51	69.00	21.03	5.00	1.43	94	0.92	60	13	102	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh, calcite veinlets throughout	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	11.9	6.4	13.0	15	**51**	**51**
69.0	21.03	74.00	22.55	5.00	1.52	100	1.20	79	7	190	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (75 to 85 degrees TCA)	Shale, medium strong, fresh, calcite veinlets throughout	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	15.5	7.5	13.0	15	**56**	**56**
74.0	22.55	79.00	24.08	5.00	1.52	100	0.72	47	12	117	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (65 to 75 degrees TCA)	Shale, medium strong, fresh, calcite infilling, joints along bedding	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	9.5	6.6	13.0	15	**49**	**49**
79.0	24.08	84.00	25.60	5.00	1.52	100	1.14	75	10	138	40	R3	Grey to light grey	Fine grained	Bedded, beds up to 1 cm, sub-horizontal (65 to 75 degrees TCA)	Shale, medium strong, fresh, calcite infilling, joints along bedding	Ynl	0	4	1	2	6	13	15			cc			JBC	4.8	14.7	6.8	13.0	15	**54**	**54**
84.0	25.60	89.00	27.13	5.00	1.46	96	1.46	96	4	292	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 2cm, sub-horizontal (65 to 75 degrees TCA)	Shale, strong to medium strong, fresh, no infilling	Ynl	0	4	1	6	6	17	15						JBC	5.7	19.2	8.6	17.0	15	**66**	**66**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Joint Condition						Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
																		Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)														
89.0	27.13	94.00	28.65	5.00	1.52	100	1.18	77	11	127	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 2cm, sub-horizontal (65 to 75 degrees TCA)	Shale, strong to medium strong, fresh, calcite veins throughout (up to 2 cm thick)	Ynl	0	4	1	2	6	13	15			cc			JBC	5.7	15.2	6.7	13.0	15	**56**	**56**
94.0	28.65	99.00	30.17	5.00	1.52	100	0.85	56	13	109	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 2cm, sub-horizontal (65 to 75 degrees TCA)	Shale, strong to medium strong, fresh, sporadic calcite veinlets thorughout	Ynl	0	4	1	2	6	13	15			cc			JBC	5.7	11.0	6.5	13.0	15	**51**	**51**
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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	RMR-89 Total Min. Joint	RMR-89 Total Run Average
0.0	0.00	1.0	0.30	1.00		0											OB													GIM							
0.0	0.00	4.00	1.22	4.00	1.10	90	0.00	0	max	5	0.5	R0	Brown and grey	Fine grained	Bedded	Upper 0.3 m is topsoil plug. Rest of run is completely weathered shale, grey and brown, with structure intact. Very soft (easily penetrated with hammer point).	Ynl	0	0	0	0	1	1	15			cly			GIM	1.1	3.0	5.0	1.0	15	25	25
4.0	1.22	9.00	2.74	5.00	0.60	39	0.00	0	max	5	0.5	R0	Beige	Fine grained	None	Completely weathered shale, some relic structure visible.	Ynl	0	0	0	0	0	0	15			cly			GIM	1.1	3.0	5.0	0.0	15	24	24
9.0	2.74	11.30	3.44	2.30	0.40	57	0.00	0	max	5	0.5	R0	Beige and medium grey	Fine grained	None	Medium grey and beige shale rubble with clay (Weathered bedorck washed out during drilling).	Ynl	0	0	0	0	1	1	15			cly	Rub		GIM	1.1	3.0	5.0	1.0	15	25	25
11.3	3.44	12.60	3.84	1.30	0.36	91	0.00	0	max	5	10	R2	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~70-50° TCA	Medium grey and beige shale, completely fractured but intact with visible bedding, some trace weathered rock..	Ynl	0	0	3	0	3	6	15			Rub	cly		GIM	2.0	3.0	5.0	6.0	15	31	31
12.6	3.84	14.40	4.39	1.80	0.50	91	0.00	0	max	5	35	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~70-80° TCA	Medium grey and beige shale, strongly fractured with trace clay and rubble on fractures.	Ynl	0	4	1	2	3	10	15			cly	Rub		GIM	4.4	3.0	5.0	10.0	15	37	37
14.4	4.39	16.30	4.97	1.90	0.53	92	0.00	0	10	48	35	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~70-80° TCA	Medium grey and beige shale, strongly fractured with trace clay and rubble on fractures.	Ynl	0	4	1	2	4	11	15			cly	FeO	Rub	GIM	4.4	3.0	5.7	11.0	15	39	39
16.3	4.97	18.40	5.61	2.10	0.67	100	0.00	0	5	112	35	R3	Beige and medium grey	Fine grained	Discontinous	Disturbed shale or conglomerate, discontinuous structure with 5-10 mm clasts.	Ynl	0	4	1	2	4	11	15			FeO	cc		GIM	4.4	3.0	6.5	11.0	15	40	40
18.4	5.61	21.20	6.46	2.80	0.80	94	0.13	15	12	62	40	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~80-90° TCA	Shale, moderately weathered. Strongly fractured and resealed with discontinuous calcite veinelts. 0.15 m rubble and gouge zone at 0.4 m.	Ynl	0	0	1	2	3	6	15			Rub	FeO		GIM	4.8	4.8	5.8	6.0	15	36	36
21.2	6.46	24.00	7.31	2.80	0.60	70	0.00	0	max	5	35	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~80-90° TCA	Shale, moderately weathered. Strongly fractured and resealed with discontinuous calcite veinelts.	Ynl	0	0	1	2	3	6	15			FeO	cc		GIM	4.4	3.0	5.0	6.0	15	33	33
24.0	7.31	29.00	8.84	5.00	1.10	72	0.14	9	12	85	35	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~80-90° TCA	Shale, several calcite veinlets throughout run. Bedding is partially disturbed and clasts (0.5-1 cm) present throughout run.	Ynl	0	1	3	2	3	9	15			cc	FeO		GIM	4.4	4.0	6.1	9.0	15	39	39
29.0	8.84	33.10	10.09	4.10	0.90	72	0.00	0	22	39	35	R3	Beige and medium grey	Fine grained	Sub-vertical bedding @ ~80-90° TCA	Shale, moderately weathered. Strongly fractured. 3-8 cm rubble zone at 0.35 m.	Ynl	0	0	1	2	3	6	15			FeO	cc		GIM	4.4	3.0	5.5	6.0	15	34	34
33.1	10.09	34.20	10.42	1.10	0.15	45	0.00	0	max	5	35	R3	Beige and medium grey	Fine grained	Rubble	Shale rubble	Ynl	0	0	1	2	3	6	15			FeO			GIM	4.4	3.0	5.0	6.0	15	33	33
34.2	10.42	38.50	11.73	4.30	1.15	88	0.64	49	15	72	50	R4	Medium grey	Fine grained	Bedded, ~60-70° TCA	Unweathered shale, calcite veinlets crosscut bedding, and bedding is partially offset on some veins.	Ynl	0	4	1	2	6	13	15			cc			GIM	5.7	9.8	6.0	13.0	15	49	49
38.5	11.73	41.90	12.77	3.40	1.05	100	0.16	15	8	117	50	R4	Medium grey	Fine grained	Bedded, ~60-70° TCA	Shale, calcite veinlets crosscut bedding, and bedding is partially offset on some veins.	Ynl	0	4	1	2	6	13	15			cc			GIM	5.7	4.8	6.6	13.0	15	45	45
41.9	12.77	46.60	14.20	4.70	1.36	95	0.96	67	7	170	50	R4	Medium grey	Fine grained	Bedded, ~60-70° TCA	Shale, calcite veinlets crosscut bedding, and bedding is partially offset on some veins.	Ynl	0	4	1	2	6	13	15			cc			GIM	5.7	13.1	7.2	13.0	15	54	54
46.60	14.20	50.00	15.24	3.40	1.09	100	0.90	87	3	273	50	R4	Medium grey	Fine grained	Bedded, ~60-70° TCA	Shale, calcite veinlets crosscut bedding, and bedding is partially offset on some veins.	Ynl	0	4	1	2	6	13	15			cc			GIM	5.7	17.2	8.4	13.0	15	59	59
50.0	15.24	53.30	16.25	3.30	0.86	86	0.14	14	10	78	50	R4	Medium grey	Fine grained	Bedded, ~60-70° TCA	Shale, calcite veinlets crosscut bedding, and bedding is partially offset on some veins. Upper 0.15 m is rubble.	Ynl	0	4	1	2	6	13	15			cc			GIM	5.7	4.6	6.1	13.0	15	44	44
53.3	16.25	58.10	17.71	4.80	1.45	99	1.21	83	8	161	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 0.5 cm, sub-vertical ~65-85° TCA	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	16.3	7.1	15.0	15	59	59
58.1	17.71	62.80	19.14	4.70	1.42	99	1.20	84	10	129	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 0.5 cm, sub-vertical ~65-85° TCA	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	16.5	6.7	15.0	15	59	59

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
62.8	19.14	67.80	20.66	5.00	1.45	95	1.12	73	9	145	50	R4	Grey to light grey	Fine grained	Bedded, beds up to 0.5 cm, sub-vertical ~65-85° TCA	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	14.4	6.9	15.0	15	**57**	**57**
67.8	20.66	73.00	22.25	5.20	1.54	97	1.20	76	11	128	50	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	14.9	6.7	15.0	15	**57**	**57**
73.0	22.25	78.10	23.80	5.10	1.60	100	1.52	98	8	178	50	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	19.7	7.3	15.0	15	**63**	**63**
78.1	23.80	83.40	25.42	5.30	1.58	98	1.30	80	5	263	60	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	6.5	15.8	8.3	15.0	15	**61**	**61**
83.4	25.42	88.20	26.88	4.80	1.42	97	1.20	82	7	178	60	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick, some clastic sections with clasts up to 1 cm diameter	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	1	2	6	13	15			cc			JBC	6.5	16.2	7.3	13.0	15	**58**	**58**
88.2	26.88	93.50	28.50	5.30	1.61	100	1.33	82	4	322	60	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	1	2	6	13	15			cc			JBC	6.5	16.2	9.0	13.0	15	**60**	**60**
93.5	28.50	98.70	30.08	5.20	1.59	100	1.15	73	11	133	50	R4	Grey to light grey	Fine grained	Bedded, subvertical, beds up to 2 cm thick, 60 to 70 degrees TCA	Shale, calcite veinlets cross-cutting bedding, fresh, strong	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	14.2	6.8	15.0	15	**57**	**57**

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ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-195

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	0.8	0.23	0.75		0										Topsoil	OB													JBC							
0.8	0.23	6.50	1.98	5.75	1.28	73	0.00	0	Max	5	0.5	R0	Orangey brown to brown	Fine grained	Completely weathered	Shale, completely weathered, mostly silty clay with some shale fragments, bedding @45 degrees, calcite veining, poor recovery	Ynl	0	0	3	0	1	4	15			cly	Rub		JBC	1.1	3.0	5.0	4.0	15	**28**	**28**
6.5	1.98	9.00	2.74	2.50	0.65	85	0.00	0	Max	5	1	R1	Grey to light grey	Fine grained	Bedded	Shale, highly fractured, mainly rubble, fragments are angular (up to 4 cm diameter)	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.1	3.0	5.0	6.0	15	**30**	**30**
9.0	2.74	15.00	4.57	6.00	1.68	92	0.37	20	30	54	5	R2	Grey to light grey	Fine grained	Bedded, subvertical bedding, up to 1 mm thick	Shale, angular fragments, last 90 cm is intact	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.5	5.4	5.7	6.0	15	**34**	**34**
15.0	4.57	19.00	5.79	4.00	1.10	90	0.10	8	25	42	10	R2	Grey to light grey	Fine grained	Bedded, (45 to 60 degrees TCA), up to 1 mm thick	Shale, angular fragments, last 90 cm is intact	Ynl	0	1	3	0	3	7	15			FeO	cly		JBC	2.0	3.9	5.6	7.0	15	**34**	**34**
19.0	5.79	22.50	6.86	3.50	1.00	94	0.00	0	22	43	10	R2	Grey to light grey	Fine grained	Bedded (45 to 65 degrees TCA)	Shale, calcite veining (up to 2 mm thick) throughout, highly fractured, oxidized joint surfaces	Ynl	0	1	3	0	3	7	15			cly	FeO		JBC	2.0	3.0	5.6	7.0	15	**33**	**33**
22.5	6.86	25.50	7.77	3.00	1.15	100	0.41	45	25	44	20	R2	Grey to light grey	Fine grained	Bedded (45 to 65 degrees TCA)	Shale, calcite veining (up to 2 mm thick) throughout, highly fractured, oxidized joint surfaces	Ynl	0	1	3	0	5	9	15			cly	FeO		JBC	3.0	9.1	5.6	9.0	15	**42**	**42**
25.5	7.77	29.00	8.84	3.50	1.09	102	0.92	86	10	99	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA)	Shale, fresh, calcite infilling	Ynl	0	4	1	2	5	12	15			cc	cly		JBC	4.8	17.1	6.3	12.0	15	**55**	**55**
29.0	8.84	34.20	10.42	5.20	1.40	88	0.56	35	32	42	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA)	Shale, fresh, calcite infilling, run is more fractured than last, calcite veinlets throughout	Ynl	0	1	3	2	5	11	15			cc	cly		JBC	4.8	7.6	5.6	11.0	15	**44**	**44**
34.2	10.42	39.00	11.89	4.80	1.50	100	1.08	74	18	79	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA), beds up to 5 mm thick	Shale, calcite veinlets throughout, slightly weathered, oxidized joint surfaces	Ynl	0	1	3	2	5	11	15			FeO	cc	cly	JBC	4.8	14.5	6.1	11.0	15	**51**	**51**
39.0	11.89	44.00	13.41	5.00	1.37	90	1.05	69	14	91	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA), beds up to 5 mm thick	Shale, calcite veinlets throughout, slightly weathered, oxidized joint surfaces	Ynl	0	4	3	2	5	14	15			cc	cly	FeO	JBC	4.8	13.5	6.2	14.0	15	**54**	**54**
44.0	13.41	49.00	14.93	5.00	1.37	90	0.44	29	30	44	30	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA), beds up to 5 mm thick	Shale, calcite veinlets throughout, slightly weathered, oxidized joint surfaces, sections of rubble and clay (about 2 cm thick)	Ynl	0	1	3	0	5	9	15			Rub	cly		JBC	3.9	6.7	5.6	9.0	15	**40**	**40**
49.0	14.93	53.00	16.15	4.00	1.30	100	0.91	75	22	57	30	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA)	Shale, calcite veinlets throughout, slightly weathered, oxidized joint surfaces	Ynl	0	1	3	0	5	9	15			cly	Rub		JBC	3.9	14.6	5.8	9.0	15	**48**	**48**
53.0	16.15	56.80	17.31	3.80	1.10	95	0.68	59	10	100	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA)	Shale, clay and calcite infilling, fresh, sections of rubble	Ynl	0	1	3	0	6	10	15			cly	Rub		JBC	4.8	11.6	6.3	10.0	15	**48**	**48**
56.8	17.31	60.30	18.38	3.50	1.00	94	0.76	71	11	83	40	R3	Grey to light grey	Fine grained	Bedded (45 to 55 degrees TCA)	Shale, clay and calcite infilling, fresh	Ynl	0	4	3	2	6	15	15			cly	cc		JBC	4.8	13.9	6.1	15.0	15	**55**	**55**
60.3	18.38	64.00	19.51	3.70	1.16	100	0.70	62	8	129	40	R3	Grey to light grey	Fine grained	Bedded, subvertical (30 to 40 degrees TCA)	Shale, sections (up to 2cm thick), of rubble and clay, calcite infilling	Ynl	0	1	3	0	6	10	15			Rub	cly		GM	4.8	12.2	6.7	10.0	15	**49**	**49**
64.0	19.51	66.80	20.36	2.80	0.58	68	0.00	0	5	97	35	R3	Medium grey	Fine grained	Bedded, subvertical (20 to 30° TCA)	Shale, fault gouge from 0.06-0.13 m. 1-3 mm thick calcite veins throughout run.	Ynl	0	0	1	0	6	7	15			gg	cc		GM	4.4	3.0	6.3	7.0	15	**36**	**36**
66.8	20.36	68.80	20.97	2.00	0.56	92	0.35	57	4	112	40	R3	Medium grey	Fine grained	Bedded, subvertical (20 to 30° TCA)	Shale, lower 5-8 cm is rubble and gouge. Calcite veinlets present throughout run.	Ynl	0	4	3	2	6	15	15			cc	gg		GM	4.8	11.3	6.5	15.0	15	**53**	**53**
68.8	20.97	71.00	21.64	2.20	0.56	84	0.32	48	5	93	35	R3	Medium grey	Fine grained	Bedded, subvertical (20 to 30° TCA)	Shale. Trace amounts of calcite veinlets present throughout run.	Ynl	0	4	1	2	6	13	15			cc			GM	4.4	9.6	6.3	13.0	15	**48**	**48**
71.0	21.64	73.80	22.49	2.80	0.56	66	0.10	12	5	93	35	R3	Medium grey	Fine grained	Bedded, (40 to 50° TCA)	Shale. Trace amounts of calcite veinlets present throughout run. Upper 7 cm is clay gouge.	Ynl	0	1	1	0	6	8	15			gg	cc		GM	4.4	4.4	6.3	8.0	15	**38**	**38**
73.8	22.49	77.10	23.50	3.30	0.79	79	0.10	10	10	72	35	R3	Medium grey	Fine grained	Bedded, (40 to 50° TCA)	Shale. Trace amounts of calcite veinlets present throughout run.	Ynl	0	4	1	2	6	13	15			cc			GM	4.4	4.1	6.0	13.0	15	**42**	**42**
77.1	23.50	81.60	24.87	4.50	1.40	100	1.29	94	4	280	35	R3	Medium grey	Fine grained	Bedded, (40 to 50° TCA)	Shale. Trace amounts of calcite veinlets present throughout run.	Ynl	0	4	1	2	6	13	15			cc			GM	4.4	18.8	8.5	13.0	15	**60**	**60**
81.6	24.87	83.80	25.54	2.20	0.55	82	0.27	40	3	138	35	R3	Medium grey	Fine grained	Bedded, (40 to 50° TCA)	Shale. Trace amounts of calcite veinlets present throughout run.	Ynl	0	4	3	2	6	15	15			cc			GM	4.4	8.4	6.8	15.0	15	**50**	**50**

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
83.8	25.54	86.70	26.42	2.90	0.85	96	0.40	45	7	106	35	R3	Medium grey	Fine grained	Bedded, (40 to 50° TCA)	Shale. Frequent discontinuous calcite veinlets throughout run.	Ynl	0	4	3	2	6	15	15			cc			GM	4.4	9.2	6.4	15.0	15	**50**	**50**
86.7	26.42	90.70	27.64	4.00	1.15	94	0.30	25	7	144	35	R3	Medium grey	Fine grained	Bedded, sub-vertically (10 to 250° TCA)	Shale, frequent discontinuous calcite veinlets. Bedding is offset ~1 mm along some calcite veinlets.	Ynl	0	1	3	2	6	12	15			cc	gg		GM	4.4	6.0	6.9	12.0	15	**44**	**44**
90.7	27.64	92.00	28.04	1.30	0.40	101	0.20	50	4	80	35	R3	Medium grey	Fine grained	Bedded, sub-vertically (10 to 250° TCA)	Shale, frequent discontinuous calcite veinlets. Bedding is offset ~1 mm along some calcite veinlets.	Ynl	0	4	3	2	6	15	15			cc			GM	4.4	10.1	6.1	15.0	15	**51**	**51**
92.0	28.04	95.00	28.95	3.00	0.90	98	0.00	0	12	69	35	R3	Medium grey	Fine grained	Bedded, sub-vertically (10 to 250° TCA)	Shale, frequent discontinuous calcite veinlets. Bedding is offset ~1 mm along some calcite veinlets.	Ynl	0	4	3	2	6	15	15			cc			GM	4.4	3.0	5.9	15.0	15	**43**	**43**
95.0	28.95	98.80	30.11	3.80	0.75	65	0.22	19	11	63	35	R3	Medium grey	Fine grained	Bedded, sub-vertically (10 to 250° TCA)	Shale, frequent discontinuous calcite veinlets. Bedding is offset ~1 mm along some calcite veinlets.	Ynl	0	4	3	2	6	15	15			cc			GM	4.4	5.3	5.9	15.0	15	**45**	**45**
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																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	8.0	2.44	8.00		0											OB													JBC							
8.0	2.44	17.50	5.33	9.50	2.25	78	0.00	0	Max	5	0.5	R0	Grey to orangey brown, multicolored	Completely weathered, soil-like	Highly fractured and oxidized	Completely weathered bedrock, clay rich, fragments consists of granodiorite and shale (up to 3 cm diameter)	OB	0	0	1	0	1	2	15			Rub	FeO	cly	JBC	1.1	3.0	5.0	2.0	15	**26**	**26**
17.5	5.33	23.50	7.16	6.00	1.40	77	0.00	0	Max	5	0.5	R0	Orangey brown to orange	Completely weathered, soil-like	Highly fractured and oxidized	Completely weathered bedrock, angular fragments shale, some granodiorite, clay rich	OB	0	0	1	0	1	2	15			Rub	FeO	cly	JBC	1.1	3.0	5.0	2.0	15	**26**	**26**
23.5	7.16	27.30	8.32	3.80	1.17	100	0.12	10	Max	5	1	R1	Brownish grey to orangey brown	Fine grained	Highly fractured and oxidized	Weathered bedrock, some intact pieces - mostly shale	Ynl	0	0	3	0	1	4	15			Rub	FeO	cly	JBC	1.1	4.2	5.0	4.0	15	**29**	**29**
27.3	8.32	32.30	9.84	5.00	1.35	89	0.20	13	Max	5	1	R1	Grey to bluish grey	Fine grained	Highly fractured and oxidized	Shale?, highly weathered, seams of iron oxide and clay, solid pieces can be penetrated by knife	Ynl	0	0	3	0	3	6	15			Rub	FeO	cly	JBC	1.1	4.5	5.0	6.0	15	**32**	**32**
32.3	9.84	37.00	11.28	4.70	1.29	90	0.20	14	Max	5	1	R1	Grey to bluish grey	Fine grained	Highly fractured and oxidized	Shale?, highly weathered, sections (about 20 cm) of oxidized clay reddish orange material	Ynl	0	0	3	0	3	6	15			FeO	cly	Rub	JBC	1.1	4.6	5.0	6.0	15	**32**	**32**
37.0	11.28	41.70	12.71	4.70	0.88	61	0.11	8	Max	5	10	R2	Brownish grey to orangey brown	Fine grained	Highly fractured and oxidized	Shale?, mostly rubble and oxidized material	Ynl	0	0	3	0	3	6	15			Rub	cly	FeO	JBC	2.0	3.9	5.0	6.0	15	**32**	**32**
41.7	12.71	45.00	13.72	3.30	1.02	101	0.41	41	15	64	20	R2	Bluish grey to medium grey	Fine grained	Microfratured, massive, some bedding	Shale?, some clasts up to 2 cm diameter, oxidized joint surfaces	Ynl	0	1	3	0	3	7	15			FeO	cly		JBC	3.0	8.5	5.9	7.0	15	**39**	**39**
45.0	13.72	50.00	15.24	5.00	1.52	100	0.70	46	25	58	20	R2	Bluish grey to medium grey	Fine grained	Microfratured, massive, some bedding	Shale?, some clasts up to 2 cm diameter, oxidized joint surfaces	Ynl	0	1	3	0	3	7	15			Rub	FeO	cly	JBC	3.0	9.3	5.8	7.0	15	**40**	**40**
50.0	15.24	55.00	16.76	5.00	1.52	100	0.46	30	35	42	15	R2	Bluish grey to medium grey	Fine grained	Microfratured, massive, some bedding	Shale?, highly oxidized, sections (up to 5 cm thick), of clayey oxidized rubble	Ynl	0	1	3	0	3	7	15			FeO	cly		JBC	2.5	6.8	5.6	7.0	15	**37**	**37**
55.0	16.76	60.00	18.29	5.00	1.52	100	0.71	47	20	72	20	R2	Grey to light grey	Fine grained	Microfratured, massive, some bedding	Shale?, some clasts up to 2 cm diameter, oxidized joint surfaces	Ynl	0	1	3	0	3	7	15			FeO	cly		JBC	3.0	9.4	6.0	7.0	15	**40**	**40**
60.0	18.29	65.00	19.81	5.00	1.50	98	0.30	20	30	48	15	R2	Grey to light grey	Fine grained	Microfratured, massive, some bedding	Shale, pockets of highly oxidized material, sections (up to 20 cm) of rubble and clay	Ynl	0	0	3	0	3	6	15			Rub	FeO	cly	JBC	2.5	5.4	5.7	6.0	15	**35**	**35**
65.0	19.81	70.00	21.33	5.00	1.52	100	0.69	45	14	101	25	R3	Pale grey to grey	Fine grained	Microfratured, massive, some bedding	Shale?, microfractured, oxidized joint surfaces	Ynl	0	1	3	2	3	9	15			FeO	cly		JBC	3.4	9.2	6.4	9.0	15	**43**	**43**
70.0	21.33	75.00	22.86	5.00	1.51	99	0.66	43	15	94	25	R3	Pale grey to grey	Fine grained	Microfratured, massive, some bedding	Shale?, microfractured, oxidized joint surfaces	Ynl	0	1	3	2	3	9	15			FeO	cly		JBC	3.4	8.9	6.3	9.0	15	**43**	**43**
75.0	22.86	80.00	24.38	5.00	1.52	100	0.62	41	25	58	25	R3	Grey to light grey	Fine grained	Microfratured, massive	Shale, oxidized patches throughout and on joint surfaces, highly fractured,	Ynl	0	1	3	2	3	9	15			FeO	cly		JBC	3.4	8.5	5.8	9.0	15	**42**	**42**
80.0	24.38	85.00	25.91	5.00	1.50	98	0.90	59	10	136	30	R3	Beige-grey	Fine grained	Microfratured, massive	Shale, oxidized zones throughout run. Trace calcite veinlets (oxide stained).	Ynl	0	4	3	2	3	12	15			FeO	cc			3.9	11.6	6.8	12.0	15	**49**	**49**
85.00	25.91	90.00	27.43	5.00	1.54	101	0.87	57	11	128	30	R3	Medium grey	Fine grained	Bedded, ~40-50° TCA	Shale, oxidized zones throughout run. Trace calcite veinlets (oxide stained).	Ynl	0	4	3	2	3	12	15			FeO	cc			3.9	11.3	6.7	12.0	15	**49**	**49**
90.0	27.43	95.00	28.95	5.00	1.50	98	1.06	70	7	188	30	R3	Medium grey	Fine grained	Bedded, ~40-50° TCA	Shale, oxidized zones throughout run. Trace calcite veinlets (oxide stained). 2-3 cm rubble and clay joint at 1.3 m.	Ynl	0	0	3	0	3	6	15			Rub	FeO	cly		3.9	13.6	7.4	6.0	15	**46**	**46**
95.0	28.95	100.00	30.48	5.00	1.53	100	0.59	39	12	118	30	R3	Medium grey	Fine grained	Bedded, ~40-50° TCA	Shale, oxidized zones throughout run. Trace clay infilling on joint.	Ynl	0	4	3	2	3	12	15			FeO	cly			3.9	8.1	6.6	12.0	15	**46**	**46**
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																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	RMR-89 Total Min. Joint	RMR-89 Total Run Average
0.0	0.00	1.5	0.46	1.50		0										Topsoil	OB													JBC							
1.5	0.46	4.00	1.22	2.50	0.80	100	0.00	0	Max	5	1	R1	Grey to light grey	Fine grained	Microfractured	Shale, highly oxidized and completely weathered	Ynl	0	0	1	0	1	2	15			cly	FeO		JBC	1.1	3.0	5.0	2.0	15	**26**	**26**
4.0	1.22	9.00	2.74	5.00	1.42	93	0.00	0	Max	5	1	R1	Grey to light grey	Fine grained	Microfractured	Shale, highly oxidized and completely weathered, clay rich, some rubble	Ynl	0	0	3	0	1	4	15			Rub	FeO	cly	JBC	1.1	3.0	5.0	4.0	15	**28**	**28**
9.0	2.74	14.00	4.27	5.00	1.43	94	0.00	0	Max	5	5	R2	Grey to light grey	Fine grained	Bedded, sub-horizontal, 70 to 80 degrees TCA	Shale, highly fractured run with sections (up to 5 cm) of clay and rubble, moderately weathered	Ynl	0	0	3	0	3	6	15			Rub	cly		JBC	1.5	3.0	5.0	6.0	15	**31**	**31**
14.0	4.27	19.00	5.79	5.00	1.45	95	0.10	7	35	40	15	R2	Grey to light grey	Fine grained	Bedded, sub-horizontal, 70 to 80 degrees TCA	Shale, highly fractured run with sections (up to 5 cm) of clay and rubble, moderately weathered, joints along bedding	Ynl	0	1	3	0	3	7	15			cly	FeO		JBC	2.5	3.7	5.6	7.0	15	**34**	**34**
19.0	5.79	24.00	7.31	5.00	1.44	94	0.10	7	35	40	15	R2	Grey to light grey	Fine grained	Bedded, sub-horizontal, 70 to 80 degrees TCA	Shale, microfractured, some sections (up to 3 cm) of clayey rubble	Ynl	0	1	3	0	5	9	15			cly	FeO		JBC	2.5	3.7	5.5	9.0	15	**36**	**36**
24.0	7.31	29.00	8.84	5.00	1.45	95	0.52	34	30	47	15	R2	Grey to light grey	Fine grained	Bedded, sub-horizontal, 70 to 80 degrees TCA	Shale, microfractured, some sections (up to 3 cm) of clayey rubble, some calcite veinlets, last 60 cm is more intact	Ynl	0	1	3	0	5	9	15			cly	FeO		JBC	2.5	7.4	5.6	9.0	15	**40**	**40**
29.0	8.84	34.00	10.36	5.00	1.52	100	0.72	47	20	72	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, lots of discontinuous calcite veinlets, few sections (up to 1 cm) of rubble and clay	Ynl	0	1	3	2	5	11	15			cly	cc	Rub	JBC	4.8	9.5	6.0	11.0	15	**46**	**46**
34.0	10.36	39.00	11.89	5.00	1.51	99	0.85	56	13	108	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, lots of discontinuous calcite veinlets, more competent than last run, no rubble sections	Ynl	0	1	3	2	5	11	15			cc	cly		JBC	4.8	11.0	6.4	11.0	15	**48**	**48**
39.0	11.89	44.00	13.41	5.00	1.00	66	0.15	10	30	32	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, lots of discontinuous calcite veinlets, low recovery run - possible washout but no evidence of clay	Ynl	0	1	3	0	5	9	15			Rub			JBC	4.8	4.1	5.4	9.0	15	**38**	**38**
44.0	13.41	48.40	14.75	4.40	1.57	100	0.58	43	40	38	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, first 30 cm is mainly rubble, large calcite vein at the end of the run, expanded across core diameter	Ynl	0	0	3	0	5	8	15			Rub			JBC	4.8	8.9	5.5	8.0	15	**42**	**42**
48.4	14.75	53.40	16.28	5.00	1.50	98	0.44	29	25	58	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, first 1 m of run is the calcite vein - angular fragments of shale (up to 2 cm diameter) are within the vein, sections of rubble	Ynl	0	0	3	0	5	8	15			Rub			JBC	4.8	6.7	5.8	8.0	15	**40**	**40**
53.4	16.28	58.60	17.86	5.20	1.51	95	0.42	26	25	58	40	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 60 to 70 degrees TCA	Shale, calcite veinlets throughout, some sections (up to 1 cm) of rubble, highly fractured run, fresh	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	4.8	6.3	5.8	12.0	15	**44**	**44**
58.6	17.86	63.70	19.41	5.10	1.50	96	0.35	23	32	45	35	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 60 to 70 degrees TCA	Shale, calcite veinlets throughout, highly fractured run	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	4.4	5.8	5.6	12.0	15	**43**	**43**
63.7	19.41	67.40	20.54	3.70	1.20	100	0.42	37	23	50	35	R3	Grey to light grey	Fine grained	Bedded, sub-horizontal, 60 to 70 degrees TCA	Shale, first 30 cm is mainly rubble, large calcite veinlets throughout	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	4.4	7.9	5.7	12.0	15	**45**	**45**
67.4	20.54	72.40	22.07	5.00	1.55	100	1.29	85	14	103	50	R4	Grey to light grey	Fine grained	Bedded, sub-horizontal, 60 to 70 degrees TCA	Shale, more competent than before, one section (up to 2 cm) of rubble, calcite veinlets throughout	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	5.7	16.7	6.4	12.0	15	**56**	**56**
72.4	22.07	77.40	23.59	5.00	1.54	100	1.00	66	15	96	50	R4	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA	Shale, calcite veinlets throughout	Ynl	0	4	3	2	6	15	15			cc			JBC	5.7	12.8	6.3	15.0	15	**55**	**55**
77.4	23.59	85.20	25.97	7.80	2.41	100	1.33	56	35	67	50	R4	Grey to light grey	Fine grained	Bedded, sub-horizontal, 65 to 75 degrees TCA, beds up to 5 mm	Shale, one section (up to 1 cm) of rubble	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	5.7	11.0	5.9	12.0	15	**50**	**50**
85.2	25.97	87.70	26.73	2.50	0.75	98	0.60	79	4	150	60	R4	Light grey to pale grey	Fine to coarse grained, porphyritic	Massive, phenocrysts (up to 5 mm)	Intrusive dyke, sharp contact, calcite phenocrysts, fresh, strong	IG	0	4	3	2	6	15	15			cc			JBC	6.5	15.5	7.0	15.0	15	**59**	**59**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
87.7	26.73	92.90	28.31	5.20	1.56	98	0.90	57	8	173	60	R4	Light grey to pale grey	Fine to coarse grained, porphyritic	Massive, phenocrysts (up to 5 mm)	Intrusive dyke (granodiorite?), joints filled with hematite and calcite	IG	0	4	3	2	6	15	15			hem	cc		JBC	6.5	11.2	7.3	15.0	15	**55**	**55**
92.9	28.31	98.00	29.87	5.10	1.55	100	1.22	78	5	258	50	R4	Light grey to pale grey	Fine to coarse grained, porphyritic	Massive, phenocrysts (up to 5 mm), , bedded shale	Intrusive dyke, calcite phenocrysts, fresh, strong - contact with Shale at 96.5 ft, contact is rubble and clay zone (3 cm thick)	IG/Ynl	0	1	3	0	6	10	15			Rub	cc		JBC	5.7	15.4	8.3	10.0	15	**54**	**54**
EOH																																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-198

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS							
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	4.8	1.46	4.80	1.2	0	0									Overburden. Upper 0.5 m is topsoil. 0.5-1.0 m is fine to medium sand, the rest of the run is fractured shale.	OB													GIM							
4.8	1.46	9.00	2.74	4.20	0.70	55	0.00	0	max	5	35	R3	Medium grey	Fine grained	Bedded	Shale, run is completely rubble with soem clay/overburden in residual fractures.	Ynl	0	0	3	0	5	8	15			FeO	cly		GIM	4.4	3.0	5.0	8.0	15	**35**	**35**
9.0	2.74	12.30	3.75	3.30	1.00	99	0.00	0	16	59	35	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA), dark grey laminations 1-5 mm thick.	Shale, calcite veins 1-2 mm thick throughout run. Some fractured surfaces are rubbly with trace clay. FeO staining on fractures	Ynl	0	1	3	2	5	11	15			Rub	cc	FeO	GIM	4.4	3.0	5.8	11.0	15	**39**	**39**
12.3	3.75	15.50	4.72	3.20	0.90	92	0.00	0	15	56	35	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA), dark grey laminations 1-5 mm thick.	Shale, calcite veins 1-2 mm thick throughout run. FeO staining on fractures	Ynl	0	4	1	2	5	12	15			FeO	cc		GIM	4.4	3.0	5.8	12.0	15	**40**	**40**
15.5	4.72	18.50	5.64	3.00	0.85	93	0.00	0	max	5	35	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA), dark grey laminations 1-5 mm thick.	Shale, calcite veins 1-2 mm thick throughout run. FeO staining on fractures. Cuttings at upper 0.2 m from redrilling.	Ynl	0	4	1	2	5	12	15			FeO	cc		GIM	4.4	3.0	5.0	12.0	15	**39**	**39**
18.5	5.64	21.70	6.61	3.20	0.98	100	0.00	0	max	5	35	R3	Medium grey	Fine grained	Fractured and rehealed with calcite, structure obscured	Shale, strongly fratured, calcite veins throughout run. Rubbly/clayey fractures 0.5-2 cm thick throughout run.	Ynl	0	1	1	2	3	7	15			Rub	FeO	cly	GIM	4.4	3.0	5.0	7.0	15	**34**	**34**
21.7	6.61	26.80	8.17	5.10	1.54	99	0.00	0	30	50	35	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Upper 0.2 m is rubble.	Ynl	0	4	1	2	3	10	15			cc	FeO	Rub	GIM	4.4	3.0	5.7	10.0	15	**38**	**38**
26.8	8.17	32.00	9.75	5.20	1.53	97	0.40	25	19	77	35	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins.	Ynl	0	4	1	2	3	10	15			cc	FeO		GIM	4.4	6.1	6.0	10.0	15	**42**	**42**
32.0	9.75	37.10	11.31	5.10	1.53	98	0.32	21	17	85	25	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins. Calcite veining itself is discontinuous.	Ynl	0	4	3	2	3	12	15			cc	FeO		GIM	3.4	5.5	6.1	12.0	15	**42**	**42**
37.1	11.31	41.50	12.65	4.40	1.35	100	0.00	0	22	59	25	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins. Calcite veining itself is discontinuous.	Ynl	0	4	3	2	3	12	15			cc	FeO		GIM	3.4	3.0	5.8	12.0	15	**39**	**39**
41.5	12.65	44.20	13.47	2.70	0.75	91	0.00	0	20	36	25	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1 cm thick sporadically throughout run.	Ynl	0	4	1	2	3	10	15			cc	FeO		GIM	3.4	3.0	5.5	10.0	15	**37**	**37**
44.2	13.47	45.80	13.96	1.60	0.46	94	0.00	0	15	29	25	R3	Beige and grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1 cm thick sporadically throughout run.	Ynl	0	4	1	2	3	10	15			cly	FeO	cc	GIM	3.4	3.0	5.4	10.0	15	**37**	**37**
45.8	13.96	49.00	14.93	3.20	1.00	100	0.15	15	22	43	25	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, strongly oxidized on fractures. Rubbly joints, <1 cm thick, throughout run with some clay.	Ynl	0	1	1	2	4	8	15			Rub	FeO	cc	GIM	3.4	4.8	5.6	8.0	15	**37**	**37**
49.0	14.93	53.40	16.28	4.40	1.30	97	0.22	16	20	62	35	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, strongly oxidized on fractures.	Ynl	0	1	1	2	5	9	15			cc	FeO		GIM	4.4	4.9	5.8	9.0	15	**39**	**39**
53.4	16.28	58.80	17.92	5.40	1.06	64	0.60	36	8	118	50	R4	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, trace calcite veinlets throughout run and oxidation onfractures.	Ynl	0	4	1	2	5	12	15			cc	FeO		GIM	5.7	7.8	6.6	12.0	15	**47**	**47**
58.8	17.92	64.00	19.51	5.20	1.56	98	0.40	25	max	5	0.5	R0	Beige	Fine grained	massive	Upper 0.35 m is completely weathered to fine sand. 0.35-0.6 m is strongly weathered shale with strong oxidation staining and calcite veining. The rest of the run is unweathered shale.	Fault	0	0	0	0	0	0	15			gg	FeO		GIM	1.1	6.1	5.0	0.0	15	**27**	**27**
64.00	19.51	69.00	21.03	5.00	1.44	94	0.00	0	19	72	40	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, 2-10 cm rubble clayey fractures and trace calcite veinlets throughout run.	Ynl	0	0	1	0	5	6	15			Rub	cly		GIM	4.8	3.0	6.0	6.0	15	**35**	**35**
69.0	21.03	74.00	22.55	5.00	1.50	98	0.12	8	22	65	40	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, trace calcite veinlets throughout run. Some minor <1 cm rubbly fractures.	Ynl	0	4	1	2	5	12	15			FeO	cc		GIM	4.8	3.9	5.9	12.0	15	**42**	**42**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
74.0	22.55	79.00	24.08	5.00	1.42	93	0.57	37	22	62	40	R3	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, medium strong, some oxidation on joint surfaces, calcite veinlets throughout	Ynl	0	0	3	0	5	8	15			FeO	cly		JBC	4.8	7.9	5.8	8.0	15	**42**	**42**
79.0	24.08	84.00	25.60	5.00	1.52	100	1.12	73	15	95	50	R4	Medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, medium strong, calcite veinlets, more competent than previous but one section (1 cm) of rubble and clay at 80.5 ft	Ynl	0	1	3	0	5	9	15			Rub	cly		JBC	5.7	14.4	6.3	9.0	15	**50**	**50**
84.0	25.60	89.00	27.13	5.00	1.50	98	0.43	28	30	48	25	R3	Medium grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout - chaotic, a 17 cm thick section of soil-like (silty clay rich) with angular fragments (up to 1 cm diameter) at 87 ft	Ynl	0	0	3	0	5	8	15			Rub	cly		JBC	3.4	6.6	5.7	8.0	15	**39**	**39**
89.0	27.13	93.50	28.50	4.50	1.34	98	0.50	36	18	71	40	R3	Medium grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout, medium strong	Ynl	0	4	3	2	6	15	15			cc	cly		JBC	4.8	7.8	6.0	15.0	15	**49**	**49**
93.5	28.50	98.50	30.02	5.00	1.55	100	0.91	60	16	91	45	R3	Medium grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout, medium strong	Ynl	0	1	3	2	6	12	15			cc	Rub		JBC	5.2	11.7	6.2	12.0	15	**50**	**50**
																EOH																					

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-201

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	2.0	0.61	2.00	0.1	0	0									Overburden. Upper 0.13m is topsoil. 0.13-0.60 m is fractured shale rubble with silty clay infill	OB													JDC							
2.0	0.61	4.50	1.37	2.50	0.45	59	0.00	0	max	5	5	R2	Dark grey	Fine grained	Bedded	Shale, run is completely rubble with some clay/overburden in residual fractures.	Ynl	0	0	6	0	1	7	15			Rub	FeO		JDC	1.5	3.0	5.0	7.0	15	**32**	**32**
4.5	1.37	9.00	2.74	4.50	1.35	98	0.37	27	16	79	25	R3	Dark grey	Fine grained	Very thickly bedded with no discernible bedding.	Shale, fractured surfaces are rubbly with FeO staining on fractures and along joints.	Ynl	0	1	3	2	5	11	15			Rub	cc	FeO	JDC	3.4	6.4	6.1	11.0	15	**42**	**42**
9.0	2.74	13.50	4.11	4.50	0.85	62	0.00	0	5	142	15	R2	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA), dark grey laminations 1-5 mm thick.	Shale, calcite veins 1-2 mm thick throughout run. FeO staining on fractures	Ynl	0	1	5	2	1	9	15			FeO	cc		JDC	2.5	3.0	6.9	9.0	15	**36**	**36**
13.5	4.11	18.50	5.64	5.00	1.52	100	0.42	28	9	152	50	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA), dark grey laminations 1-5 mm thick.	Shale, calcite veins 1-2 mm thick throughout run. FeO staining on fractures. Cuttings at upper 0.2 m from redrilling.	Ynl	0	4	3	2	5	14	15			FeO	cc		JDC	5.7	6.5	7.0	14.0	15	**48**	**48**
18.5	5.64	23.70	7.22	5.20	1.52	96	0.75	47	8	169	60	R4	Dark grey	Fine grained	Fractured and rehealed with calcite, structure obscured	Shale, strongly fratured, calcite veins throughout run. Rubbly/clayey fractures 0.5-2 cm thick throughout run.	Ynl	0	4	3	2	5	14	15			Rub	FeO	cly	JDC	6.5	9.5	7.2	14.0	15	**52**	**52**
23.7	7.22	28.70	8.75	5.00	1.52	100	0.31	20	13	109	60	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Upper 0.2 m is rubble.	Ynl	0	4	3	2	5	14	15			cc	FeO	Rub	JDC	6.5	5.5	6.5	14.0	15	**47**	**47**
28.7	8.75	30.30	9.23	1.60	0.33	68	0.00	0	0	330	40	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins.	Ynl	0	1	3	2	5	11	15			cc	FeO		JDC	4.8	3.0	9.1	11.0	15	**43**	**43**
30.3	9.23	31.30	9.54	1.00	0.32	105	0.10	33	1	160	60	R4	medium grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins. Calcite veining itself is discontinuous.	Ynl	0	4	3	2	5	14	15			cc	FeO		JDC	6.5	7.2	7.1	14.0	15	**50**	**50**
31.3	9.54	34.50	10.52	3.20	0.97	100	0.00	0	5	162	40	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1-2 cm thick throughout run. Bedding is offset ~1-3 mm by crosscutting calcite veins. Calcite veining itself is discontinuous.	Ynl	0	1	3	2	5	11	15			cc	FeO		JDC	4.8	3.0	7.1	11.0	15	**41**	**41**
34.5	10.52	39.50	12.04	5.00	1.52	100	0.31	20	11	127	40	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1 cm thick sporadically throughout run.	Ynl	0	1	3	2	5	11	15			cc	FeO		JDC	4.8	5.5	6.7	11.0	15	**43**	**43**
39.5	12.04	44.50	13.56	5.00	1.52	100	0.42	28	6	217	40	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, beige layers 1 cm thick sporadically throughout run.	Ynl	0	4	3	2	5	14	15			cly	FeO	cc	JDC	4.8	6.5	7.8	14.0	15	**48**	**48**
44.5	13.56	49.50	15.09	5.00	1.52	100	0.48	31	6	217	80	R4	Light grey	Medium grained	Massive	Granodiorite	Sill	0	1	3	2	5	11	15			Rub	FeO	cc	JDC	8.0	7.0	7.8	11.0	15	**49**	**49**
49.5	15.09	54.50	16.61	5.00	1.52	100	0.11	7	10	138	35	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, strongly oxidized on fractures.	Ynl	0	1	3	2	5	11	15			cc	FeO		JDC	4.4	3.8	6.8	11.0	15	**41**	**41**
54.5	16.61	59.50	18.13	5.00	1.52	100	0.48	31	12	117	40	R3	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, trace calcite veinlets throughout run and oxidation onfractures.	Ynl	0	4	3	2	5	14	15			cc	FeO		JDC	4.8	7.0	6.6	14.0	15	**47**	**47**
59.5	18.13	64.50	19.66	5.00	1.52	100	0.99	65	4	304	50	R4	Dark grey	Fine grained	massive	Upper 0.35 m is completely weathered to fine sand. 0.35-0.6 m is strongly weathered shale with strong oxidation staining and calcite veining. The rest of the run is unweathered shale.	Ynl	0	4	3	2	5	14	15			gg	FeO		JDC	5.7	12.7	8.8	14.0	15	**56**	**56**
64.50	19.66	69.50	21.18	5.00	1.52	100	0.86	56	8	169	50	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, 2-10 cm rubble clayey fractures and trace calcite veinlets throughout run.	Ynl	0	4	3	2	5	14	15			Rub	cly		JDC	5.7	11.1	7.2	14.0	15	**53**	**53**
69.5	21.18	74.50	22.71	5.00	1.52	100	0.70	46	11	127	50	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, trace calcite veinlets throughout run. Some minor <1 cm rubbly fractures.	Ynl	0	4	3	2	5	14	15			FeO	cc		JDC	5.7	9.3	6.7	14.0	15	**51**	**51**
74.5	22.71	79.50	24.23	5.00	1.52	100	1.07	70	7	190	50	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, medium strong, some oxidation on joint surfaces, calcite veinlets throughout	Ynl	0	4	3	0	6	13	15			FeO	cly		JDC	5.7	13.7	7.5	13.0	15	**55**	**55**

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
79.5	24.23	84.50	25.75	5.00	1.52	100	1.17	77	7	190	60	R4	Dark grey	Fine grained	Bedded sub-vertically (~20-30° TCA)	Shale, medium strong, calcite veinlets, more competent than previous but one section (1 cm) of rubble and clay at 80.5 ft	Ynl	0	4	3	2	6	15	15			Rub	cly		JDC	6.5	15.1	7.5	15.0	15	**59**	**59**
84.5	25.75	89.50	27.28	5.00	1.52	100	0.83	54	8	169	60	R4	Dark grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout - chaotic, a 17 cm thick section of soil-like (silty clay rich) with angular fragments (up to 1 cm diameter) at 87 ft	Ynl	0	4	3	2	6	15	15			Rub	cly		JDC	6.5	10.8	7.2	15.0	15	**54**	**54**
89.5	27.28	94.50	28.80	5.00	1.52	100	1.16	76	9	152	70	R4	Dark grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout, medium strong	Ynl	0	4	3	2	6	15	15			cc	cly		JDC	7.3	14.9	7.0	15.0	15	**59**	**59**
94.5	28.80	99.50	30.33	5.00	1.52	100	0.67	44	8	169	60	R4	Dark grey	Fine grained	Bedded sub-vertically (~10-20° TCA)	Shale, calcite veinlets throughout, medium strong	Ynl	0	1	3	2	6	12	15			cc	Rub		JDC	6.5	9.0	7.2	12.0	15	**50**	**50**
																	EOH																				

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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	5.0	1.52	5.00	0.0	0	0										OB																				
5.0	1.52	9.00	2.74	4.00	1.03	84	0.38	31	6	147	75	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	4	3	2	3	12	15						JDC	7.7	7.0	6.9	12.0	15	**49**	**49**
9.0	2.74	14.00	4.27	5.00	1.52	100	0.96	63	7	190	75	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	4	3	2	3	12	15						JDC	7.7	12.3	7.5	12.0	15	**54**	**54**
14.0	4.27	19.00	5.79	5.00	1.52	100	0.66	43	8	169	70	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	4	3	2	5	14	15						JDC	7.3	8.9	7.2	14.0	15	**52**	**52**
19.0	5.79	22.00	6.71	3.00	0.90	98	0.77	84	3	225	80	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	5	3	2	5	15	15						JDC	8.0	16.6	7.9	15.0	15	**63**	**63**
22.0	6.71	27.00	8.23	5.00	1.52	100	0.56	37	10	138	60	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	1	3	2	3	9	15						JDC	6.5	7.8	6.8	9.0	15	**45**	**45**
27.0	8.23	29.00	8.84	2.00	0.60	98	0.37	61	12	46	60	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	1	3	2	3	9	15						JDC	6.5	11.9	5.6	9.0	15	**48**	**48**
29.0	8.84	34.00	10.36	5.00	1.52	100	0.79	52	5	253	75	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	4	3	2	5	14	15						JDC	7.7	10.3	8.2	14.0	15	**55**	**55**
34.0	10.36	39.00	11.89	5.00	1.52	100	1.12	73	3	380	100	R5	Grey to green-grey	Medium grained, inequigranular.			IG	0	5	3	2	5	15	15						JDC	9.4	14.4	9.6	15.0	15	**63**	**63**
39.0	11.89	44.00	13.41	5.00	1.52	100	0.77	51	7	190	70	R4	Grey to green-grey	Medium grained, inequigranular.			IG	0	4	3	0	3	10	15						JDC	7.3	10.1	7.5	10.0	15	**50**	**50**
44.0	13.41	49.00	14.93	5.00	1.52	100	0.33	22	18	80	25	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	1	2	5	9	15						JDC	3.4	5.6	6.1	9.0	15	**39**	**39**
49.0	14.93	54.00	16.46	5.00	1.52	100	0.64	42	9	152	30	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	1	2	3	7	15						JDC	3.9	8.7	7.0	7.0	15	**42**	**42**
54.0	16.46	59.00	17.98	5.00	1.52	100	0.55	36	12	117	30	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	1	2	3	7	15						JDC	3.9	7.7	6.6	7.0	15	**40**	**40**
59.0	17.98	64.00	19.51	5.00	1.52	100	0.74	49	9	152	30	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	4	1	2	5	12	15						JDC	3.9	9.8	7.0	12.0	15	**48**	**48**
64.0	19.51	65.80	20.05	1.80	0.46	84	0.19	35	20	22	30	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	3	2	5	11	15						JDC	3.9	7.5	5.3	11.0	15	**43**	**43**
65.8	20.05	68.00	20.73	2.20	0.66	98	0.00	0	16	39	25	R3	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	3	2	3	9	15						JDC	3.4	3.0	5.5	9.0	15	**36**	**36**
68.00	20.73	72.70	22.16	4.70	1.02	71	0.00	0	11	85	10	R2	Medium grey and tan	Fine grained	Thinly bedded		Ynl	0	1	1	0	3	5	15						JDC	2.0	3.0	6.1	5.0	15	**31**	**31**
72.7	22.16	77.70	23.68	5.00	1.52	100	0.35	23	16	89	40	R3	Medium grey	Fine grained	Thinly bedded		Ynl	0	1	1	0	3	5	15						JDC	4.8	5.8	6.2	5.0	15	**37**	**37**
77.7	23.68	82.30	25.08	4.60	1.34	96	0.37	26	7	168	40	R3	Medium grey	Fine grained	Thinly bedded		Ynl	0	4	1	2	5	12	15						JDC	4.8	6.3	7.2	12.0	15	**45**	**45**
82.3	25.08	87.50	26.67	5.20	1.52	96	1.45	91	2	507	50	R4	Medium grey	Fine grained	Thinly bedded		Ynl	0	5	3	2	6	16	15						JDC	5.7	18.2	10.8	16.0	15	**66**	**66**
87.5	26.67	92.80	28.28	5.30	1.52	94	0.58	36	6	217	35	R3	Medium grey	Fine grained	Thinly bedded		Ynl	0	4	3	2	5	14	15						JDC	4.4	7.7	7.8	14.0	15	**49**	**49**
92.8	28.28	97.80	29.81	5.00	1.52	100	0.75	49	10	138	45	R3	Medium grey	Fine grained	Thinly bedded		Ynl	0	4	3	2	5	14	15						JDC	5.2	9.9	6.8	14.0	15	**51**	**51**
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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																		
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	4.0	1.22	4.00	0.0	0	0										OB													JDC							
4.0	1.22	9.00	2.74	5.00	0.43	28	0.00	0	0	430	5	R2	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	0	5	1	2	8	15						JDC	1.5	3.0	10.1	8.0	15	**38**	**38**
9.0	2.74	14.00	4.27	5.00	1.52	100	0.00	0	30	49	10	R2	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	1	3	2	1	7	15						JDC	2.0	3.0	5.7	7.0	15	**33**	**33**
14.0	4.27	19.00	5.79	5.00	1.52	100	0.00	0	50	30	15	R2	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	1	3	2	1	7	15						JDC	2.5	3.0	5.4	7.0	15	**33**	**33**
19.0	5.79	24.00	7.31	5.00	0.75	49	0.75	49	16	44	10	R2	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	2.0	9.9	5.6	6.0	15	**38**	**38**
24.0	7.31	26.80	8.17	2.80	0.81	95	0.00	0	11	68	25	R3	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	3	2	3	12	15						JDC	3.4	3.0	5.9	12.0	15	**39**	**39**
26.8	8.17	31.90	9.72	5.10	1.52	98	0.83	53	14	101	50	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	3	2	5	14	15						JDC	5.7	10.6	6.4	14.0	15	**52**	**52**
31.9	9.72	34.00	10.36	2.10	0.64	100	0.52	81	1	320	50	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	5.7	16.0	8.9	16.0	15	**62**	**62**
34.0	10.36	39.00	11.89	5.00	1.52	100	1.50	98	3	380	60	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	1	2	5	13	15						JDC	6.5	19.8	9.6	13.0	15	**64**	**64**
39.0	11.89	44.00	13.41	5.00	1.52	100	1.03	68	5	253	60	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	1	2	5	13	15						JDC	6.5	13.2	8.2	13.0	15	**56**	**56**
44.0	13.41	49.00	14.93	5.00	1.52	100	1.42	93	3	380	60	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	1	2	5	13	15						JDC	6.5	18.6	9.6	13.0	15	**63**	**63**
49.0	14.93	53.70	16.37	4.70	1.40	98	1.15	80	2	467	70	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	1	2	5	13	15						JDC	7.3	15.8	10.4	13.0	15	**62**	**62**
53.7	16.37	58.70	17.89	5.00	1.52	100	0.96	63	6	217	50	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	5.7	12.3	7.8	16.0	15	**57**	**57**
58.7	17.89	63.70	19.41	5.00	1.52	100	1.47	96	5	253	70	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	3	2	6	15	15						JDC	7.3	19.4	8.2	15.0	15	**65**	**65**
63.7	19.41	68.90	21.00	5.20	1.52	96	1.47	93	1	760	70	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	3	2	5	14	15						JDC	7.3	18.5	12.9	14.0	15	**68**	**68**
68.9	21.00	73.90	22.52	5.00	1.52	100	1.36	89	5	253	70	R4	Medium to dark grey	Fine grained	thinly bedded	Interbedded shale and limestone	Ynl	0	5	3	2	6	16	15						JDC	7.3	17.7	8.2	16.0	15	**64**	**64**
73.90	22.52	79.00	24.08	5.10	1.52	98	1.44	93	2	507	70	R4	Medium to dark grey	Fine grained	thinly bedded	Interbedded shale and limestone	Ynl	0	5	1	2	6	14	15						JDC	7.3	18.5	10.8	14.0	15	**66**	**66**
79.0	24.08	83.80	25.54	4.80	1.46	100	1.11	76	6	209	70	R4	Medium to dark grey	Fine grained	thinly bedded	Interbedded shale and limestone	Ynl	0	5	1	2	6	14	15						JDC	7.3	14.9	7.7	14.0	15	**59**	**59**
83.8	25.54	88.80	27.06	5.00	1.52	100	0.84	55	7	190	60	R4	Medium to dark grey	Fine grained	thinly bedded	Interbedded shale and limestone	Ynl	0	5	1	2	6	14	15						JDC	6.5	10.9	7.5	14.0	15	**54**	**54**
88.8	27.06	93.80	28.59	5.00	1.52	100	0.63	41	8	169	60	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	1	2	5	12	15						JDC	6.5	8.6	7.2	12.0	15	**49**	**49**
93.8	28.59	99.00	30.17	5.20	1.52	96	1.08	68	8	169	60	R4	Medium to dark grey	Fine grained	thinly bedded	Shale	Ynl	0	4	1	2	5	12	15						JDC	6.5	13.3	7.2	12.0	15	**54**	**54**
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DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	3.0	0.91	3.00	0.3	0	0		0								OB													JDC							
3.0	0.91	8.00	2.44	5.00	0.94	62	0.00	0	20	45	10	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	2.0	3.0	5.6	6.0	15	**32**	**32**
8.0	2.44	13.00	3.96	5.00	1.22	80	0.00	0	12	94	10	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	2.0	3.0	6.3	6.0	15	**32**	**32**
13.0	3.96	15.50	4.72	2.50	0.45	59	0.00	0	20	21	10	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	2.0	3.0	5.3	6.0	15	**31**	**31**
15.5	4.72	18.00	5.49	2.50	0.68	89	0.00	0	20	32	5	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	5	5	1	11	15						JDC	1.5	3.0	5.4	11.0	15	**36**	**36**
18.0	5.49	23.20	7.07	5.20	1.21	76	0.28	18	15	76	20	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	3.0	5.1	6.0	6.0	15	**35**	**35**
23.2	7.07	28.20	8.59	5.00	1.52	100	0.59	39	10	138	40	R3	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	1	3	2	5	11	15						JDC	4.8	8.1	6.8	11.0	15	**46**	**46**
28.2	8.59	33.30	10.15	5.10	1.52	98	0.54	35	11	127	40	R3	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	1	3	2	6	12	15						JDC	4.8	7.5	6.7	12.0	15	**46**	**46**
33.3	10.15	38.50	11.73	5.20	1.52	96	1.11	70	6	217	50	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	4	1	2	6	13	15						JDC	5.7	13.7	7.8	13.0	15	**55**	**55**
38.5	11.73	43.70	13.32	5.20	1.52	96	1.27	80	3	380	50	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	5.7	15.8	9.6	14.0	15	**60**	**60**
43.7	13.32	48.80	14.87	5.10	1.52	98	1.07	69	6	217	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	6.5	13.5	7.8	14.0	15	**57**	**57**
48.8	14.87	53.80	16.40	5.00	1.52	100	1.39	91	5	253	70	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	7.3	18.2	8.2	14.0	15	**63**	**63**
53.8	16.40	58.90	17.95	5.10	1.52	98	1.13	73	4	304	70	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	7.3	14.2	8.8	14.0	15	**59**	**59**
58.9	17.95	64.00	19.51	5.10	1.52	98	0.83	53	3	380	65	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	6.9	10.6	9.6	14.0	15	**56**	**56**
64.0	19.51	69.00	21.03	5.00	1.52	100	1.34	88	4	304	70	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	7.3	17.5	8.8	14.0	15	**62**	**62**
69.0	21.03	74.00	22.55	5.00	1.52	100	1.12	73	5	253	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	6.5	14.4	8.2	14.0	15	**58**	**58**
74.00	22.55	74.80	22.80	0.80	0.15	62	0.12	49	0	150	70	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	7.3	9.9	7.0	14.0	15	**53**	**53**
74.8	22.80	79.00	24.08	4.20	1.31	102	1.23	96	3	328	70	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	7.3	19.3	9.0	14.0	15	**65**	**65**
79.0	24.08	84.00	25.60	5.00	1.52	100	1.27	83	3	380	65	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	6.9	16.5	9.6	14.0	15	**62**	**62**
84.0	25.60	89.00	27.13	5.00	1.52	100	1.30	85	4	304	65	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	6.9	16.9	8.8	16.0	15	**64**	**64**
89.0	27.13	94.00	28.65	5.00	1.26	83	1.15	75	2	420	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	6.5	14.8	10.0	16.0	15	**62**	**62**
94.0	28.65	99.10	30.20	5.10	1.28	82	1.01	65	3	320	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	6.5	12.7	8.9	16.0	15	**59**	**59**
																EOH																					

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Sheet 1 of 1

GEOTECHNICAL DRILLHOLE LOGGING DATA SHEET
ROCK MASS CLASSIFICATION - RMR 1989
DRILLHOLE I.D. SC15-205

DRILL RUN DATA													GEOLOGY - COMMENTS					DISCONTINUITY DATA - RATING SYSTEMS							ADDITIONAL DISCONTUITY DATA						RMR CALCULATIONS						
																		Joint Condition																			
Depth From (ft)	Depth From (m)	Depth To (ft)	Depth To (m)	Run Length (ft)	Recov. Length (m)	Recov. (%)	RQD Length (m)	RQD (%)	# of Fractures	Average Fracture Spac. (mm)	UCS (Est.) (MPa)	ROCK CLASS.	Rock Colour	Rock Grain Size / Texture	Structure	Other Notes	Field Rock Interp.	Persis- P	Apert- A	Rough R	Infill I	Weath W	TOTAL (RMR)	Water Rating	Disc. Type	Aper. (mm)	Fill. Type 1 (see Leg)	Fill. Type 2 (see Leg)	Fill. Type 3 (see Leg)	Logger	RMR-89 UCS Rating	RMR-89 RQD Rating	RMR-89 Joint Spac. Rating	RMR-89 Joint Condition Rating	RMR-89 Water Rating	**RMR-89 Total** Min. Joint	**RMR-89 Total** Run Average
0.0	0.00	5.0	1.52	5.00		0											OB													JDC							
5.0	1.52	8.00	2.44	3.00	0.72	79	0.00	0	15	45	5	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	1.5	3.0	5.6	6.0	15	**31**	**31**
8.0	2.44	13.00	3.96	5.00	1.52	100	0.13	9	30	49	10	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	0	3	2	1	6	15						JDC	2.0	4.0	5.7	6.0	15	**33**	**33**
13.0	3.96	18.00	5.49	5.00	1.52	100	0.66	43	11	127	20	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	1	3	2	1	7	15						JDC	3.0	8.9	6.7	7.0	15	**41**	**41**
18.0	5.49	23.00	7.01	5.00	1.52	100	0.61	40	13	109	20	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	1	3	2	1	7	15						JDC	3.0	8.4	6.5	7.0	15	**40**	**40**
23.0	7.01	28.00	8.53	5.00	1.52	100	0.27	18	20	72	15	R2	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	1	3	2	1	7	15						JDC	2.5	5.1	6.0	7.0	15	**36**	**36**
28.0	8.53	33.00	10.06	5.00	1.52	100	0.63	41	6	217	40	R3	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	4	3	2	5	14	15						JDC	4.8	8.6	7.8	14.0	15	**50**	**50**
33.0	10.06	38.00	11.58	5.00	1.52	100	0.81	53	6	217	50	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	5.7	10.6	7.8	14.0	15	**53**	**53**
38.0	11.58	43.00	13.11	5.00	1.52	100	1.27	83	8	169	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	1	2	6	14	15						JDC	6.5	16.5	7.2	14.0	15	**59**	**59**
43.0	13.11	48.00	14.63	5.00	1.52	100	1.05	69	3	380	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	6.5	13.5	9.6	16.0	15	**61**	**61**
48.0	14.63	53.00	16.15	5.00	1.52	100	1.44	94	8	169	65	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	3	2	6	16	15						JDC	6.9	18.9	7.2	16.0	15	**64**	**64**
53.0	16.15	58.00	17.68	5.00	1.52	100	1.12	73	6	217	55	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	3	2	6	16	15						JDC	6.1	14.4	7.8	16.0	15	**59**	**59**
58.0	17.68	63.00	19.20	5.00	1.52	100	0.95	62	10	138	40	R3	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	5	2	6	18	15						JDC	4.8	12.2	6.8	18.0	15	**57**	**57**
63.0	19.20	68.00	20.73	5.00	1.52	100	1.26	83	4	304	60	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	5	2	6	18	15						JDC	6.5	16.3	8.8	18.0	15	**65**	**65**
68.0	20.73	73.00	22.25	5.00	1.52	100	1.24	81	3	380	60	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	5	2	6	18	15						JDC	6.5	16.0	9.6	18.0	15	**65**	**65**
73.0	22.25	78.00	23.77	5.00	1.52	100	0.98	64	3	380	50	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	5	2	6	18	15						JDC	5.7	12.6	9.6	18.0	15	**61**	**61**
78.00	23.77	83.00	25.30	5.00	1.52	100	1.52	100	4	304	70	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	3	2	6	16	15						JDC	7.3	20.1	8.8	16.0	15	**67**	**67**
83.0	25.30	88.00	26.82	5.00	1.52	100	1.35	89	2	507	70	R4	Dark grey	Fine grained with clasts		Debris flow conglomerate	Ynl	0	5	3	2	6	16	15						JDC	7.3	17.6	10.8	16.0	15	**67**	**67**
88.0	26.82	93.00	28.35	5.00	1.52	100	1.17	77	8	169	60	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	6.5	15.1	7.2	16.0	15	**60**	**60**
93.0	28.35	98.00	29.87	5.00	1.52	100	1.01	66	9	152	50	R4	Medium to dark grey	Fine grained	Thinly bedded	Shale	Ynl	0	5	3	2	6	16	15						JDC	5.7	13.0	7.0	16.0	15	**57**	**57**
																EOH																					

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Sheet 1 of 1

APPENDIX A4

GEOTECHNICAL TEST PIT LOGS

(Pages A4-1 to A4-45)

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,075 E , 5,179,489 N
Coordinate System: NAD83

Test Pit No.: TP15-01
Equipment Used: Komatsu 210
Total Depth: 1.1 m
Elevation: 1780 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.2) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.2 m to 0.5) m Sandy SILT; medium to dark brown, fine grained, trace clay, low plasticity, massive, compact to dense, moist; trace roots.	
1	1779					**SILTY SAND** (0.5 m to 0.7) m Silty SAND; light brown, fine to medium grained, medium plasticity, trace fine shale gravel, massive, dense, moist.	
						WEATHERED BEDROCK (0.7 m to 1.1) m SHALE; highly weathered, highly fractured, some silty sand throughout.	
						End of Test Pit: 1.1 m Sufficient excavation into weathered bedrock	
2	1778						
3	1777						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
G B GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-1

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,197 E , 5,179,536 N
Coordinate System: NAD83

Test Pit No.: TP15-02
Equipment Used: Komatsu 210
Total Depth: 1 m
Elevation: 1785 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.7) m Silty SAND; medium brown, fine to medium grained, trace clay, low plasticity, massive, dense, moist.	
1	1784					**WEATHERED BEDROCK** (0.7 m to 1) m SHALE; light grey / brown, fine grained, highly fractured, highly weathered.	
						End of Test Pit: 1 m Sufficient excavation into weathered bedrock	
2	1783						
3	1782						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-2

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,010 E , 5,179,362 N
Coordinate System: NAD83

Test Pit No.: TP15-03
Equipment Used: Komatsu 210
Total Depth: 0.6 m
Elevation: 1797 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.3) m Sandy SILT; medium brown, fine grained, moist, massive, low plasticity, firm; some organics, trace roots.	
						SANDY SILT (0.3 m to 0.5) m Sandy SILT with gravel; light brown, fine grained, moist massive, low plasticity, firm; well sorted, fine, subangular shale gravel.	
						WEATHERED BEDROCK (0.5 m to 0.6) m SHALE; light grey / brown, fine grained, highly fractured, highly weathered.	
						End of Test Pit: 0.6 m Sufficient excavation into weathered bedrock	
1	1796						
2	1795						
3	1794						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-3

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,135 E , 5,179,405 N
Coordinate System: NAD83

Test Pit No.: TP15-04
Equipment Used: Komatsu 210
Total Depth: 0.8 m
Elevation: 1796 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; dark brown, some roots, loose, moist, no plasticity.	
						SANDY SILT (0.2 m to 0.6) m Sandy SILT; light brown, some woody material, trace clay, low plasticity, massive, firm to compact, moist.	
1	1795					(0.6 m to 0.8) m SHALE; light grey, highly fratured, highly weathered, oxidized silty/clayey sand throughout.	
						End of Test Pit: 0.8 m Sufficient excavation into weathered bedrock	
2	1794						
3	1793						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-4

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,245 E , 5,179,350 N
Coordinate System: NAD83

Test Pit No.: TP15-05
Equipment Used: Komatsu 210
Total Depth: 0.6 m
Elevation: 1804 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.3) m Silty SAND, light brown, low plasticity, massive, moist, compact.	
						WEATHERED BEDROCK (0.3 m to 0.6) m SHALE; medium grey, highly weathered, fractured, some silty sand throughout.	
1	1803					End of Test Pit: 0.6 m Sufficient excavation into weathered bedrock	
2	1802						
3	1801						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-5

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

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Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Process Water Storage Pond
Coordinates: 506,244 E , 5,179,345 N
Coordinate System: NAD83

Test Pit No.: TP15-05B
Equipment Used: Komatsu 210
Total Depth: 0.5 m
Elevation: 1806 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.4) m Silty SAND; light brown, some roots, moist, loose to compact, no plasticity, massive.	
1	1805					**WEATHERED BEDROCK** (0.4 m to 0.5) m SHALE; medium grey, highly fractured, highly weathered.	
						End of Test Pit: 0.5 m Sufficient excavation into weathered bedrock	
2	1804						
3	1803						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-6

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,659 E , 5,179,290 N
Coordinate System: NAD83

Test Pit No.: TP15-06
Equipment Used: Komatsu 210
Total Depth: 0.2 m
Elevation: 1794 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						SILTY SAND (0 m to 0.2) m Silty SAND; medium brown, some roots, trace organics; topsoil.	
						WEATHERED BEDROCK (0.2 m to 0.4) m GRANODIORITE; orange/brown, highly fractured, highly weathered.	
						End of Test Pit: 0.2 m Sufficient excavation into weathered bedrock	
1	1793						
2	1792						
3	1791						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-7

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman		**Test Pit No.:** TP15-07	**Page:** 1 of 1
Location: South Impoundment		Equipment Used: Komatsu 210	Date Started: May 26, 15
Coordinates: 506,490 E , 5,179,210 N		Total Depth: 0.7 m	Date Completed: May 26, 15
Coordinate System: NAD83		Elevation: 1795 m	Logged by: JDC
			Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; medium brown, fine to medium grained, massive, moist, trace roots, slightly oxidized; some relict diorite textures at end of interval.	
1	1794					**WEATHERED BEDROCK** (0.5 m to 0.7) m GRANODIORITE; dark grey with white phenocrysts, highly weathered.	
						End of Test Pit: 0.7 m Sufficient excavation into weathered bedrock	
2	1793						
3	1792						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-8

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,469 E , 5,179,033 N
Coordinate System: NAD83

Test Pit No.: TP15-08
Equipment Used: Komatsu 210
Total Depth: 1.7 m
Elevation: 1778 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.4) m Silty SAND; dark brown, fine grained, low to no plasticity, trace roots, massive, moist, compact.	
1	1777					**WEATHERED BEDROCK** (0.4 m to 1.7) m SHALE; medium grey and tan, highly weathered, fractured, light brown clayey sand throughout.	
						End of Test Pit: 1.7 m Sufficient excavation into weathered bedrock	
2	1776						
3	1775						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

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CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-9

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,619 E , 5,179,094 N
Coordinate System: NAD83

Test Pit No.: TP15-09
Equipment Used: Komatsu 210
Total Depth: 1.7 m
Elevation: 1781 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.4) m Sandy SILT; dark brown, fine grained, no plasticity, trace roots, massive, moist, compact.	
						SILTY SAND (0.4 m to 1) m Silty SAND; medium brown and orange, highly weathered and oxidized, no plasticity, subangular diorite cobbles, moist.	
1	1780					**WEATHERED BEDROCK** (1 m to 1.7) m GRANODIORITE; highly weathered, highly fractured with orangey/brown sand throughout.	
						End of Test Pit: 1.7 m Sufficient excavation into weathered bedrock	
2	1779						
3	1778						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-10

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,545 E , 5,179,006 N
Coordinate System: NAD83

Test Pit No.: TP15-10
Equipment Used: Komatsu 210
Total Depth: 0.6 m
Elevation: 1770 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; dark brown, fine grained, low plasticity, some roots, massive, moist, compact.	
						WEATHERED BEDROCK (0.2 m to 0.6) m GRANODIORITE; medium grey, highly weathered and fractured, medium brown, medium grained FeO stained silty sand throughout.	
						End of Test Pit: 0.6 m Sufficient excavation into weathered bedrock	
1	1769						
2	1768						
3	1767						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-11

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Appendix: A4

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,418 E , 5,178,864 N
Coordinate System: NAD83

Test Pit No.: TP15-11
Equipment Used: Komatsu 210
Total Depth: 1.6 m
Elevation: 1782 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.3) m TOPSOIL; dark brown, organics, roots.	
1	1781					**SILTY SAND** (0.3 m to 1.4) m Silty SAND; medium brown, fine to medium grained, poorly graded shale gravel, no plasticity, massive, moist, compact.	
						WEATHERED BEDROCK (1.4 m to 1.6) m SHALE; dark grey and tan, highly weathered, highly fractured.	
2	1780					End of Test Pit: 1.6 m Sufficient excavation into weathered bedrock	
3	1779						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
G B GRAB ■ BLOCK

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Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-12

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman

Location: South Impoundment

Coordinates: 506,578 E , 5,178,829 N

Coordinate System: NAD83

Test Pit No.: TP15-12

Equipment Used: Komatsu 210

Total Depth: 1.8 m

Elevation: 1767 m

Page: 1 of 1

Date Started: May 26, 15

Date Completed: May 26, 15

Logged by: JDC

Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; dark brown, fine to medium grained, poorly graded shale gravel, no plasticity, massive, moist, loose.	
1	1766					**SILTY SAND** (0.2 m to 1.4) m Silty SAND; light brown, fine to medium grained, trace clay, some diorite cobbles and boulders, no plasticity, massive, dry, dense.	
						WEATHERED BEDROCK (1.4 m to 1.8) m GRANODIORITE; highly weathered, highly fractured, orange/brown coarse grained sand throughout.	
2	1765					End of Test Pit: 1.8 m Sufficient excavation into weathered bedrock	
3	1764						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-13

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,531 E , 5,178,726 N
Coordinate System: NAD83

Test Pit No.: TP15-13
Equipment Used: Komatsu 210
Total Depth: 1.4 m
Elevation: 1782 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.7) m Silty SAND; medium brown, fine to medium grained, trace clay, poorly graded shale gravel, low plasticity, massive, moist, dense.	
1	1781					**WEATHERED BEDROCK** (0.7 m to 1.4) m SHALE; highly fractured, highly weathered, orange/brown FeO staining throughout bedded rock.	
						End of Test Pit: 1.4 m Sufficient excavation into weathered bedrock	
2	1780						
3	1779						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-14

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,731 E , 5,179,489 N
Coordinate System: NAD83

Test Pit No.: TP15-14
Equipment Used: Komatsu 210
Total Depth: 1.4 m
Elevation: 1782 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.3) m Silty SAND; dark brown, fine to medium grained, trace roots, low plasticity, massive, moist, loose.	
1	1781					**SILTY SAND** (0.3 m to 0.6) m Silty SAND; light brown, medium grained, trace clay, low plasticity, massive, moist, dense.	
						WEATHERED BEDROCK (0.6 m to 1.4) m GRANODIORITE; highly weathered, relic textures with some diorite clasts, more intatc diorite cobbles at bottom.	
2	1780					End of Test Pit: 1.4 m Sufficient excavation into weathered bedrock	
3	1779						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-15

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Appendix: A4

Contractor: Brian Zimmerman

Location: South Impoundment

Coordinates: 506,725 E , 5,179,123 N

Coordinate System: NAD83

Test Pit No.: TP15-15

Equipment Used: Komatsu 210

Total Depth: 1.5 m

Elevation: 1782 m

Page: 1 of 1

Date Started: May 26, 15

Date Completed: May 26, 15

Logged by: JDC

Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.7) m Silty SAND; dark brown, fine grained, trace roots, no plasticity, massive, moist, compact.	
1	1781					**SAND WITH SILT** (0.7 m to 1.4) m SAND with silt; light brown, fine to coarse grained, trace clay, no plasticity, trace diorite clasts	
						WEATHERED BEDROCK (1.4 m to 1.5) m GRANODIORITE; weathered and fractured, fairly competent.	
						End of Test Pit: 1.5 m Sufficient excavation into weathered bedrock	
2	1780						
3	1779						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,710 E , 5,179,044 N
Coordinate System: NAD83

Test Pit No.: TP15-16
Equipment Used: Komatsu 210
Total Depth: 0.8 m
Elevation: 1773 m

Page: 1 of 1
Date Started: May 26, 15
Date Completed: May 26, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.2) m Sandy SILT; dark brown, fine grained, trace roots, no plasticity, massive, moist, firm.	
						WEATHERED BEDROCK (0.2 m to 0.8) m DEBRIS FLOW CONGLOMERATE; highly fractured, highly weathered, oxidized, silty sand with clay throughout.	
1	1772					End of Test Pit: 0.8 m Sufficient excavation into weathered bedrock	
2	1771						
3	1770						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-17

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,698 E , 5,178,905 N
Coordinate System: NAD83

Test Pit No.: TP15-17
Equipment Used: Komatsu 210
Total Depth: 3.9 m
Elevation: 1757 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.6) m Silty SAND; dark brown, fine grained, trace roots, no plasticity, massive, moist, loose.	
1	1756					**SILTY SAND** (0.6 m to 1.6) m Silty SAND; light grey/brown, fine to coarse grained, no plasticity, dense, massive.	
2	1755					**SAND** (1.6 m to 2.6) m SAND; orange, medium to coarse grained, highly oxidized; water seepage at ~2.5mbgs.	
3	1754					**WEATHERED BEDROCK** (2.6 m to 3.9) m GRANODIORITE; highly fractured, highly weathered, orange/brown, highly oxidized, wet.	

End of Test Pit: 3.9 m
Sufficient excavati

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-18

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,662 E , 5,178,851 N
Coordinate System: NAD83

Test Pit No.: TP15-18
Equipment Used: Komatsu 210
Total Depth: 0.9 m
Elevation: 1764 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.2) m TOPSOIL; dark brown, organics, roots, needles.	
						SANDY SILT (0.2 m to 0.6) m Sandy SILT; light brown, fine to medium grained, trace roots, no plasticity, massive, dry, firm, slightly oxidized (orange/brown) at bedrock contact.	
1	1763					**WEATHERED BEDROCK** (0.6 m to 0.9) m GRANODIORITE; fractured, weathered, slightly oxidized.	
						End of Test Pit: 0.9 m Sufficient excavation into weathered bedrock	
2	1762						
3	1761						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-19

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

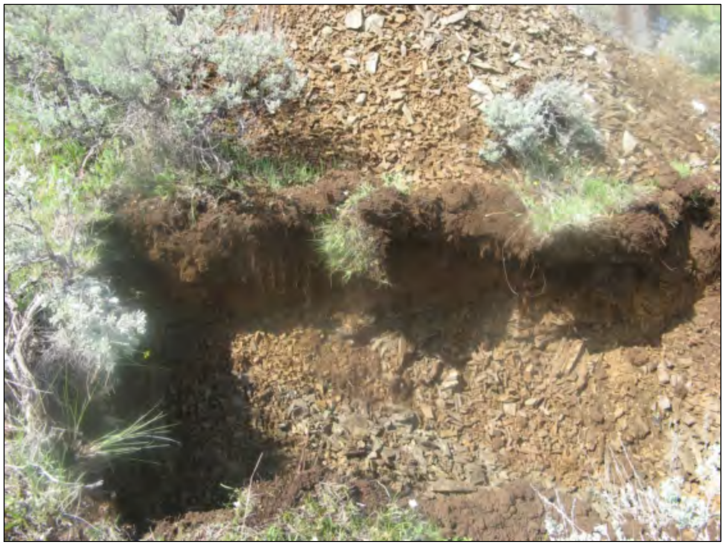
File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,768 E , 5,178,852 N
Coordinate System: NAD83

Test Pit No.: TP15-19
Equipment Used: Komatsu 210
Total Depth: 0.8 m
Elevation: 1762 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.3) m Sandy SILT; dark brown, fine to medium grained, trace roots, no plasticity, massive, compact, moist.	
1	1761					**WEATHERED BEDROCK** (0.3 m to 0.8) m SHALE; light grey/brown, highly weathered, highly fractured, oxidized.	
						End of Test Pit: 0.8 m Sufficient excavation into weathered bedrock	
2	1760						
3	1759						



GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-20

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,766 E , 5,178,916 N
Coordinate System: NAD83

Test Pit No.: TP15-20
Equipment Used: Komatsu 210
Total Depth: 2.6 m
Elevation: 1756 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
1	1755					**SILTY SAND** (0.1 m to 1.4) m Sandy SILT; dark brown, fine to medium grained, trace roots, no plasticity, moist, dense; some subangular, well sorted shale gravel.	
2	1754					**WEATHERED BEDROCK** (1.4 m to 2.6) m SHALE; light grey/brown, highly weathered, highly fractured.	
3	1753					End of Test Pit: 2.6 m Sufficient excavation into weathered bedrock	

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB
■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
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FIGURE A4-21

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: South Impoundment
Coordinates: 506,783 E , 5,179,069 N
Coordinate System: NAD83

Test Pit No.: TP15-21
Equipment Used: Komatsu 210
Total Depth: 0.6 m
Elevation: 1775 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Sandy SILT; dark brown, fine grained, trace roots, no plasticity, moist, loose.	
						WEATHERED BEDROCK (0.2 m to 0.6) m SHALE; medium grey, highly weathered, highly fractured, oxidized.	
1	1774					End of Test Pit: 0.6 m Sufficient excavation into weathered bedrock	
2	1773						
3	1772						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-22

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,394 E , 5,178,475 N
Coordinate System: NAD83

Test Pit No.: TP15-22
Equipment Used: Komatsu 210
Total Depth: 1.1 m
Elevation: 1818 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.2) m Sandy SILT; medium brown, fine to medium grained, trace clay, trace roots, low plasticity, massive, moist, firm.	
1	1817					**WEATHERED BEDROCK** (0.2 m to 1.1) m SHALEY LIMESTONE; orangey brown, highly weathered, highly fractured, oxide staining throughout rock, decomposed to dense silty clay in parts with limestone clasts.	
						End of Test Pit: 1.1 m Sufficient excavation into weathered bedrock	
2	1816						
3	1815						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-23

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,505 E , 5,178,367 N
Coordinate System: NAD83

Test Pit No.: TP15-23
Equipment Used: Komatsu 210
Total Depth: 1.5 m
Elevation: 1818 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.4) m Sandy SILT; light brown, fine to medium grained, trace clay, some roots, low plasticity, massive, moist, firm; some poorly graded, subangular, shale gravel.	
1	1817					**WEATHERED BEDROCK** (0.4 m to 0.9) m SHALE; light orange/brown, highly fractured, highly weathered, oxidized, silty clay infilling.	
						WEATHERED BEDROCK (0.9 m to 1.5) m SHALE; medium grey / brown, highly fractured, highly weathered, oxidized.	
						End of Test Pit: 1.5 m Sufficient excavation into weathered bedrock	
2	1816						
3	1815						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB
■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-24

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Appendix: A4

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,378 E , 5,178,405 N
Coordinate System: NAD83

Test Pit No.: TP15-24
Equipment Used: Komatsu 210
Total Depth: 2.1 m
Elevation: 1809 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 1.1) m Sandy SILT; medium brown, fine to medium grained, trace clay, some roots, low plasticity, massive, moist, firm; some poorly graded, subangular, shale gravel.	
1	1808					**WEATHERED BEDROCK** (1.1 m to 2.1) m SHALE; light brown/grey, highly fractured, highly weathered, some FeO staining, silty clay infilling.	
2	1807					End of Test Pit: 2.1 m Sufficient excavation into weathered bedrock	
3	1806						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-25

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,307 E , 5,178,406 N
Coordinate System: NAD83

Test Pit No.: TP15-25
Equipment Used: Komatsu 210
Total Depth: 2.1 m
Elevation: 1821 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 1.8) m Silty SAND; medium brown, fine to medium grained, trace clay, low plasticity, massive, moist, firm.	
1	1820						
						WEATHERED BEDROCK (1.8 m to 2.1) m SHALE; light brown/grey, highly fractured, highly weathered, FeO staining throughout.	
2	1819						
						End of Test Pit: 2.1 m Sufficient excavation into weathered bedrock	
3	1818						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-26

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,274 E , 5,178,292 N
Coordinate System: NAD83

Test Pit No.: TP15-26
Equipment Used: Komatsu 210
Total Depth: 1.2 m
Elevation: 1823 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 1) m Sandy SILT; light brown, fine to medium grained, some roots, no plasticity, massive, dry, firm; poorly graded, some subangular, shale gravel.	
1	1822					**WEATHERED BEDROCK** (1 m to 1.2) m SHALE; light brown/grey, highly fractured, highly weathered, some FeO staining.	
						End of Test Pit: 1.2 m Sufficient excavation into weathered bedrock	
2	1821						
3	1820						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-27

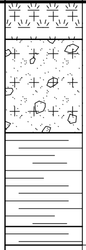
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,322 E , 5,178,273 N
Coordinate System: NAD83

Test Pit No.: TP15-27
Equipment Used: Komatsu 210
Total Depth: 1.3 m
Elevation: 1822 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						**TOPSOIL** (0 m to 0.2) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.2 m to 0.7) m Sandy SILT; light brown, fine to medium grained, some roots, no plasticity, massive, dry, firm; some poorly graded, subangular, shale gravel.	
1	1821					**WEATHERED BEDROCK** (0.7 m to 1.2) m SHALE; light brown/grey, highly fractured, highly weathered, FeO staining throughout, silty clay infilling.	
						WEATHERED BEDROCK (1.2 m to 1.3) m SHALE; light grey/brown, fractured, highly weathered, bedded.	
						End of Test Pit: 1.3 m Sufficient excavation into weathered bedrock	
2	1820						
3	1819						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
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FIGURE A4-28

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Process Water Pond (Alternate)
Coordinates: 506,403 E , 5,178,285 N
Coordinate System: NAD83

Test Pit No.: TP15-28
Equipment Used: Komatsu 210
Total Depth: 1.4 m
Elevation: 1830 m

Page: 1 of 1
Date Started: May 27, 15
Date Completed: May 27, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.2) m Sandy SILT; dark brown, fine to medium grained, some roots, trace clay, low plasticity, massive, moist, firm; some poorly graded, subangular, shale gravel.	
1	1829					**WEATHERED BEDROCK** (0.2 m to 1) m SHALE; light brown/grey, highly fractured, highly weathered, some FeO staining, silty clay infilling throughout.	
						WEATHERED BEDROCK (1 m to 1.4) m SHALE; light grey/brown, fractured, highly weathered, bedded, some silty clay infilling.	
						End of Test Pit: 1.4 m Sufficient excavation into weathered bedrock	
2	1828						
3	1827						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-29

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman		**Test Pit No.:** TP15-29	**Page:** 1 of 1
Location: Non Contact Water Reservoir		Equipment Used: Komatsu 210	Date Started: Jun 4, 15
Coordinates: 507,539 E , 5,178,679 N		Total Depth: 1.7 m	Date Completed: Jun 4, 15
Coordinate System: NAD83		Elevation: 1774 m	Logged by: JDC
			Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.3) m Sandy SILT; dark brown, fine to medium grained, trace roots, trace clay, no plasticity, massive, moist, firm; trace poorly graded, subangular, shale gravel.	
1	1773					**SANDY SILT** (0.3 m to 1) m Sandy SILT; light brown, fine to medium grained, trace roots, no plasticity, massive, dry, firm; trace poorly graded, subangular, shale gravel.	
						WEATHERED BEDROCK (1 m to 1.5) m SHALE; light brown/grey, highly fractured, highly weathered, silty sand infilling throughout.	
2	1772					**WEATHERED BEDROCK** (1.5 m to 1.7) m SHALE; highly weathered, highly fractured, FeO stained.	
						End of Test Pit: 1.7 m Sufficient excavation into weathered bedrock	
3	1771						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-30

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,562 E , 5,178,612 N
Coordinate System: NAD83

Test Pit No.: TP15-30
Equipment Used: Komatsu 210
Total Depth: 2.3 m
Elevation: 1773 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.4) m Silty SAND; dark brown, fine to medium grained, low plasticity, massive, moist, compact.	
1	1772					**SILTY SAND** (0.4 m to 1.7) m Silty SAND; medium brown, fine to medium grained, low plasticity, massive, moist, compact to dense.	
2	1771					**WEATHERED BEDROCK** (1.7 m to 2.3) m SHALE; grey/brown, highly weathered, highly fractured, some FeO staining.	
3	1770					End of Test Pit: 2.3 m Sufficient excavation into weathered bedrock	

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

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Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-31

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,538 E , 5,178,578 N
Coordinate System: NAD83

Test Pit No.: TP15-31
Equipment Used: Komatsu 210
Total Depth: 2.1 m
Elevation: 1776 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.4) m Silty SAND; medium brown, fine to medium grained, low plasticity, massive, moist, loose, trace roots; some poorly graded, subangular shale gravel.	
1	1775					**SILTY SAND** (0.4 m to 0.8) m Silty SAND; brown/orange, fine to medium grained, low plasticity, massive, moist, compact; some poorly graded, subangular shale gravel.	
2	1774					**WEATHERED BEDROCK** (0.8 m to 2.1) m SHALE; orange/grey, highly weathered, highly fractured, FeO stained.	
						End of Test Pit: 2.1 m Sufficient excavation into weathered bedrock	
3	1773						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
G B GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-32

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,699 E , 5,178,733 N
Coordinate System: NAD83

Test Pit No.: TP15-32
Equipment Used: Komatsu 210
Total Depth: 1.8 m
Elevation: 1774 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; dark brown, trace roots, fine to medium grained, low plasticity, massive, moist, compact.	
1	1773					**SILTY SAND** (0.5 m to 1.3) m Silty SAND; light brown, fine to medium grained, no plasticity, massive, dry, compact.	
						WEATHERED BEDROCK (1.3 m to 1.8) m SHALE; brown, highly weathered, highly fractured, silty sand infilling.	
2	1772					End of Test Pit: 1.8 m Sufficient excavation into weathered bedrock	
3	1771						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
G B GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-33

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,700 E , 5,178,695 N
Coordinate System: NAD83

Test Pit No.: TP15-33
Equipment Used: Komatsu 210
Total Depth: 1.9 m
Elevation: 1769 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SANDY SILT (0.1 m to 0.7) m Sandy SILT; dark brown, trace roots, fine to medium grained, low plasticity, massive, moist, compact.	
1	1768					**SANDY SILT** (0.7 m to 1.8) m Sandy SILT; light brown, fine to medium grained, no plasticity, massive, dry, compact.	
2	1767					**WEATHERED BEDROCK** (1.8 m to 1.9) m SHALE; medium brown, weathered, highly fractured.	
						End of Test Pit: 1.9 m Sufficient excavation into weathered bedrock	
3	1766						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-34

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,685 E , 5,178,620 N
Coordinate System: NAD83

Test Pit No.: TP15-34
Equipment Used: Komatsu 210
Total Depth: 1.2 m
Elevation: 1772 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.3) m Silty SAND; medium brown, trace roots, trace clay, fine to medium grained, low plasticity, massive, moist, compact, some poorly graded, subangular shale gravel.	
1	1771					**WEATHERED BEDROCK** (0.3 m to 1.2) m SHALE; brown/grey, highly weathered, highly fractured.	
						End of Test Pit: 1.2 m Sufficient excavation into weathered bedrock	
2	1770						
3	1769						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-35

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,861 E , 5,178,588 N
Coordinate System: NAD83

Test Pit No.: TP15-35
Equipment Used: Komatsu 210
Total Depth: 1.1 m
Elevation: 1773 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; medium brown, trace roots, fine to medium grained, no plasticity, massive, moist, loose; some poorly graded, subangular shale gravel.	
1	1772					**WEATHERED BEDROCK** (0.2 m to 1.1) m SHALE; brown/grey, highly weathered, highly fractured.	
						End of Test Pit: 1.1 m Sufficient excavation into weathered bedrock	
2	1771						
3	1770						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-36

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,875 E , 5,178,652 N
Coordinate System: NAD83

Test Pit No.: TP15-36
Equipment Used: Komatsu 210
Total Depth: 1 m
Elevation: 1764 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; dark brown, some roots, fine to medium grained, no plasticity, massive, moist, loose; some poorly graded, subangular shale gravel.	
						WEATHERED BEDROCK (0.2 m to 1) m SHALE; brown/grey, highly weathered, highly fractured, some FeO staining.	
1	1763					End of Test Pit: 1 m Sufficient excavation into weathered bedrock	
2	1762						
3	1761						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-37

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,830 E , 5,178,744 N
Coordinate System: NAD83

Test Pit No.: TP15-37
Equipment Used: Komatsu 210
Total Depth: 1 m
Elevation: 1775 m

Page: 1 of 1
Date Started: Jun 2, 15
Date Completed: Jun 2, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots.	
						SILTY SAND (0.1 m to 0.2) m Silty SAND; dark brown, some roots, fine to medium grained, no plasticity, massive, moist, loose; some poorly graded, subangular shale gravel.	
1	1774					**WEATHERED BEDROCK** (0.2 m to 1) m SHALE; brown/grey, highly weathered, highly fractured, some FeO staining.	
						End of Test Pit: 1 m Sufficient excavation into weathered bedrock	
2	1773						
3	1772						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-38

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor:	Brian Zimmerman
Location:	Non Contact Water Reservoir
Coordinates:	507,920 E , 5,178,783 N
Coordinate System:	NAD83
Test Pit No.:	TP15-38
Equipment Used:	Komatsu 210
Total Depth:	0.8 m
Elevation:	1768 m
Page:	1 of 1
Date Started:	Jun 2, 15
Date Completed:	Jun 2, 15
Logged by:	JDC
Reviewed by:	GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.2) m Silty SAND; dark brown, organics, roots; some poorly graded, subangular shale gravel.	
						WEATHERED BEDROCK (0.2 m to 0.8) m SHALE; grey/brown, highly weathered, highly fractured, some FeO staining throughout, silty sand infilling.	
						End of Test Pit: 0.8 m Sufficient excavation into weathered bedrock	
1	1767						
2	1766						
3	1765						

GENERAL REMARKS:

Easy excavation

SAMPLING SYMBOLS:

GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-39

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Non Contact Water Reservoir
Coordinates: 507,961 E , 5,178,671 N
Coordinate System: NAD83

Test Pit No.: TP15-39
Equipment Used: Komatsu 210
Total Depth: 1.2 m
Elevation: 1760 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; medium brown, trace roots, fine to medium grained, trace clay, medium plasticity, massive, moist, compact.	
1	1759					**WEATHERED BEDROCK** (0.5 m to 1.2) m SHALE; brown/grey, highly weathered, highly fractured, some FeO staining.	
						End of Test Pit: 1.2 m Sufficient excavation into weathered bedrock	
2	1758						
3	1757						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-40

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

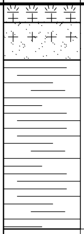
Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Proposed Portal
Coordinates: 506,919 E , 5,179,822 N
Coordinate System: NAD83

Test Pit No.: TP15-40
Equipment Used: Komatsu 210
Total Depth: 1.2 m
Elevation: 1787 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM



DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.3) m Silty SAND; medium brown, fine to medium grained, trace clay, medium plasticity, massive, moist, compact; trace poorly graded, subangular shale gravel.	
1	1786					**WEATHERED BEDROCK** (0.3 m to 1.2) m SHALE; brown/grey, highly weathered, highly fractured, FeO staining throughout, silty sand infilling.	
						End of Test Pit: 1.2 m Sufficient excavation into weathered bedrock	
2	1785						
3	1784						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-41

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Proposed Portal
Coordinates: 506,989 E , 5,179,808 N
Coordinate System: NAD83

Test Pit No.: TP15-41
Equipment Used: Komatsu 210
Total Depth: 2.4 m
Elevation: 1790 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.9) m Silty SAND; medium brown, trace roots, fine to medium grained, low plasticity, massive, moist, compact.	
1	1789					**SILTY SAND** (0.9 m to 1.5) m Silty SAND; brown, medium grained, no plasticity, massive, moist, dense.	
2	1788					**WEATHERED BEDROCK** (1.5 m to 2.4) m SHALE; orange/brown, highly weathered, highly fractured, FeO staining throughout, silty sand infilling.	
3	1787					End of Test Pit: 2.4 m Sufficient excavation into weathered bedrock	

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold
CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-42

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Proposed Portal
Coordinates: 507,059 E , 5,179,806 N
Coordinate System: NAD83

Test Pit No.: TP15-42
Equipment Used: Komatsu 210
Total Depth: 1.6 m
Elevation: 1791 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; medium brown, trace roots, fine to medium grained, no plasticity, massive, dry, compact.	
1	1790					**WEATHERED BEDROCK** (0.5 m to 1.6) m SHALE; highly weathered, highly fractured, silty sand infilling.	
						End of Test Pit: 1.6 m Sufficient excavation into weathered bedrock	
2	1789						
3	1788						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-43

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Contractor: Brian Zimmerman
Location: Proposed Portal
Coordinates: 506,993 E , 5,179,873 N
Coordinate System: NAD83

Test Pit No.: TP15-43
Equipment Used: Komatsu 210
Total Depth: 1.9 m
Elevation: 1797 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; medium brown, trace roots, fine to medium grained, trace clay, low plasticity, massive, moist, compact.	
1	1796					**WEATHERED BEDROCK** (0.5 m to 1.1) m SHALE; highly weathered, highly fractured, silty sand infilling.	
						WEATHERED BEDROCK (1.1 m to 1.9) m GRANODIORITE regolith; completely weathered, light brown, trace shale clasts throughout.	
2	1795					End of Test Pit: 1.9 m Sufficient excavation into weathered bedrock	
3	1794						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
G B GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-44

File:M:\1\01\00460\03\A\DATA\GINT\PROJECTS\BBCP TEST PITS.GPJ
Library: M:\1\01\00093\07\A\DATA\TASK 600 - SITE INVESTIGATIONS\GINT\LIBRARY\2015 KP CANADA GINT LIBRARY - REV A.GLB, TEST PIT LOG WITH PHOTO - PORTRAIT, 2015 KP CANADA GINT DATA TEMPLATE - REV A.GDT, Mar 3, 16

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

Contractor: Brian Zimmerman
Location: Proposed Portal
Coordinates: 506,994 E , 5,179,964 N
Coordinate System: NAD83

Test Pit No.: TP15-44
Equipment Used: Komatsu 210
Total Depth: 0.8 m
Elevation: 1785 m

Page: 1 of 1
Date Started: Jun 4, 15
Date Completed: Jun 4, 15
Logged by: JDC
Reviewed by: GIM

DEPTH - (m)	ELEVATION - (m)	SAMPLES	SAMPLE NO.	GRAPHIC LOG	WATER LEVEL	MATERIAL DESCRIPTION	COMMENTS
						TOPSOIL (0 m to 0.1) m TOPSOIL; dark brown, organics, roots, silty sand.	
						SILTY SAND (0.1 m to 0.5) m Silty SAND; medium brown, fine to medium grained, no plasticity, massive, moist, compact.	
1	1784					**WEATHERED BEDROCK** (0.5 m to 0.8) m SHALE; slightly weathered, highly fractured, silty sand infilling.	
						End of Test Pit: 0.8 m Sufficient excavation into weathered bedrock	
2	1783						
3	1782						

GENERAL REMARKS:
Easy excavation

SAMPLING SYMBOLS:
GB GRAB ■ BLOCK

Tintina Resources Inc.
Black Butte Copper Project

Knight Piésold CONSULTING

Project No.	Ref. No.	Rev.
VA101-460/03	1	0

FIGURE A4-45

Logging conducted according to the ASTM 2488 standard and the Canadian Foundation Engineering Manual, 4th Edition, 2006.

APPENDIX B

HYDROGEOLOGICAL DRILLHOLE DATA

(Pages B-1 to B-72)

Knight Piésold
CONSULTING

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 12:53

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-180**
Test No. 1

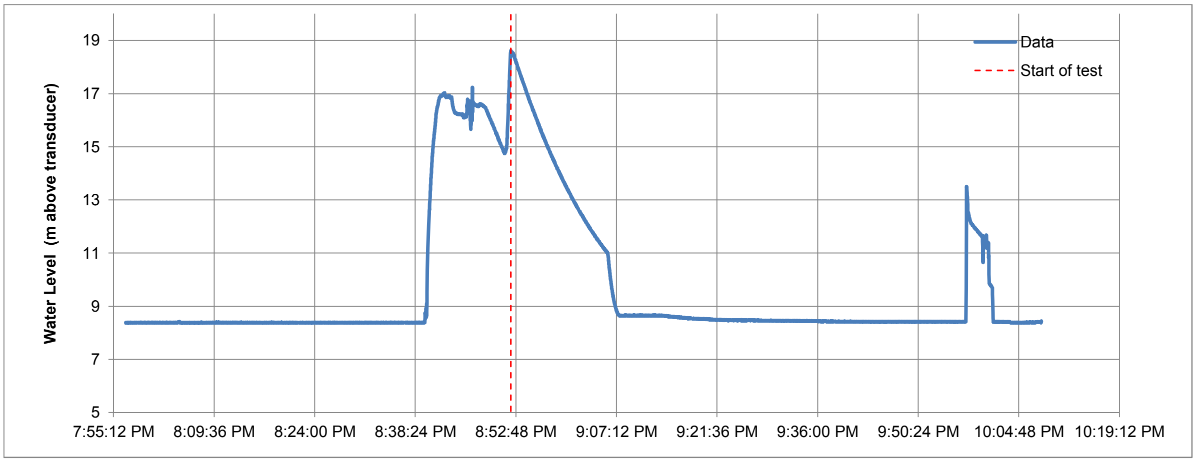
Monitoring Instrument Type Transducer
Slug Type 19 L of water
Test Date 4-Mar-15

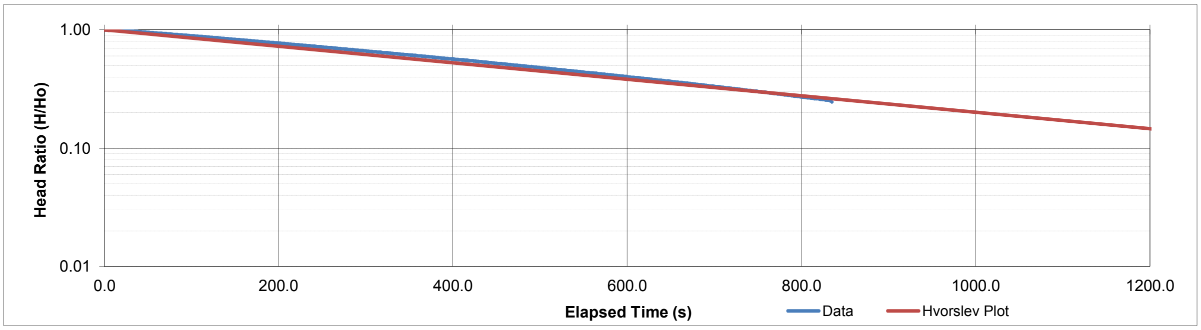
Packer Type HQ Nitrogen
Packer Inflation Time 5:51:46 PM

Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 8.1 **m along hole**
Bottom of test interval 19.5 **m along hole**
Test length, L 11.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 8:52:05 PM
Initial water level 8.40 **m above transducer**
Water level after slug 18.61 **m above transducer**
Change in Water Level, H_o 10.21 **m**
Expected Change in Water Level, H_o 4 **m**

Transmissivity, T 7E-06 **m^2/s**
Hydraulic Conductivity, K 6E-07 **m/s**
Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-180 Hvorslev_Packer Drillhole.xlsx]SC15-180 Hvorslev Packer #1

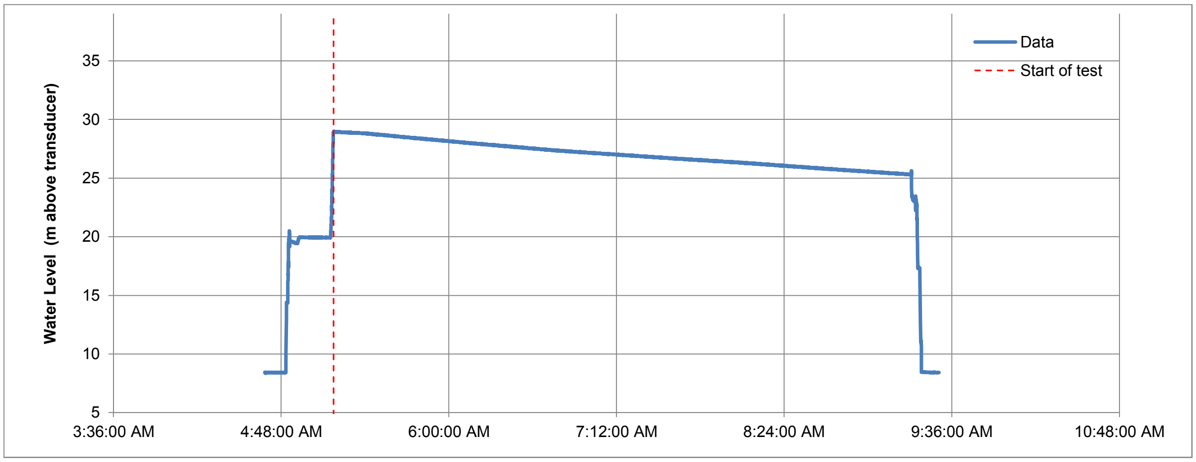
A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

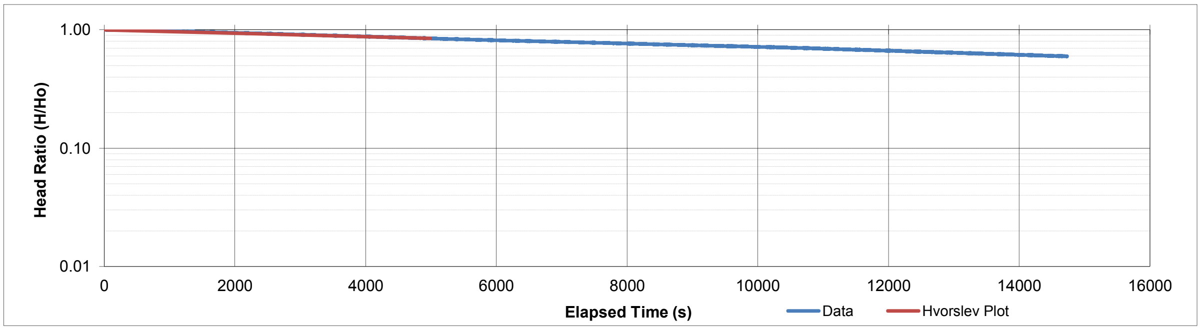
TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 12:53

Project No.	VA101-460/03			**Drillhole**	**SC15-180**	
Field Technician	JBC			**Test No.**	2	
Analyst	GIM					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	38	L of water		**Packer Inflation Time**	4:51:33 AM	
Test Date	5-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	5:10:27 AM	
Top of test interval	18.7	**m along hole**		**Initial water level**	20.00	**m above transducer**
Bottom of test interval	30.2	**m along hole**		**Water level after slug**	28.94	**m above transducer**
Test length, L	11.4	**m along hole**		**Change in Water Level, H_o**	8.94	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	8	**m**
Transmissivity, T	1E-07	**m^2/s**				
Hydraulic Conductivity, K	1E-08	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-180 Hvorslev_Packer Drillhole.xlsx]SC15-180 Hvorslev Packer #2

A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 12:55

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Monitoring Instrument Type Transducer
Slug Type 40 L of water
Test Date 6-Mar-15

Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 9.6 **m along hole**
Bottom of test interval 14.9 **m along hole**
Test length, L 5.3 **m along hole**
Drillhole angle 90 **degrees**

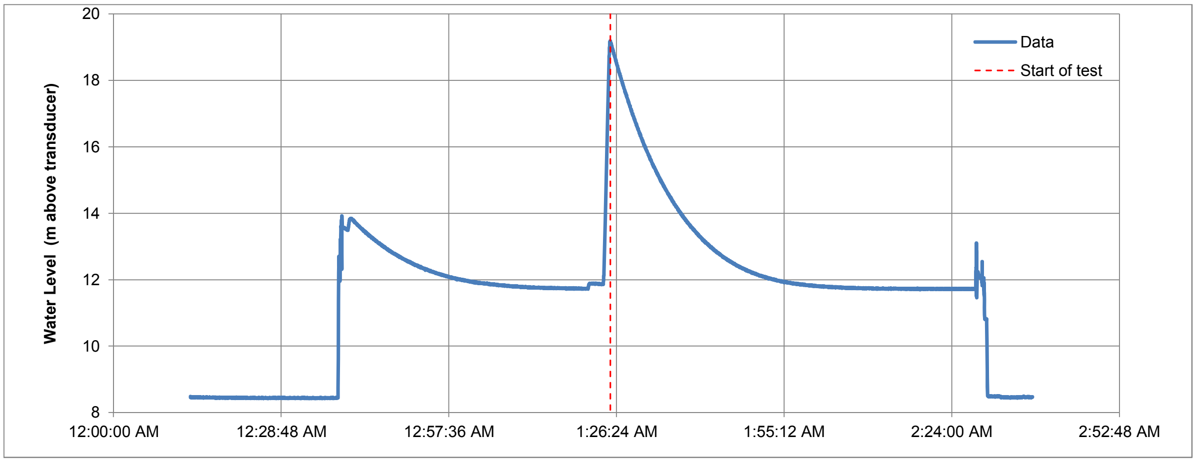
Drillhole **SC15-181**
Test No. 1

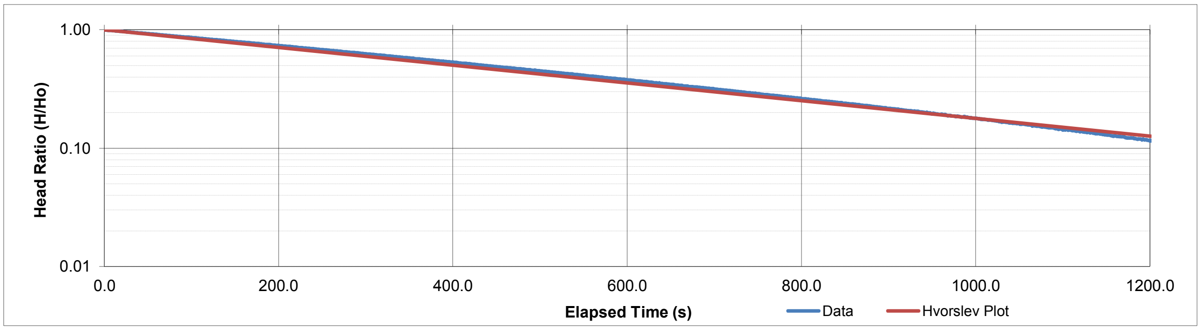
Packer Type HQ Nitrogen
Packer Inflation Time 12:38:35 AM

Slug Injected, Time = 0 1:25:22 AM
Initial water level 11.75 **m above transducer**
Water level after slug 19.18 **m above transducer**
Change in Water Level, H_o 7.43 **m**
Expected Change in Water Level, H_o 8 **m**

Transmissivity, T 6E-06 **m^2/s**
Hydraulic Conductivity, K 1E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-181 Hvorslev_Packer Drillhole.xlsx]SC15-181 Hvorslev Packer #1

A	6MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 12:55

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole **SC15-181**
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 40 L of water
Test Date 6-Mar-15

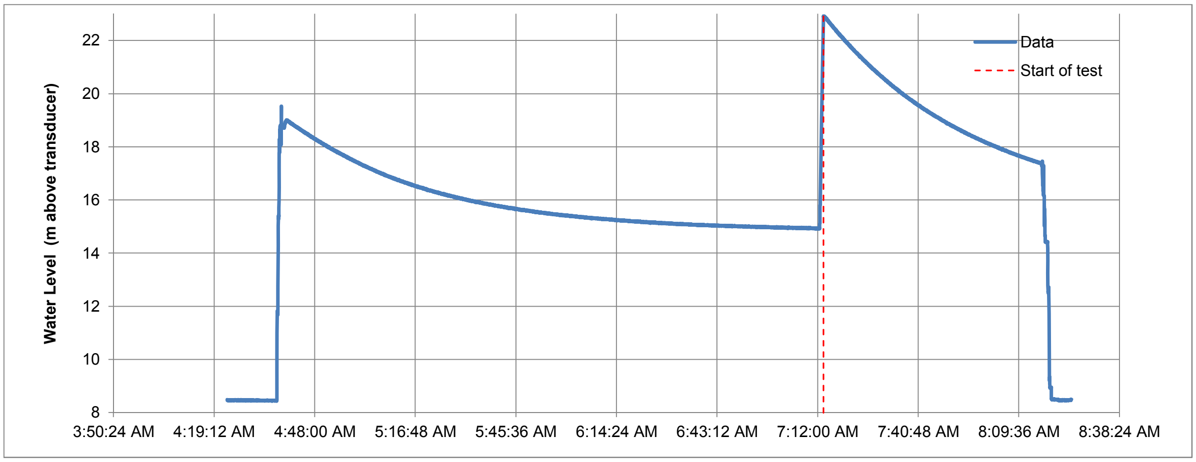
Packer Type HQ Nitrogen
Packer Inflation Time 4:42:00 AM

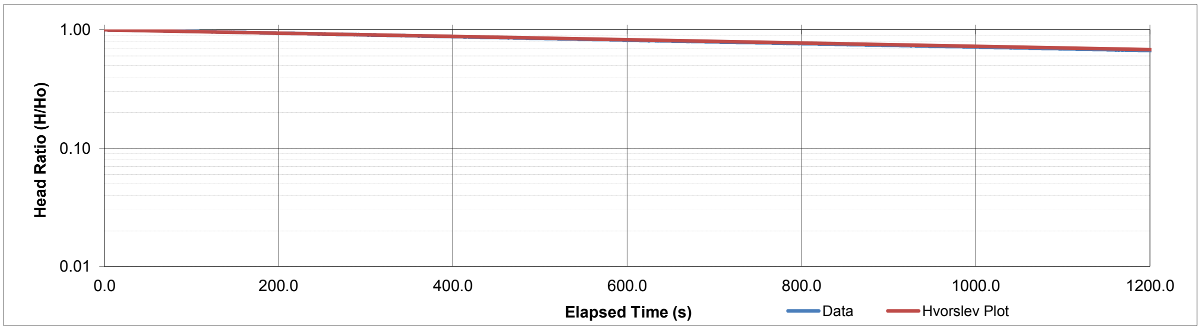
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 12.6 **m along hole**
Bottom of test interval 21.0 **m along hole**
Test length, L 8.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 7:13:42 AM
Initial water level 14.92 **m above transducer**
Water level after slug 22.92 **m above transducer**
Change in Water Level, H_o 7.99 **m**
Expected Change in Water Level, H_o 8 **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 2E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-181 Hvorslev_Packer Drillhole.xlsx]SC15-181 Hvorslev Packer #2

A	6MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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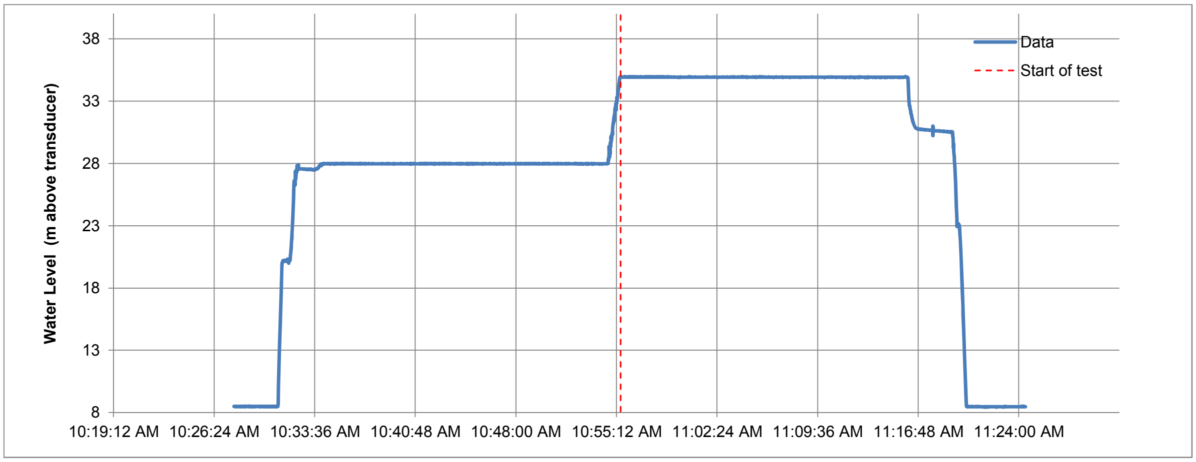
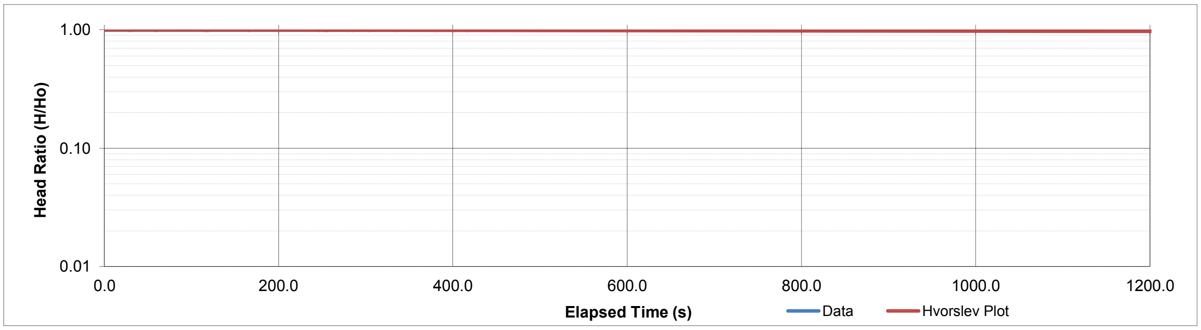
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 12:55

Project No.	VA101-460/03			**Drillhole**	**SC15-181**	
Field Technician	GM			**Test No.**	3	
Analyst	GM					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	40	L of water		**Packer Inflation Time**		
Test Date	6-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	10:55:30 AM	
Top of test interval	20.3	**m along hole**		**Initial water level**	27.99	**m above transducer**
Bottom of test interval	30.1	**m along hole**		**Water level after slug**	34.97	**m above transducer**
Test length, L	9.8	**m along hole**		**Change in Water Level, H_o**	6.99	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	8	**m**

Transmissivity, T	1E-07	**m^2/s**		
Hydraulic Conductivity, K	1E-08	**m/s**	Intercept	1.0





TEST COMMENTS:

Driller bailed water out of hole with core tube before inserting packer.
After inflation and start of test, water level dropped 1.5 cm after 20 minutes. The test was ended. The packer was checked for blockages on surface and none were found. Core showed the rock to be very competent so a low permeability is not unusual.

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A	6MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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HYDRAULIC CONDUCTIVITY CALCULATION
USING CONSTANT HEAD METHOD

Print 02/26/16 13:18

Project No. VA101-460/3
Field Technician JBC
Analyst JBC

Drillhole SC15-182
Test No. 1

Monitoring Instrument Type Transducer

Transducer Position: 2.2 **m (Downhole from top of rods)**

Test Date 6-Mar-15

Drill-hole diameter, D HQ3 0.096 m
Diameter of drill pipe, d HQ3 0.078 m
Top of test interval 2.0 **m along hole**
Bottom of test interval 7.3 **m along hole**
Test length, L 5.3 **m along hole**
Drill-hole angle 90 **degrees**

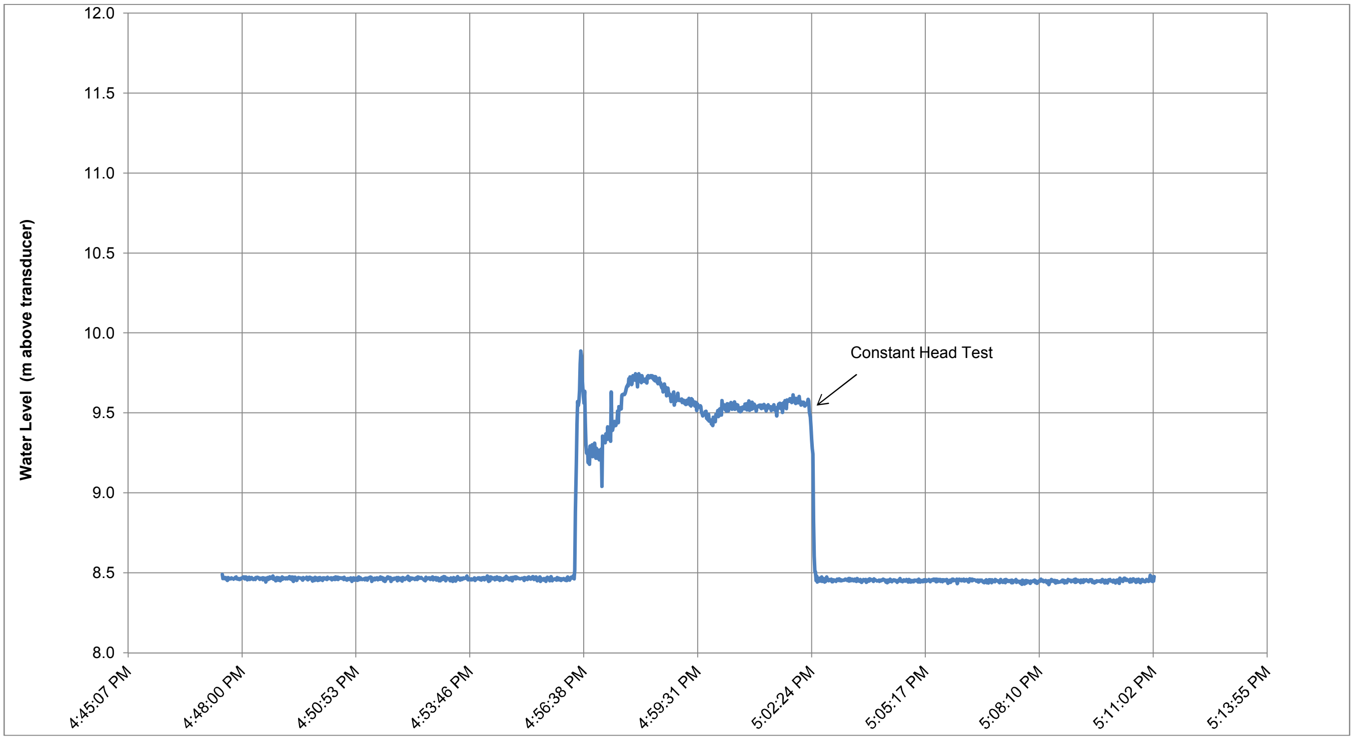
Test Start Time 4:56 PM
Initial Water Level 8.5 **m above transducer**
Water Level During Testing 9.5 **m above transducer**
Head Maintained above Initial , Hc 1.1 **m**

$$K = \frac{Q}{FH_C}$$

$$F = \frac{2\pi L}{ln(2L/D)}, \quad for\ L > 4D$$

Hydraulic Conductivity, K 2E-04 **m/s**
Transmissivity, T 8E-04 **m²/s**

Shape Factor, F 7.1
Q 1.2E-03 **m³/s**



References:

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50
Hoek, E., Bray, J., 1981. Rock Slope Engineering, CRC Press, pp 368

TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-182 Hvorslev_Packer Drillhole.xlsx]SC15-182 Constant Head Test #1

REV	DATE	DESCRIPTION	PREP'D	CHK'D
A	7MAR'15	ISSUED WITH REPORT	JBC	GIM

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING CONSTANT HEAD METHOD

Print 02/26/16 13:18

Project No. VA101-460/3
Field Technician JBC
Analyst JBC

Drillhole **SC15-182**
Test No. 2

Monitoring Instrument Type Transducer

Transducer Position: 6.8 **m (Downhole from top of rods)**

Test Date 6-Mar-15

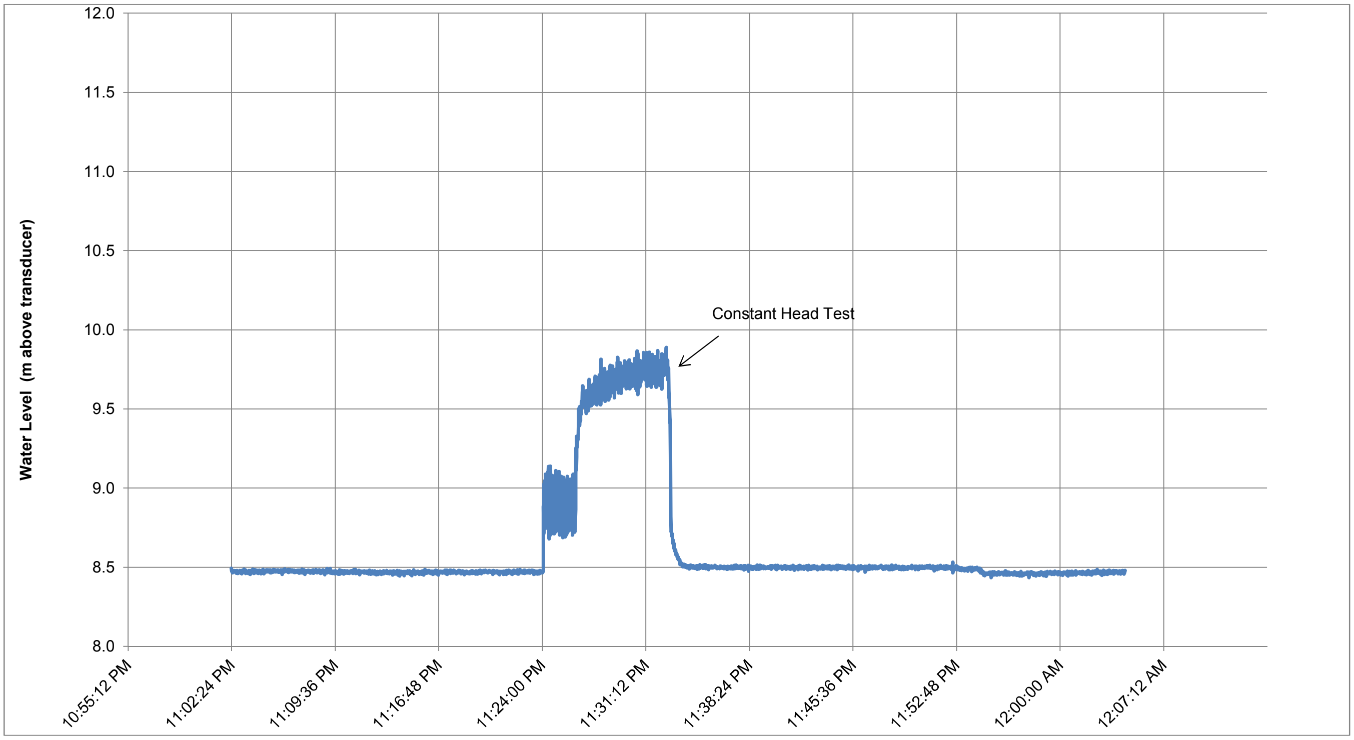
Drill-hole diameter, D	HQ3	0.096	m
Diameter of drill pipe, d	HQ3	0.078	m
Top of test interval	6.6	**m along hole**	
Bottom of test interval	13.4	**m along hole**	
Test length, L	6.9	**m along hole**	
Drill-hole angle	90	**degrees**	

Test Start Time	11:26 PM	
Initial Water Level	8.5	**m above transducer**
Water Level During Testing	9.7	**m above transducer**
Head Maintained above Initial , Hc	1.2	**m**

$$K = \frac{Q}{FH_C}$$

$$F = \frac{2\pi L}{\ln(2L/D)}, \quad for\ L > 4D$$

Hydraulic Conductivity, K	1E-04	**m/s**
Transmissivity, T	8E-04	**m^2/s**
Shape Factor, F	8.7	
Q	1.2E-03	**m^3/s**



References:

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50
Hoek, E., Bray, J., 1981. Rock Slope Engineering, CRC Press, pp 368

TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-182 Hvorslev_Packer Drillhole.xlsx]SC15-182 Constant Head Test #2

A	7MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:18

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-182
Test No. 3

Monitoring Instrument Type Transducer
Slug Type 76 L of water
Test Date 7-Mar-15

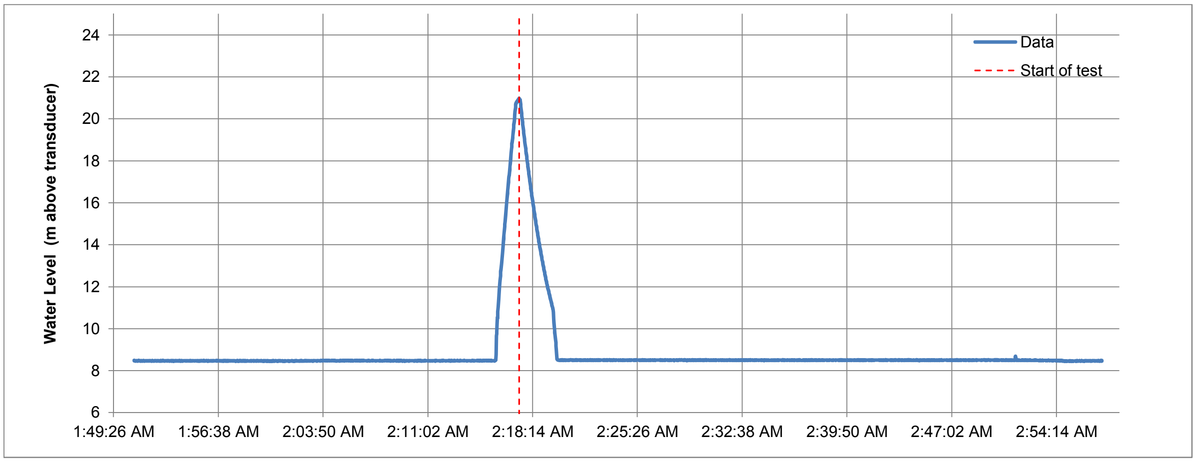
Packer Type HQ Nitrogen
Packer Inflation Time 2:02:00 AM

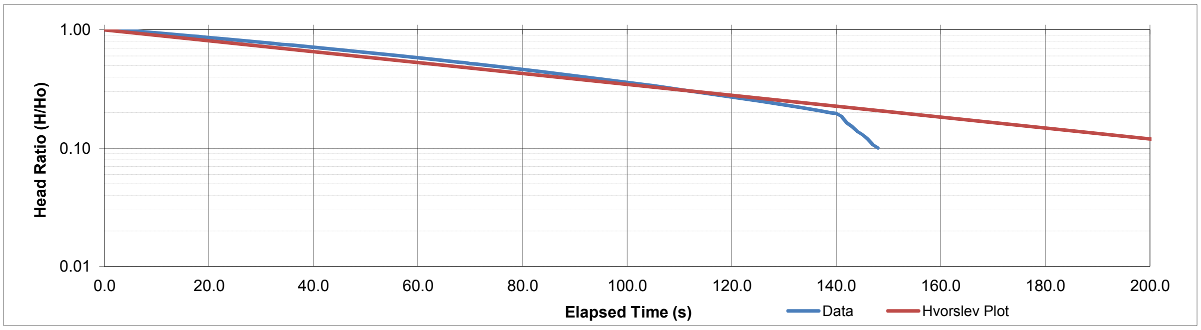
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 12.6 **m along hole**
Bottom of test interval 19.5 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:17:19 AM
Initial water level 8.46 **m above transducer**
Water level after slug 20.98 **m above transducer**
Change in Water Level, H_o 12.52 **m**
Expected Change in Water Level, H_o 16 **m**

Transmissivity, T 4E-05 **m^2/s**
Hydraulic Conductivity, K 6E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

Drill lost water return at 38.5' and have not regained circulation.

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A	7MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING CONSTANT HEAD METHOD

Print 02/26/16 13:18

Project No. VA101-460/3
Field Technician JBC
Analyst JBC

Drillhole SC15-182
Test No. 4

Monitoring Instrument Type Transducer

Transducer Position: 19.0 **m (Downhole from top of rods)**

Test Date 7-Mar-15

Drill-hole diameter, D HQ3 0.096 m
Diameter of drill pipe, d HQ3 0.078 m
Top of test interval 18.7 **m along hole**
Bottom of test interval 25.6 **m along hole**
Test length, L 6.9 **m along hole**
Drill-hole angle 90 **degrees**

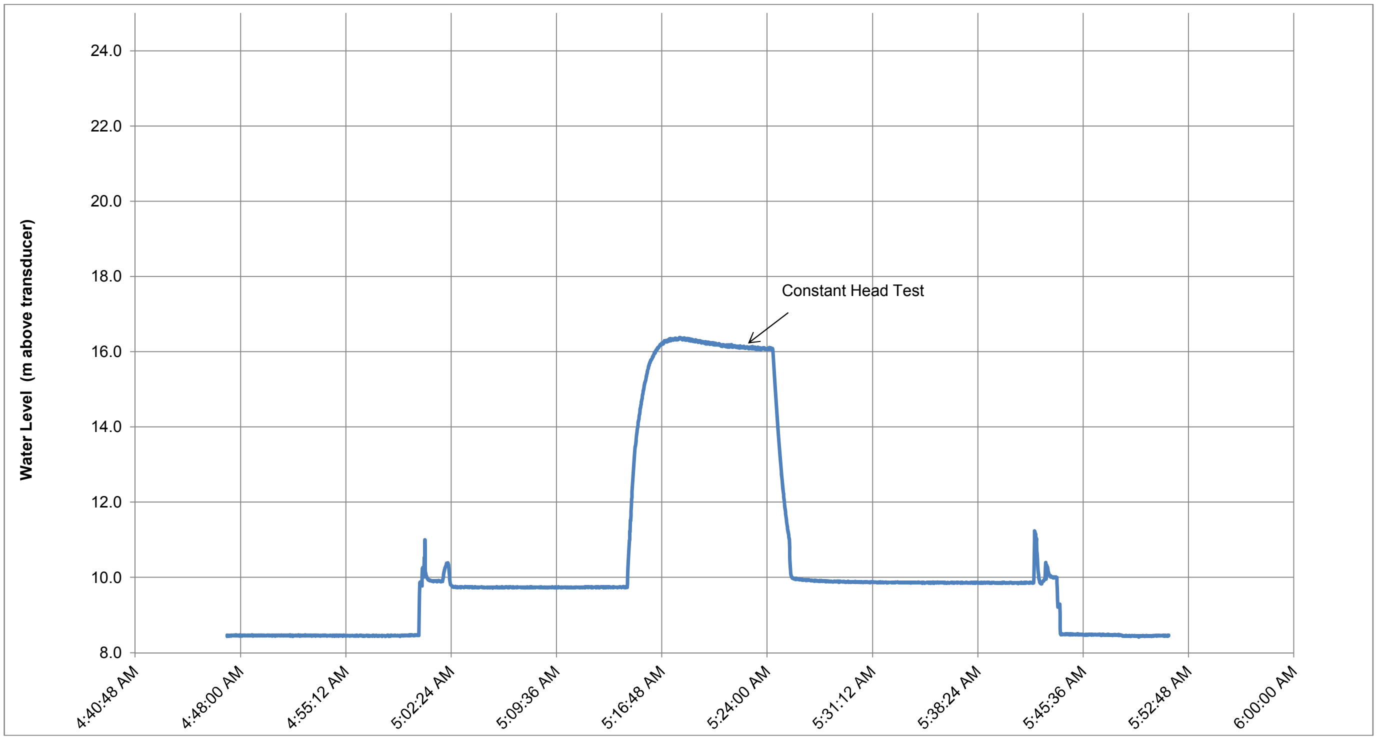
Test Start Time 5:14 AM
Initial Water Level 9.7 **m above transducer**
Water Level During Testing 16.2 **m above transducer**
Head Maintained above Initial , Hc 6.4 **m**

$$K = \frac{Q}{FH_C}$$

$$F = \frac{2\pi L}{\ln(2L/D)}, \quad for\ L > 4D$$

Hydraulic Conductivity, K 1E-05 **m/s**
Transmissivity, T 8E-05 **m^2/s**

Shape Factor, F 8.7
Q 6.2E-04 **m^3/s**



References:

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50
Hoek, E., Bray, J., 1981. Rock Slope Engineering, CRC Press, pp 368

TEST COMMENTS:

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A	7MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:18

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-182
Test No. 5

Monitoring Instrument Type Transducer
Slug Type 50 Gallons Water
Test Date 7-Mar-15

Packer Type HQ Nitrogen
Packer Inflation Time 8:15:00 AM

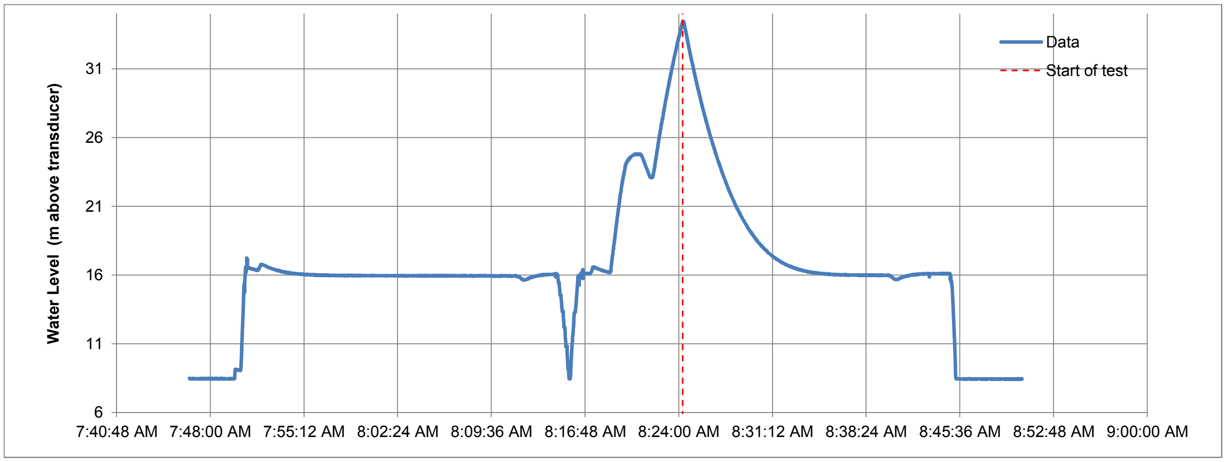
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	24.8	**m along hole**	
Bottom of test interval	30.2	**m along hole**	
Test length, L	5.3	**m along hole**	
Drillhole angle	90	**degrees**	

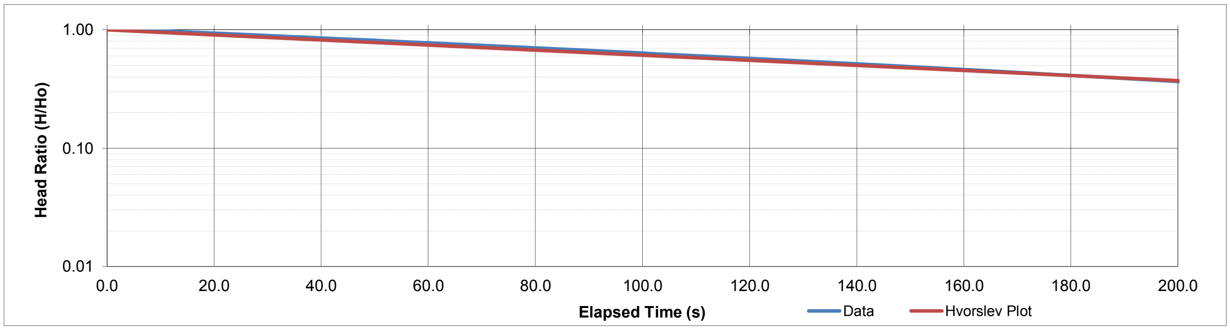
Slug Injected, Time = 0	8:24:18 AM	
Initial water level	15.96	**m above transducer**
Water level after slug	34.42	**m above transducer**
Change in Water Level, H_o	18.46	**m**
Expected Change in Water Level, H_o	11	**m**

Transmissivity, T 2E-05 **m^2/s**

Hydraulic Conductivity, K 3E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

Filled rods with approximately 50 gallons of water (see notes for flow meter measurements). Stopped filling for ~30 seconds) at 2.5 minutes into test to switch water tanks.

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A	7MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:34

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-183
Test No. 1

Monitoring Instrument Type Transducer
Slug Type Gal of water
Test Date 7-Mar-15

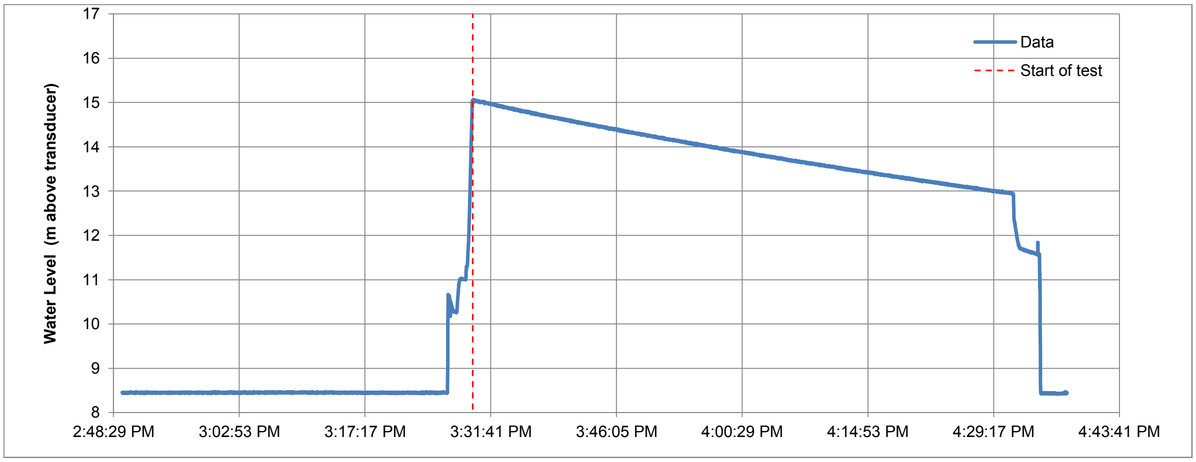
Packer Type HQ Nitrogen
Packer Inflation Time 5:51:46 PM

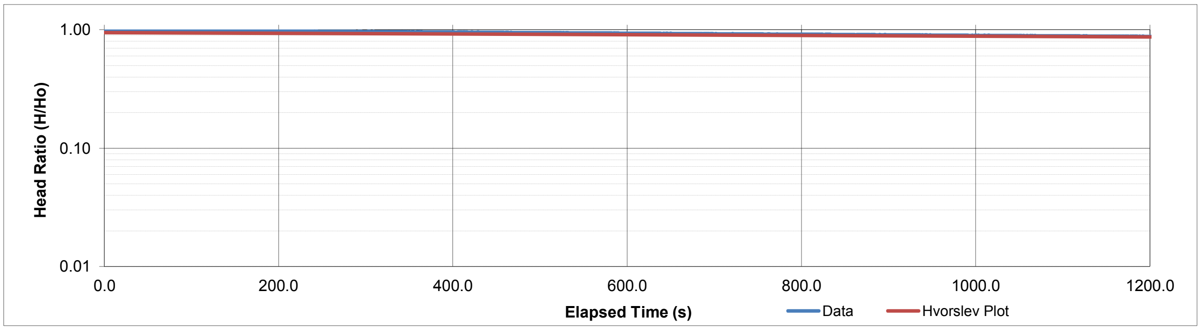
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 5.0 **m along hole**
Bottom of test interval 11.9 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 3:29:38 PM
Initial water level 8.43 **m above transducer**
Water level after slug 15.05 **m above transducer**
Change in Water Level, H_o 6.62 **m**
Expected Change in Water Level, H_o 0 **m**

Transmissivity, T 3E-07 **m^2/s**
Hydraulic Conductivity, K 4E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

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A	8MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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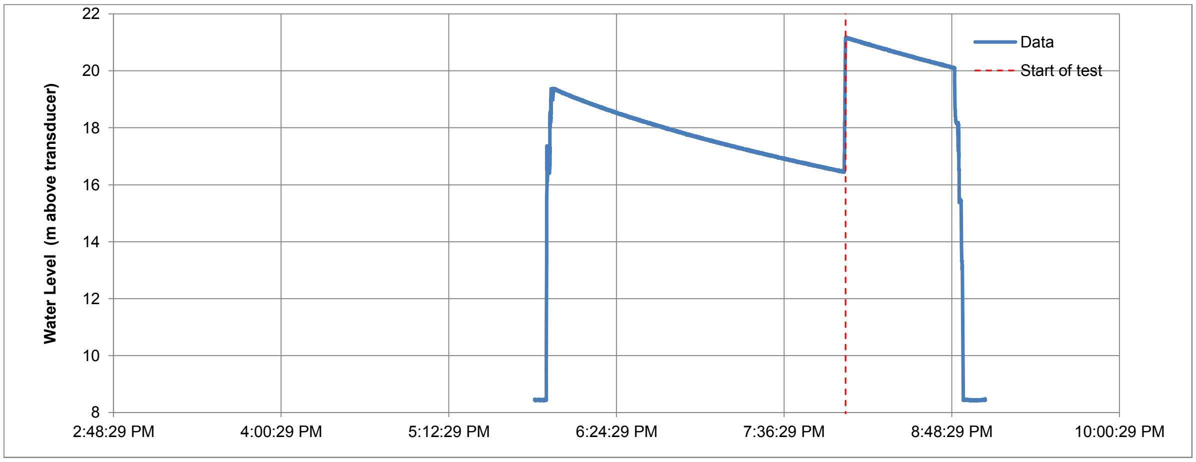
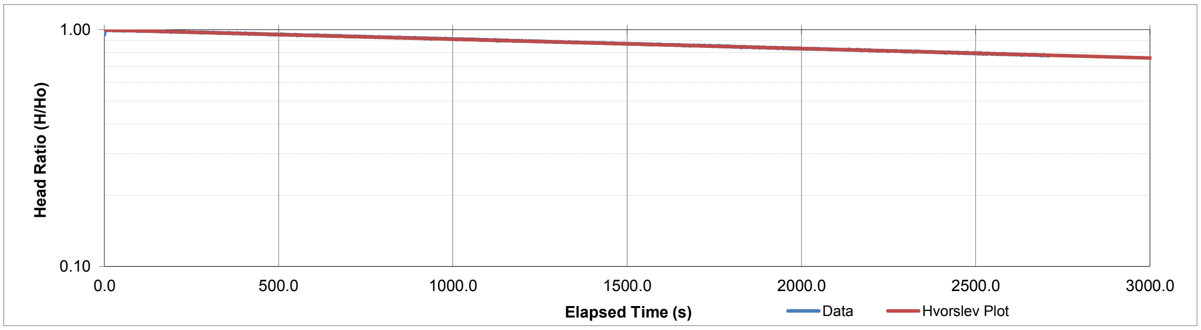
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:34

Project No.	VA101-460/03		
Field Technician	JBC		
Analyst	JBC		
Monitoring Instrument Type	Transducer		
Slug Type	26.5	Lof water	
Test Date	7-Mar-15		
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	11.1	**m along hole**	
Bottom of test interval	18.0	**m along hole**	
Test length, L	6.9	**m along hole**	
Drillhole angle	90	**degrees**	
Transmissivity, T	3E-07	**m^2/s**	
Hydraulic Conductivity, K	5E-08	**m/s**	

Drillhole	**SC15-183**	
Test No.	2	
Packer Type	HQ Nitrogen	
Packer Inflation Time	5:51:46 PM	
Slug Injected, Time = 0	8:02:50 PM	
Initial water level	16.45	**m above transducer**
Water level after slug	21.18	**m above transducer**
Change in Water Level, H_o	4.7	**m**
Expected Change in Water Level, H_o	5.6	**m**
Intercept	1.0	





TEST COMMENTS:

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A	8MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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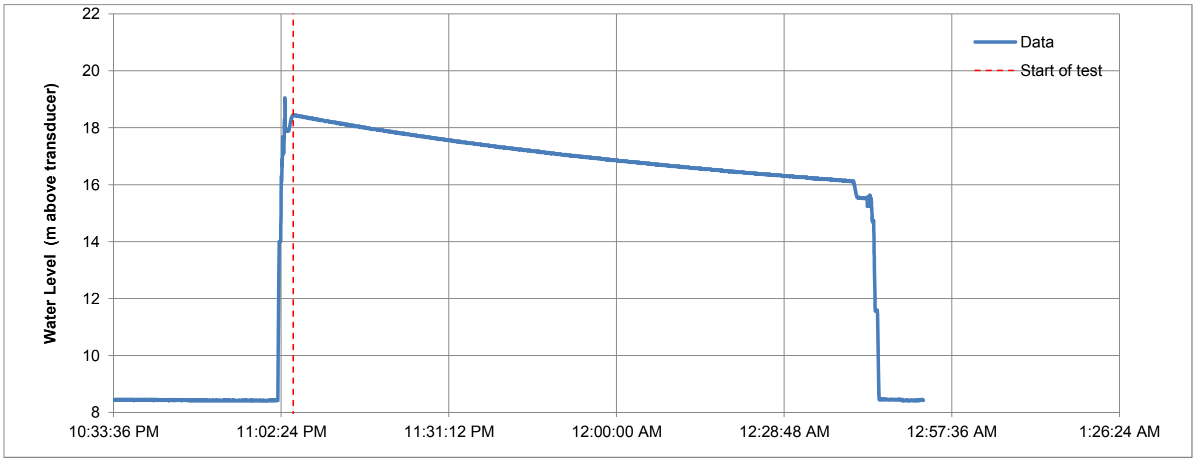
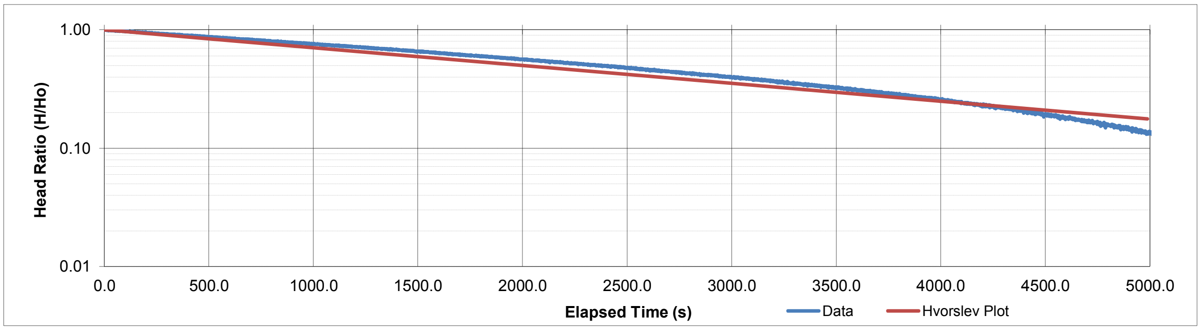
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:34

Project No.	VA101-460/03			**Drillhole**	**SC15-183**	
Field Technician	JBC			**Test No.**	3	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	n/a	Lof water		**Packer Inflation Time**	11:03:00 AM	
Test Date	7-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	11:04:29 PM	
Top of test interval	17.2	**m along hole**		**Initial water level**	16.00	**m above transducer**
Bottom of test interval	24.1	**m along hole**		**Water level after slug**	18.46	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	2.5	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	n/a	**m**
Transmissivity, T	1E-06	**m^2/s**				
Hydraulic Conductivity, K	2E-07	**m/s**		Intercept	1.0	





TEST COMMENTS:

No slug inserted as the initial water level recovery was relatively linear based on manual water level measurements for 1.5 hour. Transducer data indicate a slight curve towards a water level of 16 m above transducer. The initial water level recovery curve was used for the K value estimation since there was no slug insertion for the actual falling head test.

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-183 Hvorslev_Packer Drillhole.xlsx]SC15-183 Hvorslev Packer #3

A	8MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:34

Project No. VA101-460/03
Field Technician JBC/GIM
Analyst GIM

Drillhole SC15-183
Test No. 4

Monitoring Instrument Type Transducer
Slug Type 79.5 L of water
Test Date 8-Mar-15

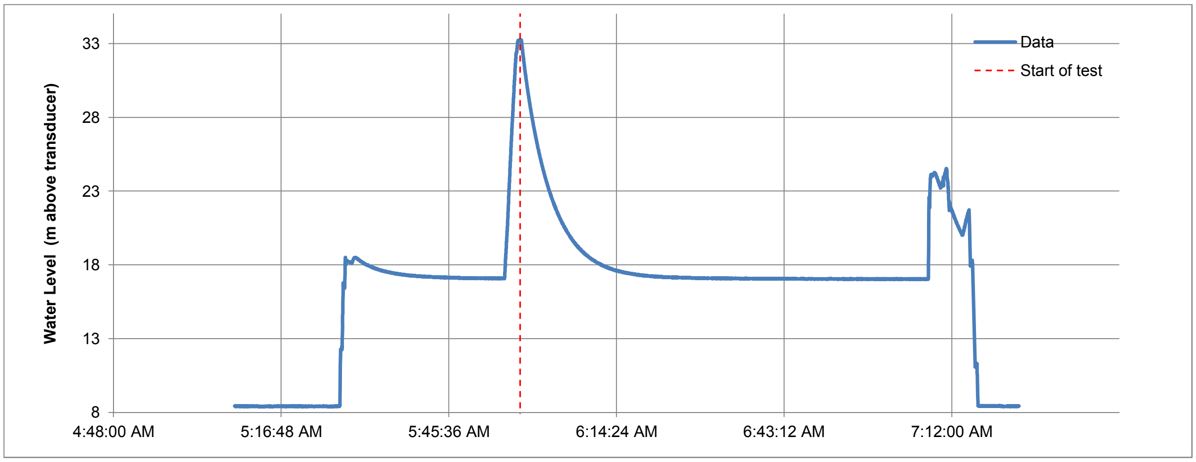
Packer Type HQ Nitrogen
5:29:00 AM

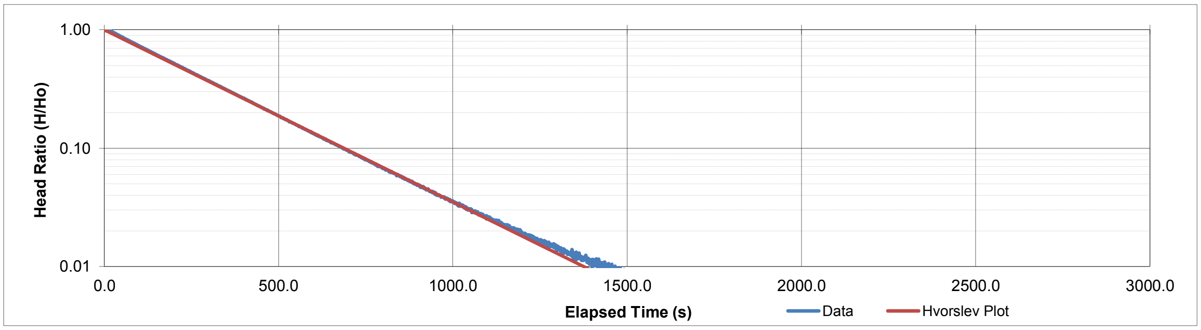
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 23.3 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 5:57:51 AM
Initial water level 17.04 **m above transducer**
Water level after slug 33.24 **m above transducer**
Change in Water Level, H_o 16.2 **m**
Expected Change in Water Level, H_o 16.7 **m**

Transmissivity, T 1E-05 **m^2/s**
Hydraulic Conductivity, K 2E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

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A	8MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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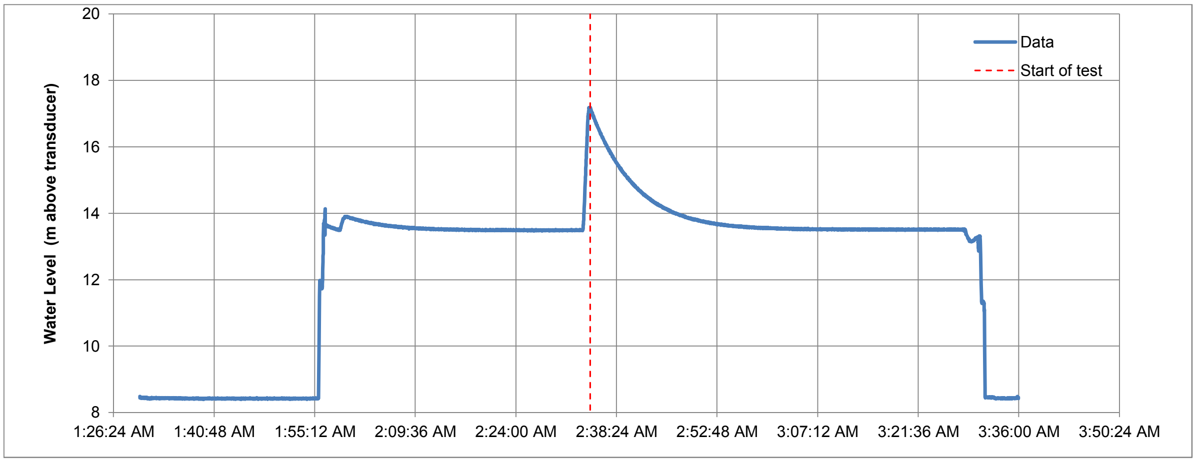
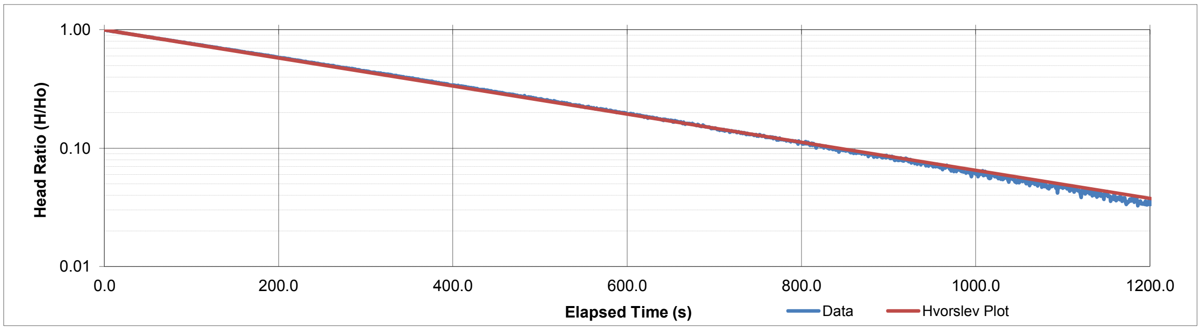
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:41

Project No.	VA101-460/03			**Drillhole**	**SC15-184**	
Field Technician	JBC			**Test No.**	1	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	PQ Nitrogen	
Slug Type	40	L of water		**Packer Inflation Time**	1:58:00 AM	
Test Date	9-Mar-15					
Drillhole diameter, D	PQ3	0.123	m			
Drill rod diameter, d	PQ3	0.103	m	**Slug Injected, Time = 0**	2:34:39 AM	
Top of test interval	6.6	**m along hole**		**Initial water level**	13.50	**m above transducer**
Bottom of test interval	13.4	**m along hole**		**Water level after slug**	17.19	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	3.68	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	5	**m**
Transmissivity, T	2E-05	**m^2/s**				
Hydraulic Conductivity, K	3E-06	**m/s**		Intercept	1.0	





TEST COMMENTS:

A	9MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:41

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-184
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 19 L of water (approx.)
Test Date 9-Mar-15

Packer Type PQ Nitrogen
Packer Inflation Time 7:57:00 AM

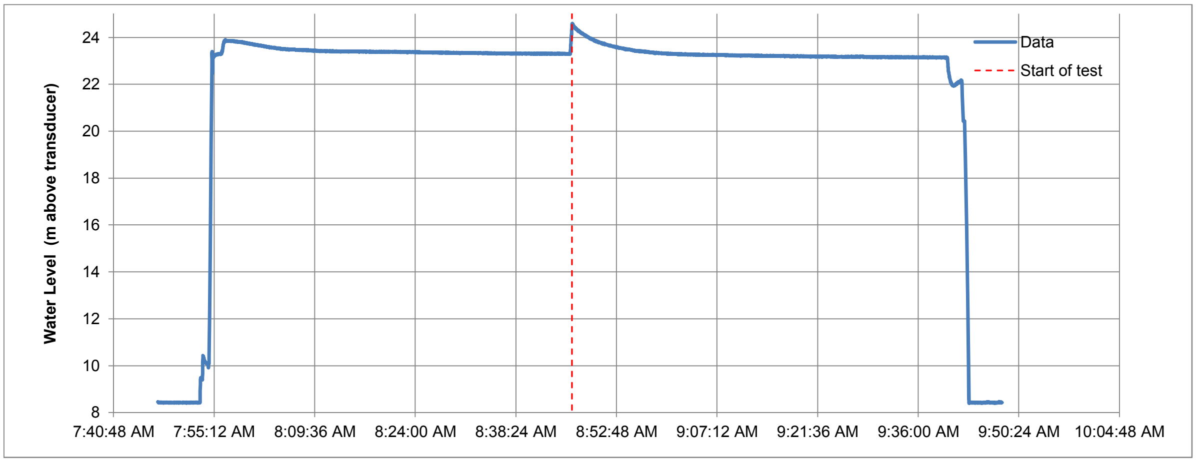
Drillhole diameter, D	PQ3	0.123	m
Drill rod diameter, d	PQ3	0.103	m
Top of test interval	14.2	**m along hole**	
Bottom of test interval	20.9	**m along hole**	
Test length, L	6.7	**m along hole**	
Drillhole angle	90	**degrees**	

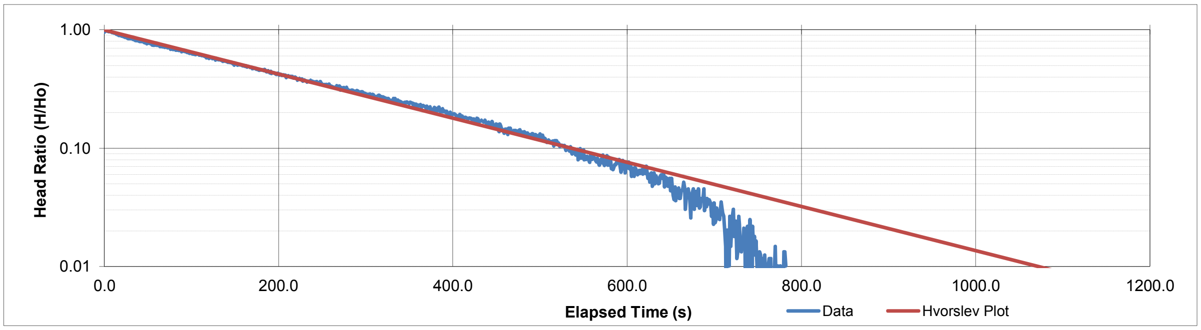
Slug Injected, Time = 0	8:46:27 AM	
Initial water level	23.31	**m above transducer**
Water level after slug	24.59	**m above transducer**
Change in Water Level, H_o	1.28	**m**
Expected Change in Water Level, H_o	2	**m**

Transmissivity, T 3E-05 **m^2/s**

Hydraulic Conductivity, K 4E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

Water level is higher than in previous test

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-184 Hvorslev_Packer Drillhole.xlsx]SC15-184 Hvorslev Packer #2

A	9MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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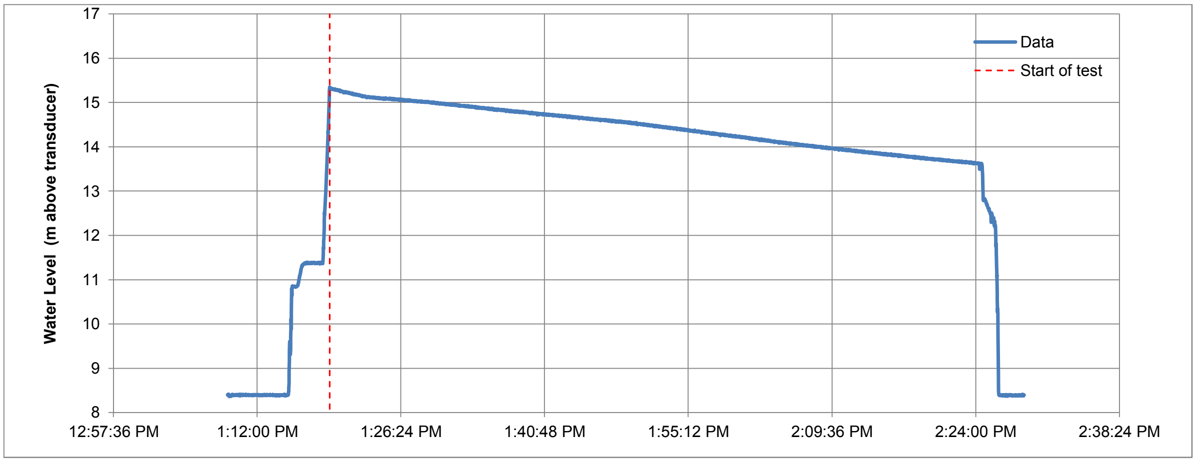
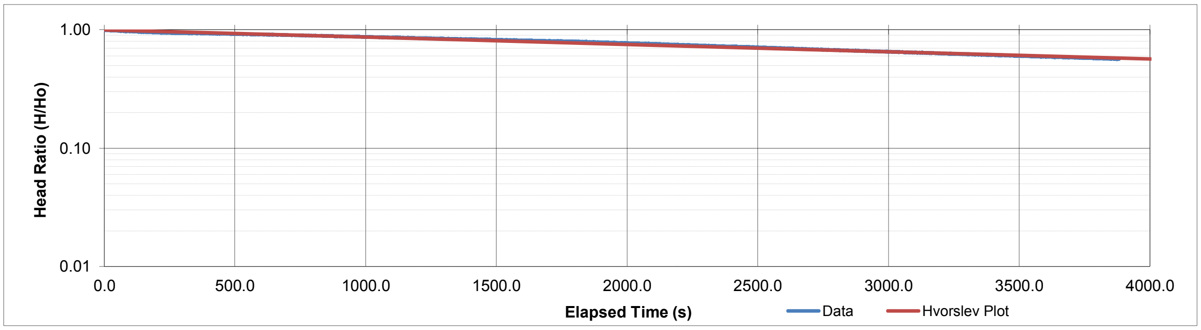
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:48

Project No.	VA101-460/03			**Drillhole**	**SC15-185**	
Field Technician	GIM			**Test No.**	1	
Analyst	GIM					
Monitoring Instrument Type	Transducer			**Packer Type**	PQ Nitrogen	
Slug Type			L of water	**Packer Inflation Time**		
Test Date	10-Mar-15					
Drillhole diameter, D	PQ3	0.123	m			
Drill rod diameter, d	PQ3	0.103	m	**Slug Injected, Time = 0**	1:19:16 PM	
Top of test interval	5.6		**m along hole**	**Initial water level**	11.38	**m above transducer**
Bottom of test interval	11.9		**m along hole**	**Water level after slug**	15.35	**m above transducer**
Test length, L	6.2		**m along hole**	**Change in Water Level, H_o**	3.97	**m**
Drillhole angle	90		**degrees**	**Expected Change in Water Level, H_o**	0	**m**
Transmissivity, T	9E-07		**m^2/s**			
Hydraulic Conductivity, K	1E-07		**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-185 Hvorslev_Packer Drillhole.xlsx]SC15-185 Hvorslev Packer #1

A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:48

Project No. VA101-460/03
Field Technician GIM
Analyst GIM

Drillhole SC15-185
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 193 L of water over 3:35
Test Date 10-Mar-15

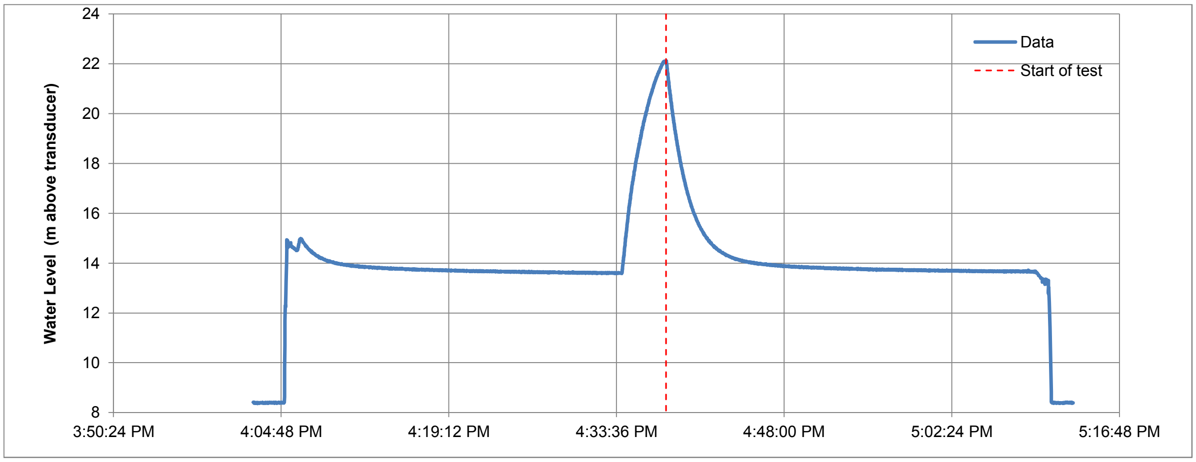
Packer Type PQ Nitrogen
Packer Inflation Time 4:05:00 PM

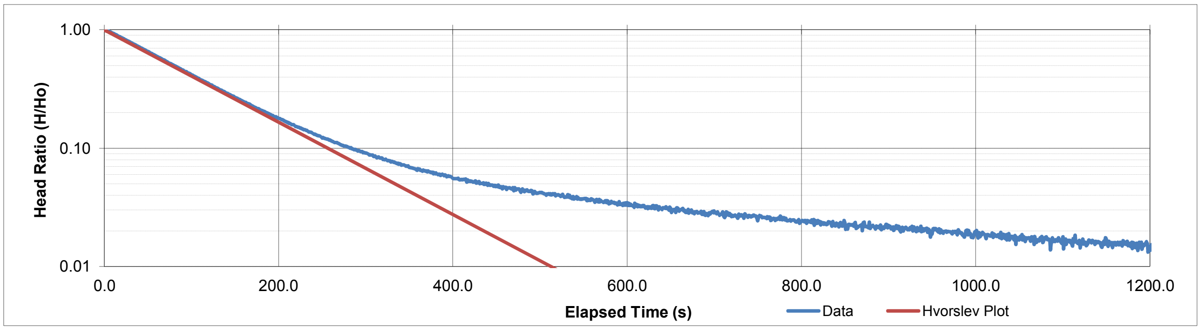
Drillhole diameter, D PQ3 0.123 m
Drill rod diameter, d PQ3 0.103 m
Top of test interval 12.6 **m along hole**
Bottom of test interval 18.0 **m along hole**
Test length, L 5.3 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 4:37:51 PM
Initial water level 13.60 **m above transducer**
Water level after slug 22.11 **m above transducer**
Change in Water Level, H_o 8.51 **m**
Expected Change in Water Level, H_o 23 **m**

Transmissivity, T 5E-05 **m^2/s**
Hydraulic Conductivity, K 1E-05 **m/s**

Intercept 1.0





TEST COMMENTS:

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A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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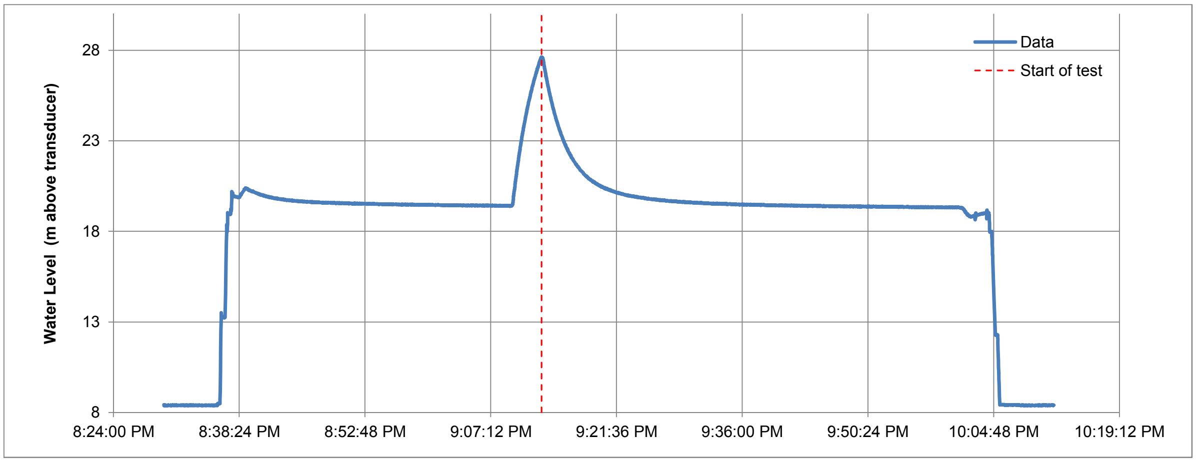
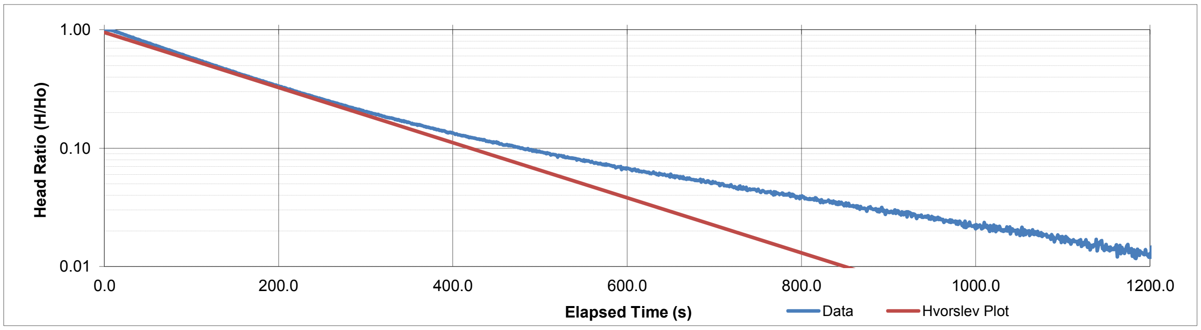
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:48

Project No.	VA101-460/03			**Drillhole**	**SC15-185**	
Field Technician	JBC			**Test No.**	3	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	PQ Nitrogen	
Slug Type	140	L of water		**Packer Inflation Time**	8:38:00 PM	
Test Date	10-Mar-15					
Drillhole diameter, D	PQ3	0.123	m			
Drill rod diameter, d	PQ3	0.103	m	**Slug Injected, Time = 0**	9:13:02 PM	
Top of test interval	17.2	**m along hole**		**Initial water level**	19.43	**m above transducer**
Bottom of test interval	24.1	**m along hole**		**Water level after slug**	27.62	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	8.19	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	17	**m**
Transmissivity, T	3E-05	**m^2/s**				
Hydraulic Conductivity, K	5E-06	**m/s**		Intercept	1.0	





TEST COMMENTS:

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A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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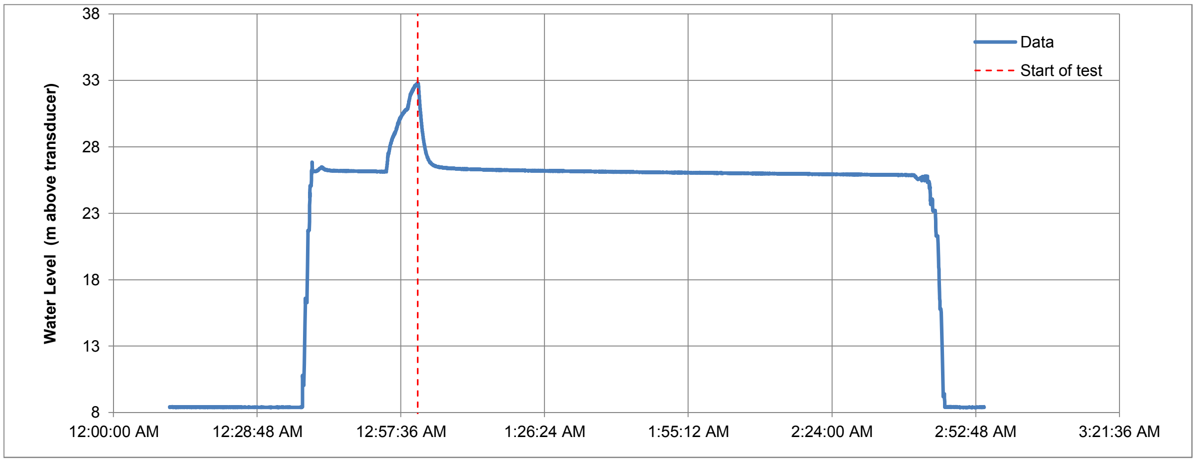
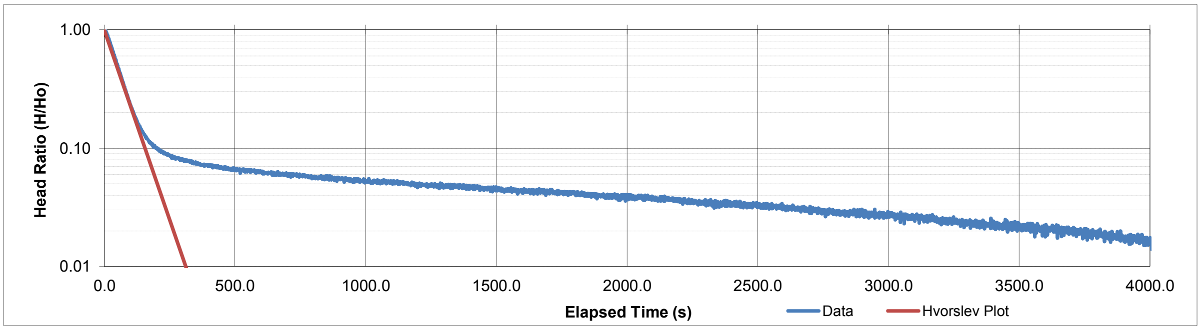
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:48

Project No.	VA101-460/03	
Field Technician	JBC	
Analyst	JBC	
Monitoring Instrument Type	Transducer	
Slug Type	341	L of water
Test Date	11-Mar-15	
Drillhole diameter, D	PQ3	0.123 m
Drill rod diameter, d	PQ3	0.103 m
Top of test interval	23.3	**m along hole**
Bottom of test interval	30.2	**m along hole**
Test length, L	6.9	**m along hole**
Drillhole angle	90	**degrees**
Transmissivity, T	9E-05	**m^2/s**
Hydraulic Conductivity, K	1E-05	**m/s**

Drillhole	**SC15-185**	
Test No.	4	
Packer Type	PQ Nitrogen	
Packer Inflation Time	12:45:00 AM	
Slug Injected, Time = 0	1:01:00 AM	
Initial water level	25.89	**m above transducer**
Water level after slug	32.80	**m above transducer**
Change in Water Level, H_o	6.91	**m**
Expected Change in Water Level, H_o	41	**m**
Intercept	1.0	





TEST COMMENTS:

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A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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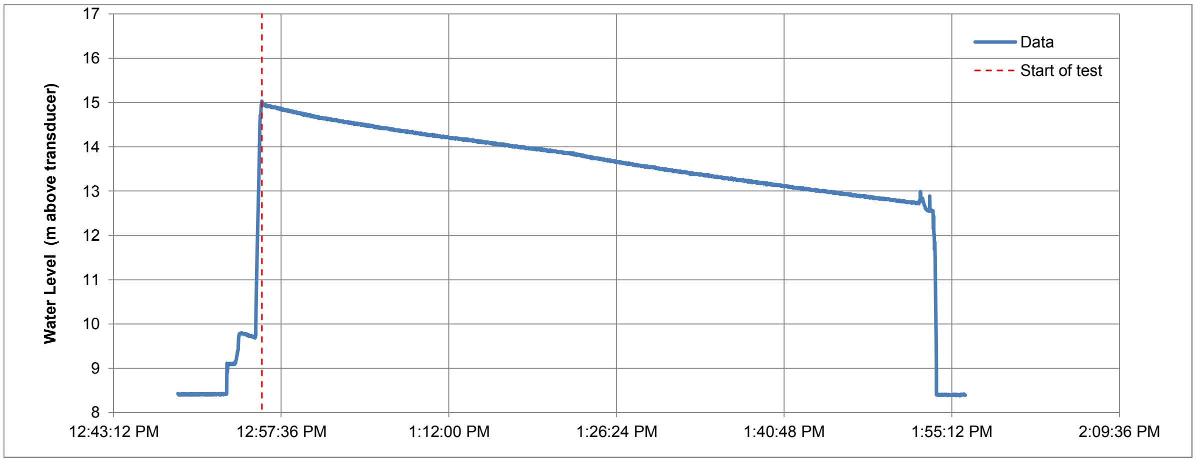
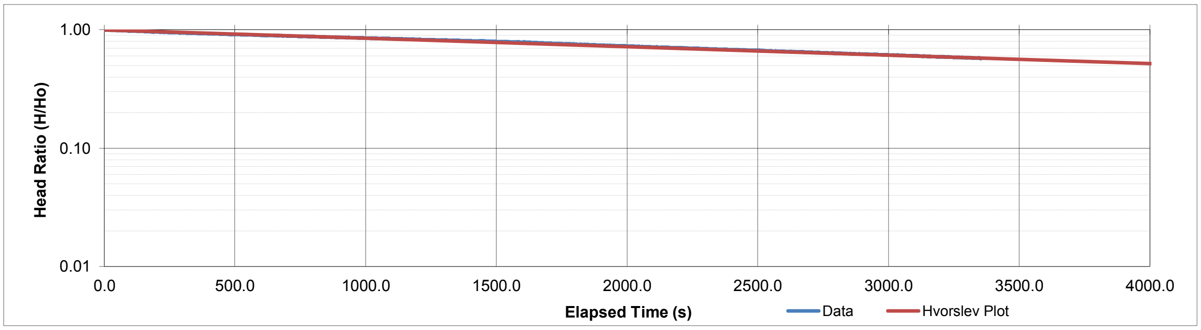
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:50

Project No.	VA101-460/03			**Drillhole**	**SC15-186**	
Field Technician	GM			**Test No.**	1	
Analyst	GM					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	unknown	L of water		**Packer Inflation Time**	12:52:56 PM	
Test Date	11-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	12:55:57 PM	
Top of test interval	5.0	**m along hole**		**Initial water level**	9.73	**m above transducer**
Bottom of test interval	11.9	**m along hole**		**Water level after slug**	14.96	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	5.23	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	#VALUE!	**m**
Transmissivity, T	6E-07	**m^2/s**				
Hydraulic Conductivity, K	9E-08	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-186 Hvorslev_Packer Drillhole.xlsx]SC15-186 Hvorslev Packer #1

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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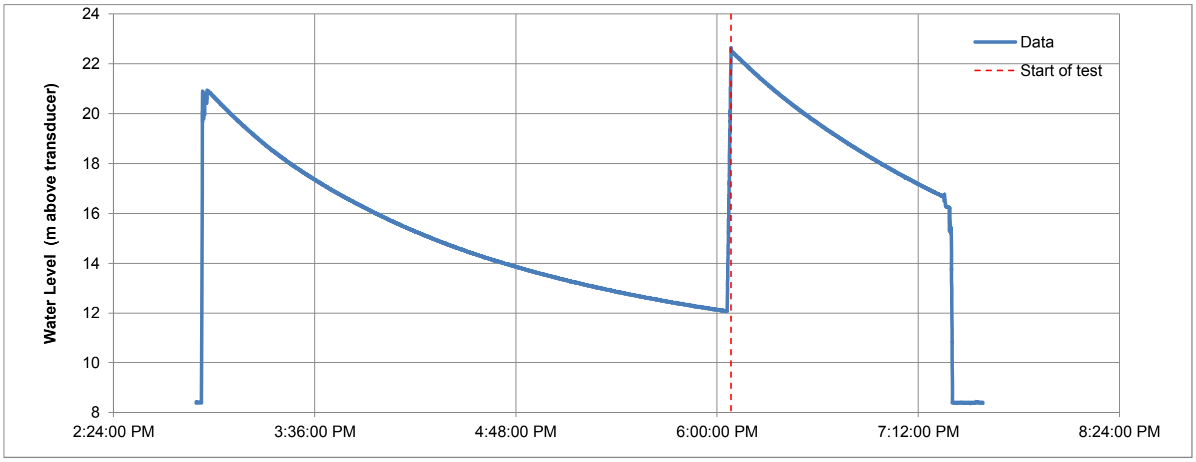
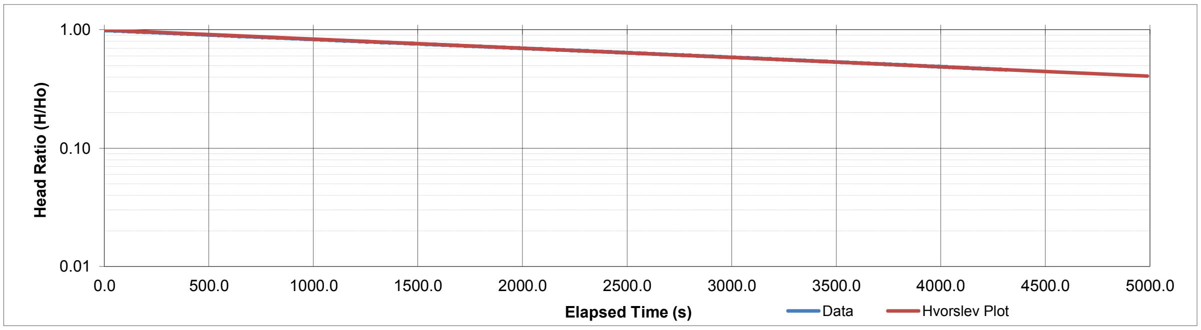
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:50

Project No.	VA101-460/03		**Drillhole**	**SC15-186**	
Field Technician	GM		**Test No.**	2	
Analyst	JBC				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	unknown	L of water	**Packer Inflation Time**	12:52:56 PM	
Test Date	11-Mar-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	6:05:02 PM	
Top of test interval	12.6	**m along hole**	**Initial water level**	12.00	**m above transducer**
Bottom of test interval	18.0	**m along hole**	**Water level after slug**	22.64	**m above transducer**
Test length, L	5.3	**m along hole**	**Change in Water Level, H_o**	10.64	**m**
Drillhole angle	90	**degrees**	**Expected Change in Water Level, H_o**	#VALUE!	**m**
Transmissivity, T	6E-07	**m^2/s**			
Hydraulic Conductivity, K	1E-07	**m/s**	Intercept	1.0	





TEST COMMENTS:

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A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:50

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-186
Test No. 3

Monitoring Instrument Type Transducer
Slug Type n/a L of water
Test Date 11-Mar-15

Packer Type HQ Nitrogen
Packer Inflation Time 8:47:00 PM

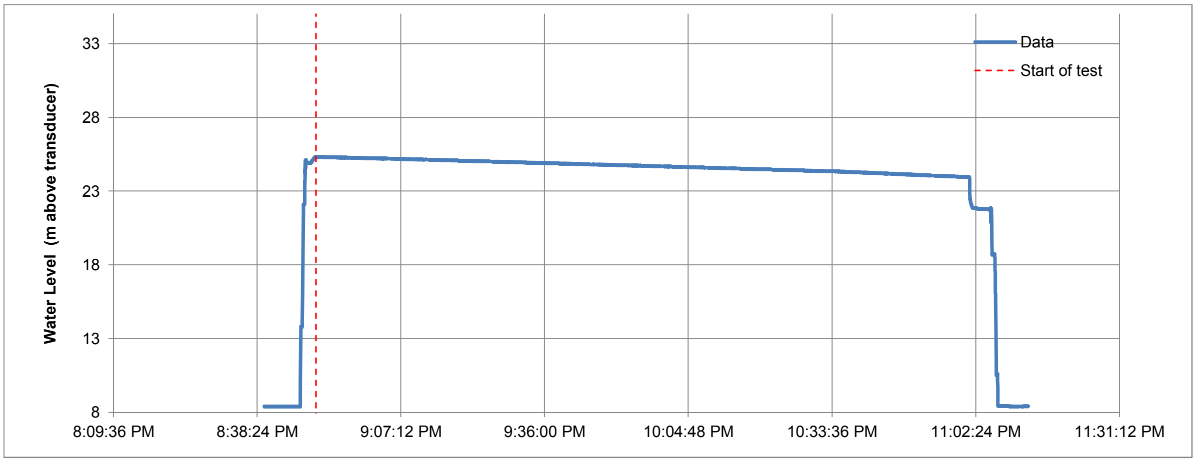
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	17.2	**m along hole**	
Bottom of test interval	24.1	**m along hole**	
Test length, L	6.9	**m along hole**	
Drillhole angle	90	**degrees**	

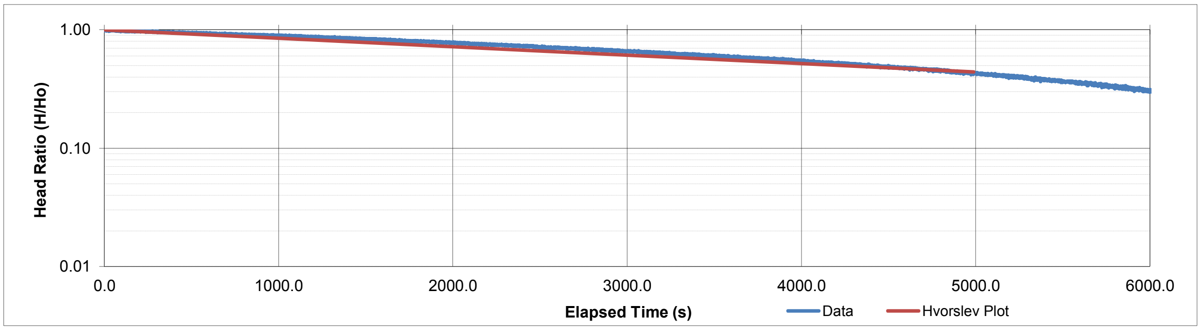
Slug Injected, Time = 0	8:50:12 PM	
Initial water level	23.95	**m above transducer**
Water level after slug	25.33	**m above transducer**
Change in Water Level, H_o	1.38	**m**
Expected Change in Water Level, H_o	#VALUE!	**m**

Transmissivity, T 6E-07 **m^2/s**

Hydraulic Conductivity, K 9E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

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A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:50

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Monitoring Instrument Type Transducer
Slug Type 40 L of water
Test Date 12-Mar-15

Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 23.3 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

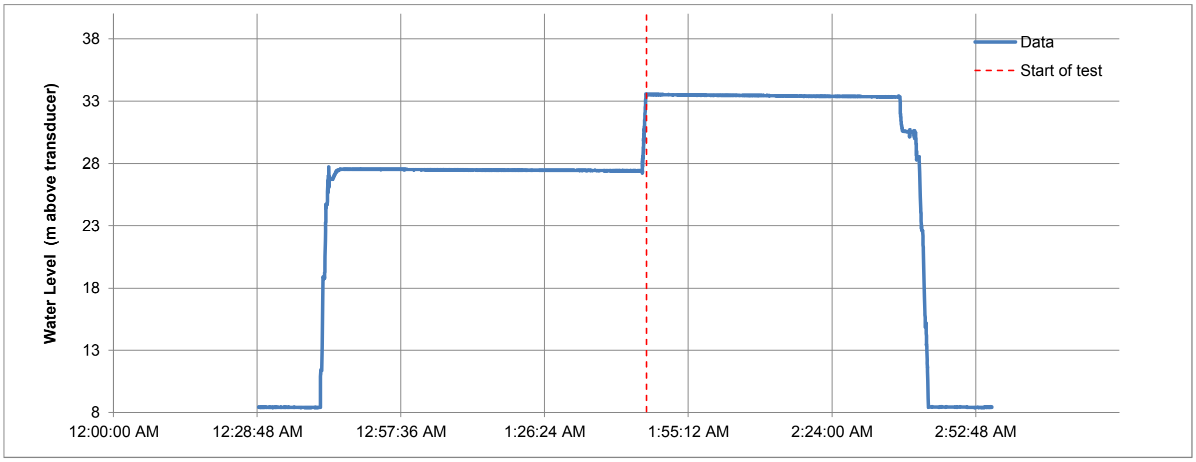
Drillhole **SC15-186**
Test No. 4

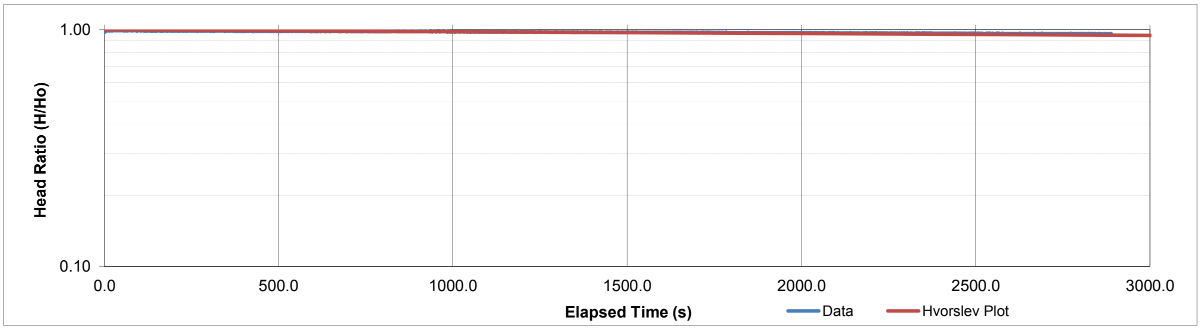
Packer Type HQ Nitrogen
Packer Inflation Time 12:44:00 AM

Slug Injected, Time = 0 1:46:51 AM
Initial water level 27.43 **m above transducer**
Water level after slug 33.58 **m above transducer**
Change in Water Level, H_o 6.15 **m**
Expected Change in Water Level, H_o 8 **m**

Transmissivity, T 7E-08 **m^2/s**
Hydraulic Conductivity, K 1E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-186 Hvorslev_Packer Drillhole.xlsx]SC15-186 Hvorslev Packer #4

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:56

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-187
Test No. 1

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 12-Mar-15

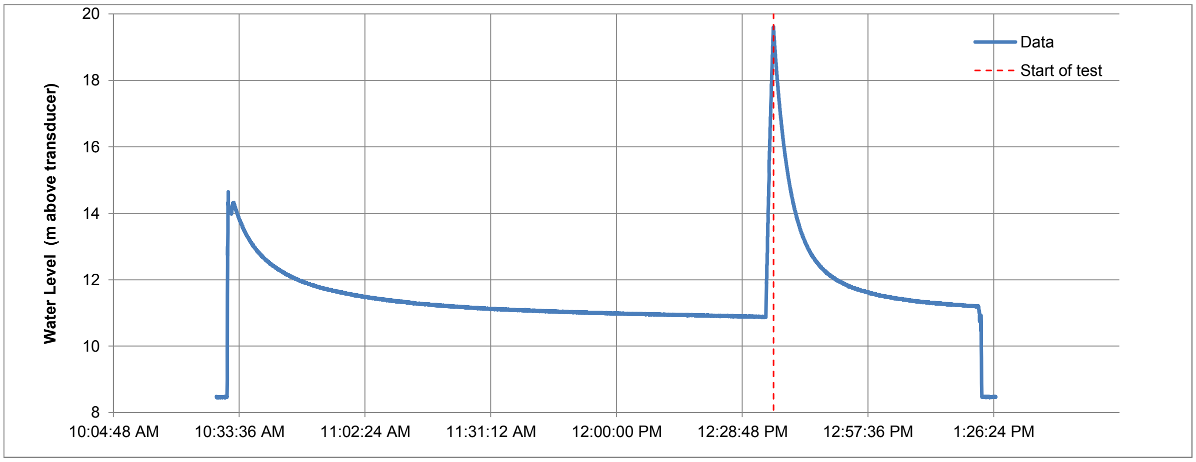
Packer Type HQ Nitrogen
Packer Inflation Time 10:31:00 AM

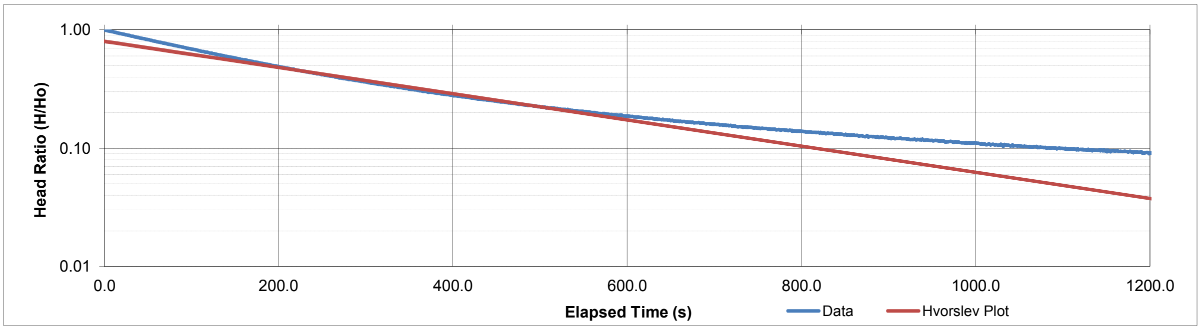
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 3.5 **m along hole**
Bottom of test interval 8.8 **m along hole**
Test length, L 5.3 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:35:58 PM
Initial water level 10.89 **m above transducer**
Water level after slug 19.61 **m above transducer**
Change in Water Level, H_o 8.72 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 9E-06 **m^2/s**
Hydraulic Conductivity, K 2E-06 **m/s**

Intercept 0.8





TEST COMMENTS:

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A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:56

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-187
Test No. 2

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 12-Mar-15

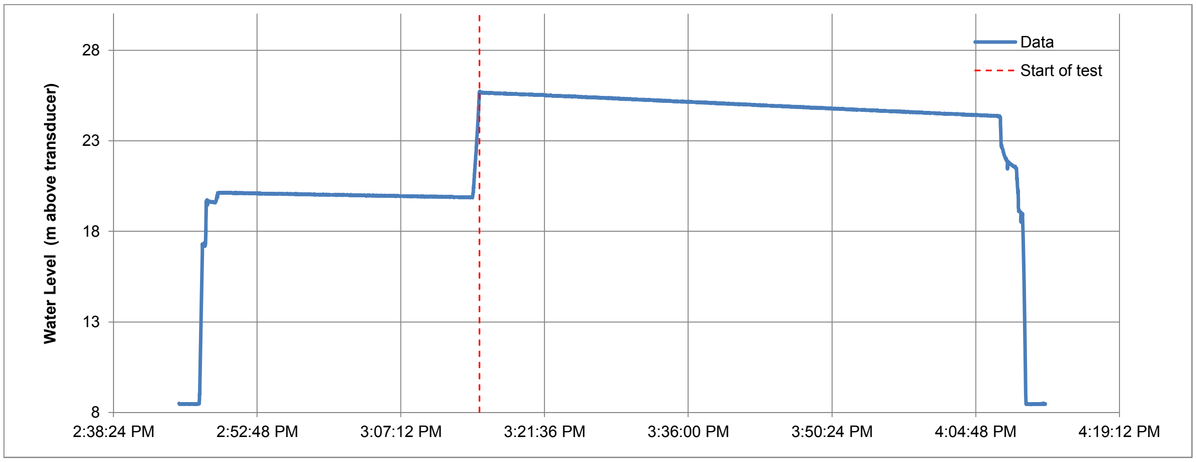
Packer Type HQ Nitrogen
Packer Inflation Time 2:48:00 PM

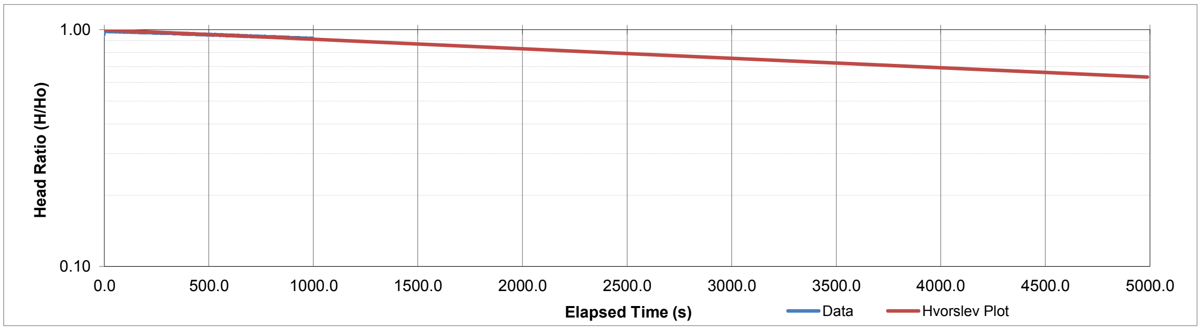
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 9.6 **m along hole**
Bottom of test interval 22.6 **m along hole**
Test length, L 13.0 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 3:15:05 PM
Initial water level 19.87 **m above transducer**
Water level after slug 25.74 **m above transducer**
Change in Water Level, H_o 5.86 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 4E-07 **m^2/s**
Hydraulic Conductivity, K 3E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-187 Hvorslev_Packer Drillhole.xlsx]SC15-187 Hvorslev Packer #2

A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 13:56

Project No. VA101-460/03
Field Technician GM/JBC
Analyst JBC

Drillhole **SC15-187**
Test No. 3

Monitoring Instrument Type Transducer
Slug Type 72 L of water
Test Date 12-Mar-15

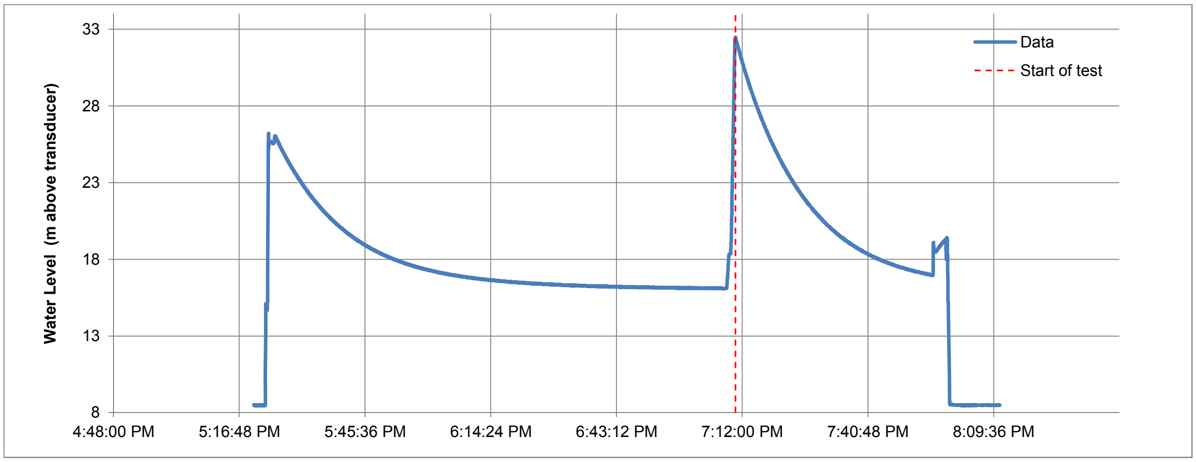
Packer Type HQ Nitrogen
Packer Inflation Time 5:21:00 PM

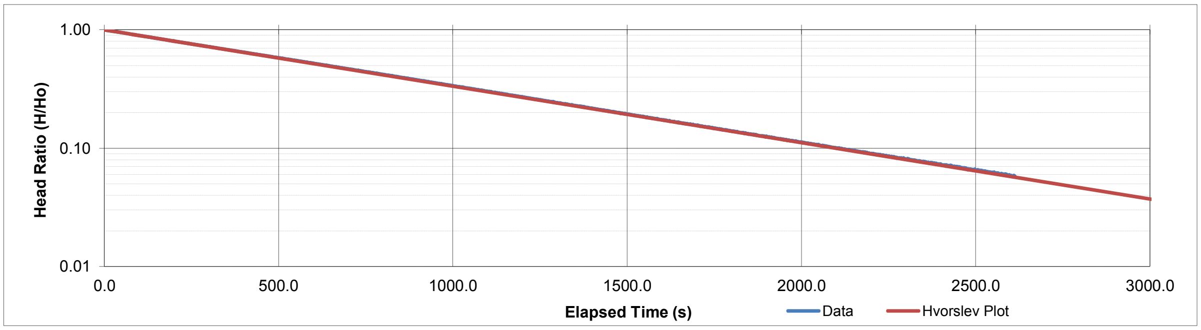
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 23.3 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 7:10:27 PM
Initial water level 16.11 **m above transducer**
Water level after slug 32.47 **m above transducer**
Change in Water Level, H_o 16.37 **m**
Expected Change in Water Level, H_o 15 **m**

Transmissivity, T 4E-06 **m^2/s**
Hydraulic Conductivity, K 6E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-187 Hvorslev_Packer Drillhole.xlsx]SC15-187 Hvorslev Packer #3

A	4MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:17

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-188**
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 15 L of water
Test Date 13-Mar-15

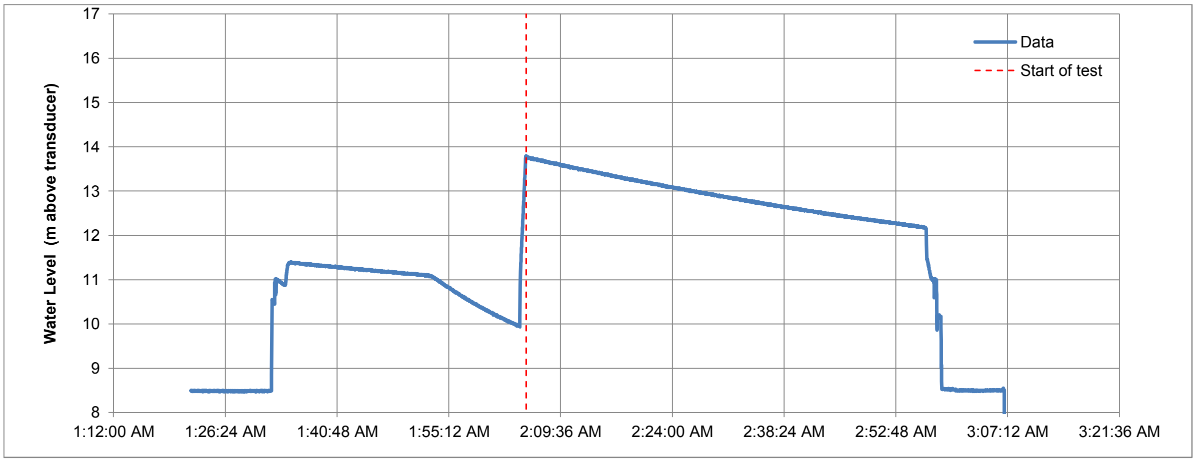
Packer Type HQ Nitrogen
Packer Inflation Time 1:35:00 AM

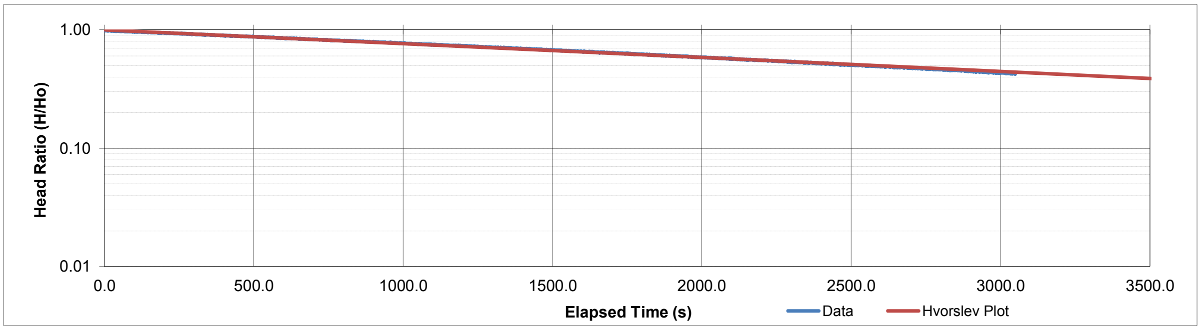
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 3.5 **m along hole**
Bottom of test interval 8.8 **m along hole**
Test length, L 5.3 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:05:10 AM
Initial water level 11.00 **m above transducer**
Water level after slug 13.80 **m above transducer**
Change in Water Level, H_o 2.80 **m**
Expected Change in Water Level, H_o 3 **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 2E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-188 Hvorslev_Packer Drillhole.xlsx]SC15-188 Hvorslev Packer #1

A	13MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:17

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-188**
Test No. 2

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 13-Mar-15

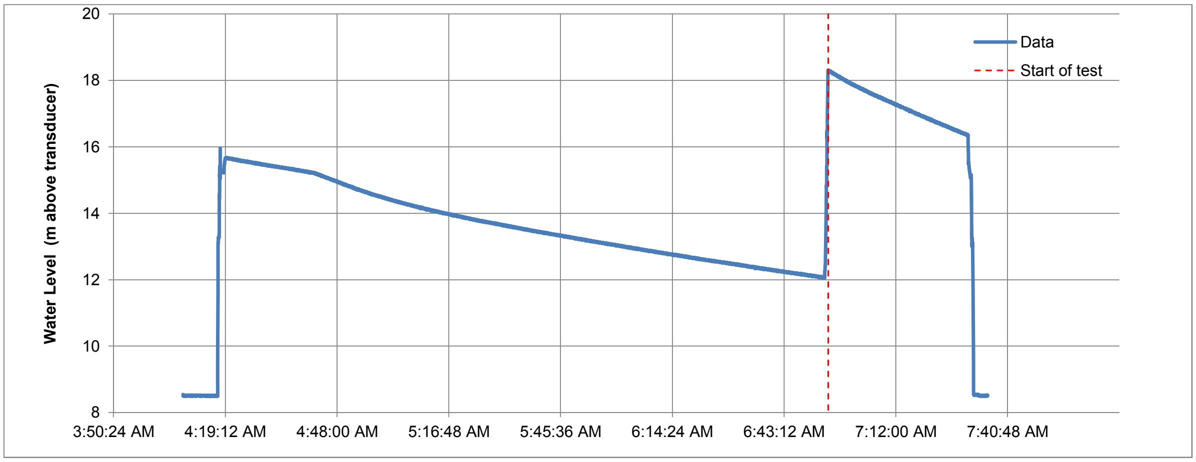
Packer Type HQ Nitrogen
Packer Inflation Time 4:20:00 AM

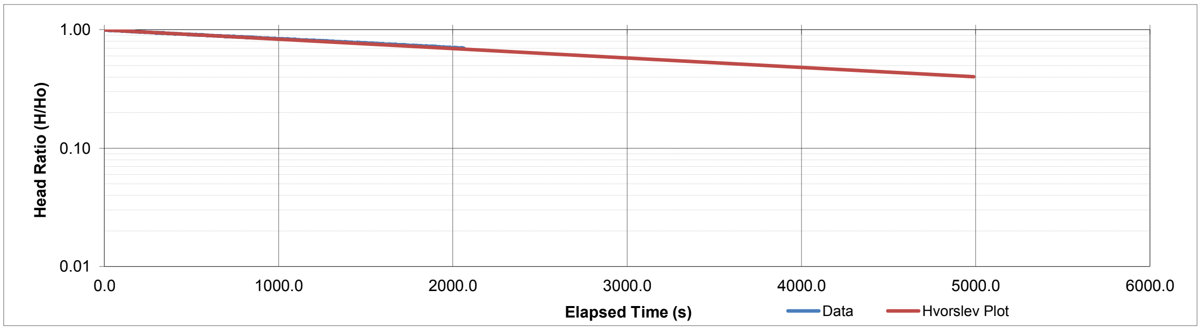
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 8.1 **m along hole**
Bottom of test interval 14.9 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 6:54:36 AM
Initial water level 12.05 **m above transducer**
Water level after slug 18.31 **m above transducer**
Change in Water Level, H_o 6.26 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 7E-07 **m^2/s**
Hydraulic Conductivity, K 1E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-188 Hvorslev_Packer Drillhole.xlsx]SC15-188 Hvorslev Packer #2

A	13MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:17

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-188
Test No. 3

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 13-Mar-15

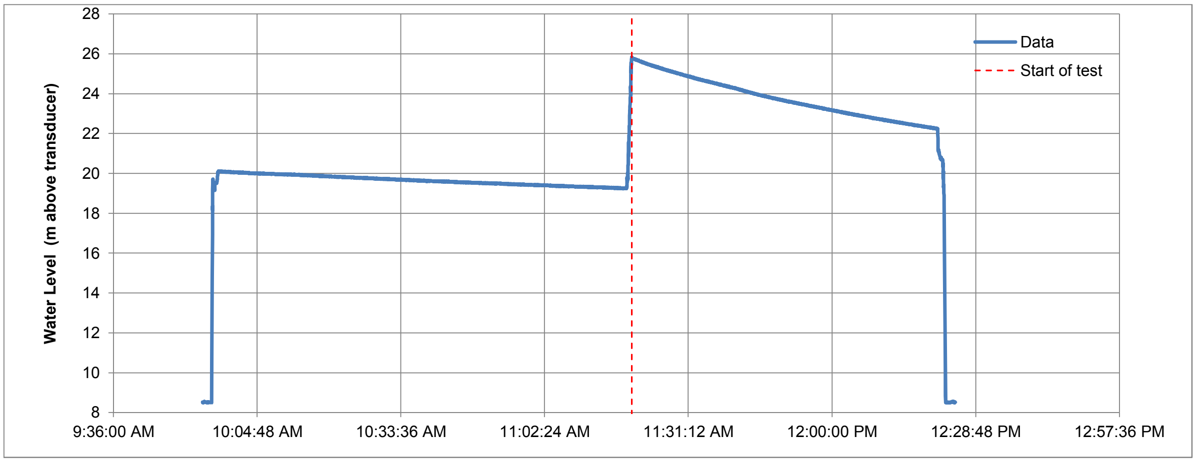
Packer Type HQ Nitrogen
Packer Inflation Time 9:56:00 AM

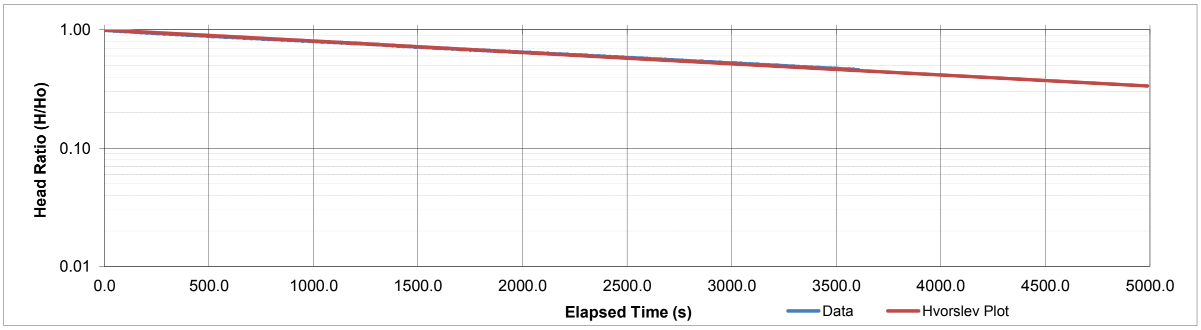
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 15.7 **m along hole**
Bottom of test interval 22.6 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 11:19:53 AM
Initial water level 19.28 **m above transducer**
Water level after slug 25.83 **m above transducer**
Change in Water Level, H_o 6.56 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 8E-07 **m^2/s**
Hydraulic Conductivity, K 1E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-188 Hvorslev_Packer Drillhole.xlsx]SC15-188 Hvorslev Packer #3

A	13MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:17

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole **SC15-188**
Test No. 4

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 13-Mar-15

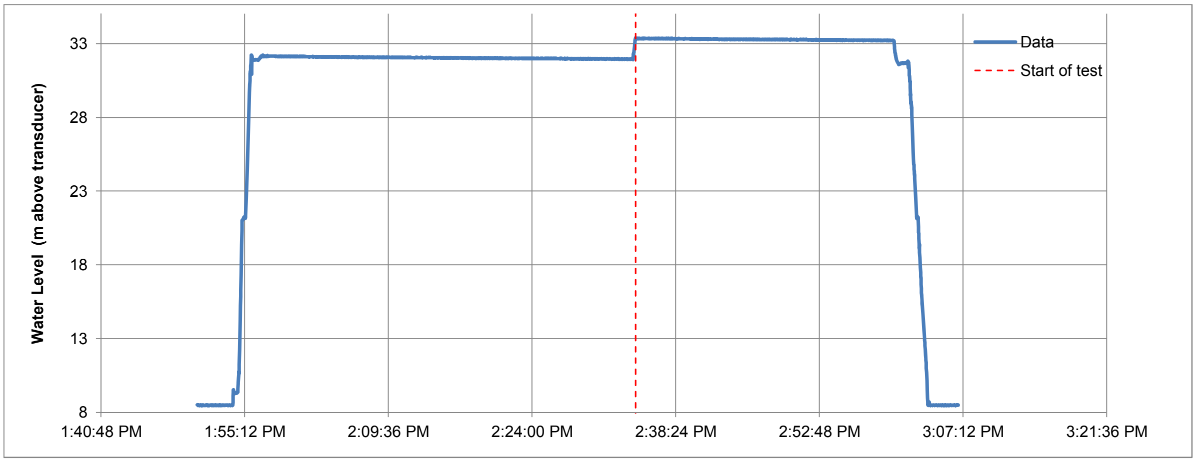
Packer Type HQ Nitrogen
Packer Inflation Time 1:56:00 PM

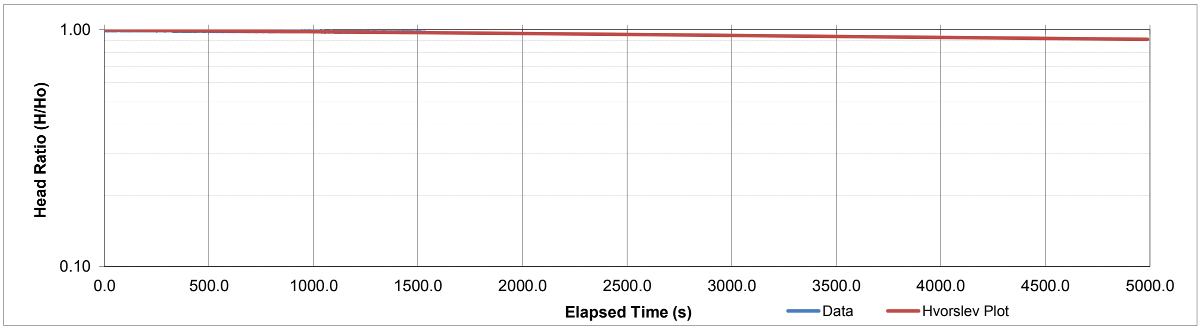
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 23.3 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:34:23 PM
Initial water level 25.83 **m above transducer**
Water level after slug 33.38 **m above transducer**
Change in Water Level, H_o 7.55 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 7E-08 **m^2/s**
Hydraulic Conductivity, K 1E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-188 Hvorslev_Packer Drillhole.xlsx]SC15-188 Hvorslev Packer #4

A	13MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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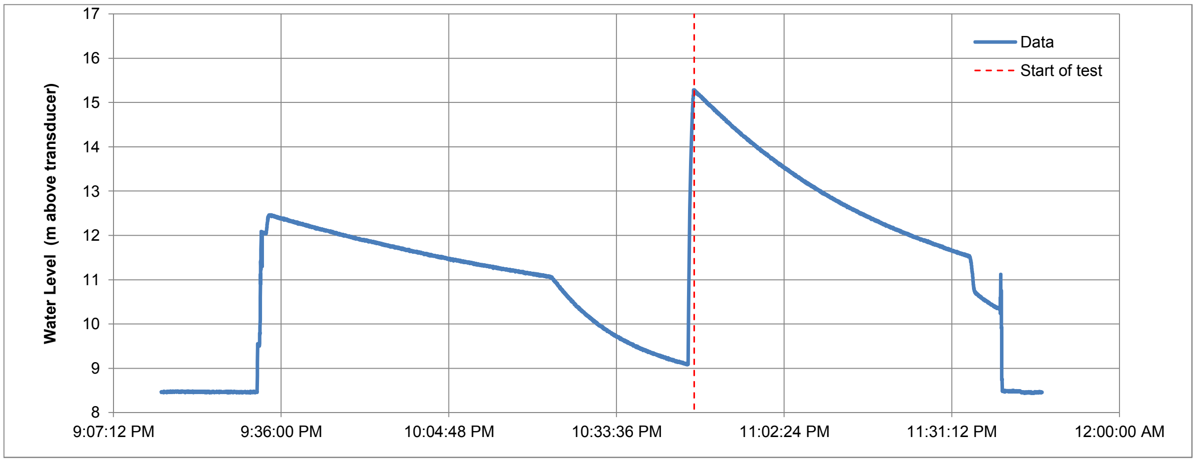
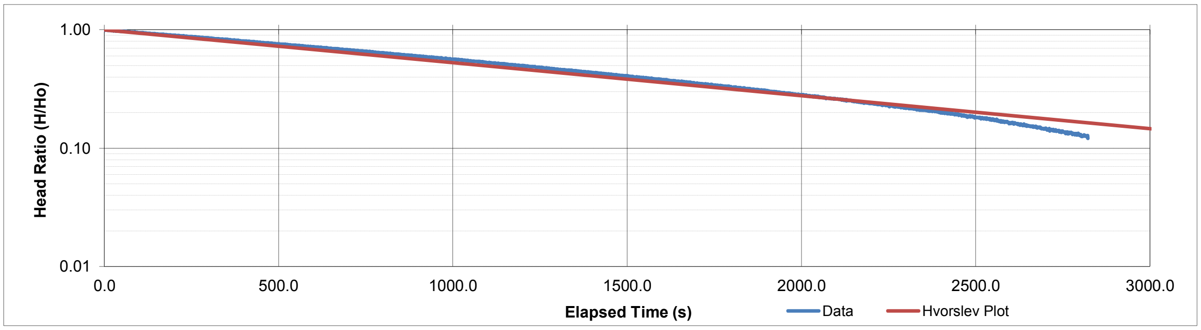
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:31

Project No.	VA101-460/03			**Drillhole**	**SC15-189**	
Field Technician	JBC			**Test No.**	1	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	21	L of water		**Packer Inflation Time**	9:32:00 PM	
Test Date	13-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	10:46:58 PM	
Top of test interval	5.0	**m along hole**		**Initial water level**	11.00	**m above transducer**
Bottom of test interval	11.9	**m along hole**		**Water level after slug**	15.29	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	4.29	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	4	**m**
Transmissivity, T	2E-06	**m^2/s**				
Hydraulic Conductivity, K	4E-07	**m/s**		Intercept	1.0	





TEST COMMENTS:

Saw bubbles from the top of the rods during the falling head test. Suspected leak from the bladder. Observed that the inflation pressure of 100 psi had decreased at the end of the test to approximately 75 psi. This gradual decrease in inflation pressure could explain the two slope patterns observed during the initial water level recovery. Informed drillers to inspect the nitrogen line connection for the next test. The first slope pattern was taken into the analysis of the K value as it has a more comparable slope to the falling head test recovery.

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-189 Hvorslev_Packer Drillhole.xlsx]SC15-189 Hvorslev Packer #1

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:31

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-189
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 43 L of water
Test Date 14-Mar-15

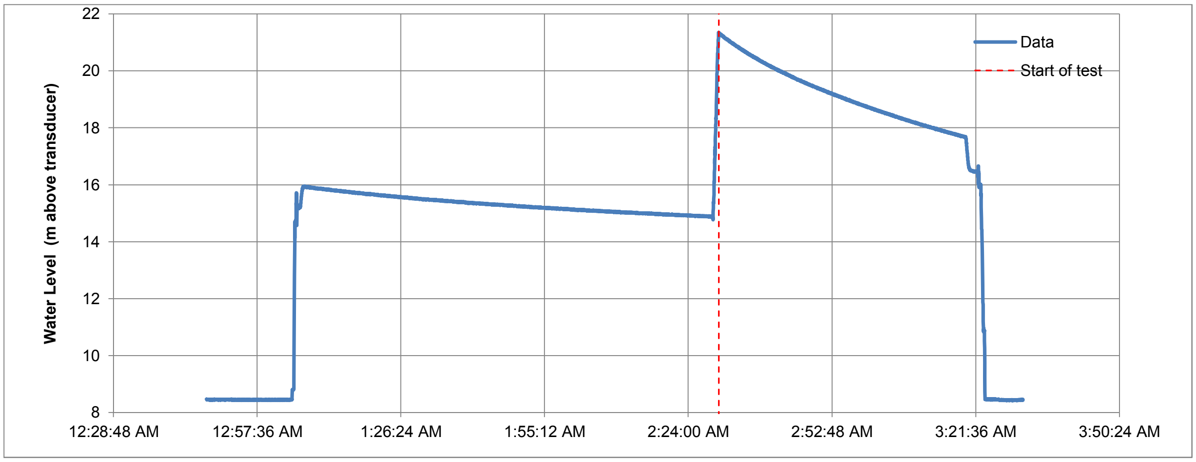
Packer Type HQ Nitrogen
Packer Inflation Time 1:05:00 AM

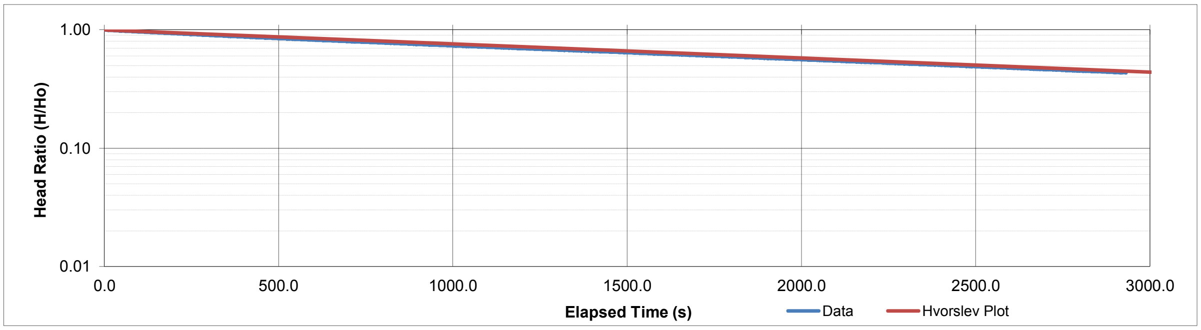
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 11.1 **m along hole**
Bottom of test interval 18.0 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:30:09 AM
Initial water level 14.91 **m above transducer**
Water level after slug 21.35 **m above transducer**
Change in Water Level, H_o 6.44 **m**
Expected Change in Water Level, H_o 9 **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 2E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-189 Hvorslev_Packer Drillhole.xlsx]SC15-189 Hvorslev Packer #2

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:31

Project No. VA101-460/03
Field Technician JBC
Analyst GIM

Drillhole **SC15-189**
Test No. 3

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 14-Mar-15

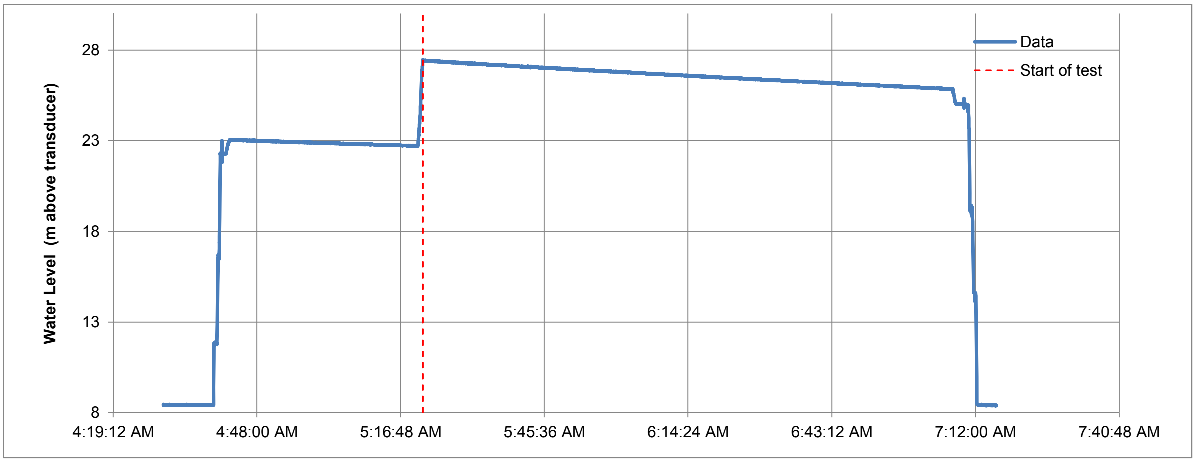
Packer Type HQ Nitrogen
Packer Inflation Time 4:42:00 AM

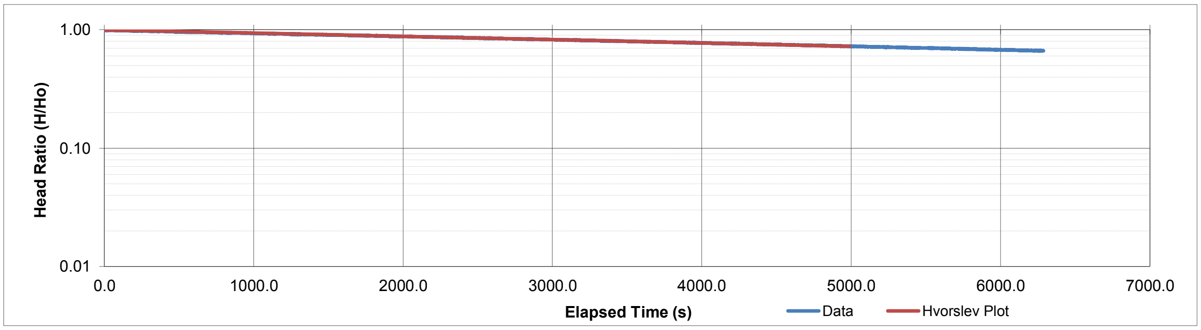
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 17.2 **m along hole**
Bottom of test interval 24.1 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 5:21:14 AM
Initial water level 22.71 **m above transducer**
Water level after slug 27.45 **m above transducer**
Change in Water Level, H_o 4.74 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 2E-07 **m^2/s**
Hydraulic Conductivity, K 4E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-189 Hvorslev_Packer Drillhole.xlsx]SC15-189 Hvorslev Packer #3

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:31

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-189
Test No. 4

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 14-Mar-15

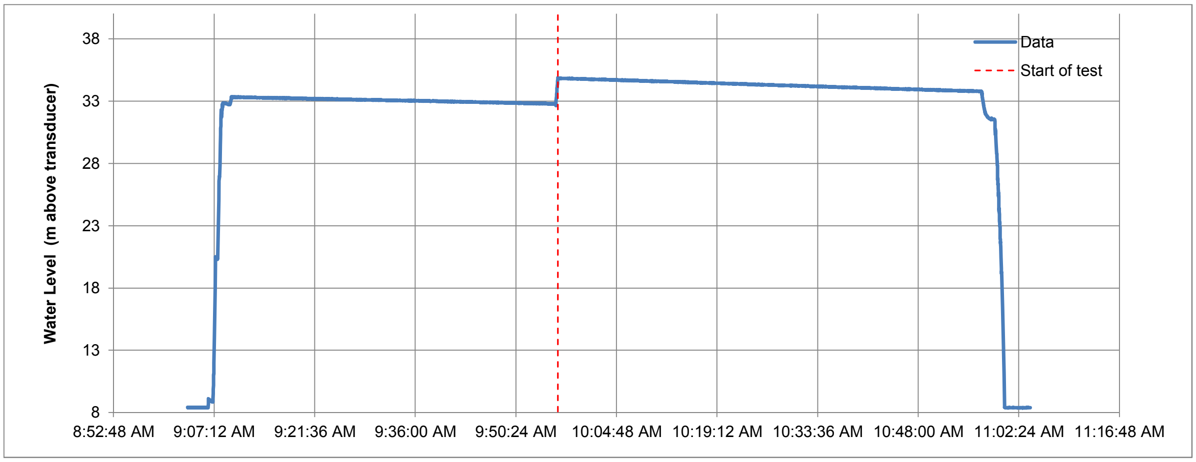
Packer Type HQ Nitrogen
Packer Inflation Time 9:09:00 AM

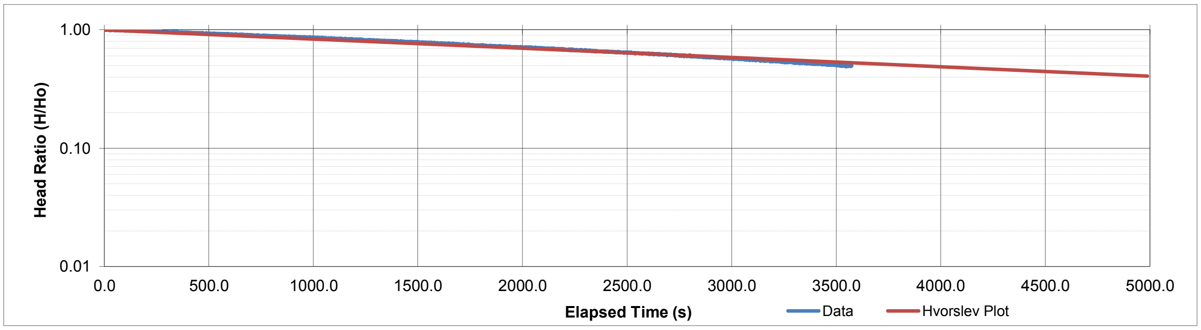
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	24.8	**m along hole**	
Bottom of test interval	30.2	**m along hole**	
Test length, L	5.3	**m along hole**	
Drillhole angle	90	**degrees**	

Slug Injected, Time = 0	9:56:26 AM	
Initial water level	32.79	**m above transducer**
Water level after slug	34.84	**m above transducer**
Change in Water Level, H_o	2.05	**m**
Expected Change in Water Level, H_o	#VALUE!	**m**

Transmissivity, T 6E-07 **m^2/s**
Hydraulic Conductivity, K 1E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

Water level dropping very slowly at a linear rate. Did not wait for static water level and ran test for 60 minutes.

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-189 Hvorslev_Packer Drillhole.xlsx]SC15-189 Hvorslev Packer #4

A	11MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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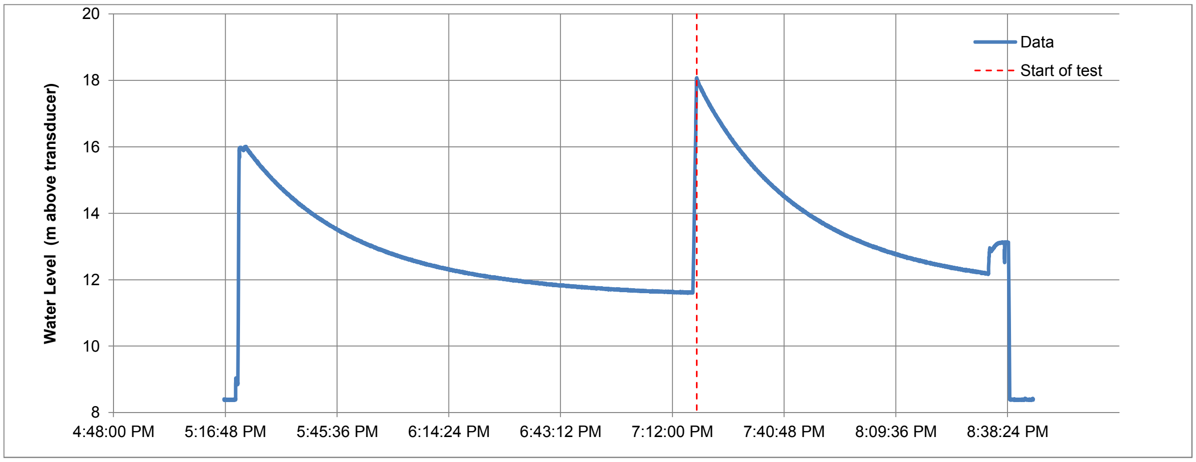
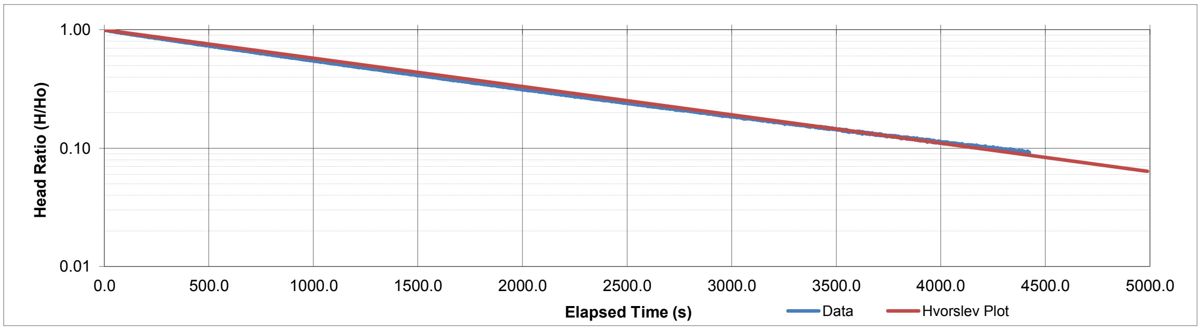
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:34

Project No.	VA101-460/03		**Drillhole**	**SC15-190**	
Field Technician	GM/JBC		**Test No.**	1	
Analyst	JBC				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	36	L of water	**Packer Inflation Time**	5:20:00 PM	
Test Date	14-Mar-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	7:18:16 PM	
Top of test interval	8.1	**m along hole**	**Initial water level**	11.62	**m above transducer**
Bottom of test interval	14.8	**m along hole**	**Water level after slug**	18.08	**m above transducer**
Test length, L	6.8	**m along hole**	**Change in Water Level, H_o**	6.5	**m**
Drillhole angle	90	**degrees**	**Expected Change in Water Level, H_o**	7.6	**m**
Transmissivity, T	2E-06	**m^2/s**			
Hydraulic Conductivity, K	3E-07	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-190 Hvorslev_Packer Drillhole.xlsx]SC15-190 Hvorslev Packer #1

A	14MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:34

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-190
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 45 L of water
Test Date 15-Mar-15

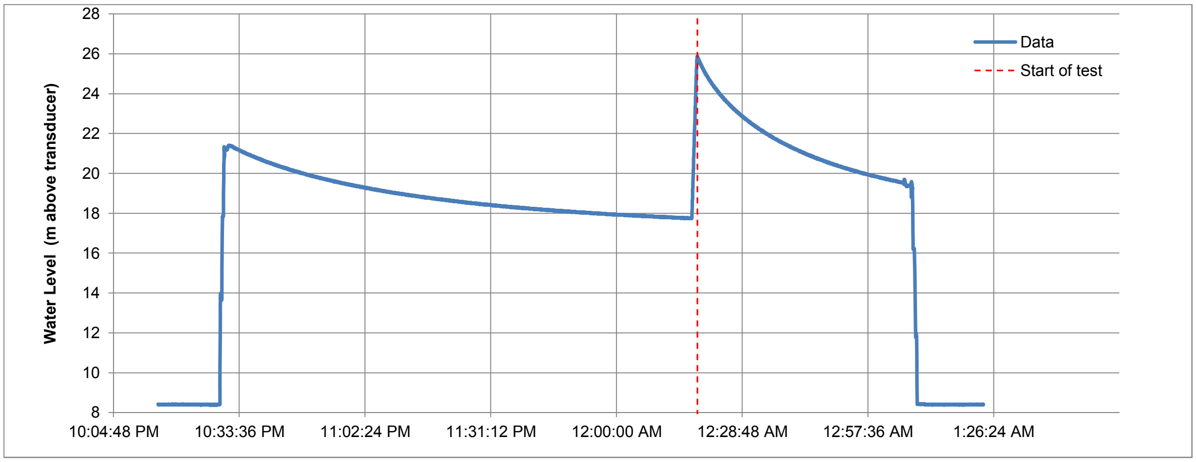
Packer Type HQ Nitrogen
Packer Inflation Time 10:30:00 PM

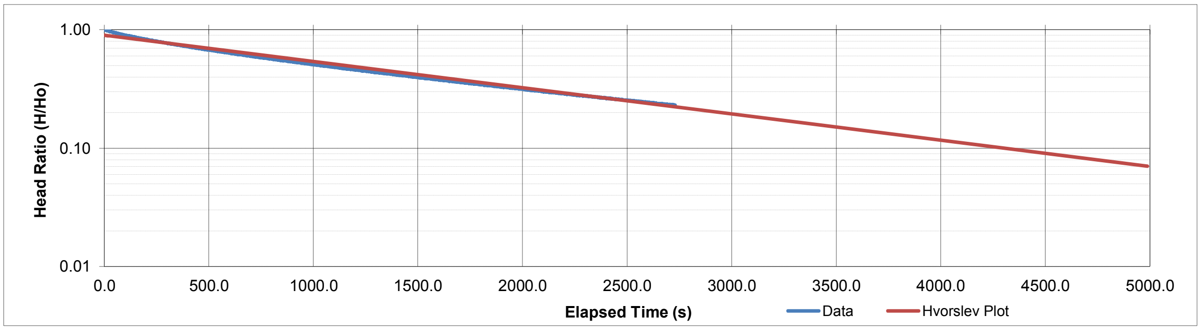
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 15.7 **m along hole**
Bottom of test interval 22.1 **m along hole**
Test length, L 6.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:18:31 AM
Initial water level 17.73 **m above transducer**
Water level after slug 25.89 **m above transducer**
Change in Water Level, H_o 8.2 **m**
Expected Change in Water Level, H_o 9.6 **m**

Transmissivity, T 2E-06 **m^2/s**
Hydraulic Conductivity, K 3E-07 **m/s**

Intercept 0.9





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-190 Hvorslev_Packer Drillhole.xlsx]SC15-190 Hvorslev Packer #2

A	14MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 14:34

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-190**
Test No. 3

Monitoring Instrument Type Transducer
Slug Type 34 L of water
Test Date 15-Mar-15

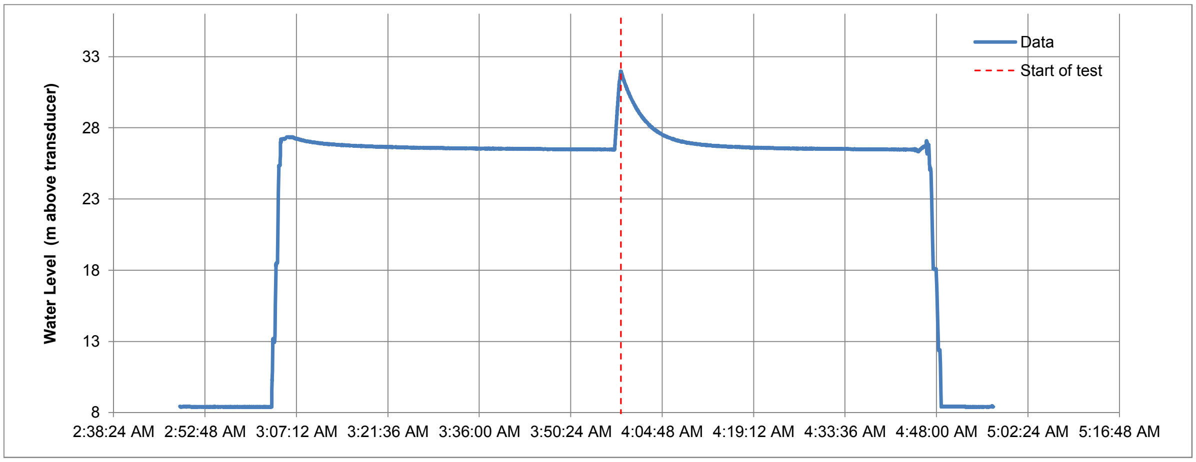
Packer Type HQ Nitrogen
Packer Inflation Time 3:05:00 AM

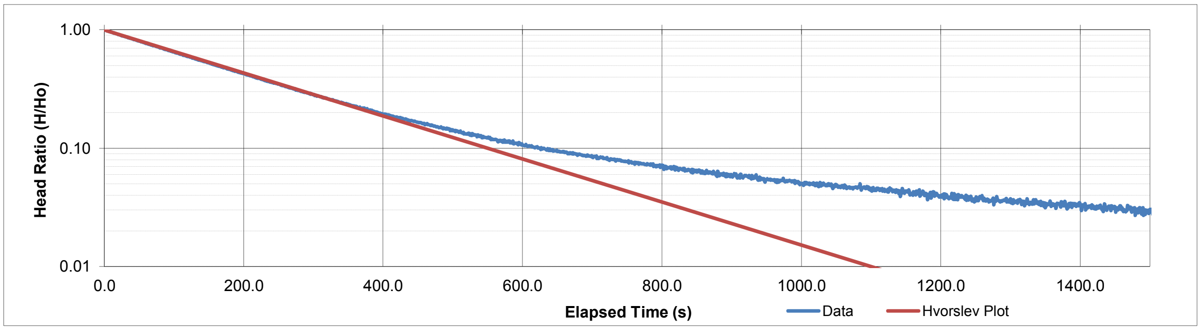
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 21.8 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 8.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 3:58:19 AM
Initial water level 26.40 **m above transducer**
Water level after slug 31.97 **m above transducer**
Change in Water Level, H_o 5.6 **m**
Expected Change in Water Level, H_o 7.2 **m**

Transmissivity, T 2E-05 **m^2/s**
Hydraulic Conductivity, K 2E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-190 Hvorslev_Packer Drillhole.xlsx]SC15-190 Hvorslev Packer #3

A	14MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:02

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole **SC15-191**
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 102 L of water over 2 minutes
Test Date 15-Mar-15

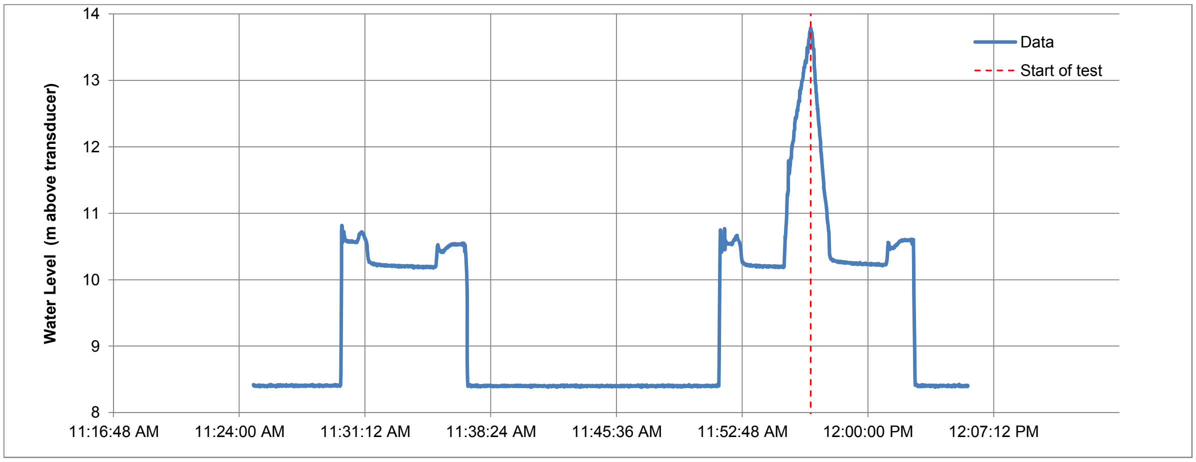
Packer Type HQ Nitrogen
Packer Inflation Time 11:30:00 AM

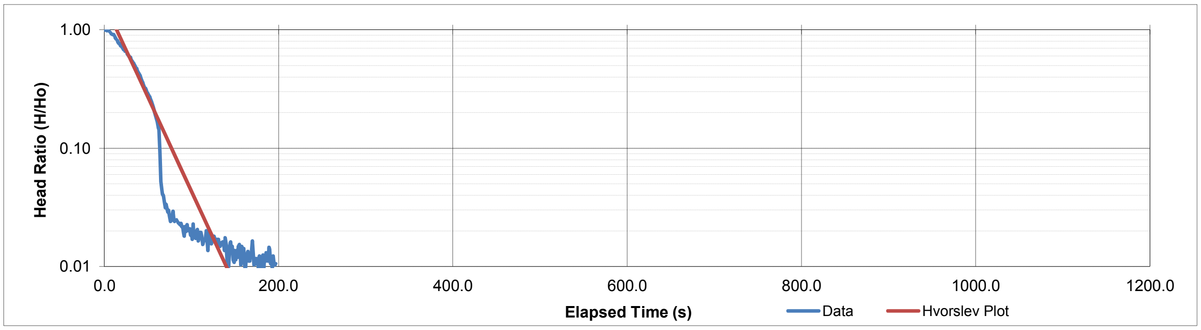
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 8.1 **m along hole**
Bottom of test interval 14.9 **m along hole**
Test length, L 6.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 11:56:43 AM
Initial water level 10.20 **m above transducer**
Water level after slug 13.78 **m above transducer**
Change in Water Level, H_o 3.59 **m**
Expected Change in Water Level, H_o 21 **m**

Transmissivity, T 1E-04 **m^2/s**
Hydraulic Conductivity, K 2E-05 **m/s**

Intercept 1.7





TEST COMMENTS:

Put packer down hole, but could not measure static water level because it was below the packer. Pulled packer to measure open hole WL, and measured it at 8.62 mbsu (~24 ft), which was still above the packer level, meaning the zone was saturated. Proceeded to put packer back down and run falling head test.
Pumped water down hole at 19 gal /minute but couldn't fill rods. Drillers lost return from 35-39 ft.

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-191 Hvorslev_Packer Drillhole.xlsx]SC15-191 Hvorslev Packer #1

A	15MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:02

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-191
Test No. 2

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 15-Mar-15

Packer Type HQ Nitrogen
Packer Inflation Time 2:03:00 PM

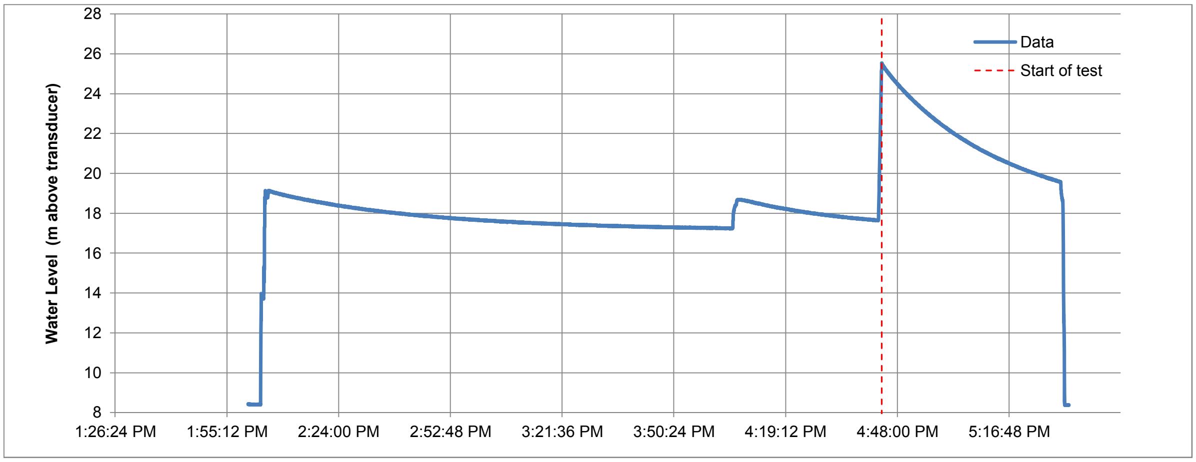
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	15.7	**m along hole**	
Bottom of test interval	22.6	**m along hole**	
Test length, L	6.9	**m along hole**	
Drillhole angle	90	**degrees**	

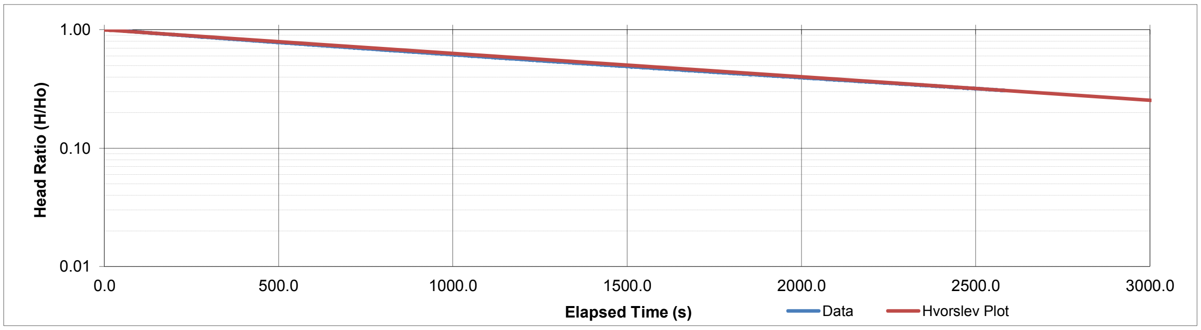
Slug Injected, Time = 0	4:43:57 PM	
Initial water level	17.24	**m above transducer**
Water level after slug	25.40	**m above transducer**
Change in Water Level, H_o	8.16	**m**
Expected Change in Water Level, H_o	#VALUE!	**m**

Transmissivity, T 2E-06 **m^2/s**

Hydraulic Conductivity, K 3E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-191 Hvorslev_Packer Drillhole.xlsx]SC15-191 Hvorslev Packer #2

A	15MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:02

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-191**
Test No. 3

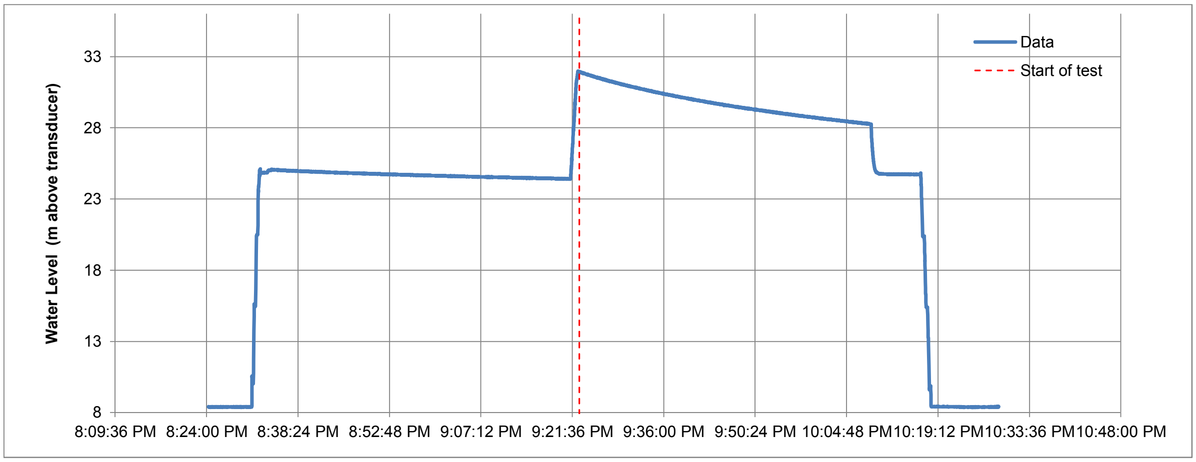
Monitoring Instrument Type Transducer
Slug Type 42 L of water
Test Date 15-Mar-15

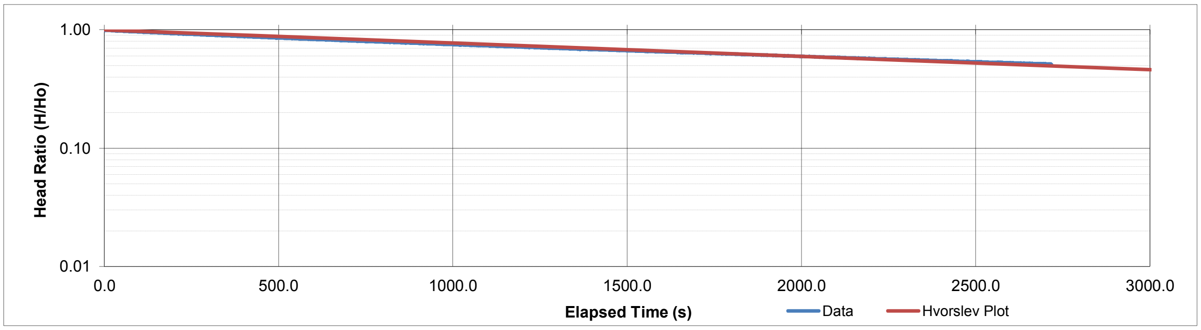
Packer Type HQ Nitrogen
Packer Inflation Time 8:33:00 PM

Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 21.8 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 8.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 9:22:43 PM
Initial water level 24.40 **m above transducer**
Water level after slug 31.99 **m above transducer**
Change in Water Level, H_o 7.59 **m**
Expected Change in Water Level, H_o 9 **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 1E-07 **m/s**
Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-191 Hvorslev_Packer Drillhole.xlsx]SC15-191 Hvorslev Packer #3

A	15MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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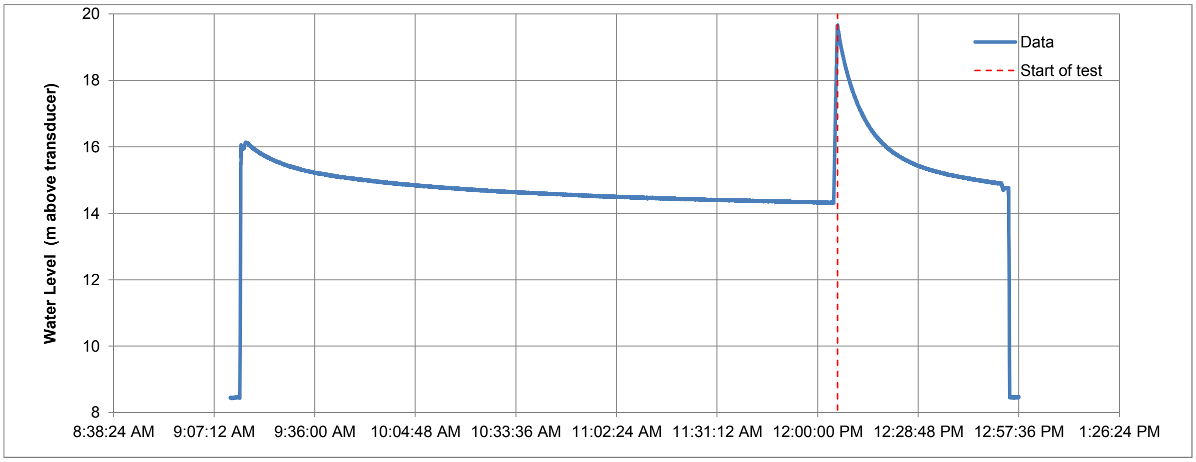
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

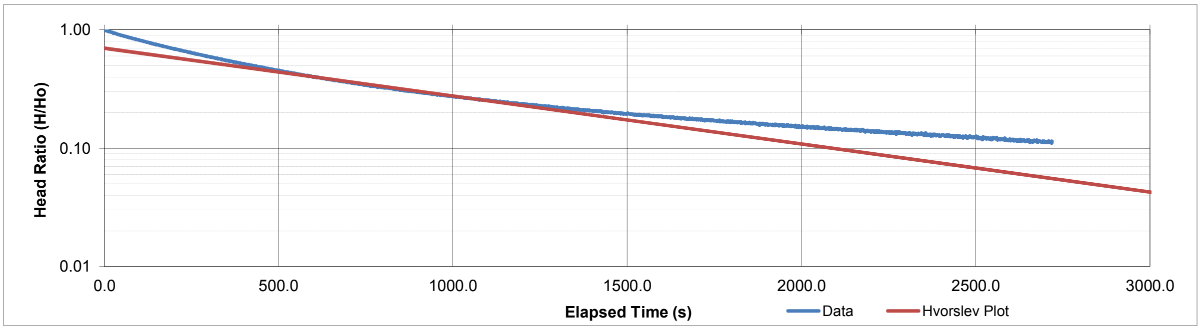
Print 02/26/16 15:04

Project No.	VA101-460/03		**Drillhole**	**SC15-192**	
Field Technician	GM		**Test No.**	1	
Analyst	GM				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	30	L of water	**Packer Inflation Time**	9:12:00 AM	
Test Date	16-Mar-15				

Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	12:05:41 PM	
Top of test interval	9.6	**m along hole**		**Initial water level**	14.31	**m above transducer**
Bottom of test interval	19.8	**m along hole**		**Water level after slug**	19.67	**m above transducer**
Test length, L	10.2	**m along hole**		**Change in Water Level, H_o**	5.36	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	6	**m**

Transmissivity, T	4E-06	**m^2/s**		
Hydraulic Conductivity, K	4E-07	**m/s**	Intercept	0.7





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-192 Hvorslev_Packer Drillhole.xlsx]SC15-192 Hvorslev Packer #1

A	16MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:04

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole SC15-192
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 32 L of water
Test Date 16-Mar-15

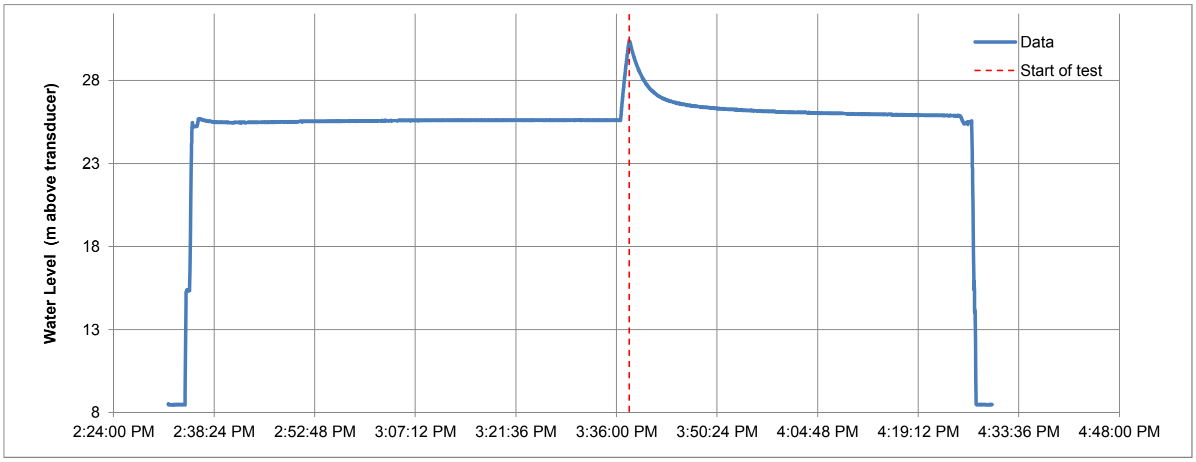
Packer Type HQ Nitrogen
Packer Inflation Time 2:30:00 PM

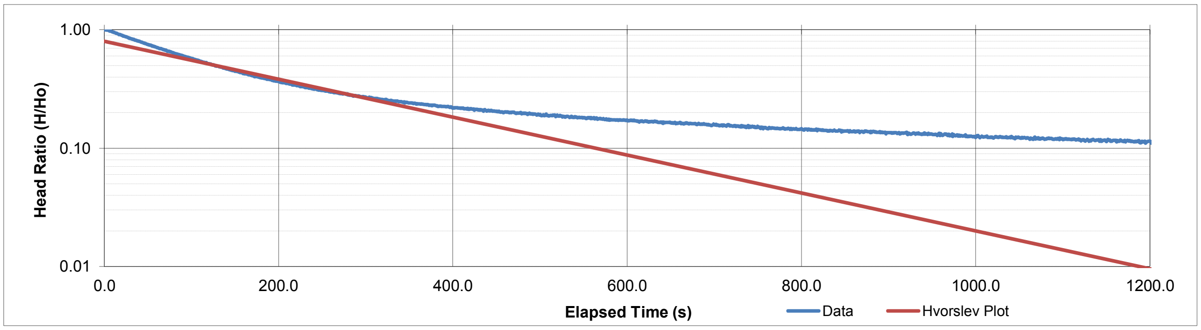
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 20.6 **m along hole**
Bottom of test interval 30.5 **m along hole**
Test length, L 9.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 3:37:50 PM
Initial water level 25.59 **m above transducer**
Water level after slug 30.39 **m above transducer**
Change in Water Level, H_o 4.79 **m**
Expected Change in Water Level, H_o 7 **m**

Transmissivity, T 1E-05 **m^2/s**
Hydraulic Conductivity, K 2E-06 **m/s**

Intercept 0.8





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-192 Hvorslev_Packer Drillhole.xlsx]SC15-192 Hvorslev Packer #2

A	16MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:06

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole **SC15-193**
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 15 L of water
Test Date 17-Mar-15

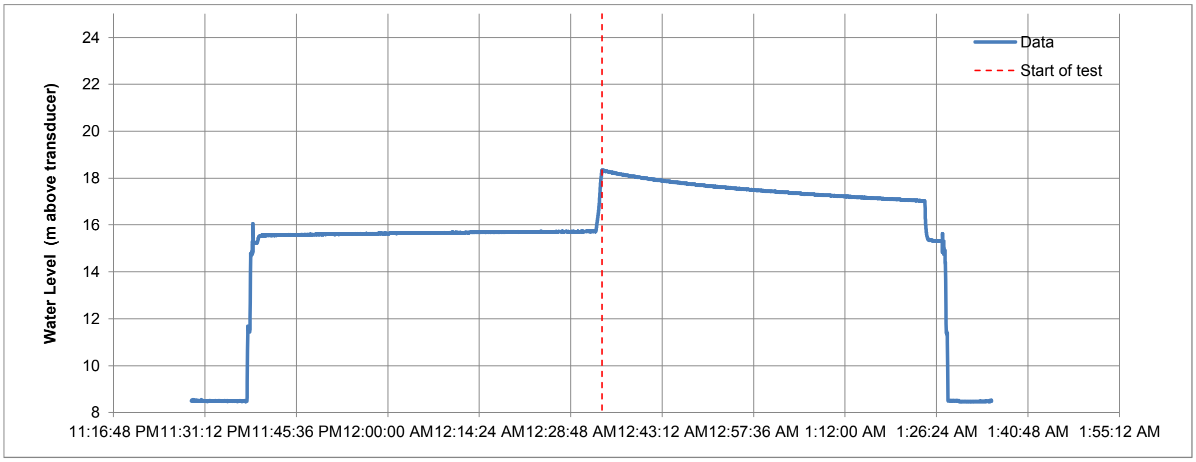
Packer Type HQ Nitrogen
Packer Inflation Time 11:39:00 PM

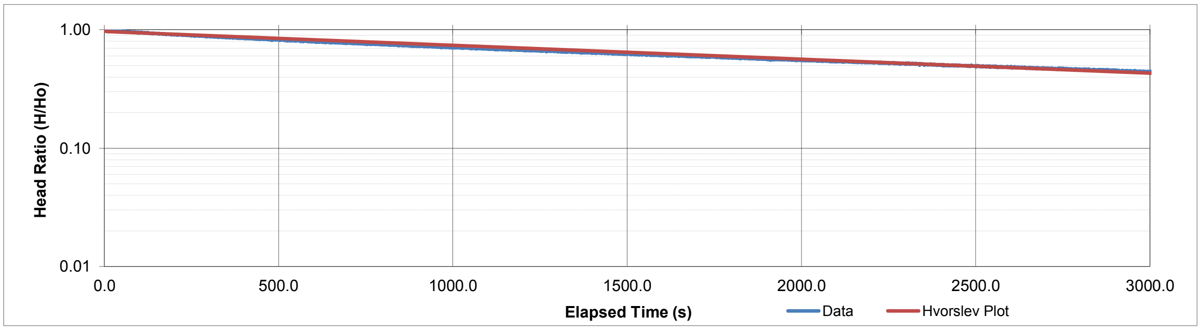
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 8.1 **m along hole**
Bottom of test interval 18.0 **m along hole**
Test length, L 9.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:33:45 AM
Initial water level 16.00 **m above transducer**
Water level after slug 18.35 **m above transducer**
Change in Water Level, H_o 2.35 **m**
Expected Change in Water Level, H_o 3 **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 1E-07 **m/s**

Intercept 1.0





TEST COMMENTS:

A	17MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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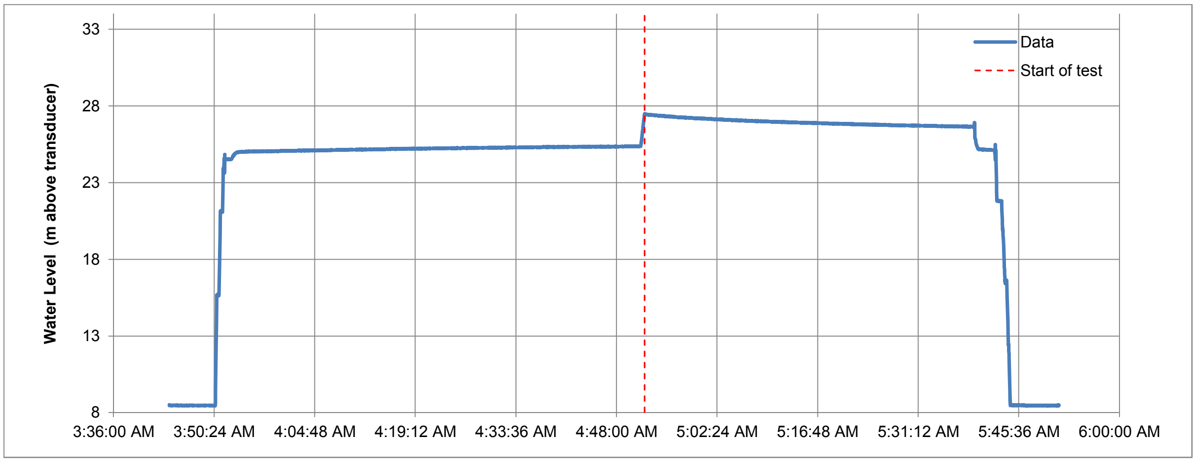
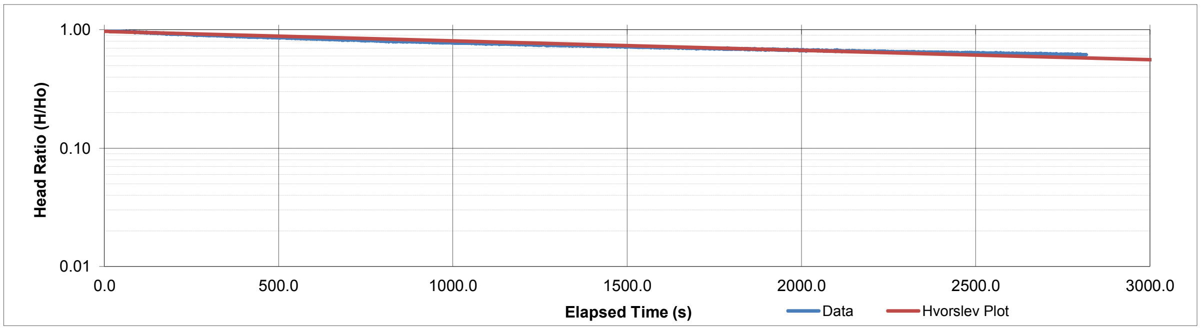
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:06

Project No.	VA101-460/03			**Drillhole**	**SC15-193**	
Field Technician	JBC			**Test No.**	2	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	15	L of water		**Packer Inflation Time**	3:53:00 AM	
Test Date	17-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	4:52:03 AM	
Top of test interval	17.2	**m along hole**		**Initial water level**	25.30	**m above transducer**
Bottom of test interval	30.2	**m along hole**		**Water level after slug**	27.48	**m above transducer**
Test length, L	13.0	**m along hole**		**Change in Water Level, H_o**	2.18	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	3	**m**
Transmissivity, T	8E-07	**m^2/s**				
Hydraulic Conductivity, K	6E-08	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-193 Hvorslev_Packer Drillhole.xlsx]SC15-193 Hvorslev Packer #2

A	17MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:08

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-194
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 102 L of water
Test Date 17-Mar-15

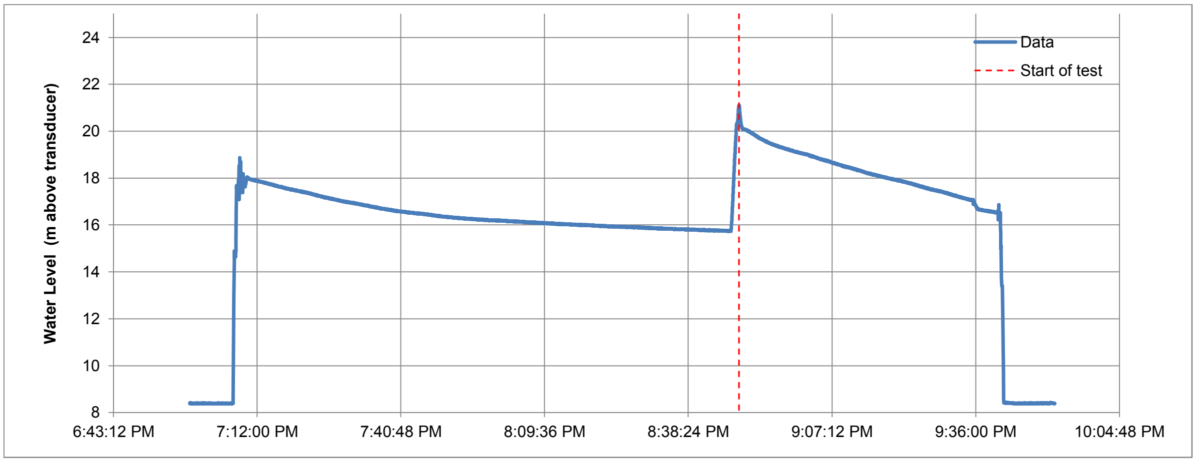
Packer Type PQ Nitrogen
Packer Inflation Time 7:07:00 PM

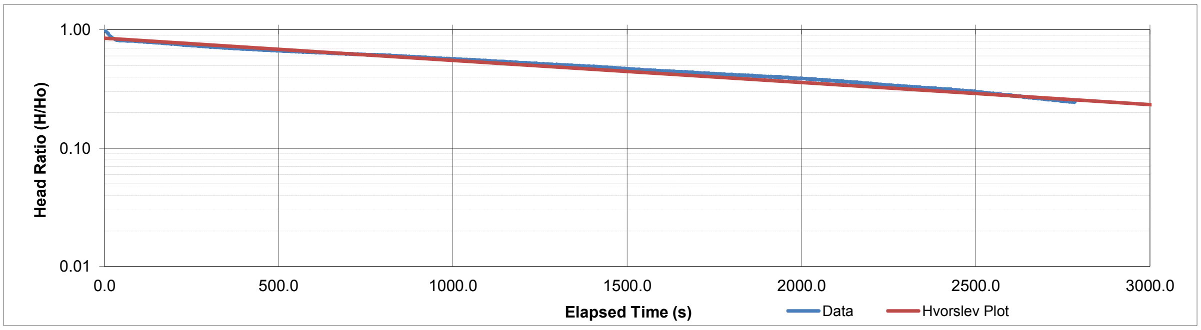
Drillhole diameter, D PQ3 0.123 m
Drill rod diameter, d PQ3 0.103 m
Top of test interval 12.6 **m along hole**
Bottom of test interval 17.7 **m along hole**
Test length, L 5.1 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 8:48:35 PM
Initial water level 15.76 **m above transducer**
Water level after slug 21.10 **m above transducer**
Change in Water Level, H_o 5.34 **m**
Expected Change in Water Level, H_o 12 **m**

Transmissivity, T 3E-06 **m^2/s**
Hydraulic Conductivity, K 5E-07 **m/s**

Intercept 0.9





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-194 Hvorslev_Packer Drillhole.xlsx]SC15-194 Hvorslev Packer #1

A	17MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:08

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-194
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 42 L of water
Test Date 18-Mar-15

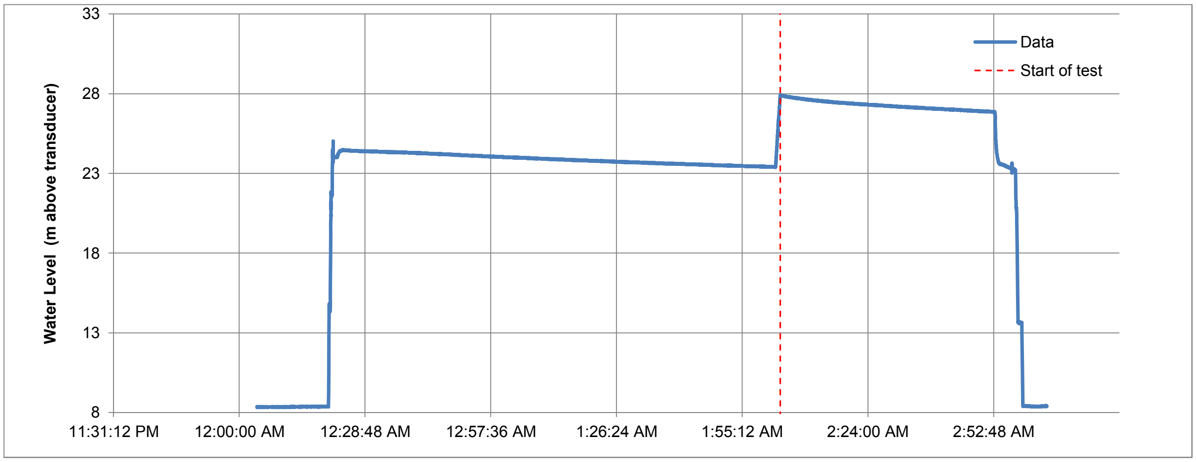
Packer Type PQ Nitrogen
Packer Inflation Time 12:23:00 AM

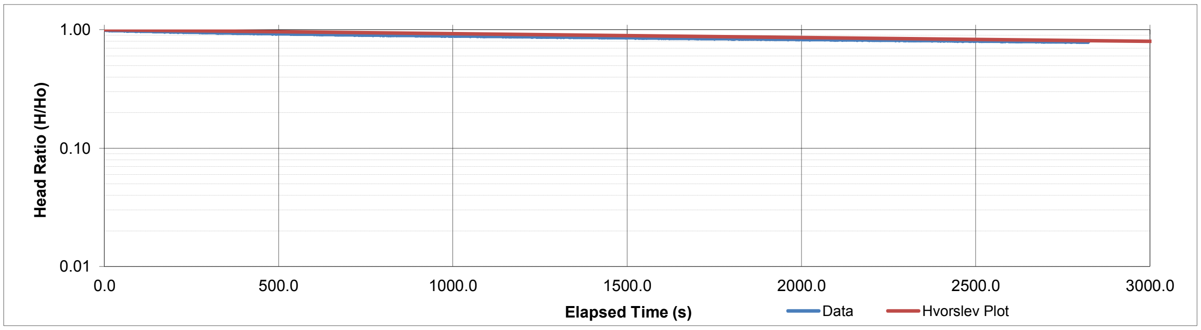
Drillhole diameter, D PQ3 0.123 m
Drill rod diameter, d PQ3 0.103 m
Top of test interval 17.2 **m along hole**
Bottom of test interval 23.8 **m along hole**
Test length, L 6.6 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:03:57 AM
Initial water level 23.00 **m above transducer**
Water level after slug 27.93 **m above transducer**
Change in Water Level, H_o 4.93 **m**
Expected Change in Water Level, H_o 5 **m**

Transmissivity, T 5E-07 **m^2/s**
Hydraulic Conductivity, K 7E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-194 Hvorslev_Packer Drillhole.xlsx]SC15-194 Hvorslev Packer #2

A	17MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:08

Project No. VA101-460/03
Field Technician JBC/GM
Analyst GM

Drillhole SC15-194
Test No. 3

Monitoring Instrument Type Transducer
Slug Type 87 L of water
Test Date 18-Mar-15

Packer Type PQ Nitrogen
Packer Inflation Time

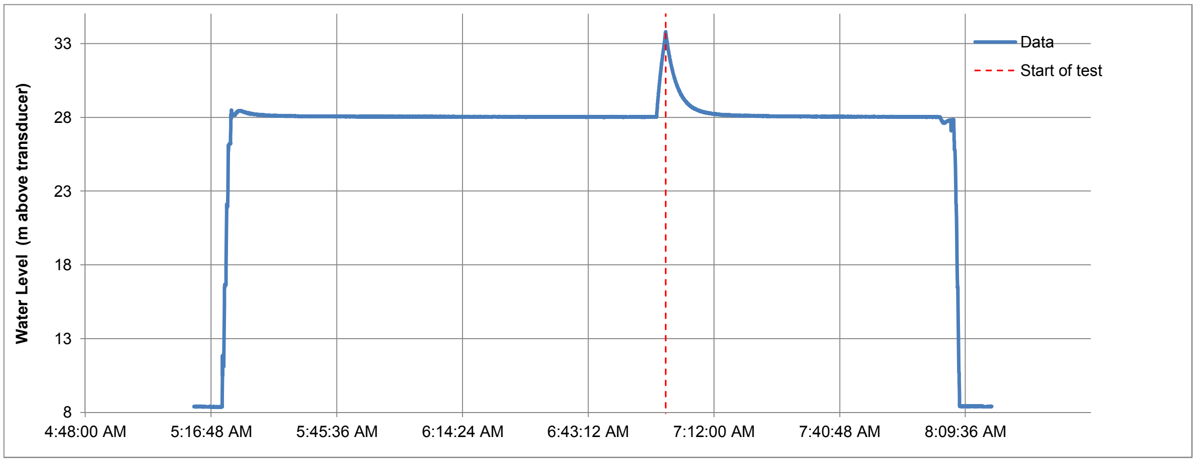
Drillhole diameter, D	PQ3	0.123	m
Drill rod diameter, d	PQ3	0.103	m
Top of test interval	23.3	**m along hole**	
Bottom of test interval	30.1	**m along hole**	
Test length, L	6.8	**m along hole**	
Drillhole angle	90	**degrees**	

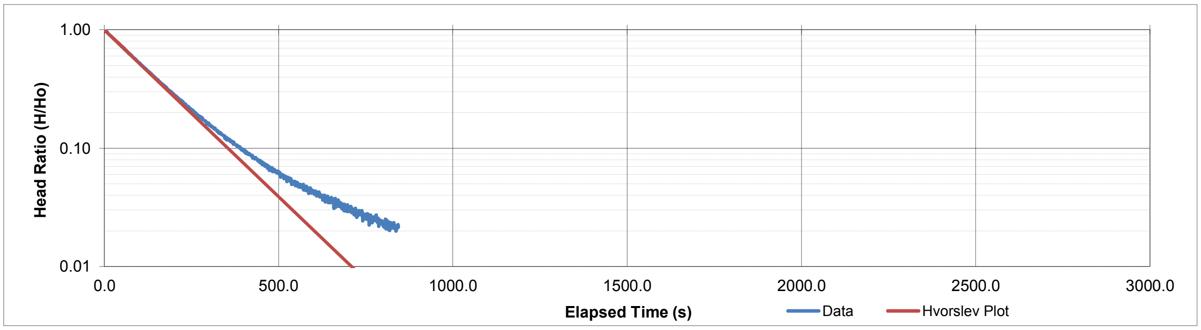
Slug Injected, Time = 0	7:00:56 AM	
Initial water level	28.03	**m above transducer**
Water level after slug	33.74	**m above transducer**
Change in Water Level, H_o	5.71	**m**
Expected Change in Water Level, H_o	10	**m**

Transmissivity, T 4E-05 **m^2/s**

Hydraulic Conductivity, K 6E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-194 Hvorslev_Packer Drillhole.xlsx]SC15-194 Hvorslev Packer #3

A	17MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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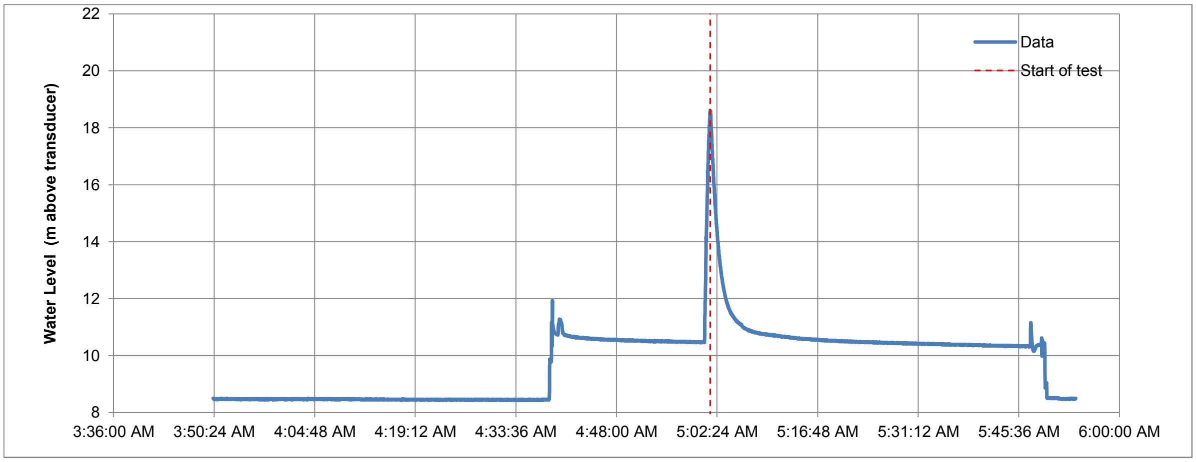
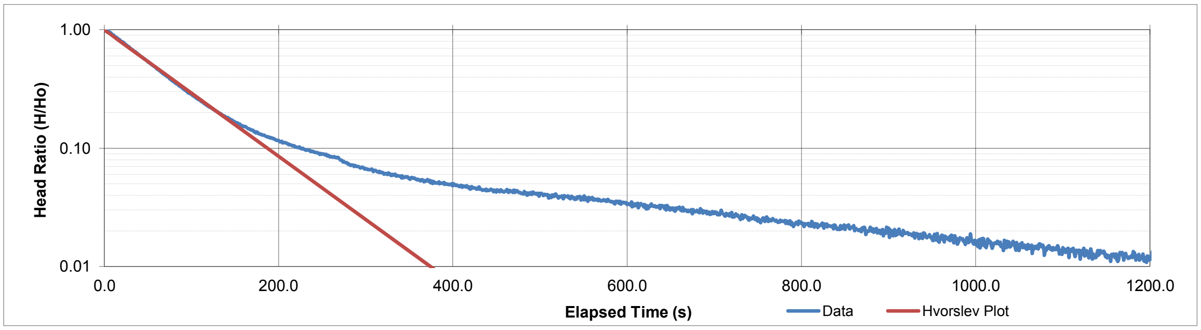
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:09

Project No.	VA101-460/03		**Drillhole**	**SC15-195**	
Field Technician	JBC		**Test No.**	1	
Analyst	JBC				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	60.56018168	L of water	**Packer Inflation Time**	4:40:00 AM	
Test Date	19-Mar-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	5:01:26 AM	
Top of test interval	9.6	**m along hole**	**Initial water level**	10.40	**m above transducer**
Bottom of test interval	19.5	**m along hole**	**Water level after slug**	18.61	**m above transducer**
Test length, L	9.9	**m along hole**	**Change in Water Level, H_o**	8.21	**m**
Drillhole angle	90	**degrees**	**Expected Change in Water Level, H_o**	13	**m**
Transmissivity, T	5E-05	**m^2/s**			
Hydraulic Conductivity, K	5E-06	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-195 Hvorslev_Packer Drillhole.xlsx]SC15-195 Hvorslev Packer #1

A	19MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:09

Project No. VA101-460/03
Field Technician GM
Analyst GM/JBC

Drillhole SC15-195
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 19 L of water
Test Date 19-Mar-15

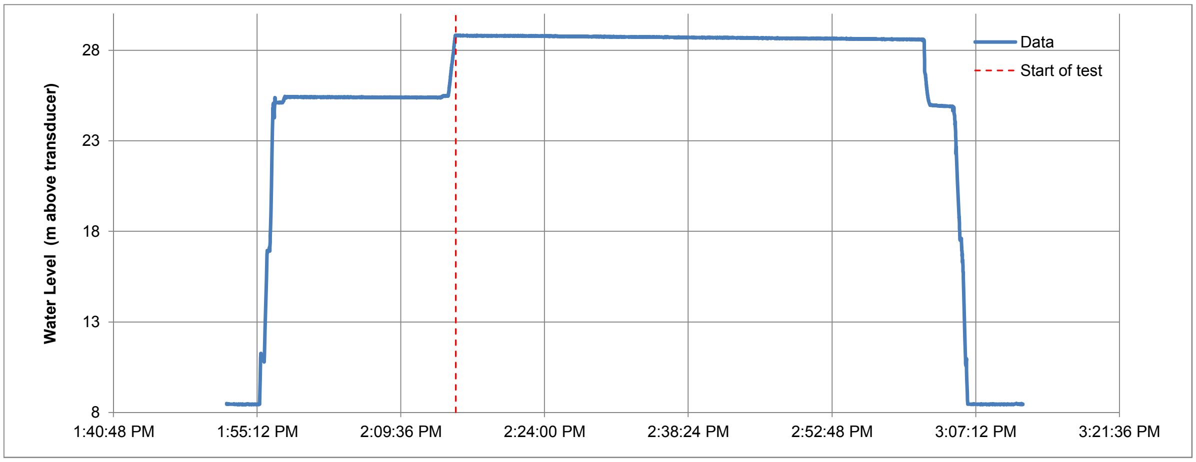
Packer Type HQ Nitrogen
Packer Inflation Time 1:57:00 PM

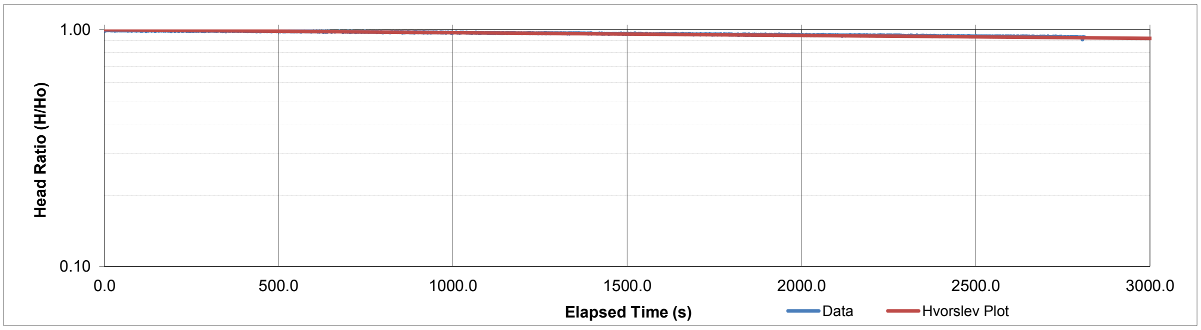
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 18.7 **m along hole**
Bottom of test interval 30.1 **m along hole**
Test length, L 11.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:15:07 PM
Initial water level 25.37 **m above transducer**
Water level after slug 28.83 **m above transducer**
Change in Water Level, H_o 3.46 **m**
Expected Change in Water Level, H_o 4 **m**

Transmissivity, T 1E-07 **m^2/s**
Hydraulic Conductivity, K 1E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-195 Hvorslev_Packer Drillhole.xlsx]SC15-195 Hvorslev Packer #2

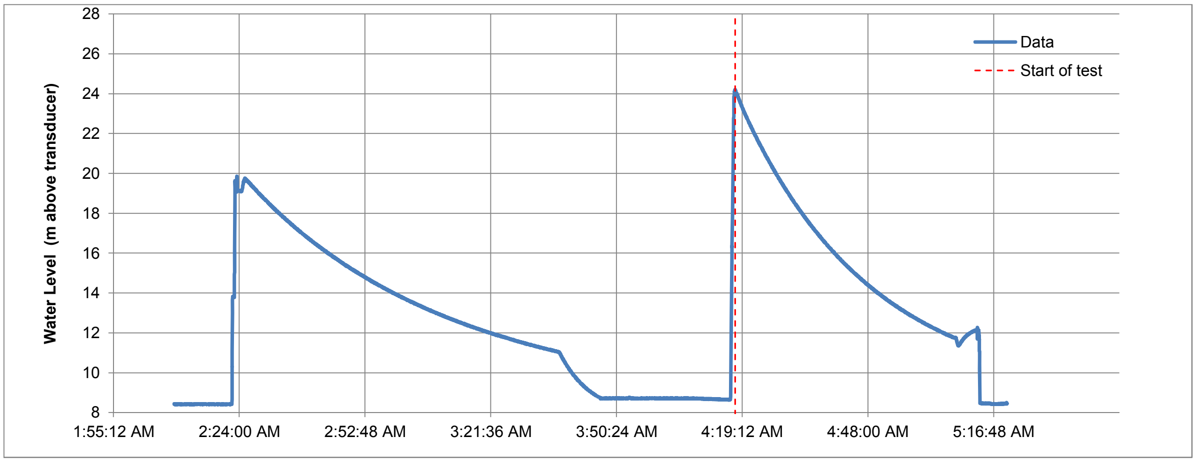
A	19MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

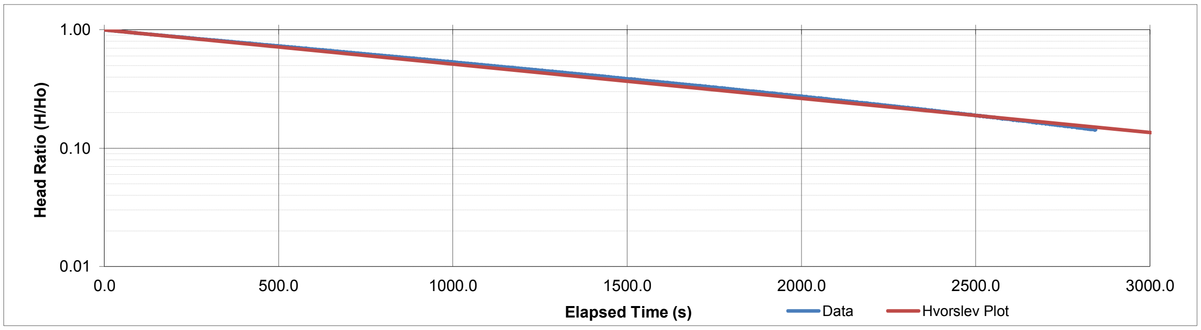
TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:11

Project No.	VA101-460/03			**Drillhole**	**SC15-196**	
Field Technician	JBC			**Test No.**	1	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	64	L of water		**Packer Inflation Time**	2:25:00 AM	
Test Date	20-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	4:17:36 AM	
Top of test interval	13.6	**m along hole**		**Initial water level**	10.00	**m above transducer**
Bottom of test interval	22.9	**m along hole**		**Water level after slug**	24.20	**m above transducer**
Test length, L	9.3	**m along hole**		**Change in Water Level, H_o**	14.20	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	14	**m**
Transmissivity, T	3E-06	**m^2/s**				
Hydraulic Conductivity, K	3E-07	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-196 Hvorslev_Packer Drillhole.xlsx]SC15-196 Hvorslev Packer #1

A	19MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:11

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole **SC15-196**
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 45 L of water
Test Date 20-Mar-15

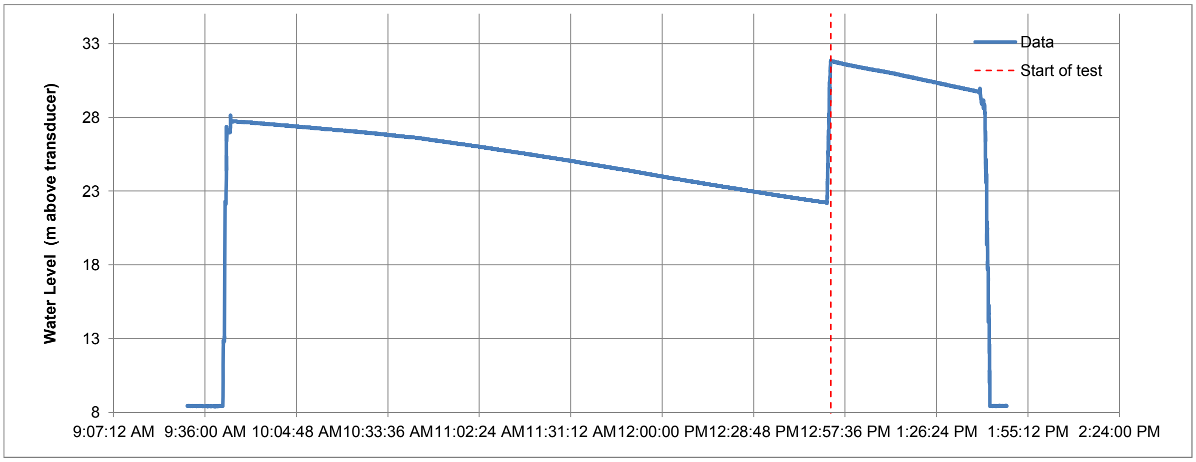
Packer Type HQ Nitrogen
Packer Inflation Time

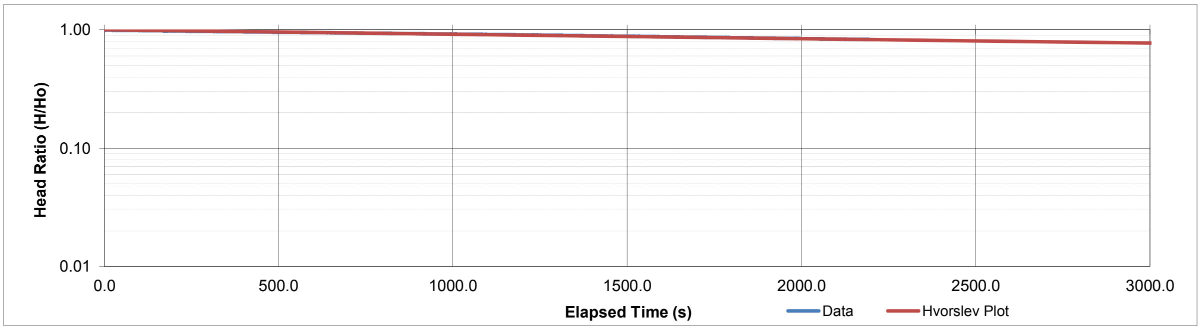
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 22.1 **m along hole**
Bottom of test interval 30.5 **m along hole**
Test length, L 8.4 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:53:06 PM
Initial water level 22.17 **m above transducer**
Water level after slug 31.86 **m above transducer**
Change in Water Level, H_o 9.69 **m**
Expected Change in Water Level, H_o 10 **m**

Transmissivity, T 3E-07 **m^2/s**
Hydraulic Conductivity, K 4E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-196 Hvorslev_Packer Drillhole.xlsx]SC15-196 Hvorslev Packer #2

A	19MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:14

Project No. VA101-460/03
Field Technician JBC
Analyst JBC

Drillhole SC15-197
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 13 L of water
Test Date 21-Mar-15

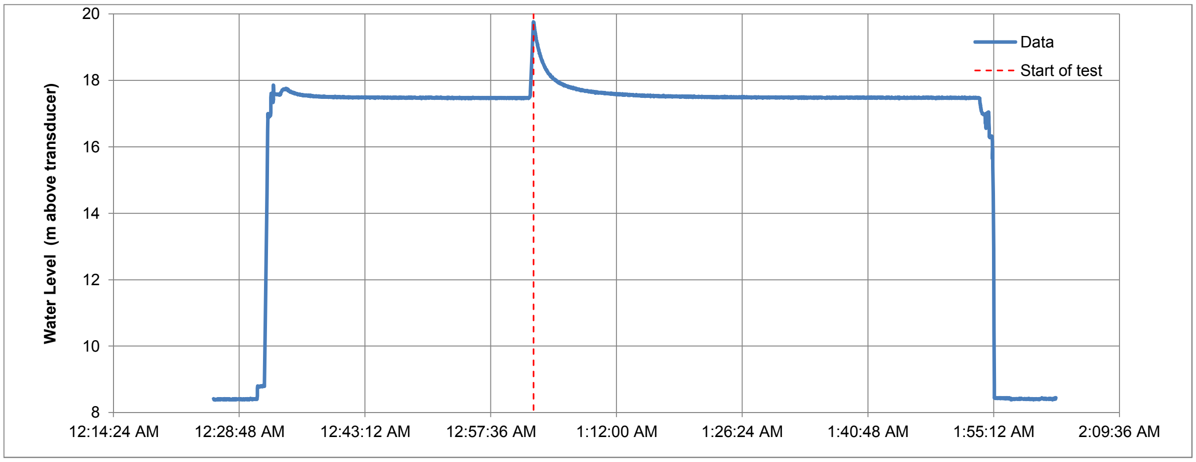
Packer Type HQ Nitrogen
Packer Inflation Time 12:33:00 AM

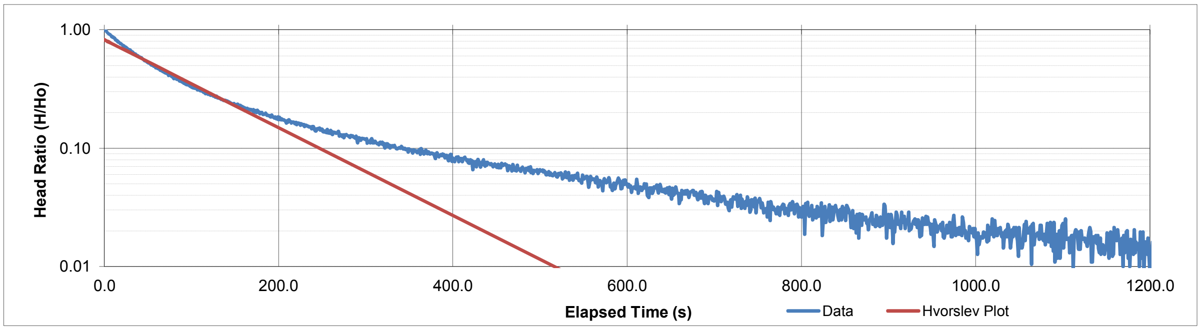
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	9.6	**m along hole**	
Bottom of test interval	19.4	**m along hole**	
Test length, L	9.8	**m along hole**	
Drillhole angle	90	**degrees**	

Slug Injected, Time = 0	1:02:31 AM	
Initial water level	17.47	**m above transducer**
Water level after slug	19.76	**m above transducer**
Change in Water Level, H_o	2.29	**m**
Expected Change in Water Level, H_o	3	**m**

Transmissivity, T 3E-05 **m^2/s**
Hydraulic Conductivity, K 4E-06 **m/s**

Intercept 0.8





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-197 Hvorslev_Packer Drillhole.xlsx]SC15-197 Hvorslev Packer #1

A	21MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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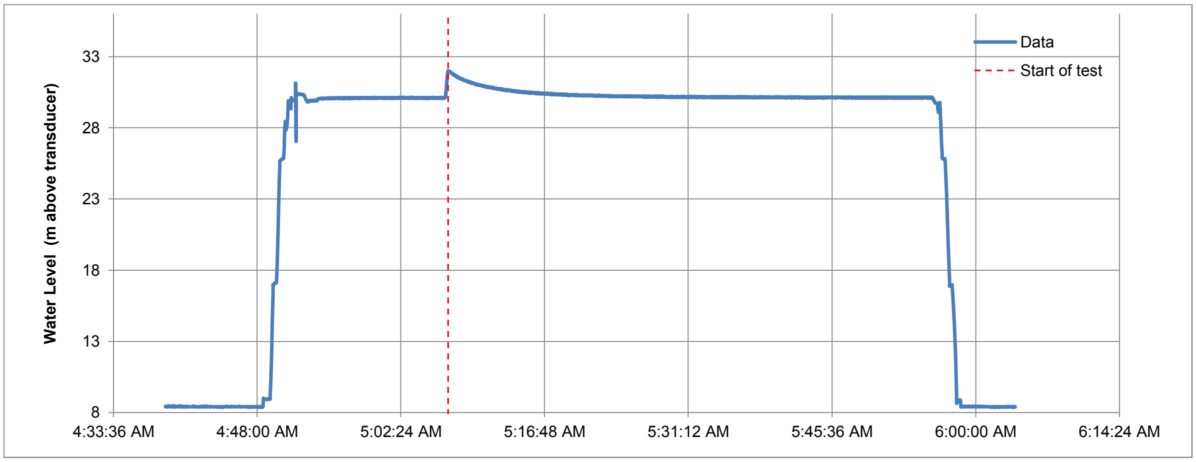
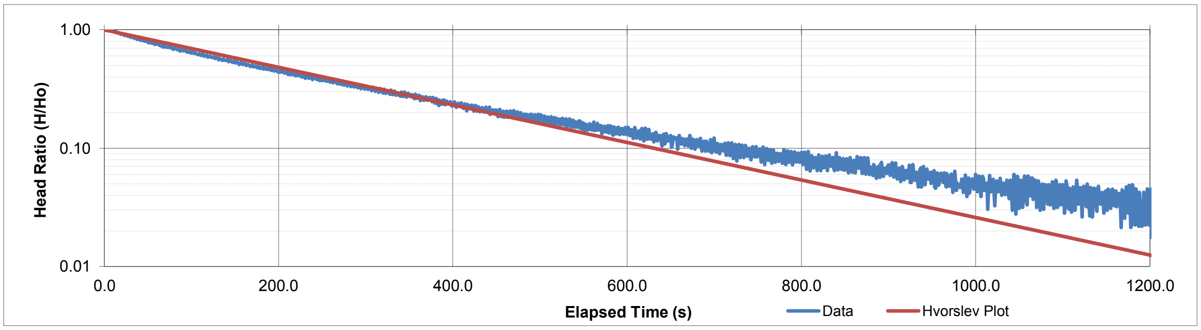
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:14

Project No.	VA101-460/03			**Drillhole**	**SC15-197**	
Field Technician	JBC			**Test No.**	2	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	13	L of water		**Packer Inflation Time**	4:50:00 AM	
Test Date	21-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	5:07:08 AM	
Top of test interval	18.7	**m along hole**		**Initial water level**	30.13	**m above transducer**
Bottom of test interval	29.9	**m along hole**		**Water level after slug**	32.00	**m above transducer**
Test length, L	11.1	**m along hole**		**Change in Water Level, H_o**	1.87	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	3	**m**
Transmissivity, T	2E-05	**m^2/s**				
Hydraulic Conductivity, K	1E-06	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-197 Hvorslev_Packer Drillhole.xlsx]SC15-197 Hvorslev Packer #2

A	21MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:30

Project No. VA101-460/03
Field Technician GM
Analyst GM

Drillhole **SC15-198**
Test No. 1

Monitoring Instrument Type Transducer
Slug Type unknown L of water
Test Date 21-Mar-15

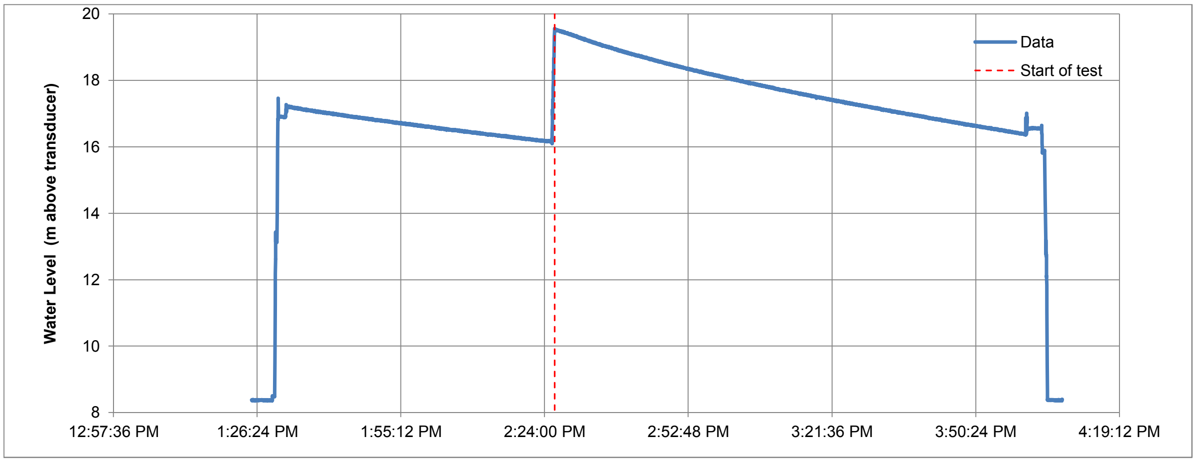
Packer Type HQ Nitrogen
Packer Inflation Time 1:32:00 PM

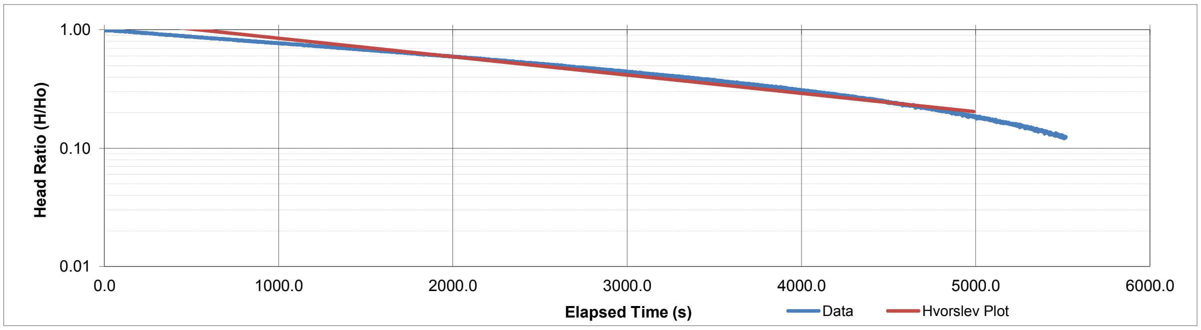
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 9.6 **m along hole**
Bottom of test interval 16.3 **m along hole**
Test length, L 6.7 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 2:26:02 PM
Initial water level 16.00 **m above transducer**
Water level after slug 19.56 **m above transducer**
Change in Water Level, H_o 3.56 **m**
Expected Change in Water Level, H_o #VALUE! **m**

Transmissivity, T 1E-06 **m^2/s**
Hydraulic Conductivity, K 2E-07 **m/s**

Intercept 1.2





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-198 Hvorslev_Packer Drillhole.xlsx]SC15-198 Hvorslev Packer #1

REV	DATE	DESCRIPTION	PREP'D	CHK'D
A	22MAR'15	ISSUED WITH REPORT	JBC	GIM

TINTINA RESOURCES INC.
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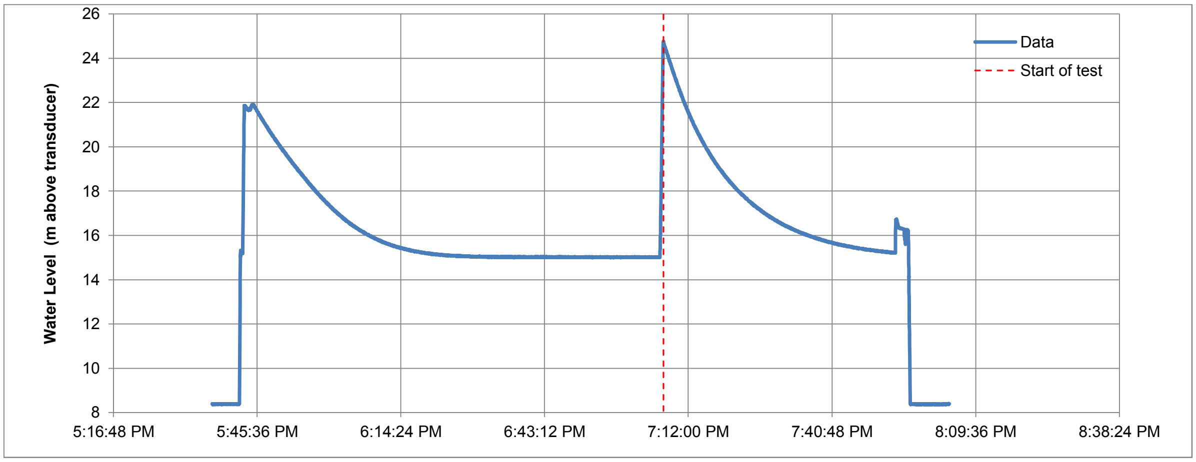
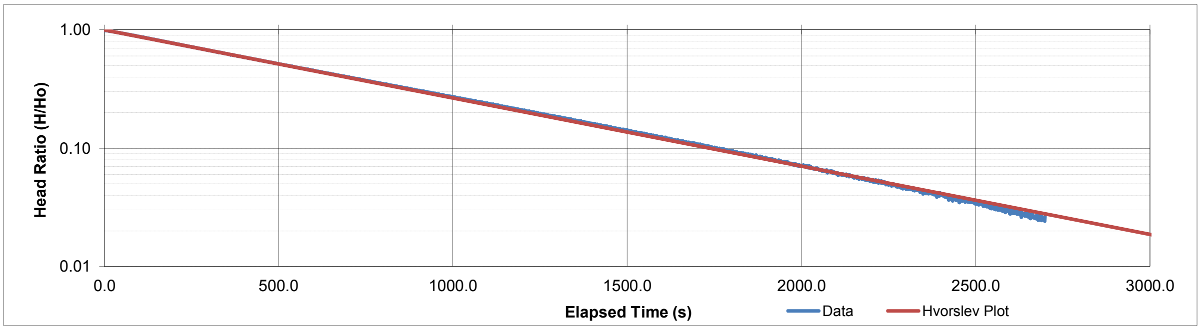
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:30

Project No.	VA101-460/03			**Drillhole**	**SC15-198**	
Field Technician	GM/JBC			**Test No.**	2	
Analyst	JBC					
Monitoring Instrument Type	Transducer			**Packer Type**	HQ Nitrogen	
Slug Type	61	L of water		**Packer Inflation Time**	5:45:00 PM	
Test Date	21-Mar-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	7:07:01 PM	
Top of test interval	15.7	**m along hole**		**Initial water level**	15.00	**m above transducer**
Bottom of test interval	22.6	**m along hole**		**Water level after slug**	24.77	**m above transducer**
Test length, L	6.9	**m along hole**		**Change in Water Level, H_o**	9.77	**m**
Drillhole angle	90	**degrees**		**Expected Change in Water Level, H_o**	13	**m**
Transmissivity, T	5E-06	**m^2/s**				
Hydraulic Conductivity, K	7E-07	**m/s**		Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-198 Hvorslev_Packer Drillhole.xlsx]SC15-198 Hvorslev Packer #2

A	22MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

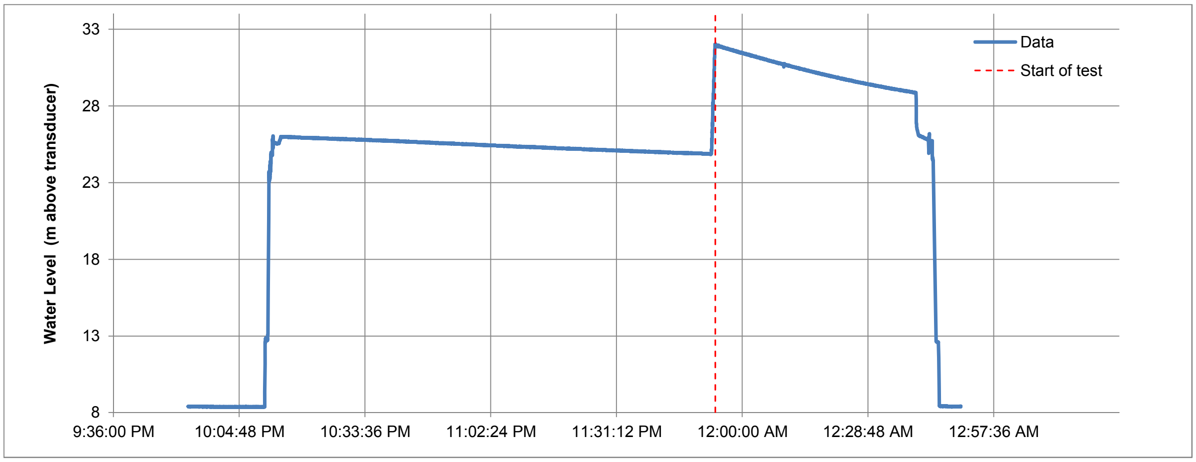
TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

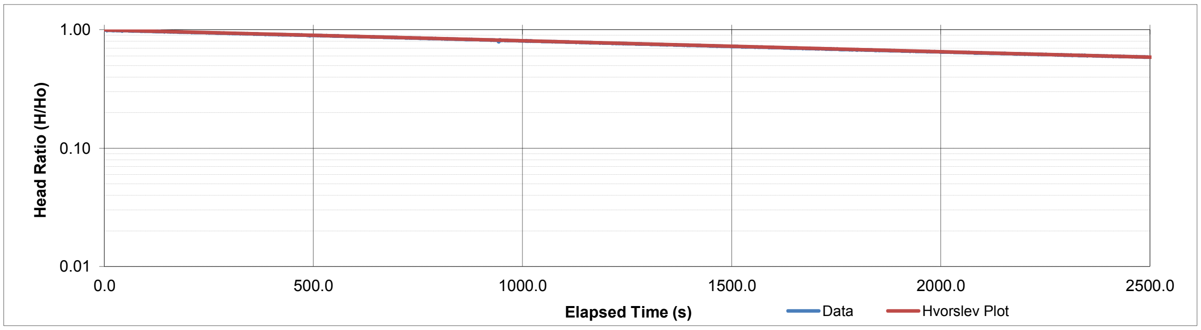
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:30

Project No.	VA101-460/03	
Field Technician	JBC	
Analyst	JBC	
Monitoring Instrument Type	Transducer	
Slug Type	38	L of water
Test Date	21-Mar-15	
Drillhole diameter, D	HQ3	0.096 m
Drill rod diameter, d	HQ3	0.078 m
Top of test interval	21.8	**m along hole**
Bottom of test interval	30.0	**m along hole**
Test length, L	8.2	**m along hole**
Drillhole angle	90	**degrees**
Transmissivity, T	8E-07	**m^2/s**
Hydraulic Conductivity, K	1E-07	**m/s**

Drillhole	**SC15-198**	
Test No.	3	
Packer Type	HQ Nitrogen	
Packer Inflation Time	10:13:00 PM	
Slug Injected, Time = 0	11:53:51 PM	
Initial water level	24.86	**m above transducer**
Water level after slug	32.02	**m above transducer**
Change in Water Level, H_o	7.16	**m**
Expected Change in Water Level, H_o	8	**m**
Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-198 Hvorslev_Packer Drillhole.xlsx]SC15-198 Hvorslev Packer #3

A	22MAR'15	ISSUED WITH REPORT	JBC	GIM
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:34

Project No. VA101-460/03
Field Technician JBC
Analyst KTD

Drillhole **SC15-201**
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 13 L of water
Test Date 28-May-15

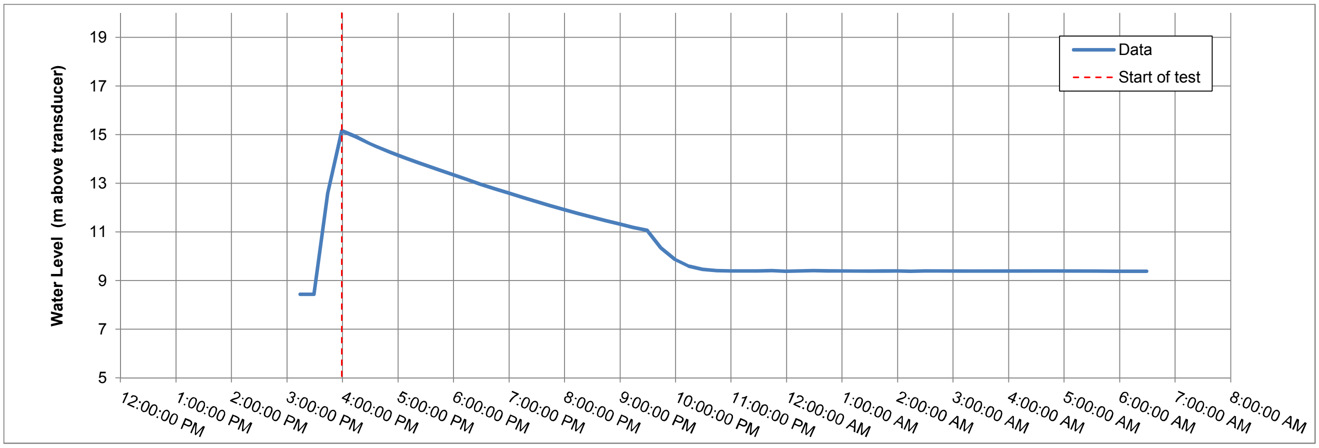
Packer Type -
Packer Inflation Time -

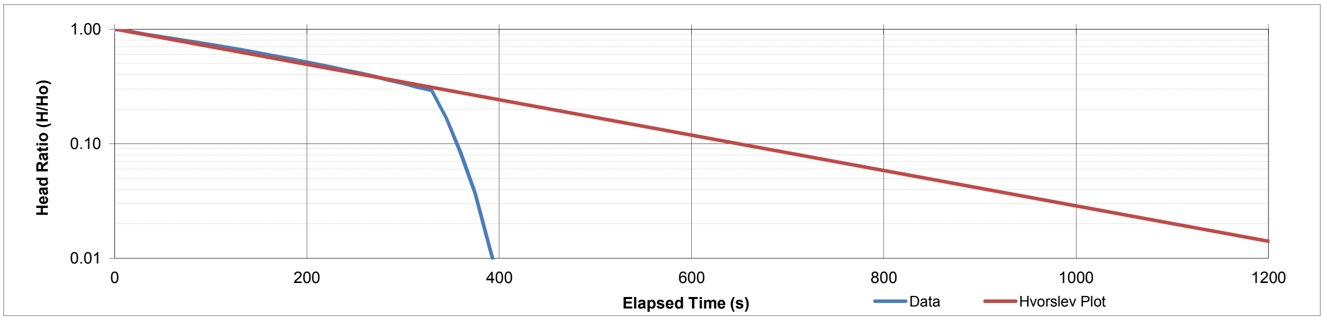
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	5.6	**m along hole**	
Bottom of test interval	12.0	**m along hole**	
Test length, L	6.4	**m along hole**	
Drillhole angle	90	**degrees**	

Slug Injected, Time = 0	3:59:09 PM	
Initial water level	9.38	**m above transducer**
Water level after slug	15.17	**m above transducer**
Change In Water Level, H_o	5.78	**m**
Expected Change In Water Level, H_o	3	**m**

Transmissivity, T 1E-05 **m^2/s**
Hydraulic Conductivity, K 2E-06 **m/s**

Intercept 1.0





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM STABLE WATER LEVEL RECORDED AFTER RECOVERY TEST AT 14:29 (9.38 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-201 Hvorslev_Packer Drillhole.xlsx]SC15-201 Hvorslev Packer #1

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

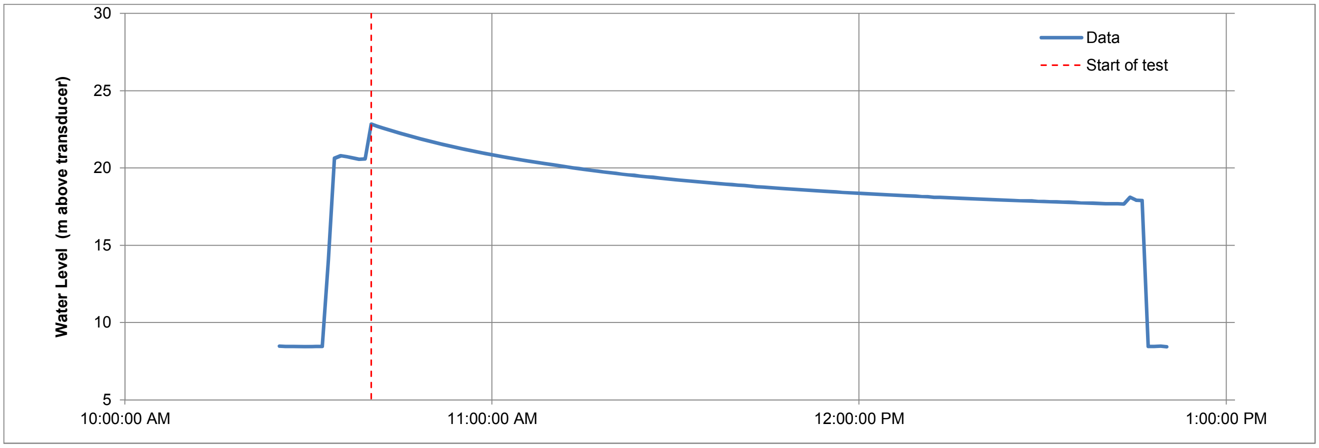
TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

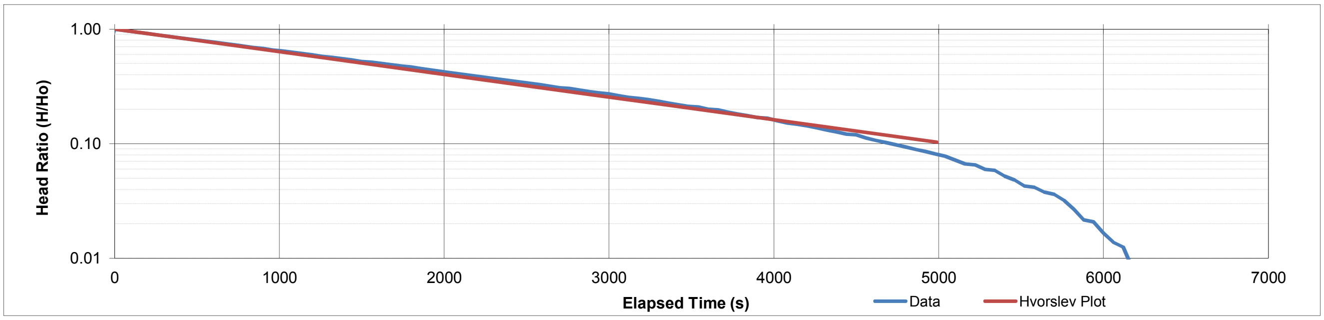
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:34

Project No.	VA101-460/03		
Field Technician	JBC		
Analyst	KTD		
Monitoring Instrument Type	Transducer		
Slug Type	16	L of water	
Test Date	29-May-15		
Drillhole diameter, D	HQ3	0.096	m
Drill rod diameter, d	HQ3	0.078	m
Top of test interval	11.4	**m along hole**	
Bottom of test interval	24.2	**m along hole**	
Test length, L	12.8	**m along hole**	
Drillhole angle	90	**degrees**	
Transmissivity, T	2E-06	**m^2/s**	
Hydraulic Conductivity, K	2E-07	**m/s**	

Drillhole	**SC15-201**	
Test No.	2	
Packer Type	-	
Packer Inflation Time	-	
Slug Injected, Time = 0	10:40:17 AM	
Initial water level	17.89	**m above transducer**
Water level after slug	22.83	**m above transducer**
Change In Water Level, H_o	4.94	**m**
Expected Change In Water Level, H_o	3	**m**
Intercept	1.0	





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM STABLE WATER LEVEL RECORDED AFTER RECOVERY TEST AT 12:50 (17.89 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-201 Hvorslev_Packer Drillhole.xlsx]SC15-201 Hvorslev Packer #2

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

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TINTINA RESOURCES INC.
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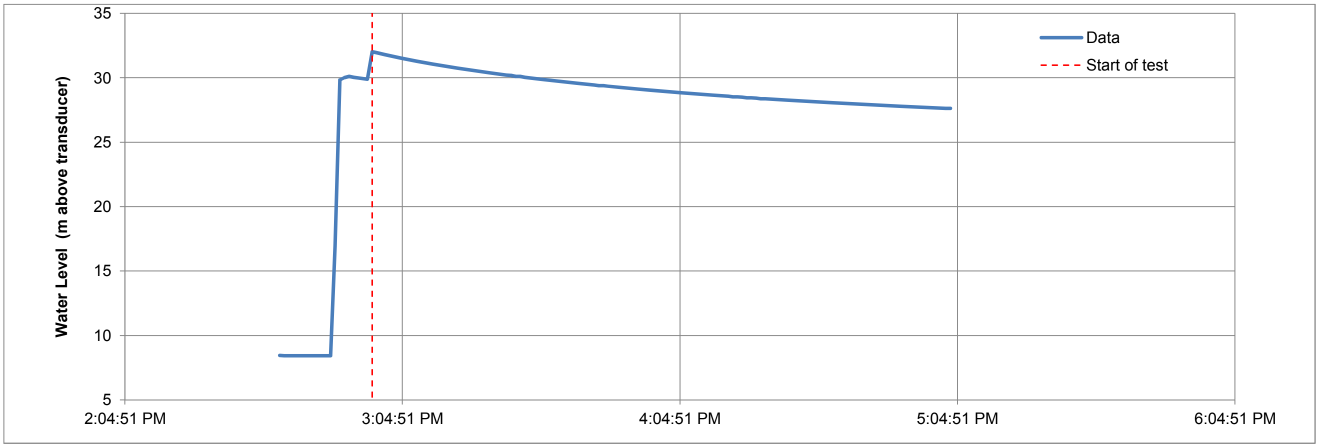
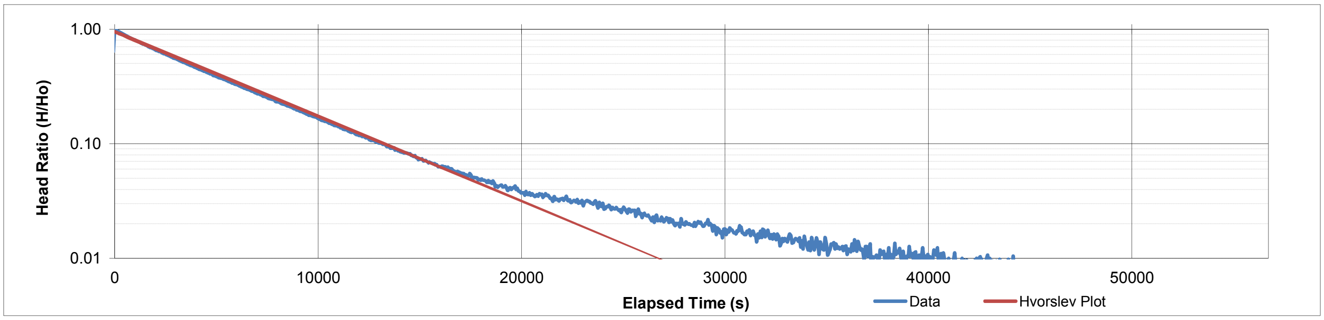
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:34

Project No.	VA101-460/03	
Field Technician	JBC	
Analyst	KTD	
Monitoring Instrument Type	Transducer	
Slug Type	10	L of water
Test Date	29-May-15	
Drillhole diameter, D	HQ3	0.096 m
Drill rod diameter, d	HQ3	0.078 m
Top of test interval	22.1	**m along hole**
Bottom of test interval	30.3	**m along hole**
Test length, L	8.2	**m along hole**
Drillhole angle	90	**degrees**
Transmissivity, T	7E-07	**m^2/s**
Hydraulic Conductivity, K	8E-08	**m/s**

Drillhole	**SC15-201**	
Test No.	3	
Packer Type	-	
Packer Inflation Time	-	
Slug Injected, Time = 0	2:58:20 PM	
Initial water level	26.13	**m above transducer**
Water level after slug	32.03	**m above transducer**
Change In Water Level, H_o	5.90	**m**
Expected Change In Water Level, H_o	2	**m**
Intercept	1.0	





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM STABLE WATER LEVEL RECORDED AFTER RECOVERY TEST AT 18:30 (26.13 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-201 Hvorslev_Packer Drillhole.xlsx]SC15-201 Hvorslev Packer #3

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:38

Project No. VA101-460/03
Field Technician JBC
Analyst KTD

Drillhole SC15-202
Test No. 1

Monitoring Instrument Type Transducer
Slug Type 8 L of water
Test Date 30-May-15

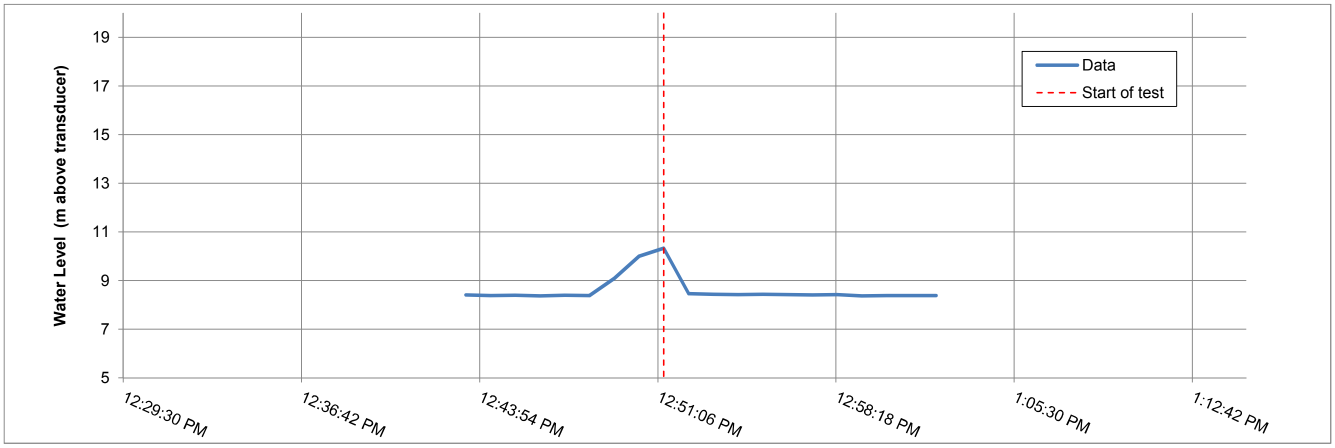
Packer Type -
Packer Inflation Time -

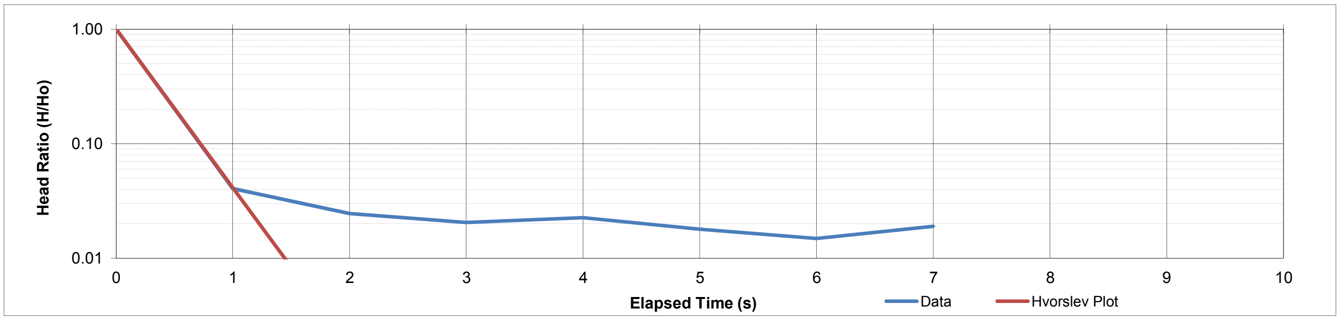
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 2.4 **m along hole**
Bottom of test interval 10.4 **m along hole**
Test length, L 7.9 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:51:21 PM
Initial water level 8.38 **m above transducer**
Water level after slug 10.33 **m above transducer**
Change In Water Level, H_o 1.95 **m**
Expected Change In Water Level, H_o 2 **m**

Transmissivity, T 1E-02 **m^2/s**
Hydraulic Conductivity, K 2E-03 **m/s**

Intercept 1.0





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-202 Hvorslev_Packer Drillhole.xlsx]SC15-202 Hvorslev Packer #1

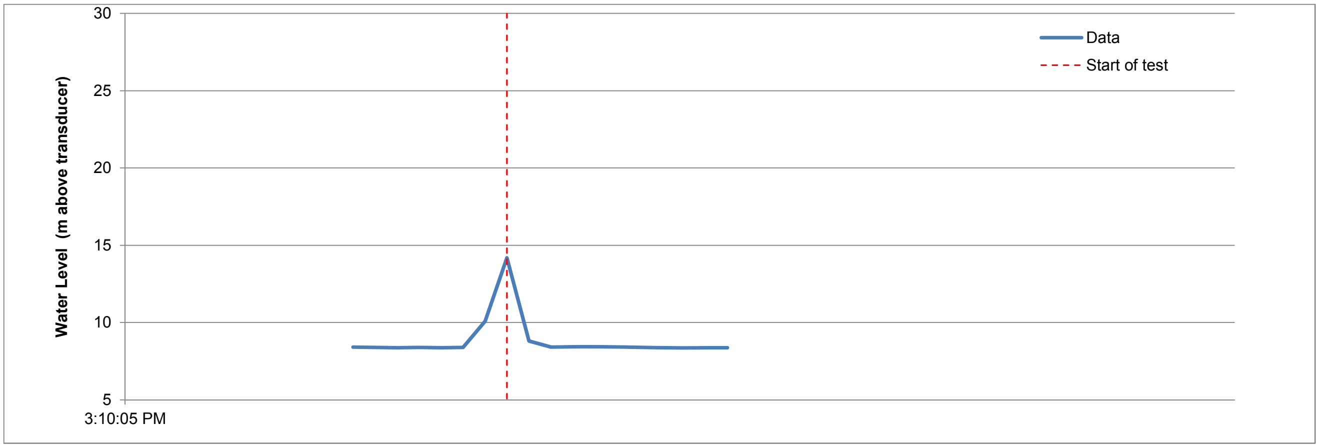
A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

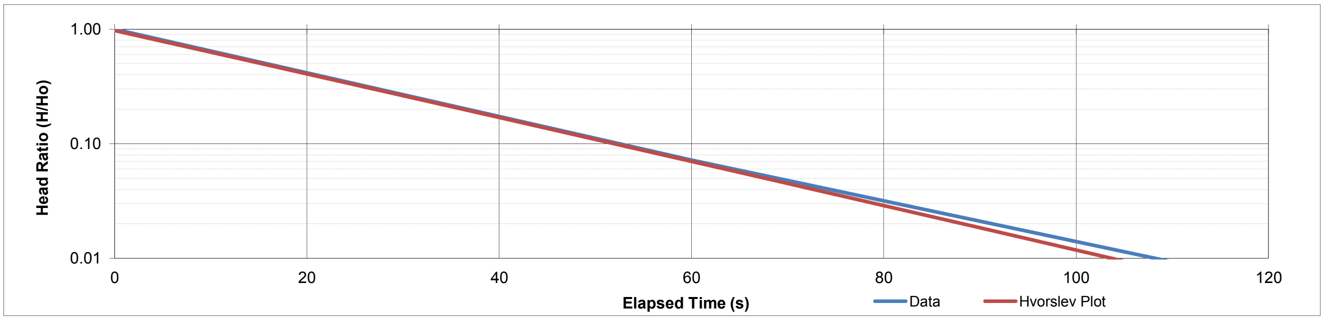
TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:38

Project No.	VA101-460/03		**Drillhole**	**SC15-202**	
Field Technician	JBC		**Test No.**	2	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	49	L of water	**Packer Inflation Time**	-	
Test Date	29-May-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	3:27:26 PM	
Top of test interval	6.7	**m along hole**	**Initial water level**	8.38	**m above transducer**
Bottom of test interval	14.9	**m along hole**	**Water level after slug**	14.19	**m above transducer**
Test length, L	8.2	**m along hole**	**Change In Water Level, H_o**	5.81	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	10	**m**
Transmissivity, T	2E-04	**m^2/s**			
Hydraulic Conductivity, K	2E-05	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-202 Hvorslev_Packer Drillhole.xlsx]SC15-202 Hvorslev Packer #2

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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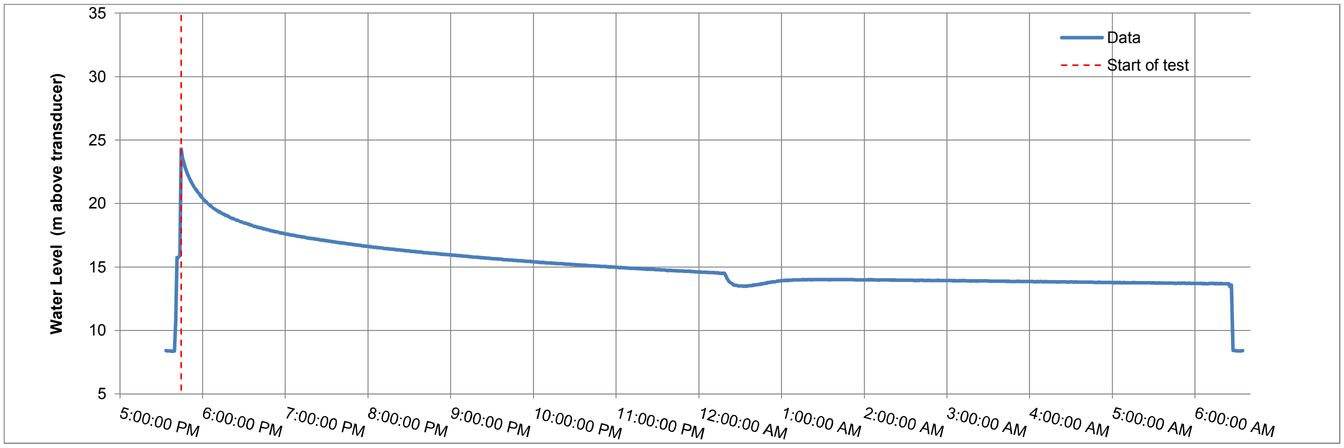
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

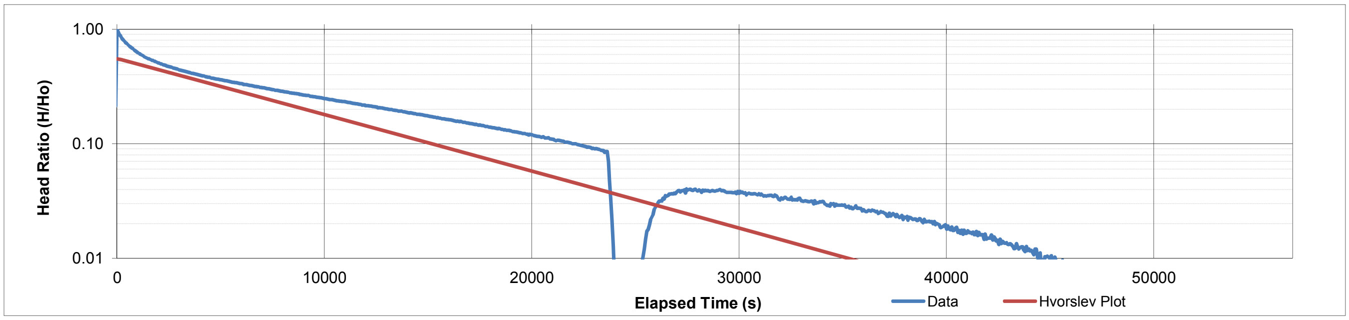
Print 02/26/16 15:38

Project No.	VA101-460/03			**Drillhole**	**SC15-202**	
Field Technician	JBC			**Test No.**	3	
Analyst	KTD					
Monitoring Instrument Type	Transducer			**Packer Type**	-	
Slug Type	Unknown Water Vol.	L of water		**Packer Inflation Time**	-	
Test Date	30-May-15					
Drillhole diameter, D	HQ3	0.096	m			
Drill rod diameter, d	HQ3	0.078	m	**Slug Injected, Time = 0**	5:44:28 PM	
Top of test interval	14.3	**m along hole**		**Initial water level**	13.58	**m above transducer**
Bottom of test interval	20.7	**m along hole**		**Water level after slug**	24.29	**m above transducer**
Test length, L	6.4	**m along hole**		**Change In Water Level, H_o**	10.71	**m**
Drillhole angle	90	**degrees**		**Expected Change In Water Level, H_o**	-	**m**

Transmissivity, T	3E-07	**m^2/s**
Hydraulic Conductivity, K	5E-08	**m/s**

Intercept 0.6





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM WATER LEVEL RECORDED AFTER RECOVERY TEST AT 18:26 (13.58 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-202 Hvorslev_Packer Drillhole.xlsx]SC15-202 Hvorslev Packer #3

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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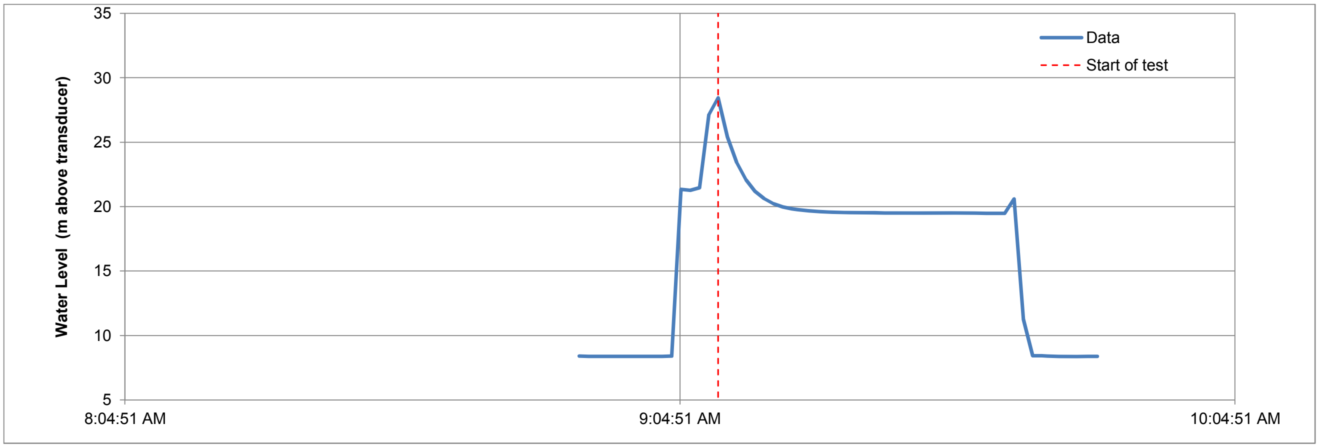
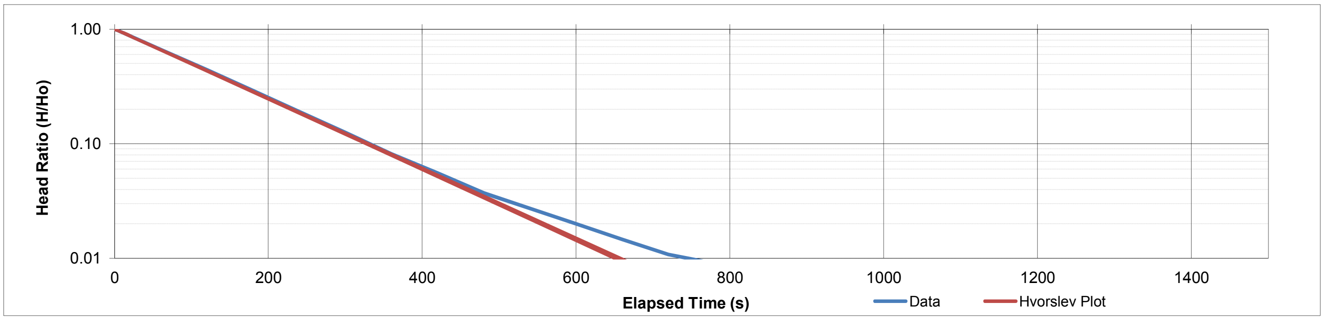
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:38

Project No.	VA101-460/03		**Drillhole**	**SC15-202**	
Field Technician	JBC		**Test No.**	4	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	-	
Slug Type	44	L of water	**Packer Inflation Time**	-	
Test Date	31-May-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	9:08:59 AM	
Top of test interval	20.1	**m along hole**	**Initial water level**	19.48	**m above transducer**
Bottom of test interval	29.8	**m along hole**	**Water level after slug**	28.45	**m above transducer**
Test length, L	9.7	**m along hole**	**Change In Water Level, H_o**	8.97	**m**
Drillhole Angle	90	**degrees**	**Expected Change In Water Level, H_o**	9	**m**
Transmissivity, T	3E-05	**m^2/s**			
Hydraulic Conductivity, K	3E-06	**m/s**	Intercept	1.0	





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM WATER LEVEL RECORDED AFTER RECOVERY TEST AT 21:37 (19.38 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-202 Hvorslev_Packer Drillhole.xlsx]SC15-202 Hvorslev Packer #4

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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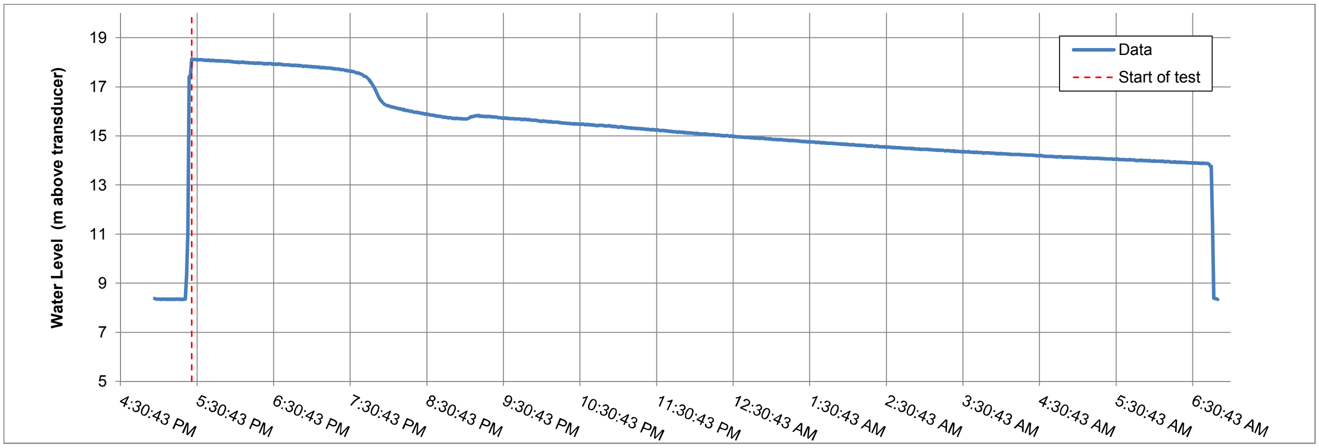
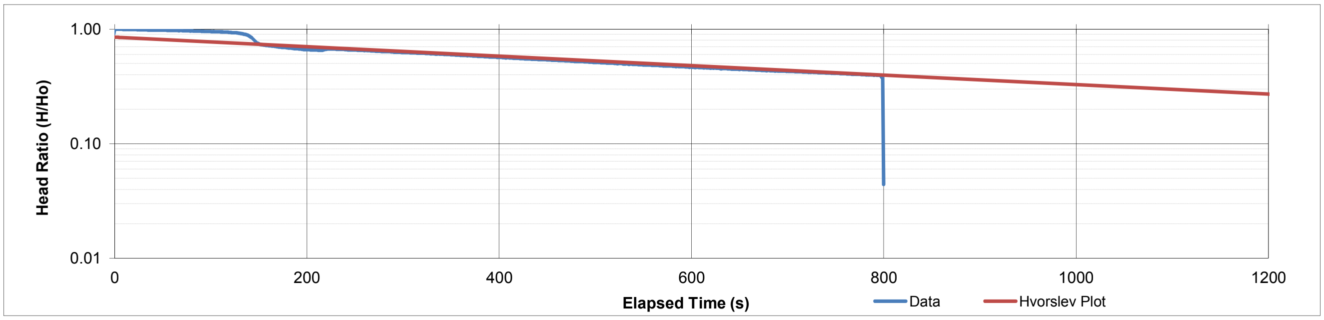
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:41

Project No.	VA101-460/03		**Drillhole**	**SC15-203**	
Field Technician	JBC		**Test No.**	1	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	-	
Slug Type	5	L of water	**Packer Inflation Time**	-	
Test Date	28-May-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	5:26:26 PM	
Top of test interval	8.5	**m along hole**	**Initial water level**	11.09	**m above transducer**
Bottom of test interval	14.9	**m along hole**	**Water level after slug**	18.13	**m above transducer**
Test length, L	6.4	**m along hole**	**Change In Water Level, H_o**	7.04	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	1	**m**
Transmissivity, T	4E-06	**m^2/s**			
Hydraulic Conductivity, K	6E-07	**m/s**	Intercept	0.9	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-203 Hvorslev_Packer Drillhole.xlsx]SC15-203 Hvorslev Packer #1

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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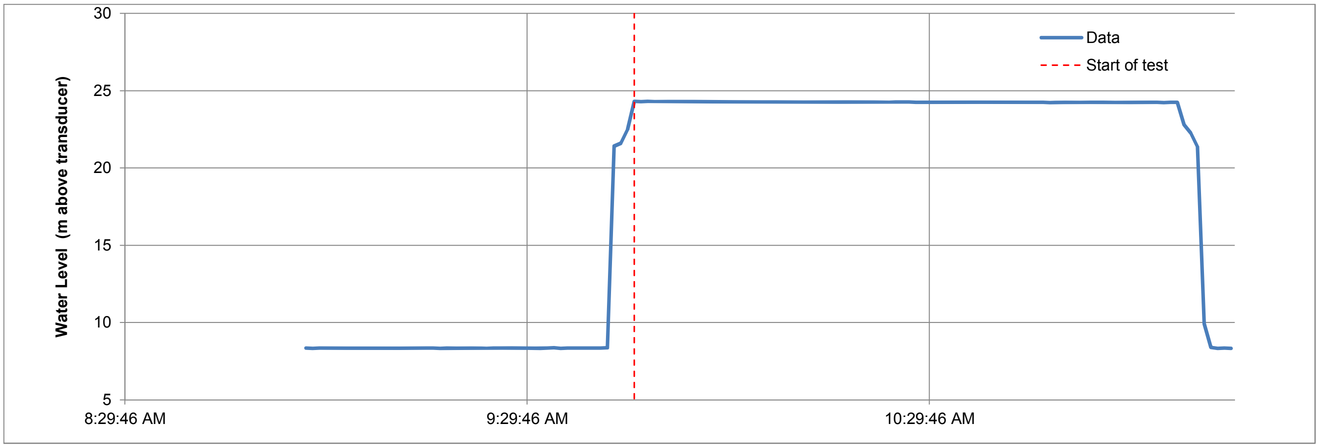
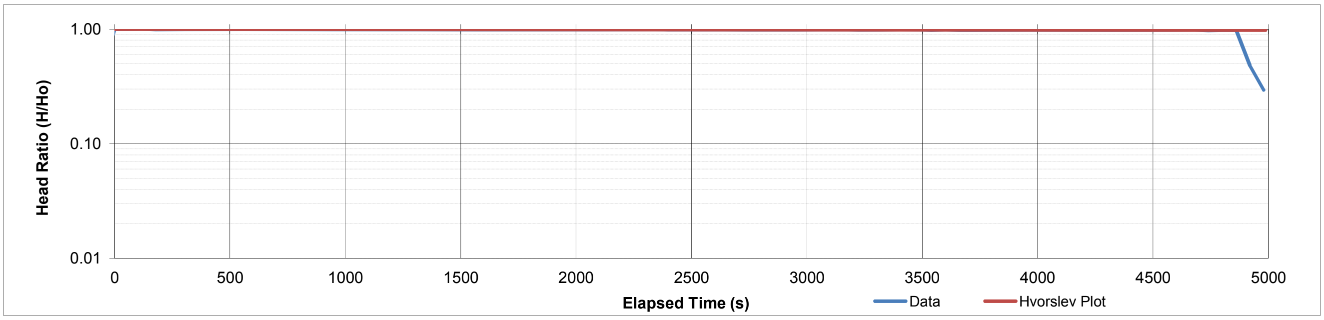
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:41

Project No.	VA101-460/03		**Drillhole**	**SC15-203**	
Field Technician	JBC		**Test No.**	2	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	HQ Nitrogen	
Slug Type	11	L of water	**Packer Inflation Time**	-	
Test Date	29-May-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	9:45:46 AM	
Top of test interval	14.0	**m along hole**	**Initial water level**	21.41	**m above transducer**
Bottom of test interval	22.5	**m along hole**	**Water level after slug**	24.30	**m above transducer**
Test length, L	8.5	**m along hole**	**Change In Water Level, H_o**	2.89	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	2	**m**
Transmissivity, T	2E-08	**m^2/s**			
Hydraulic Conductivity, K	2E-09	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-203 Hvorslev_Packer Drillhole.xlsx]SC15-203 Hvorslev Packer #2

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:41

Project No. VA101-460/03
Field Technician JBC
Analyst KTD

Drillhole SC15-203
Test No. 3

Monitoring Instrument Type Transducer
Slug Type 10 L of water
Test Date 29-May-15

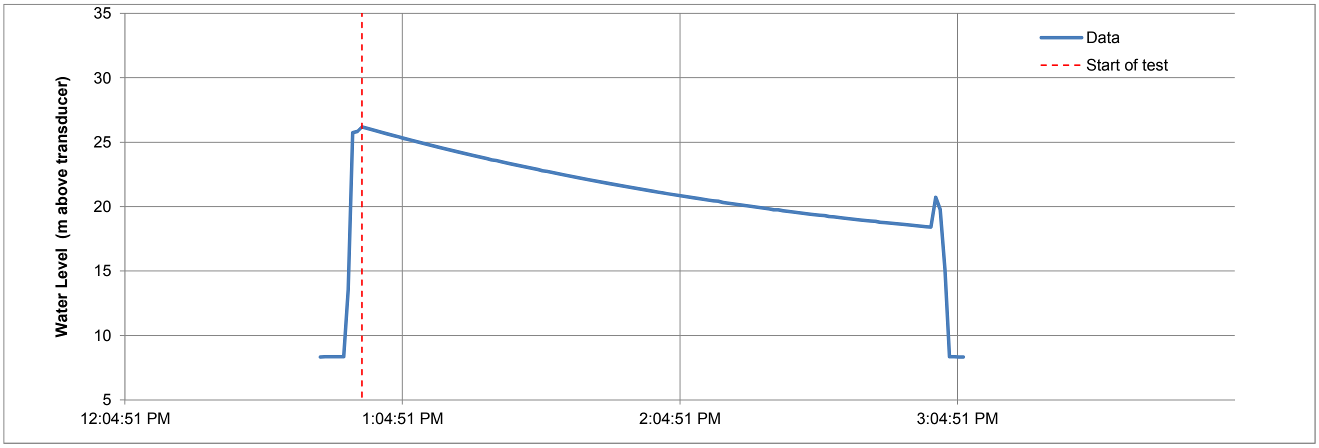
Packer Type HQ Nitrogen
Packer Inflation Time -

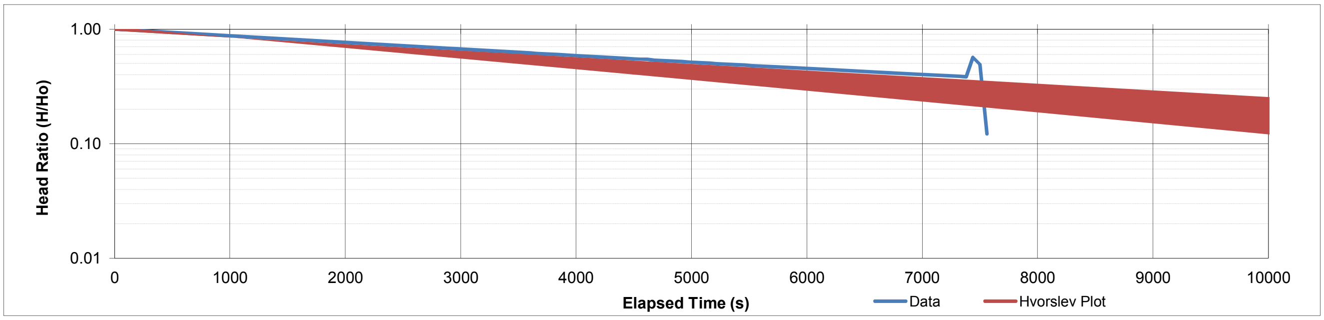
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 21.6 **m along hole**
Bottom of test interval 30.2 **m along hole**
Test length, L 8.5 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 12:56:09 PM
Initial water level 13.54 **m above transducer**
Water level after slug 26.20 **m above transducer**
Change In Water Level, H_o 12.65 **m**
Expected Change In Water Level, H_o 2 **m**

Transmissivity, T 5E-07 **m^2/s**
Hydraulic Conductivity, K 6E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

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A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

Knight Piésold
CONSULTING

TINTINA RESOURCES INC.
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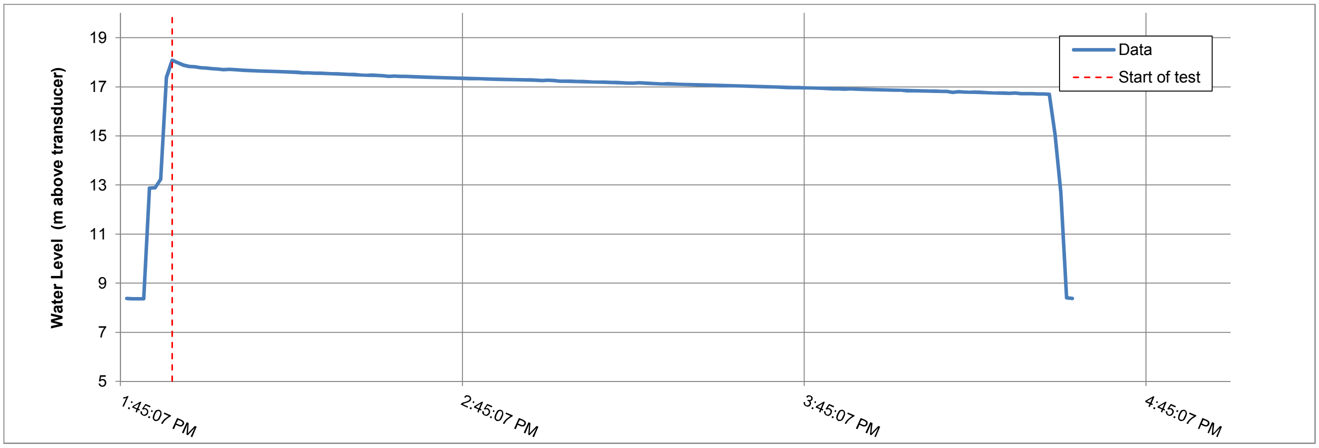
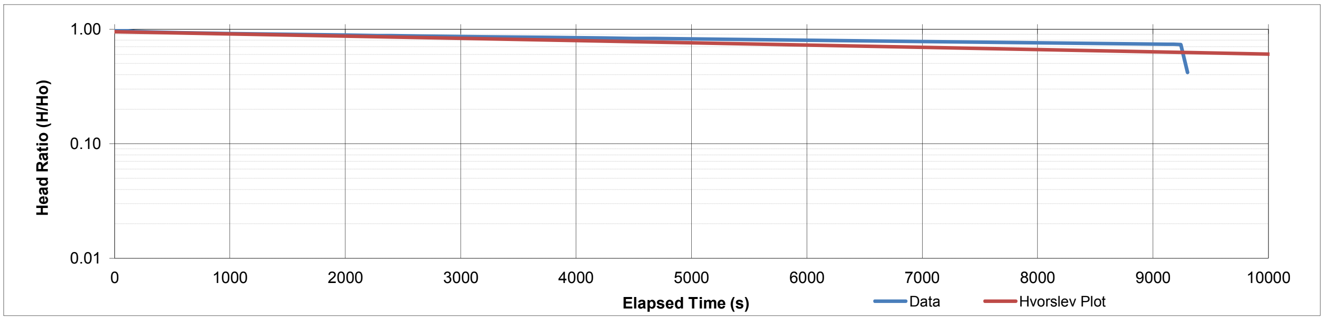
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:42

Project No.	VA101-460/03	
Field Technician	JBC	
Analyst	KTD	
Monitoring Instrument Type	Transducer	
Slug Type	24	L of water
Test Date	28-May-15	
Drillhole diameter, D	HQ3	0.096 m
Drill rod diameter, d	HQ3	0.078 m
Top of test interval	7.9	**m along hole**
Bottom of test interval	14.9	**m along hole**
Test length, L	6.9	**m along hole**
Drillhole angle	90	**degrees**
Transmissivity, T	1E-07	**m^2/s**
Hydraulic Conductivity, K	2E-08	**m/s**

Drillhole	**SC15-204**	
Test No.	1	
Packer Type	-	
Packer Inflation Time	-	
Slug Injected, Time = 0	1:54:12 PM	
Initial water level	12.87	**m above transducer**
Water level after slug	18.08	**m above transducer**
Change In Water Level, H_o	5.20	**m**
Expected Change In Water Level, H_o	5	**m**
Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-204 Hvorslev_Packer Drillhole.xlsx]SC15-204 Hvorslev Packer #1

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:42

Project No. VA101-460/03
Field Technician JBC
Analyst KTD

Drillhole SC15-204
Test No. 2

Monitoring Instrument Type Transducer
Slug Type 18 L of water
Test Date 2-Jun-15

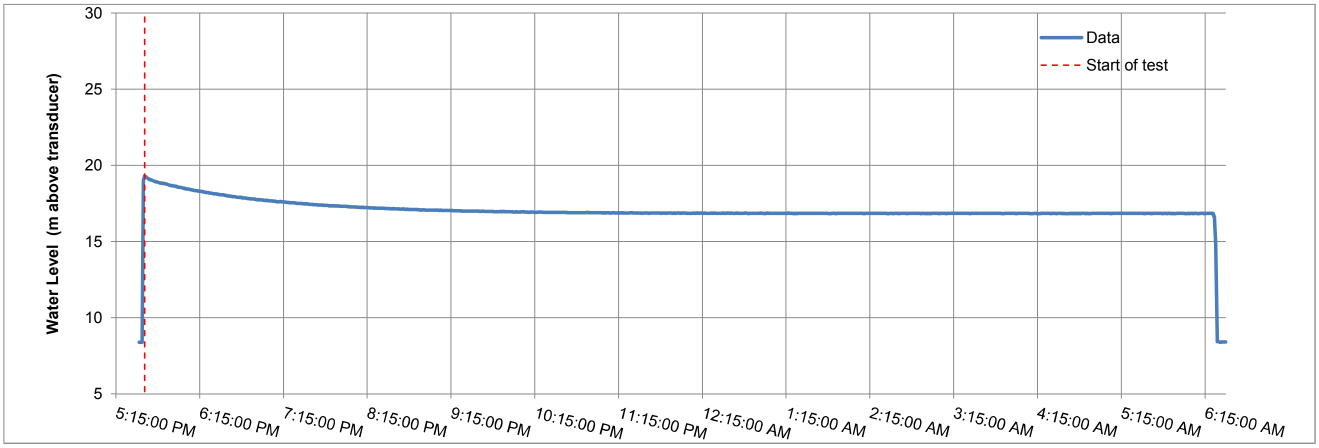
Packer Type -
Packer Inflation Time -

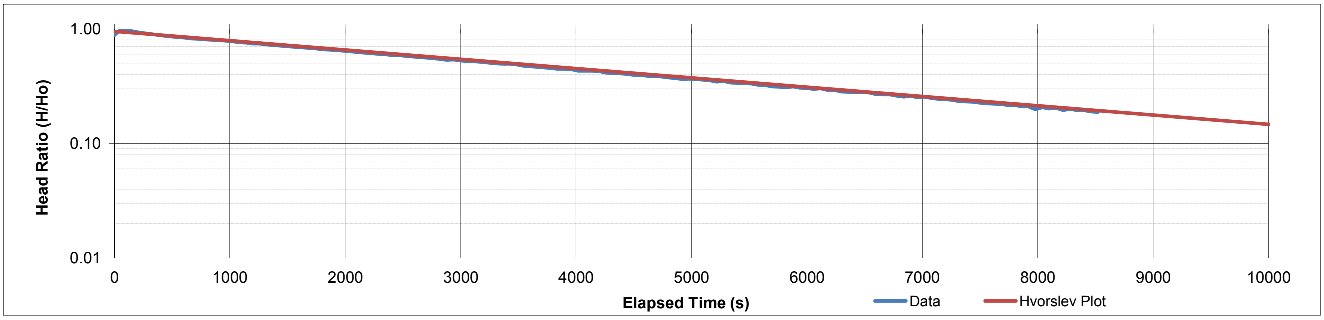
Drillhole diameter, D HQ3 0.096 m
Drill rod diameter, d HQ3 0.078 m
Top of test interval 12.5 **m along hole**
Bottom of test interval 22.6 **m along hole**
Test length, L 10.1 **m along hole**
Drillhole angle 90 **degrees**

Slug Injected, Time = 0 5:35:42 PM
Initial water level 16.86 **m above transducer**
Water level after slug 19.31 **m above transducer**
Change In Water Level, H_o 2.45 **m**
Expected Change In Water Level, H_o 4 **m**

Transmissivity, T 8E-07 **m^2/s**
Hydraulic Conductivity, K 8E-08 **m/s**

Intercept 1.0





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM STABLE WATER LEVEL RECORDED AFTER RECOVERY TEST AT 18:20 (16.86 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-204 Hvorslev_Packer Drillhole.xlsx]SC15-204 Hvorslev Packer #2

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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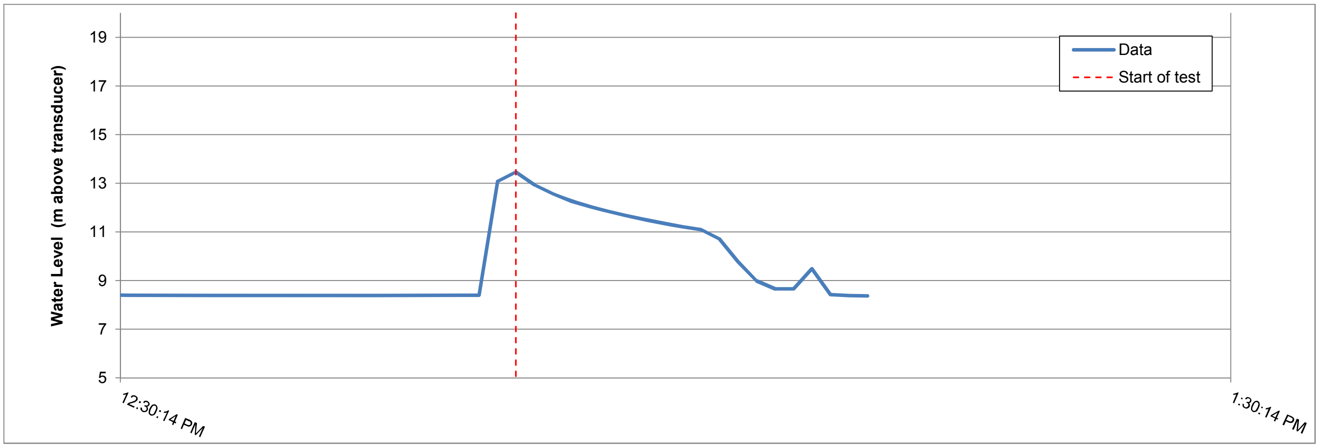
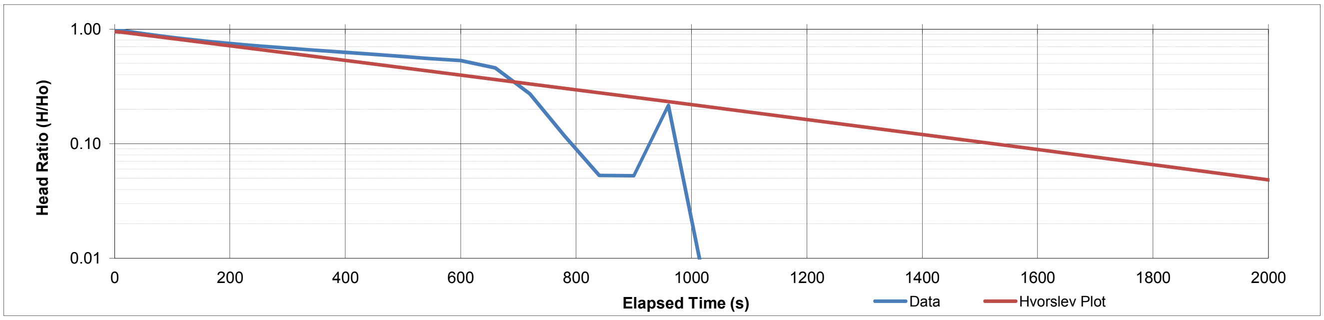
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:44

Project No.	VA101-460/03		**Drillhole**	**SC15-205**	
Field Technician	JBC		**Test No.**	1	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	-	
Slug Type	33	L of water	**Packer Inflation Time**	-	
Test Date	3-Jun-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	12:51:37 PM	
Top of test interval	4.6	**m along hole**	**Initial water level**	8.39	**m above transducer**
Bottom of test interval	11.6	**m along hole**	**Water level after slug**	13.46	**m above transducer**
Test length, L	7.0	**m along hole**	**Change In Water Level, H_o**	5.07	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	7	**m**
Transmissivity, T	4E-06	**m^2/s**			
Hydraulic Conductivity, K	5E-07	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-205 Hvorslev_Packer Drillhole.xlsx]SC15-204 Hvorslev Packer #1

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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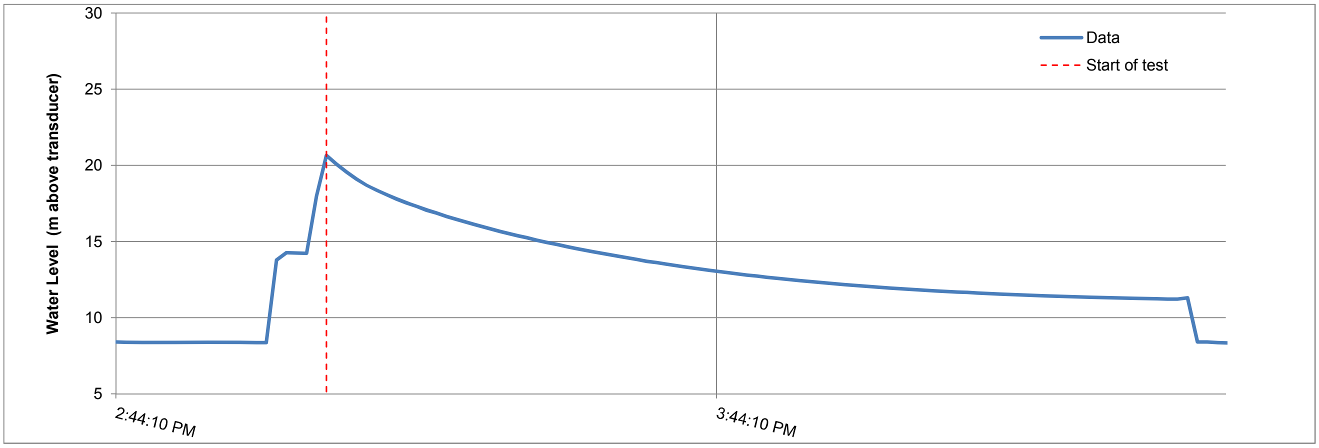
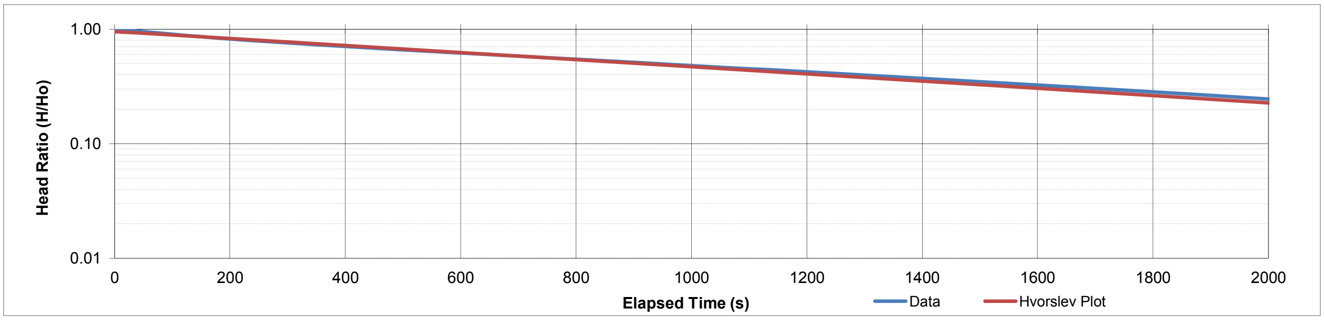
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:44

Project No.	VA101-460/03		**Drillhole**	**SC15-205**	
Field Technician	JBC		**Test No.**	2	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	-	
Slug Type	37	L of water	**Packer Inflation Time**	-	
Test Date	3-Jun-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	3:05:12 PM	
Top of test interval	10.7	**m along hole**	**Initial water level**	11.28	**m above transducer**
Bottom of test interval	22.2	**m along hole**	**Water level after slug**	20.66	**m above transducer**
Test length, L	11.6	**m along hole**	**Change In Water Level, H_o**	9.39	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	8	**m**
Transmissivity, T	3E-06	**m^2/s**			
Hydraulic Conductivity, K	2E-07	**m/s**	Intercept	1.0	





TEST COMMENTS:

1. INITIAL WATER LEVEL AT THE START OF THE TEST WAS NOT FULLY RECOVERED. FOR THE ANALYSIS THE INITIAL WATER LEVEL PRIOR TO SLUG INSERTION WAS INFERRED FROM WATER LEVEL RECORDED AFTER RECOVERY TEST AT 16:25 (11.28 meters above transducer)

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-205 Hvorslev_Packer Drillhole.xlsx]SC15-204 Hvorslev Packer #2

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

TINTINA RESOURCES INC.
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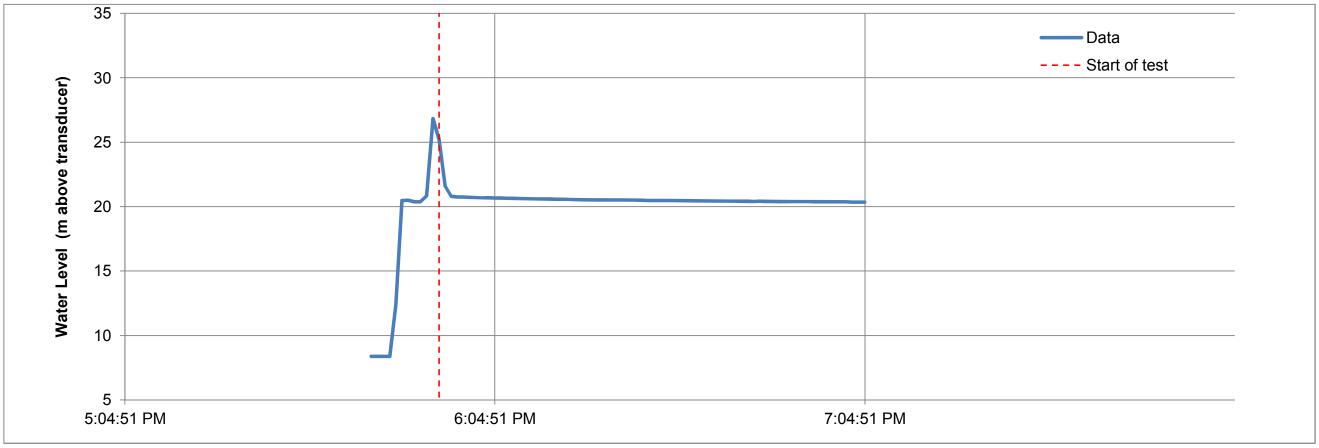
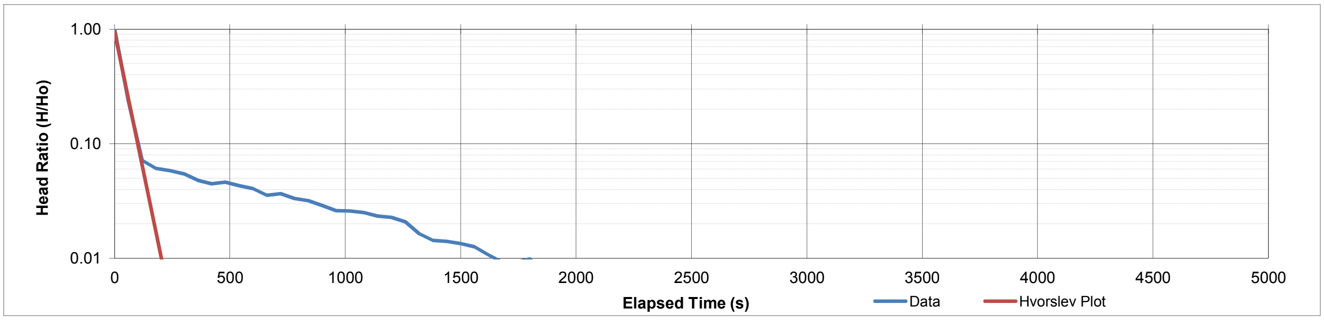
HYDRAULIC CONDUCTIVITY CALCULATION
USING HVORSLEV (1951) METHOD

Print 02/26/16 15:44

Project No.	VA101-460/03		**Drillhole**	**SC15-205**	
Field Technician	JBC		**Test No.**	3	
Analyst	KTD				
Monitoring Instrument Type	Transducer		**Packer Type**	-	
Slug Type	48	L of water	**Packer Inflation Time**	-	
Test Date	3-Jun-15				
Drillhole diameter, D	HQ3	0.096 m			
Drill rod diameter, d	HQ3	0.078 m	**Slug Injected, Time = 0**	5:55:48 PM	
Top of test interval	19.8	**m along hole**	**Initial water level**	20.47	**m above transducer**
Bottom of test interval	29.9	**m along hole**	**Water level after slug**	25.21	**m above transducer**
Test length, L	10.1	**m along hole**	**Change In Water Level, H_o**	4.75	**m**
Drillhole angle	90	**degrees**	**Expected Change In Water Level, H_o**	10	**m**
Transmissivity, T	9E-05	**m^2/s**			
Hydraulic Conductivity, K	9E-06	**m/s**	Intercept	1.0	





TEST COMMENTS:

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\B1 - Hydraulic Conductivity Testing Sheets\[SC15-205 Hvorslev_Packer Drillhole.xlsx]SC15-204 Hvorslev Packer #3

A	10JUN'15	ISSUED WITH REPORT	KTD	MBG
REV	DATE	DESCRIPTION	PREP'D	CHK'D

APPENDIX C

LABORATORY TEST RESULTS

APPENDIX C1

SOIL LABORATORY TESTING RESULTS

(Pages C1-1 to C1-43)

TABLE C1.1

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION
SUMMARY OF 2015 SOIL LABORATORY TEST RESULTS

Print Feb/29/16 10:02:59

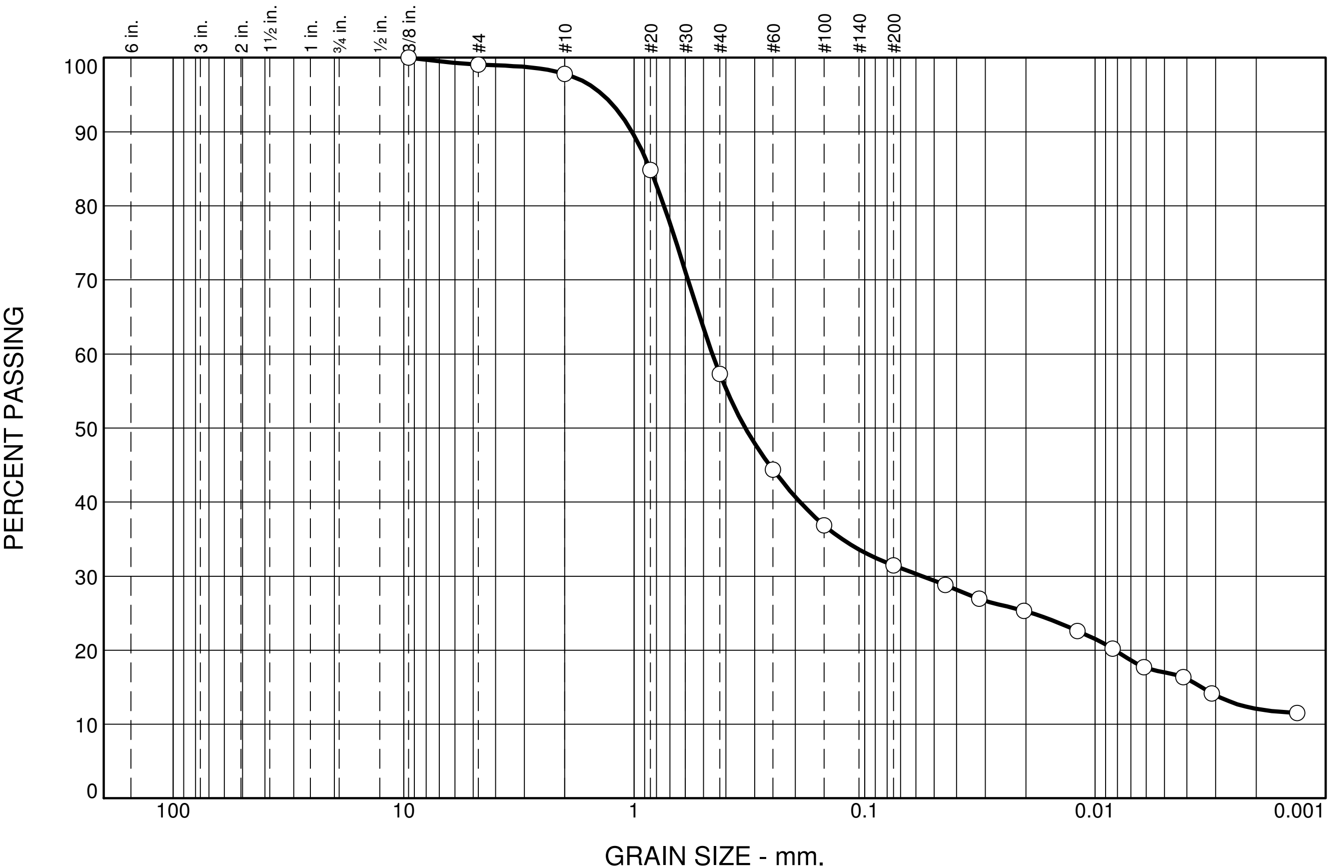
Sample Location	Sample I.D.	Sample General Area	Coordinates (Easting, Northing)		Depth (ft)		Depth (m)		Natural Moisture Content	Percent Passing 3/8"	Percent Passing #200	Atterberg Limits[1]			Particle Size Distribution				USCS	Triaxial Testing				Description
												P.L. %	L.L. %	P.I. %	Gravel %	Sand %	Silt %	Clay %		Total		Effective		
					From	To	From	To	(%)	Sieve	Sieve				+ 5 mm	5 to 0.074 mm	0.074 to 0.002 mm	- 0.002 mm		φ` (deg)	c (kpa)	φ` (deg)	c (kpa)	
SC15-181	SPT01	South Impoundment Embankment	506,592	5,178,968	5	7	1.5	2.1	20.0	98.2	32.9	19	30	11	6.4	60.7	22.9	10.0	SC					clayey SAND
	SPT02				10	12	3.0	3.7	19.4	83.0	20.0	24	33	9	24.9	55.1	13.7	6.3	SC					clayey SAND with gravel
	SPT03				15	17	4.6	5.2	16.9	92.3	25.0	28	33	5	9.0	66.0	18.2	6.8	SM					silty SAND
	SPT04				20	20.3	6.1	6.2	19.3	100.0	23.0	NP	NP	NP	0.0	77.0	15.5	7.5	SM					silty SAND
	SHELBY01				17.5	18	5.3	5.5	23.2	100.0	26.2	31	33	2	0.2	73.6	20.8	5.4	SM					silty SAND
SC15-184	SPT01	Seepage Collection Pond	507,044	5,178,970	5	7	1.5	2.1	23.0	96.0	12.7	29	30	1	14.9	72.4	7.7	5.0	SM					silty SAND
	SPT02				10	12	3.0	3.7	25.3	96.1	41.4	19	34	15	13.0	45.6	28.0	13.4	SC					clayey SAND
	SHELBY01				12	13	3.7	4.0												37.6	0	47.0	64.8	
SC15-191	Weathered Rock	Process Water Pond	507,024	5,179,469	13.3	14	4.1	4.3	14.2	63.3	9.9	21	27	6	56.1	34.0	9.9	-	GP-GC					poorly graded GRAVEL with siltyclay and sand
SC15-192	SPT01	West Impoundment Embankment	504,689	5,178,984	5	7	1.5	2.1	20.9	79.4	40.1	18	31	13	31.6	28.3	28.6	11.5	GC					clayey GRAVEL with sand
	SPT02				10	12	3.0	3.7	21.1	100.0	13.1	NP	NP	NP	0.4	86.5	9.6	3.5	SM					silty SAND
	SPT03				15	17	4.6	5.2	11.1	81.6	12.1	24	32	8	39.1	48.8	12.1	-	SM					silty SAND with gravel
SC15-193	SPT01	West Impoundment Embankment	504,857	5,178,786	5	7	1.5	2.1	18.7	76.5	24.9	18	28	10	34.0	41.1	18.3	6.6	SC					clayey SAND with gravel
	SPT02				10	12	3.0	3.7	25.0	82.0	12.3	24	38	14	48.9	38.8	12.3	-	GC					clayey GRAVEL with sand
SC15-196	SPT01	East Impoundment Embankment	507,619	5,179,697	3	5	0.9	1.5	24.5	90.6	32.8	23	58	35	29.0	38.2	15.3	17.5	SC					clayey SAND with gravel
	SPT02				8	10	2.4	3.0	19.8	98.0	36.6	23	47	24	4.7	58.7	19.5	17.1	SC					clayey SAND
SC15-198	Grab Sump	SAG Mill	506,592	5,179,745	4	n/a	1.2	n/a	14.1	100.0	31.4	22	36	14	0.9	67.7	19.3	12.1	SC					clayey SAND
TP15-02	Grab Sample	Process Water Storage Pond	506,197	5,179,536	1.0	1.6	0.3	0.5	n/a	98.9	32.7	22	33	11	4.8	62.5	20.3	12.4	SC					clayey SAND
TP15-08	Grab Sample	South Impoundment Area	506,469	5,179,033	1.0	2.0	0.3	0.6	n/a	91.1	31.1	20	39	19	18.2	50.7	18	13.1	SC					clayey SAND with gravel
TP15-12	Grab Sample	South Impoundment Area	506,578	5,178,829	1.3	2.0	0.4	0.6	n/a	95.3	39.2	18	33	15	11.6	49.2	25.9	13.3	SC					clayey SAND
TP15-13	Grab Sample	South Impoundment Area	506,531	5,178,726	1.3	1.6	0.4	0.5	n/a	98.9	37.7	19	35	16	7.1	55.2	22.5	15.2	SC					clayey SAND
TP15-15	Grab Sample	South Impoundment Embankment	506,725	5,179,123	2.4	3.3	0.7	1.0	n/a	100.0	18.6	21	29	8	3.4	78	10.8	7.8	SC					clayey SAND
TP15-24	Grab Sample	Process Water Pond (Alternate)	506,378	5,178,405	1.0	1.6	0.3	0.5	n/a	97.0	38.3	18	29	11	11.5	50.2	26.2	12.1	SC					clayey SAND
TP15-25	Grab Sample	Process Water Pond (Alternate)	506,307	5,178,406	1.3	2.0	0.4	0.6	n/a	99.2	32.9	19	28	9	6.3	60.8	21.7	11.2	SC					clayey SAND
TP15-30	Grab Sample	Non Contact Water Reservoir	507,562	5,178,612	0.7	1.0	0.2	0.3	n/a	98.0	38.7	25	40	15	7.9	53.4	26.1	12.6	SC					clayey SAND
TP15-30	Grab Sample	Non Contact Water Reservoir	507,562	5,178,612	1.0	2.0	0.3	0.6	n/a	86.1	15.8	19	34	15	38.9	45.3	8.7	7.1	SC					clayey SAND with gravel
TP15-37	Grab Sample	Non Contact Water Reservoir	507,830	5,178,744	0.7	1.6	0.2	0.5	n/a	100.0	50.7	20	32	12	5.2	44.1	33.6	17.1	CL					sandy lean CLAY
TP15-40	Grab Sample	Proposed Portal	506,919	5,179,822	0.3	0.7	0.1	0.2	n/a	95.7	62	23	45	22	10.9	27.1	40.5	21.5	CL					sandy lean CLAY
TP15-42	Grab Sample	Proposed Portal	507,059	5,179,806	1.5	2.1	0.5	0.7	n/a	84.3	34.9	21	39	18	34.3	30.8	19.5	15.4	GC					clayey gravel with SAND
SC15-205	Grab Sump	Non Contact Water Reservoir	507,971	5,178,618	1.6	2.3	0.5	0.7	n/a	99.5	37.3	24	36	12	3.6	59.1	26	11.3	SC					clayey SAND

M:\1\01\00460\03\A\Report\1 - 2015 Geotech SI Report\Appendices\C1 - Soil Laboratory Testing Results\[Summary Tables_June26.xlsx]Table 4 Soil Lab Results

NOTES:
1. NP = NON-PLASTIC
2. SAMPLE "SC15-184 - SHELBY01' SENT FOR MULTISTAGE TRIAXIAL TEST

A	22MAR'15	ISSUED WITH REPORT	JDC	GIM
REV	DATE	DESCRIPTION	PREP'D	REV'D

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	1.3	40.5	25.9	19.3	12.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.1		
#10	97.8		
#20	84.9		
#40	57.3		
#60	44.4		
#100	36.9		
#200	31.4		
0.0446 mm.	28.8		
0.0319 mm.	26.9		
0.0204 mm.	25.3		
0.0119 mm.	22.6		
0.0084 mm.	20.2		
0.0061 mm.	17.7		
0.0041 mm.	16.4		
0.0031 mm.	14.2		
0.0013 mm.	11.5		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 22 LL= 36 PI= 14

Coefficients

D_{90}= 1.0227 D_{85}= 0.8536 D_{60}= 0.4578
D_{50}= 0.3294 D_{30}= 0.0563 D_{15}= 0.0034
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(1)

Remarks

Sample No.: Grab Sump **Source of Sample:** **Date:** 3/30/15
Location: SC15-198 **Elev./Depth:** @4'

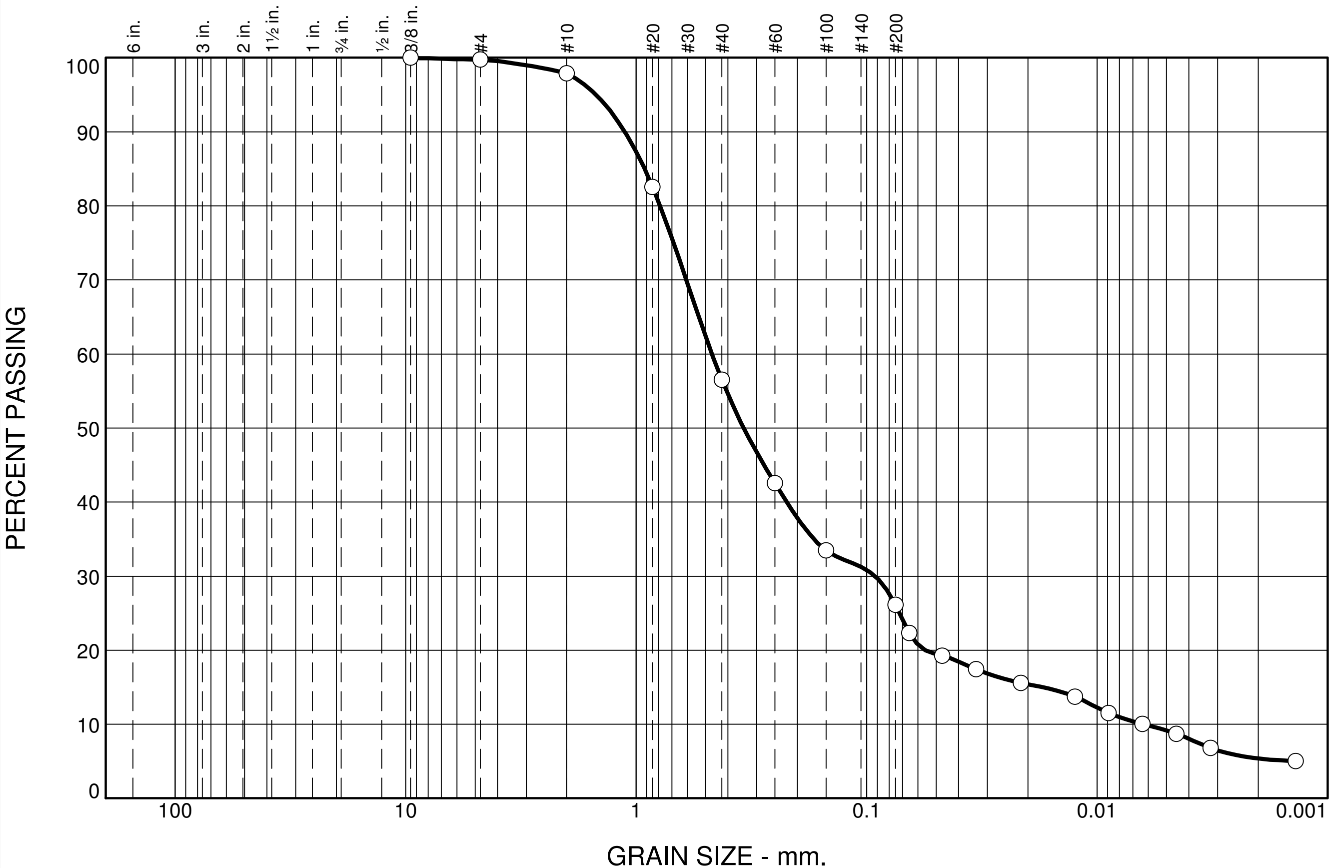
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.9	41.4	30.3	20.8	5.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.8		
#10	97.9		
#20	82.6		
#40	56.5		
#60	42.6		
#100	33.5		
#200	26.2		
0.0653 mm.	22.3		
0.0470 mm.	19.3		
0.0335 mm.	17.4		
0.0214 mm.	15.6		
0.0125 mm.	13.7		
0.0089 mm.	11.5		
0.0064 mm.	10.1		
0.0045 mm.	8.7		
0.0032 mm.	6.8		
0.0014 mm.	5.0		

* (no specification provided)

Soil Description

silty SAND

Atterberg Limits

PL= 31 LL= 33 PI= 2

Coefficients

D_{90}= 1.1204 D_{85}= 0.9201 D_{60}= 0.4691
D_{50}= 0.3415 D_{30}= 0.0921 D_{15}= 0.0172
D_{10}= 0.0063 C_u= 74.98 C_c= 2.89

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SHELBY01 **Source of Sample:** **Date:**
Location: SC15-181 **Elev./Depth:** 17.5'-18'

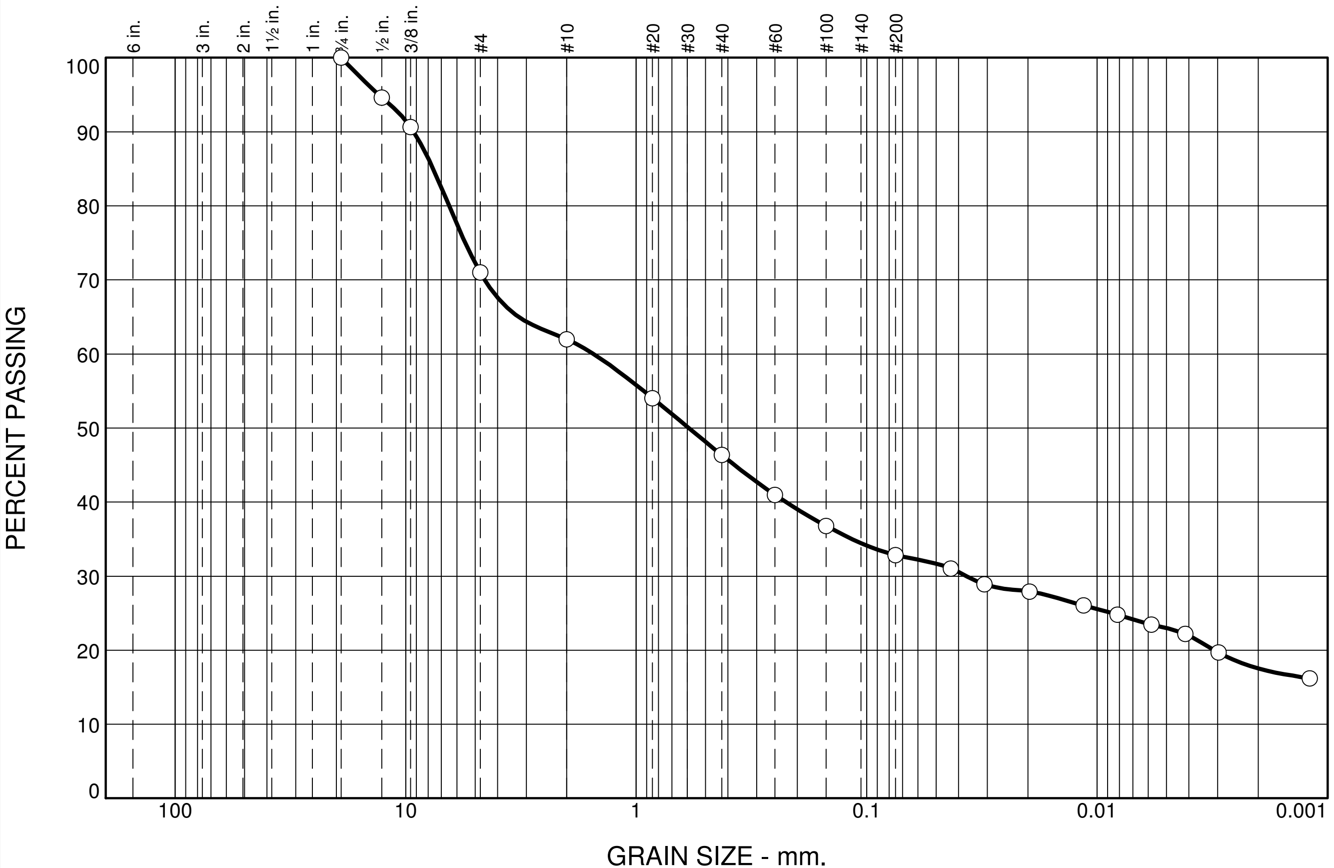
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.0	9.0	15.6	13.6	15.3	17.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	94.6		
0.375	90.6		
#4	71.0		
#10	62.0		
#20	54.0		
#40	46.4		
#60	41.0		
#100	36.8		
#200	32.8		
0.0431 mm.	31.0		
0.0309 mm.	28.9		
0.0196 mm.	27.9		
0.0115 mm.	26.0		
0.0082 mm.	24.8		
0.0058 mm.	23.5		
0.0041 mm.	22.2		
0.0030 mm.	19.7		
0.0012 mm.	16.2		

* (no specification provided)

Soil Description

clayey SAND with gravel

Atterberg Limits

PL= 23 LL= 58 PI= 35

Coefficients

D_{90}= 9.2286 D_{85}= 7.6121 D_{60}= 1.5328
D_{50}= 0.5916 D_{30}= 0.0369 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-7(4)

Remarks

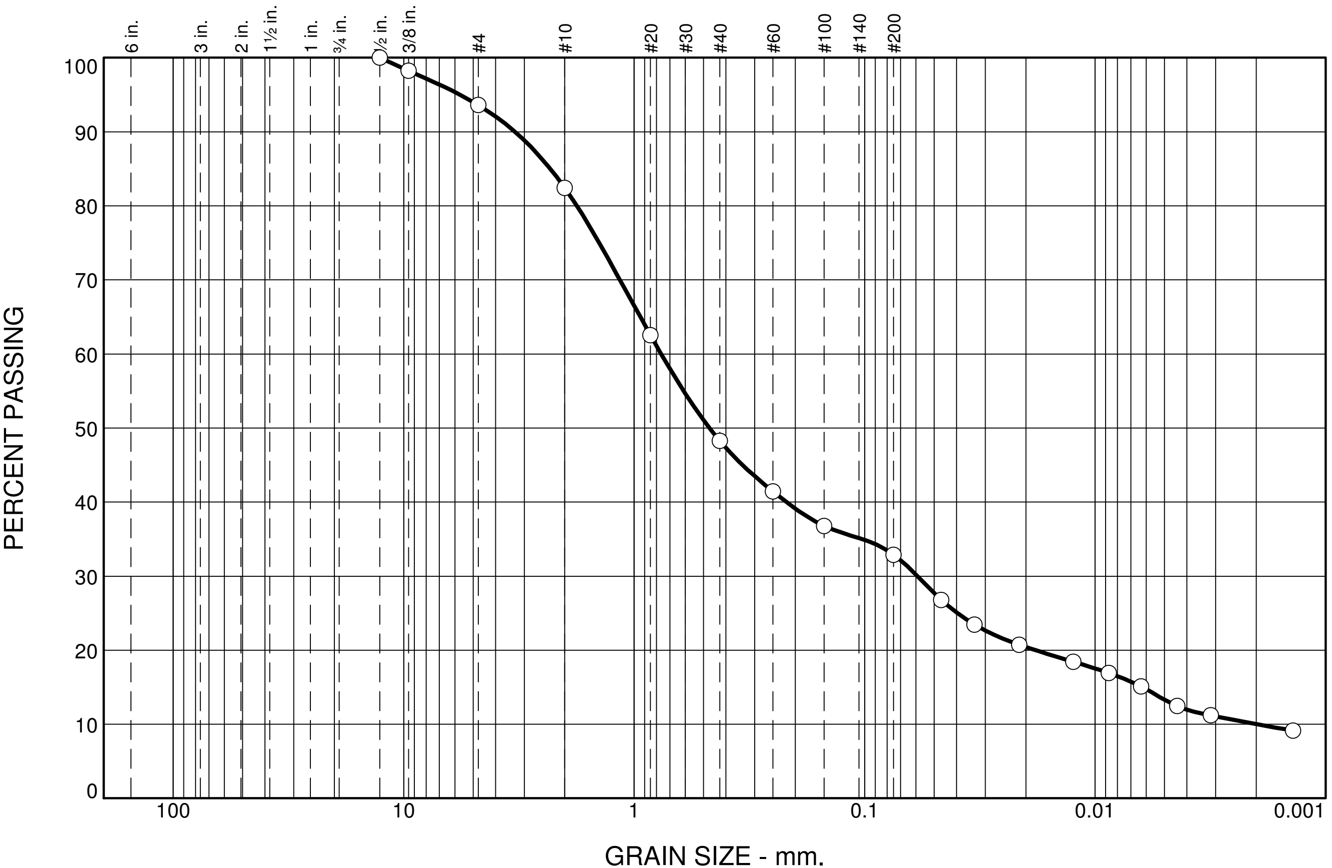
Sample No.: SPT01 **Source of Sample:** **Date:** 3/30/15
Location: SC15-196 **Elev./Depth:** 3'-5'

Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.4	11.2	34.1	15.4	22.9	10.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
0.375	98.2		
#4	93.6		
#10	82.4		
#20	62.5		
#40	48.3		
#60	41.4		
#100	36.8		
#200	32.9		
0.0465 mm.	26.8		
0.0334 mm.	23.5		
0.0214 mm.	20.7		
0.0124 mm.	18.5		
0.0087 mm.	16.9		
0.0063 mm.	15.1		
0.0044 mm.	12.5		
0.0031 mm.	11.2		
0.0014 mm.	9.1		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 19 LL= 30 PI= 11

Coefficients

D_{90}= 3.2950 D_{85}= 2.3119 D_{60}= 0.7637

D_{50}= 0.4714 D_{30}= 0.0591 D_{15}= 0.0062

D_{10}= 0.0020 C_u= 385.93 C_c= 2.31

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Sample No.: SPT01
Location: SC15-181
Source of Sample:
Date: 3/30/15
Elev./Depth: 5'-7'

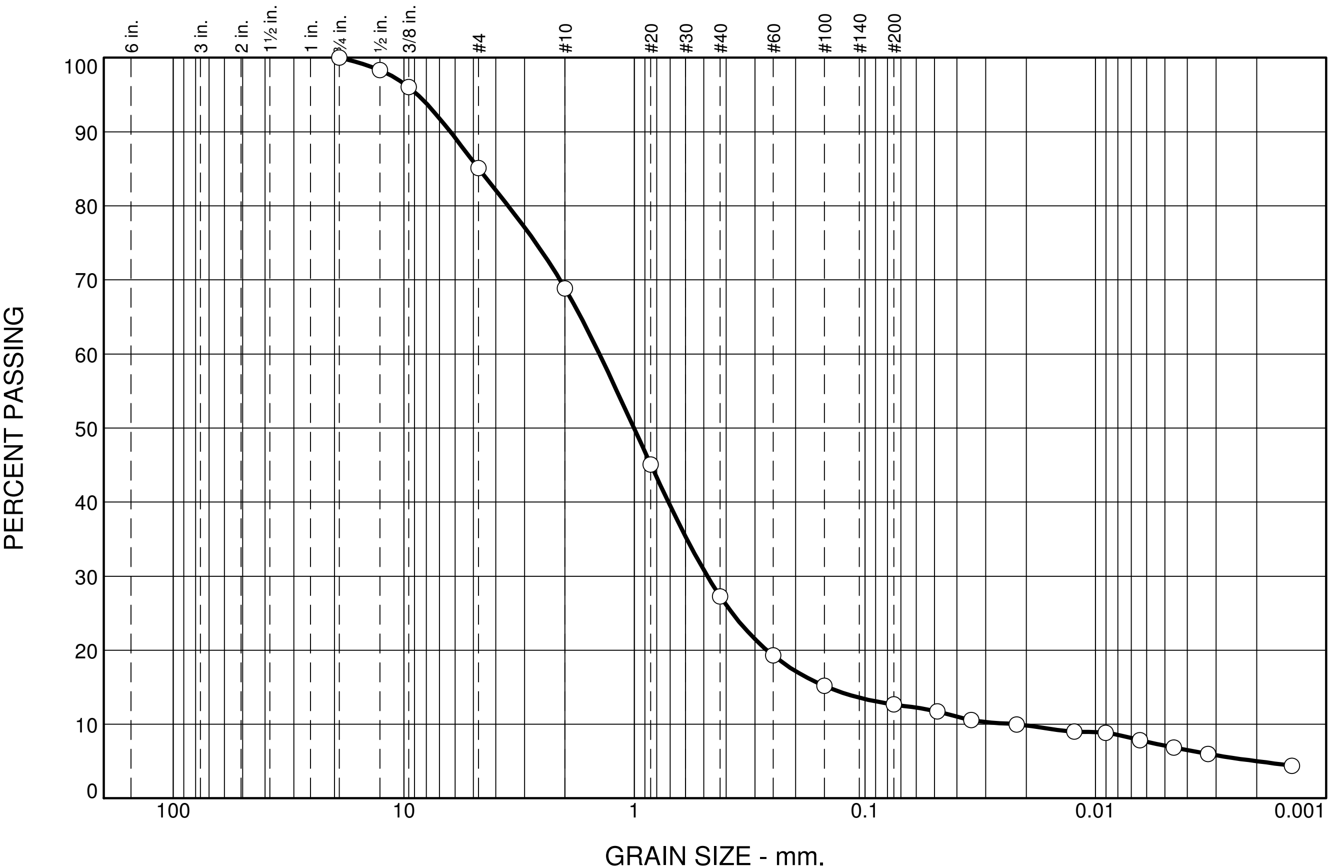
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03
Figure

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.9	16.2	41.6	14.6	7.7	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.3		
0.375	96.0		
#4	85.1		
#10	68.9		
#20	45.1		
#40	27.3		
#60	19.3		
#100	15.2		
#200	12.7		
0.0486 mm.	11.7		
0.0346 mm.	10.6		
0.0220 mm.	10.0		
0.0123 mm.	9.0		
0.0090 mm.	8.8		
0.0064 mm.	7.9		
0.0046 mm.	6.9		
0.0032 mm.	6.0		
0.0014 mm.	4.4		

* (no specification provided)

Soil Description

silty SAND

Atterberg Limits

PL= 29 LL= 30 PI= 1

Coefficients

D_{90}= 6.2846 D_{85}= 4.7245 D_{60}= 1.4200

D_{50}= 1.0054 D_{30}= 0.4826 D_{15}= 0.1451

D_{10}= 0.0222 C_u= 63.89 C_c= 7.38

Classification

USCS= SM AASHTO= A-1-b

Remarks

Sample No.: SPT01 **Source of Sample:** **Date:** 3/30/15

Location: SC15-184 **Elev./Depth:** 5'-7'

Knight Piésold CONSULTING

Client:

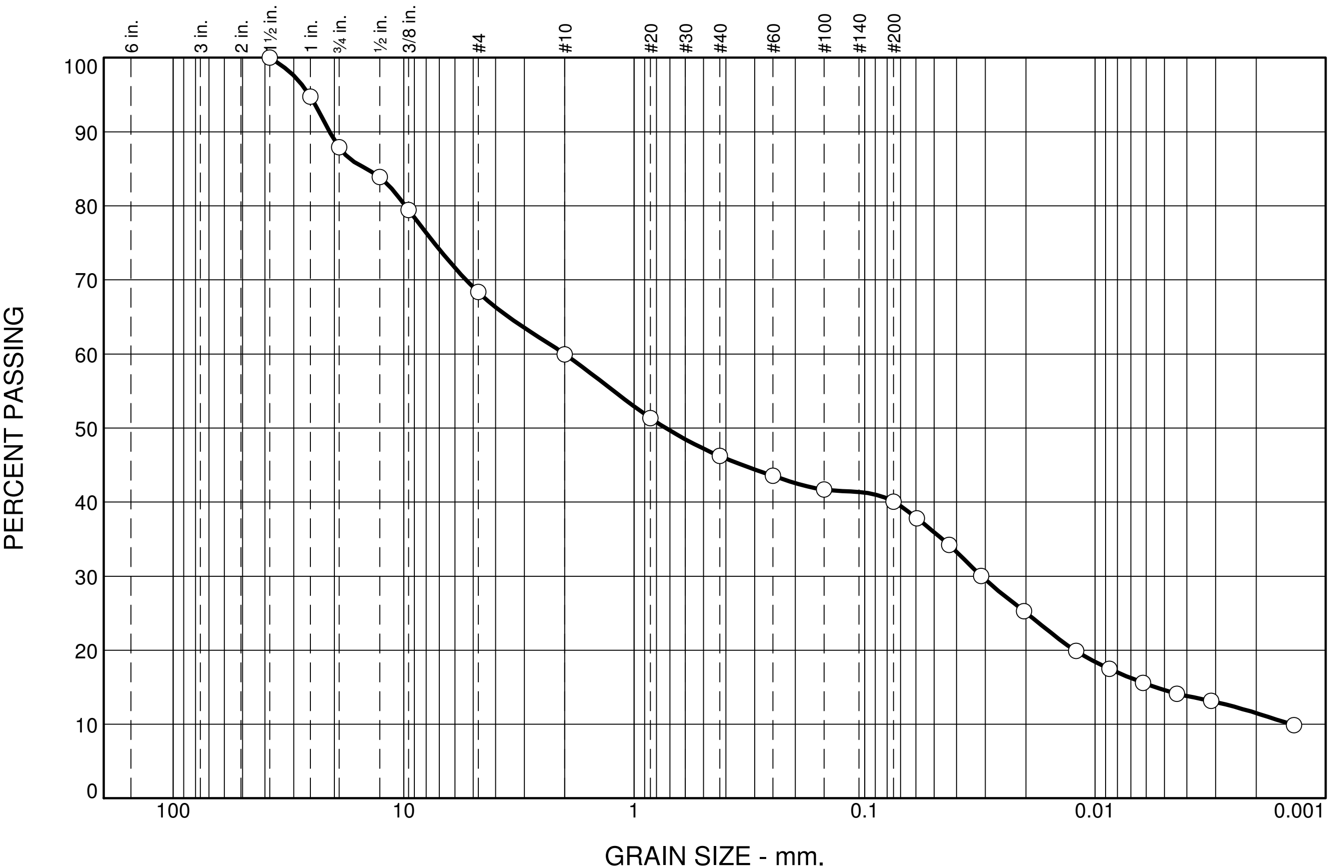
Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.1	19.5	8.4	13.8	6.1	28.6	11.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	94.8		
.75	87.9		
.5	83.9		
0.375	79.4		
#4	68.4		
#10	60.0		
#20	51.4		
#40	46.2		
#60	43.5		
#100	41.7		
#200	40.1		
0.0594 mm.	37.8		
0.0430 mm.	34.2		
0.0312 mm.	30.0		
0.0203 mm.	25.3		
0.0121 mm.	19.9		
0.0087 mm.	17.5		
0.0062 mm.	15.6		
0.0044 mm.	14.1		
0.0031 mm.	13.1		
0.0014 mm.	9.9		

* (no specification provided)

Soil Description

clayey GRAVEL with sand

Atterberg Limits

PL= 18 LL= 31 PI= 13

Coefficients

D_{90}= 20.9536 D_{85}= 14.5035 D_{60}= 2.0079
D_{50}= 0.7285 D_{30}= 0.0311 D_{15}= 0.0055
D_{10}= 0.0014 C_u= 1420.19 C_c= 0.34

Classification

USCS= GC AASHTO= A-6(2)

Remarks

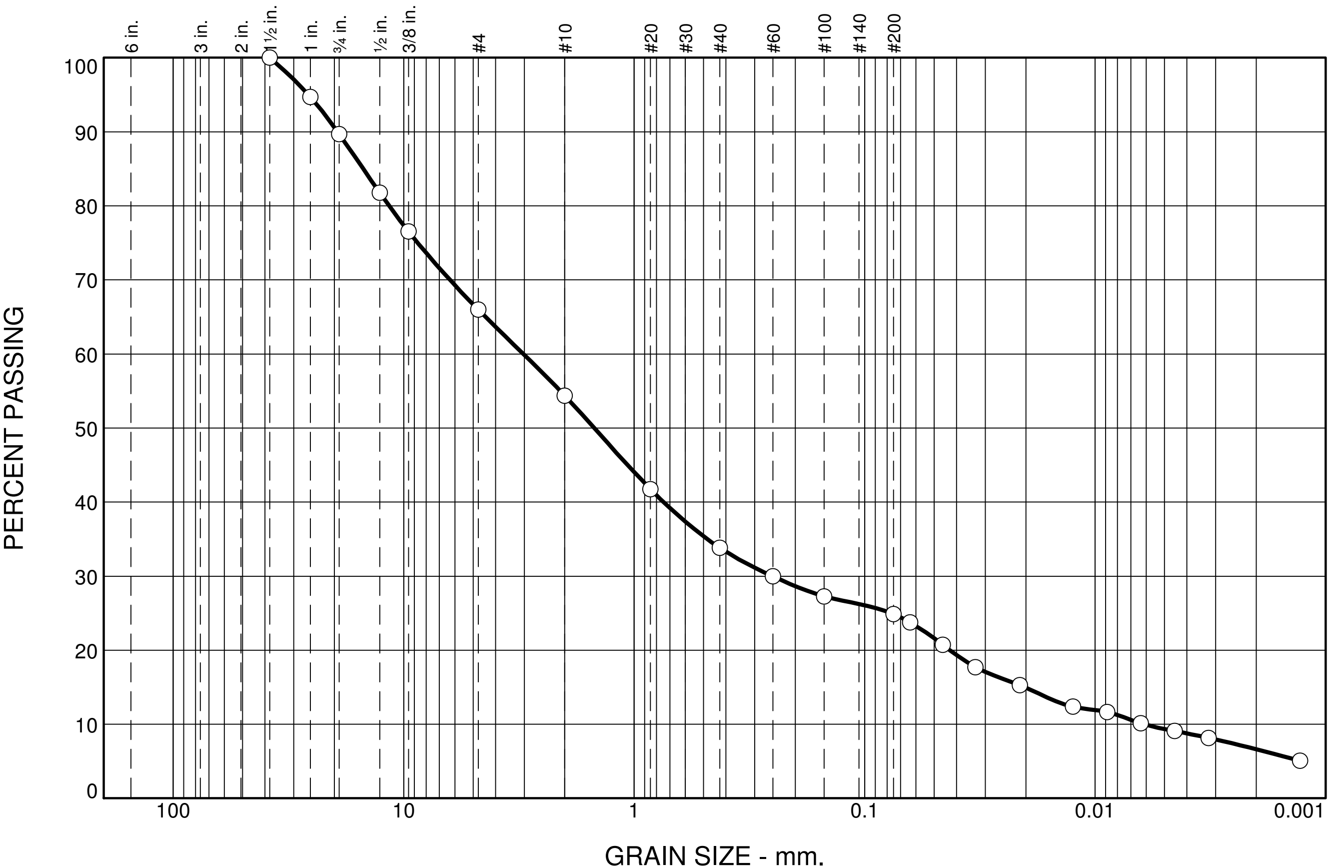
Sample No.: SPT01
Location: SC15-192
Source of Sample:
Date: 3/30/15
Elev./Depth: 5'-7'

Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.3	23.7	11.6	20.6	8.9	18.3	6.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	94.7		
.75	89.7		
.5	81.8		
0.375	76.5		
#4	66.0		
#10	54.4		
#20	41.8		
#40	33.8		
#60	30.0		
#100	27.3		
#200	24.9		
0.0634 mm.	23.7		
0.0458 mm.	20.7		
0.0331 mm.	17.7		
0.0212 mm.	15.3		
0.0125 mm.	12.4		
0.0089 mm.	11.6		
0.0063 mm.	10.1		
0.0045 mm.	9.1		
0.0032 mm.	8.2		
0.0013 mm.	5.1		

* (no specification provided)

Soil Description

clayey SAND with gravel

Atterberg Limits

PL= 18 LL= 28 PI= 10

Coefficients

D_{90}= 19.3705 D_{85}= 14.9916 D_{60}= 3.0243
D_{50}= 1.4899 D_{30}= 0.2510 D_{15}= 0.0202
D_{10}= 0.0061 C_u= 492.69 C_c= 3.39

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

Sample No.: SPT01 **Source of Sample:** **Date:** 3/30/15
Location: SC15-193 **Elev./Depth:** 5'-7'

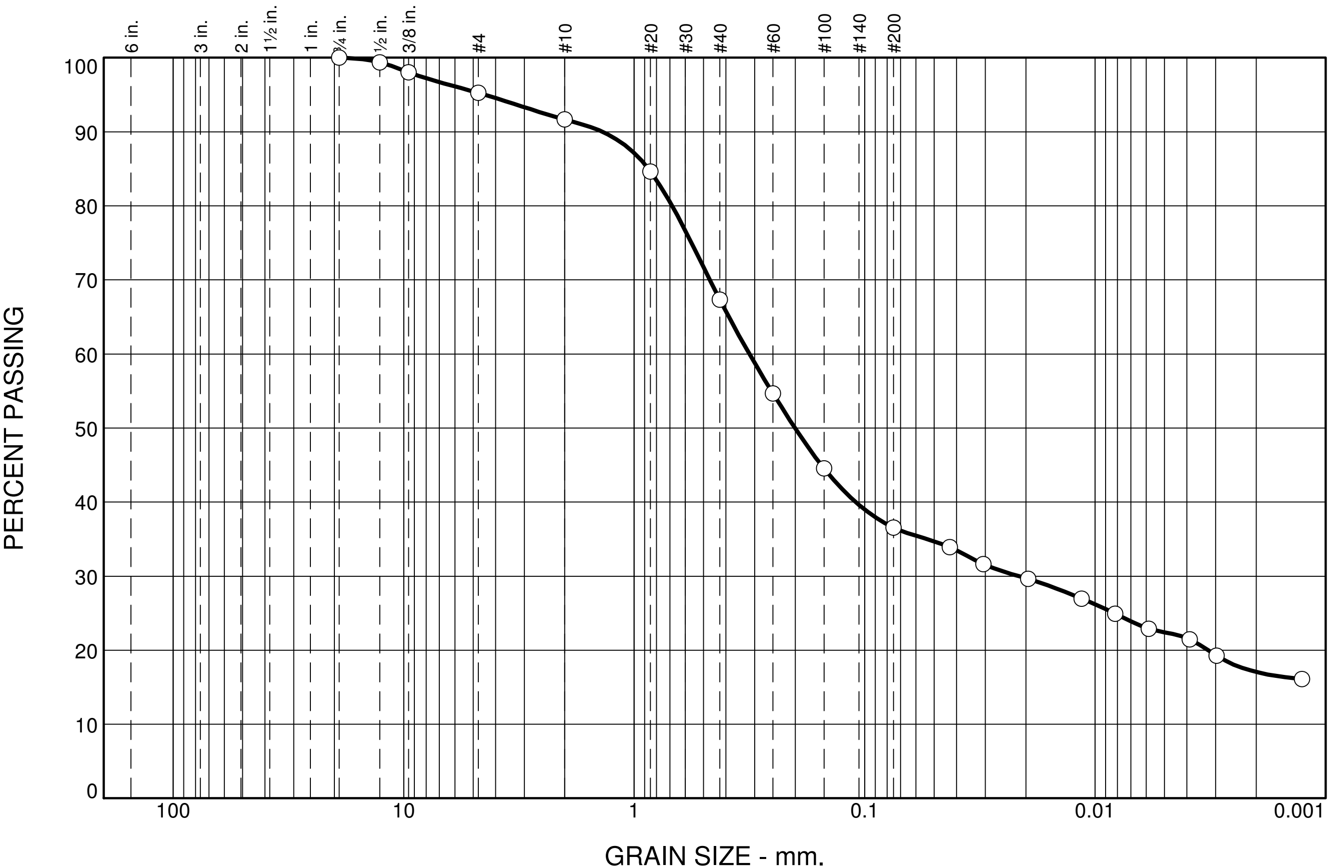
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.7	3.6	24.4	30.7	19.5	17.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	99.4		
0.375	98.0		
#4	95.3		
#10	91.7		
#20	84.6		
#40	67.3		
#60	54.7		
#100	44.5		
#200	36.6		
0.0427 mm.	33.9		
0.0306 mm.	31.6		
0.0195 mm.	29.6		
0.0114 mm.	27.0		
0.0082 mm.	24.9		
0.0058 mm.	22.9		
0.0039 mm.	21.4		
0.0030 mm.	19.2		
0.0013 mm.	16.1		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 23 LL= 47 PI= 24

Coefficients

D_{90}= 1.3722	D_{85}= 0.8680	D_{60}= 0.3163
D_{50}= 0.2007	D_{30}= 0.0214	D_{15}=
D_{10}=	C_u=	C_c=

Classification

USCS= SC AASHTO= A-7-6(4)

Remarks

Sample No.: SPT02 **Source of Sample:** **Date:** 3/30/15
Location: SC15-196 **Elev./Depth:** 8'-10'

Knight Piésold CONSULTING

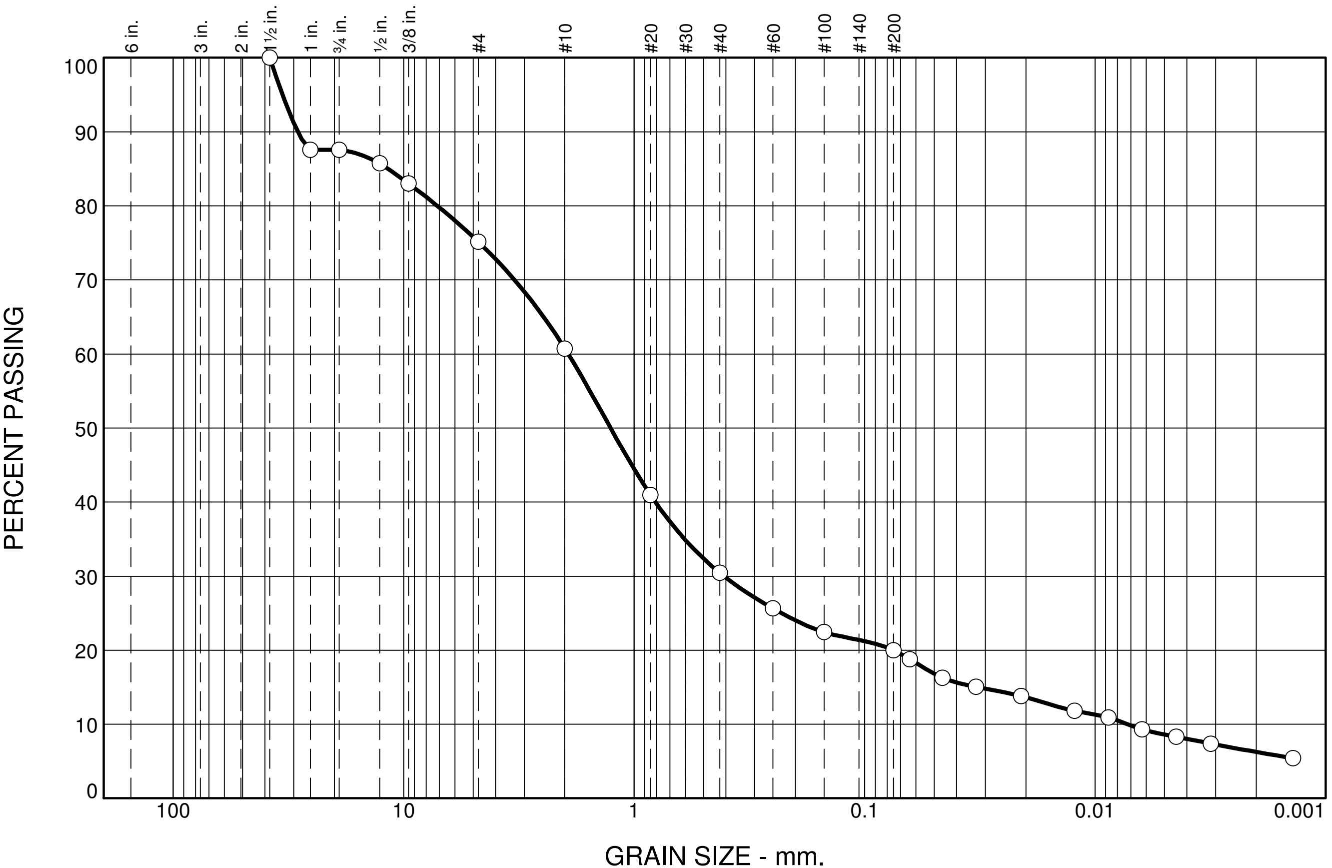
Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Particle Size Distribution Report

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.4	12.5	14.4	30.3	10.4	13.7	6.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	87.6		
.75	87.6		
.5	85.7		
0.375	83.0		
#4	75.1		
#10	60.7		
#20	41.0		
#40	30.4		
#60	25.7		
#100	22.4		
#200	20.0		
0.0636 mm.	18.8		
0.0460 mm.	16.3		
0.0328 mm.	15.0		
0.0210 mm.	13.8		
0.0123 mm.	11.8		
0.0088 mm.	10.9		
0.0063 mm.	9.3		
0.0044 mm.	8.3		
0.0031 mm.	7.4		
0.0014 mm.	5.4		

* (no specification provided)

Soil Description

clayey SAND with gravel

Atterberg Limits

PL= 24 LL= 33 PI= 9

Coefficients

D_{90}= 28.8034 D_{85}= 11.6925 D_{60}= 1.9330
D_{50}= 1.2657 D_{30}= 0.4078 D_{15}= 0.0322
D_{10}= 0.0072 C_u= 267.72 C_c= 11.91

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

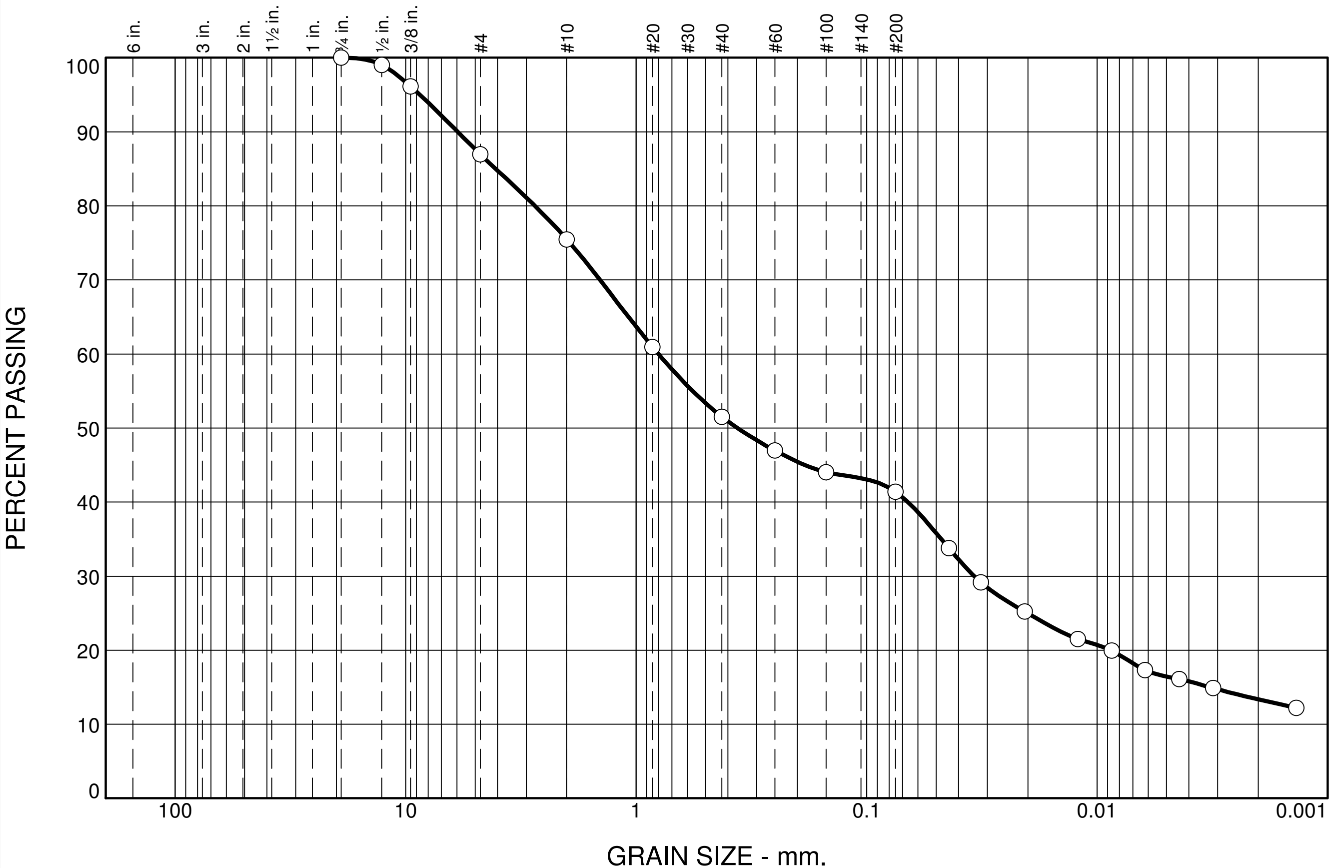
Sample No.: SPT02 **Source of Sample:** **Date:** 3/30/15
Location: SC15-181 **Elev./Depth:** 10'-12'

Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.0	11.5	24.0	10.1	28.0	13.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	99.0		
0.375	96.1		
#4	87.0		
#10	75.5		
#20	61.0		
#40	51.5		
#60	47.0		
#100	44.1		
#200	41.4		
0.0440 mm.	33.8		
0.0319 mm.	29.2		
0.0206 mm.	25.2		
0.0121 mm.	21.5		
0.0086 mm.	19.9		
0.0062 mm.	17.3		
0.0044 mm.	16.1		
0.0031 mm.	14.9		
0.0014 mm.	12.2		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 19 LL= 34 PI= 15

Coefficients

D_{90}= 5.9544 D_{85}= 4.0694 D_{60}= 0.8008
D_{50}= 0.3638 D_{30}= 0.0341 D_{15}= 0.0032
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(2)

Remarks

Sample No.: SPT02 **Source of Sample:** **Date:** 3/30/15
Location: SC15-184 **Elev./Depth:** 10'-12'

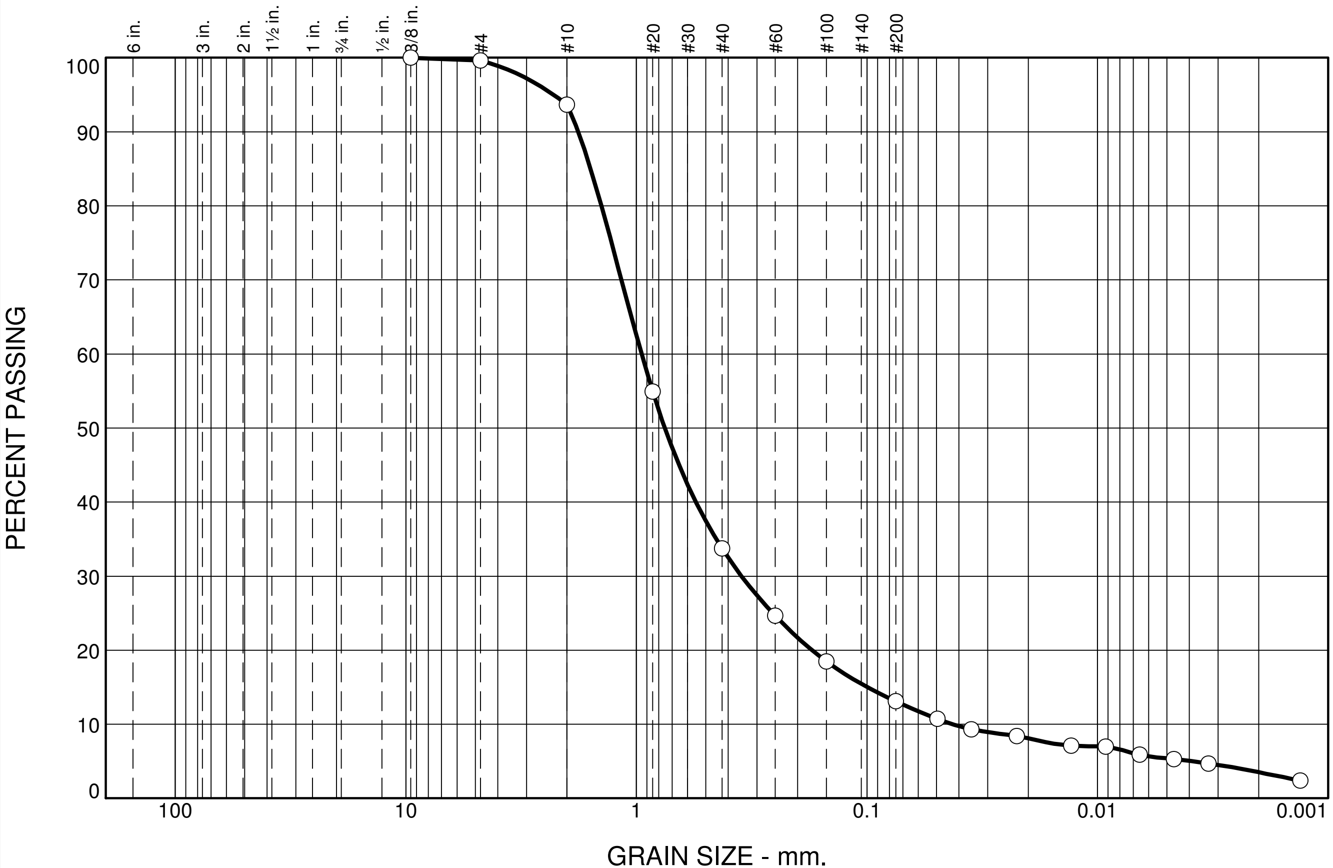
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	5.9	59.9	20.7	9.6	3.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	99.6		
#10	93.7		
#20	54.9		
#40	33.8		
#60	24.7		
#100	18.5		
#200	13.1		
0.0495 mm.	10.7		
0.0353 mm.	9.3		
0.0224 mm.	8.4		
0.0130 mm.	7.1		
0.0092 mm.	7.0		
0.0066 mm.	5.9		
0.0047 mm.	5.3		
0.0033 mm.	4.7		
0.0013 mm.	2.4		

* (no specification provided)

Soil Description

silty SAND

Atterberg Limits

PL= NP	LL= NP	PI= NP

Coefficients

D_{90}= 1.7894	D_{85}= 1.5818	D_{60}= 0.9497
D_{50}= 0.7531	D_{30}= 0.3500	D_{15}= 0.0994
D_{10}= 0.0424	C_u= 22.37	C_c= 3.04

Classification

USCS= SM

AASHTO= A-1-b

Remarks

Sample No.: SPT02

Location: SC15-192

Source of Sample:

Date: 3/30/15

Elev./Depth: 10'-12'

Knight Piésold
CONSULTING

Client:

Project: Black Butte Copper Project

Project No: VA101-00460/03

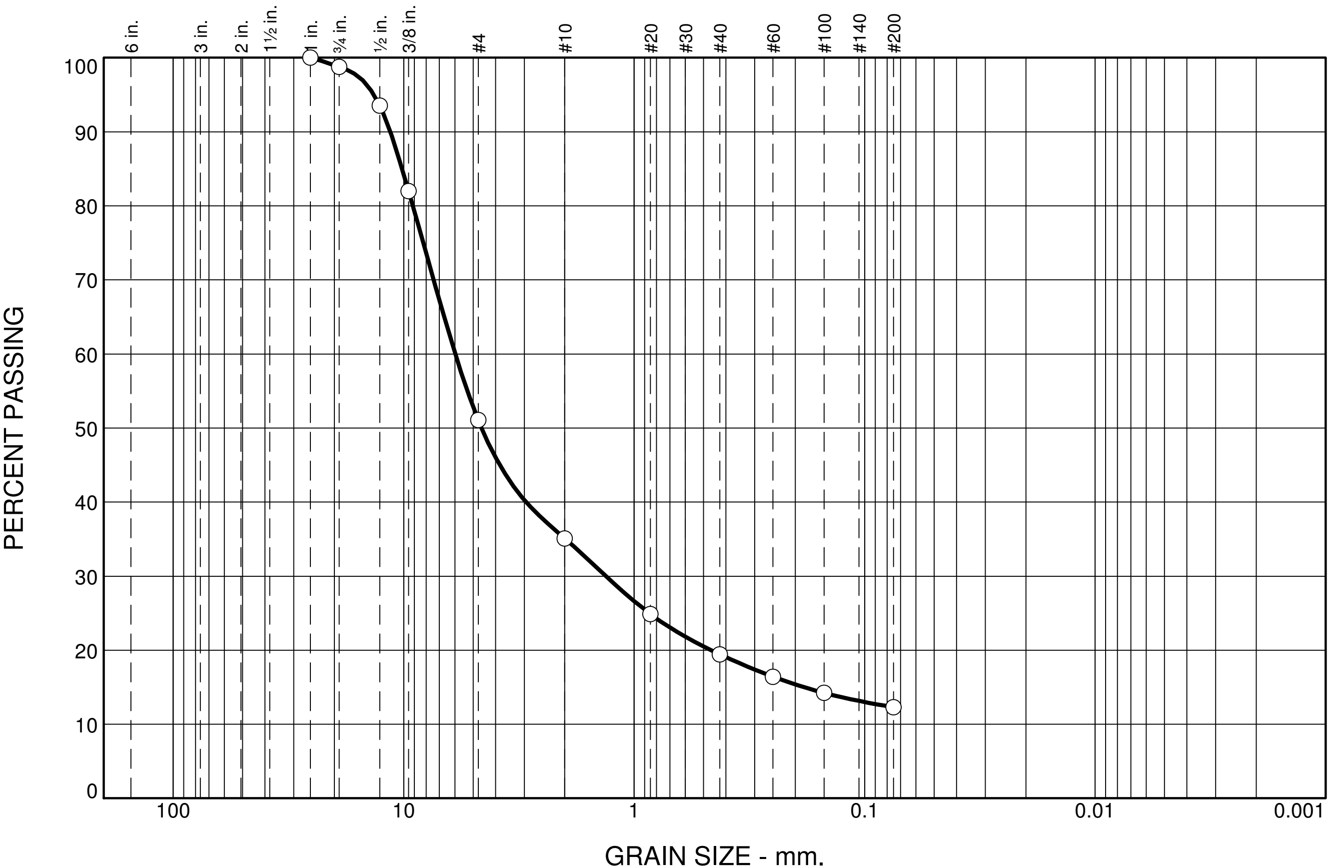
Figure

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT

Checked By: JDB

Particle Size Distribution Report



The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.2	47.7	16.0	15.7	7.1	12.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	98.8		
.5	93.5		
0.375	82.0		
#4	51.1		
#10	35.1		
#20	24.9		
#40	19.4		
#60	16.4		
#100	14.2		
#200	12.3		

* (no specification provided)

Soil Description

clayey GRAVEL with sand

Atterberg Limits

PL= 24 LL= 38 PI= 14

Coefficients

D_{90}= 11.4408 D_{85}= 10.1627 D_{60}= 5.9702

D_{50}= 4.5957 D_{30}= 1.3258 D_{15}= 0.1835

D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

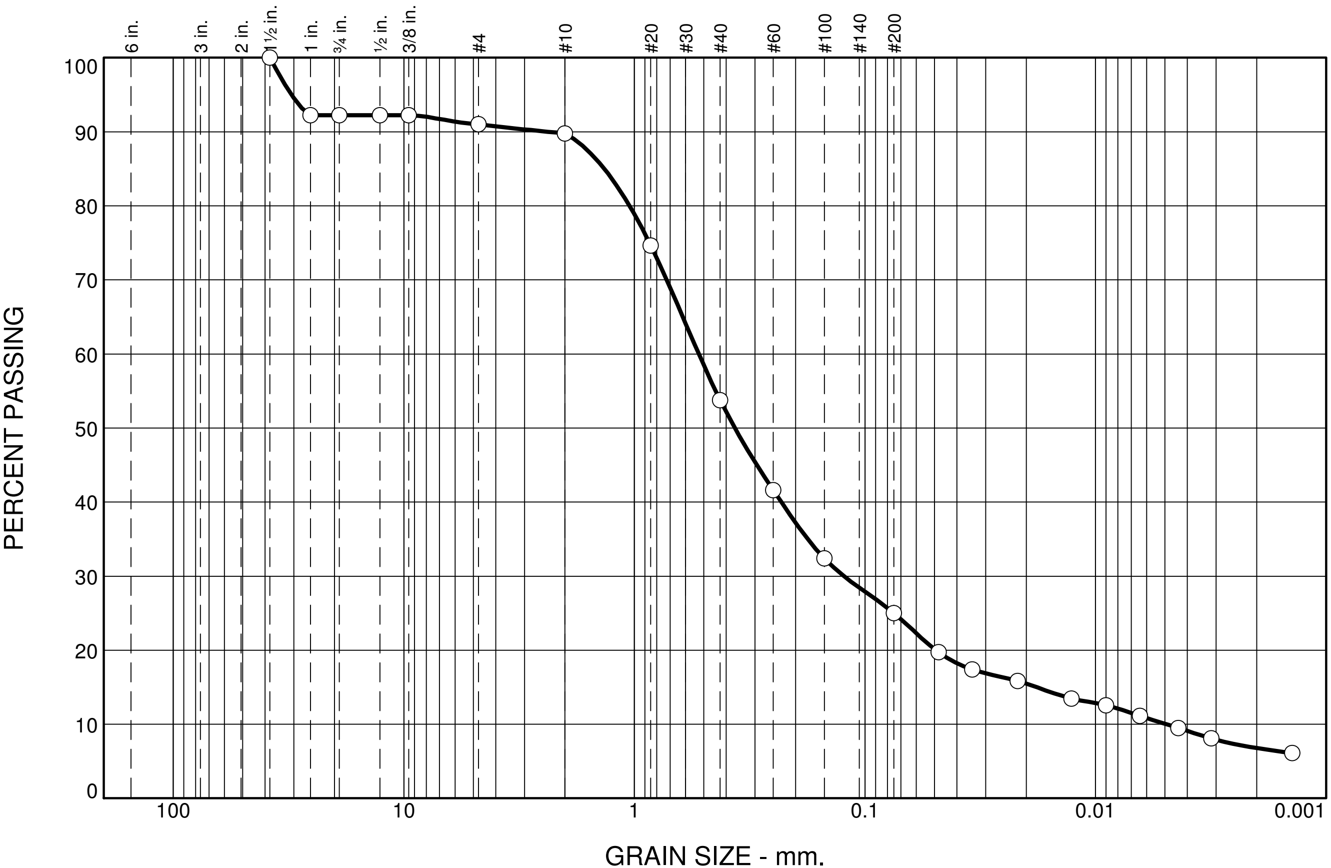
Sample No.: SPT02
Location: SC15-193
Source of Sample:
Date: 3/30/15
Elev./Depth: 10'-12'

Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03
Figure

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.7	1.3	1.2	36.0	28.8	18.2	6.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	92.3		
.75	92.3		
.5	92.3		
0.375	92.3		
#4	91.0		
#10	89.8		
#20	74.7		
#40	53.8		
#60	41.6		
#100	32.4		
#200	25.0		
0.0480 mm.	19.7		
0.0343 mm.	17.4		
0.0218 mm.	15.8		
0.0127 mm.	13.5		
0.0090 mm.	12.6		
0.0064 mm.	11.1		
0.0044 mm.	9.5		
0.0032 mm.	8.1		
0.0014 mm.	6.1		

* (no specification provided)

Soil Description

silty SAND

Atterberg Limits

PL= 28 LL= 33 PI= 5

Coefficients

D_{90}= 2.3629 D_{85}= 1.3500 D_{60}= 0.5256
D_{50}= 0.3669 D_{30}= 0.1235 D_{15}= 0.0180
D_{10}= 0.0049 C_u= 106.45 C_c= 5.88

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SPT03
Location: SC15-181
Source of Sample:
Date: 3/30/15
Elev./Depth: 15'-17'

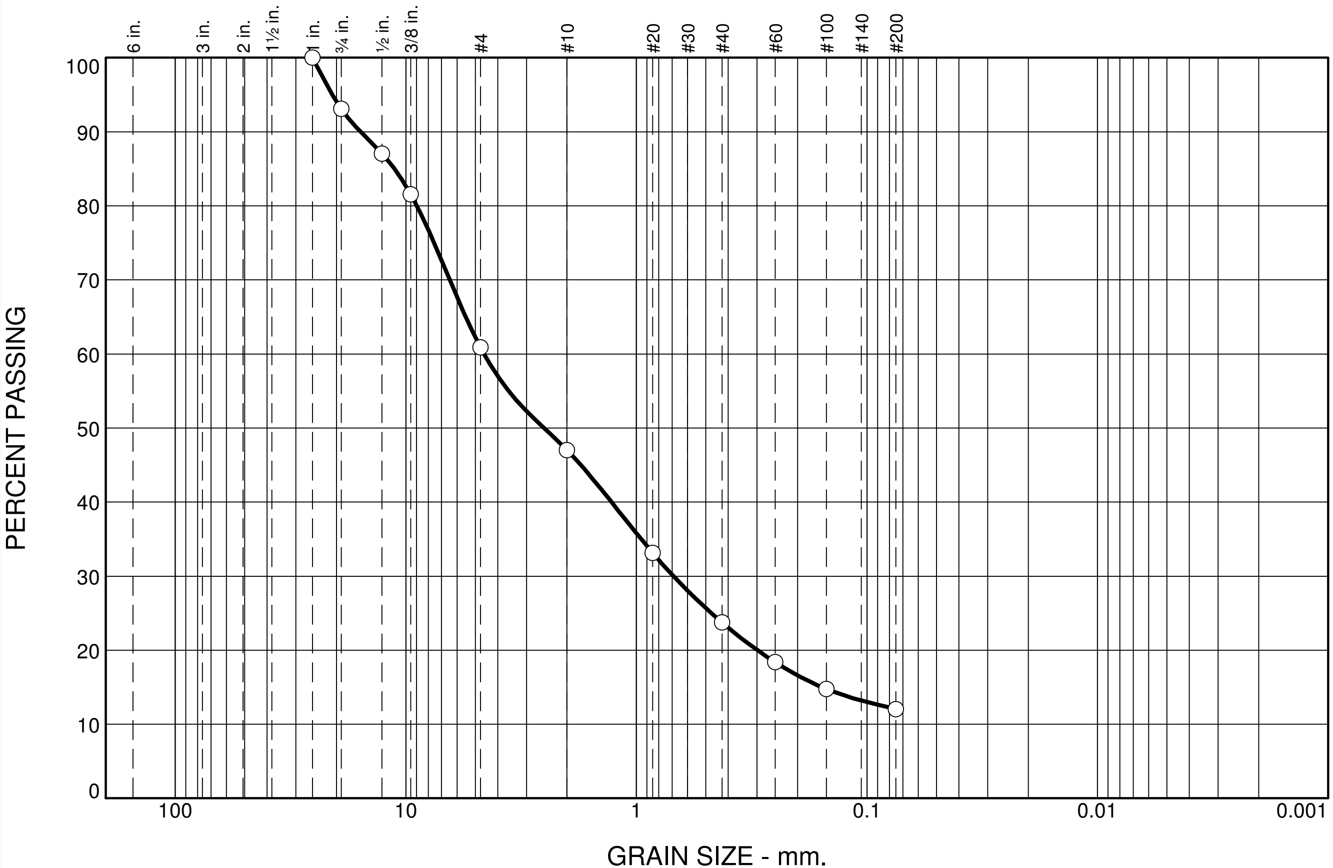
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.9	32.2	13.9	23.3	11.6	12.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	93.1		
.5	87.1		
0.375	81.6		
#4	60.9		
#10	47.0		
#20	33.1		
#40	23.7		
#60	18.4		
#100	14.8		
#200	12.1		

* (no specification provided)

Soil Description

silty SAND with gravel

Atterberg Limits

PL= 24 LL= 32 PI= 8

Coefficients

D_{90}= 15.7289 D_{85}= 11.2092 D_{60}= 4.5819
D_{50}= 2.5180 D_{30}= 0.6908 D_{15}= 0.1563
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SPT03
Location: SC15-192
Source of Sample:
Date: 3/30/15
Elev./Depth: 15'-17'

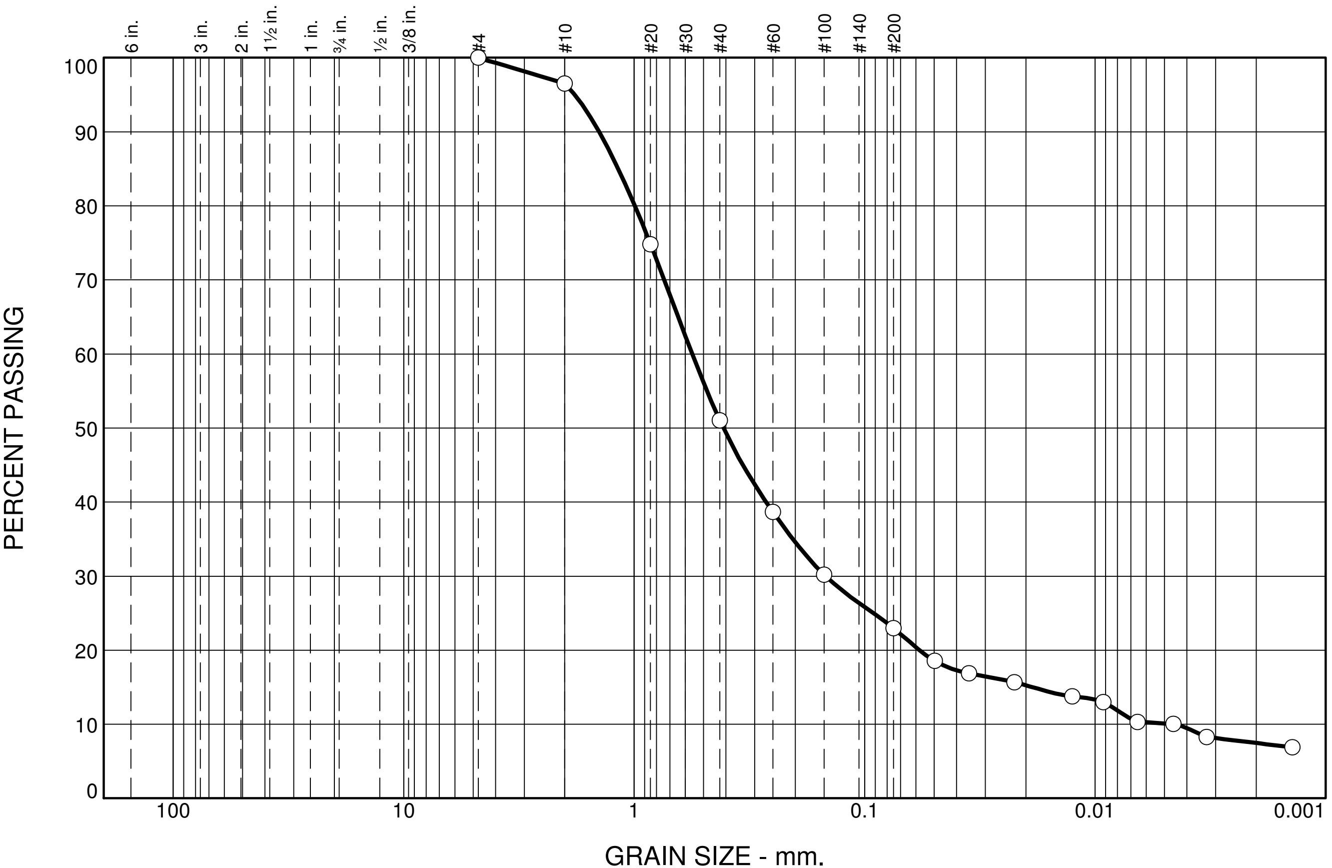
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.5	45.4	28.1	15.5	7.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.5		
#20	74.8		
#40	51.1		
#60	38.7		
#100	30.2		
#200	23.0		
0.0497 mm.	18.6		
0.0353 mm.	16.9		
0.0224 mm.	15.7		
0.0126 mm.	13.7		
0.0092 mm.	13.0		
0.0066 mm.	10.3		
0.0046 mm.	10.0		
0.0033 mm.	8.3		
0.0014 mm.	6.9		

* (no specification provided)

Soil Description

silty SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 1.4194 D_{85}= 1.1733 D_{60}= 0.5599
D_{50}= 0.4096 D_{30}= 0.1476 D_{15}= 0.0186
D_{10}= 0.0045 C_u= 123.98 C_c= 8.62

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: SPT04
Location: SC15-181
Source of Sample:
Date: 3/30/15
Elev./Depth: 20'-20.25'

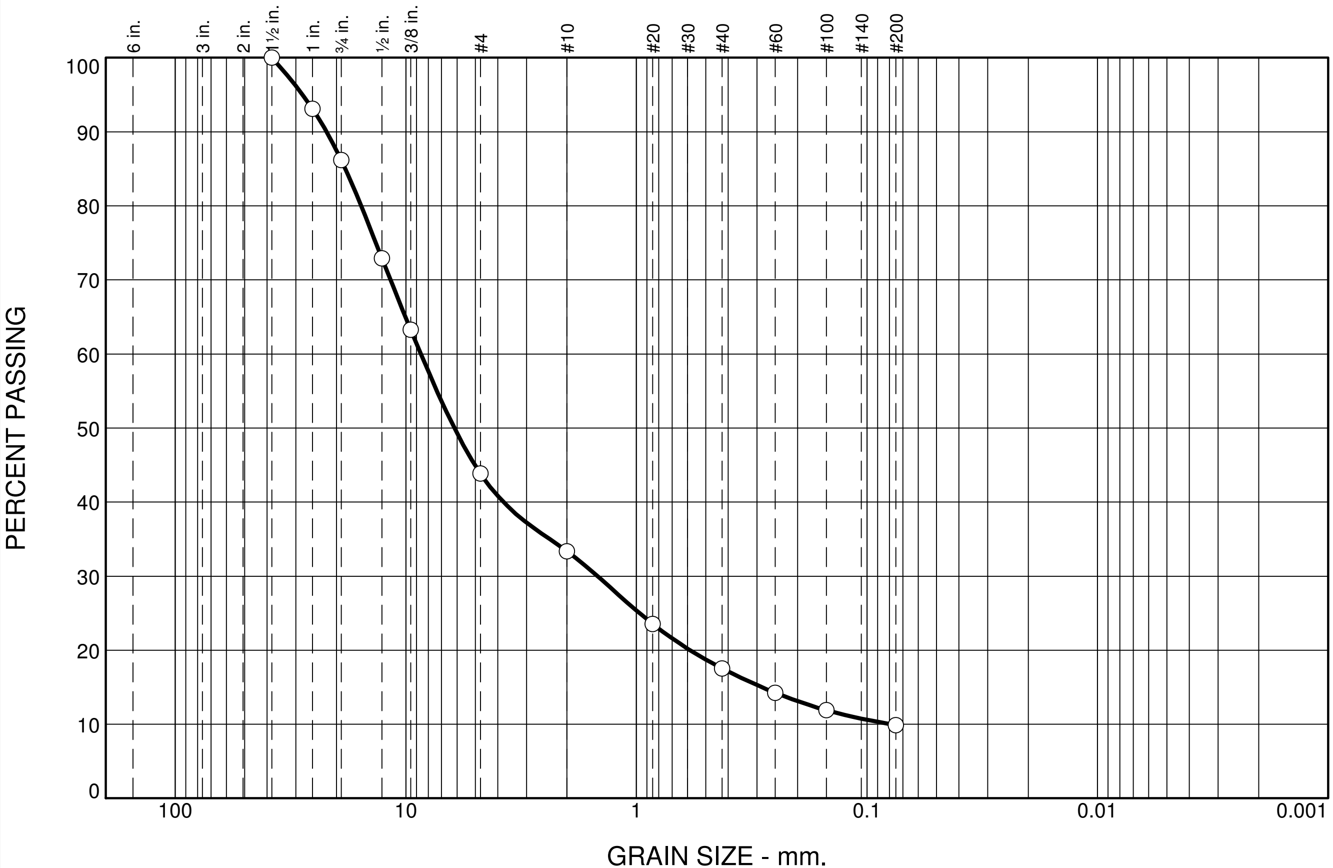
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.8	42.3	10.5	15.9	7.6	9.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	93.1		
.75	86.2		
.5	72.9		
0.375	63.3		
#4	43.9		
#10	33.4		
#20	23.5		
#40	17.5		
#60	14.3		
#100	11.9		
#200	9.9		

* (no specification provided)

Soil Description

poorly graded GRAVEL with siltyclay and sand

Atterberg Limits

PL= 21 LL= 27 PI= 6

Coefficients

D_{90}= 22.0514 D_{85}= 18.2964 D_{60}= 8.6092
D_{50}= 6.1588 D_{30}= 1.4755 D_{15}= 0.2854
D_{10}= 0.0786 C_u= 109.54 C_c= 3.22

Classification

USCS= GP-GC AASHTO= A-1-a

Remarks

Sample No.: Weathered Rock **Source of Sample:** **Date:** 3/30/15
Location: SC15-191 **Elev./Depth:** 13.3'-14'

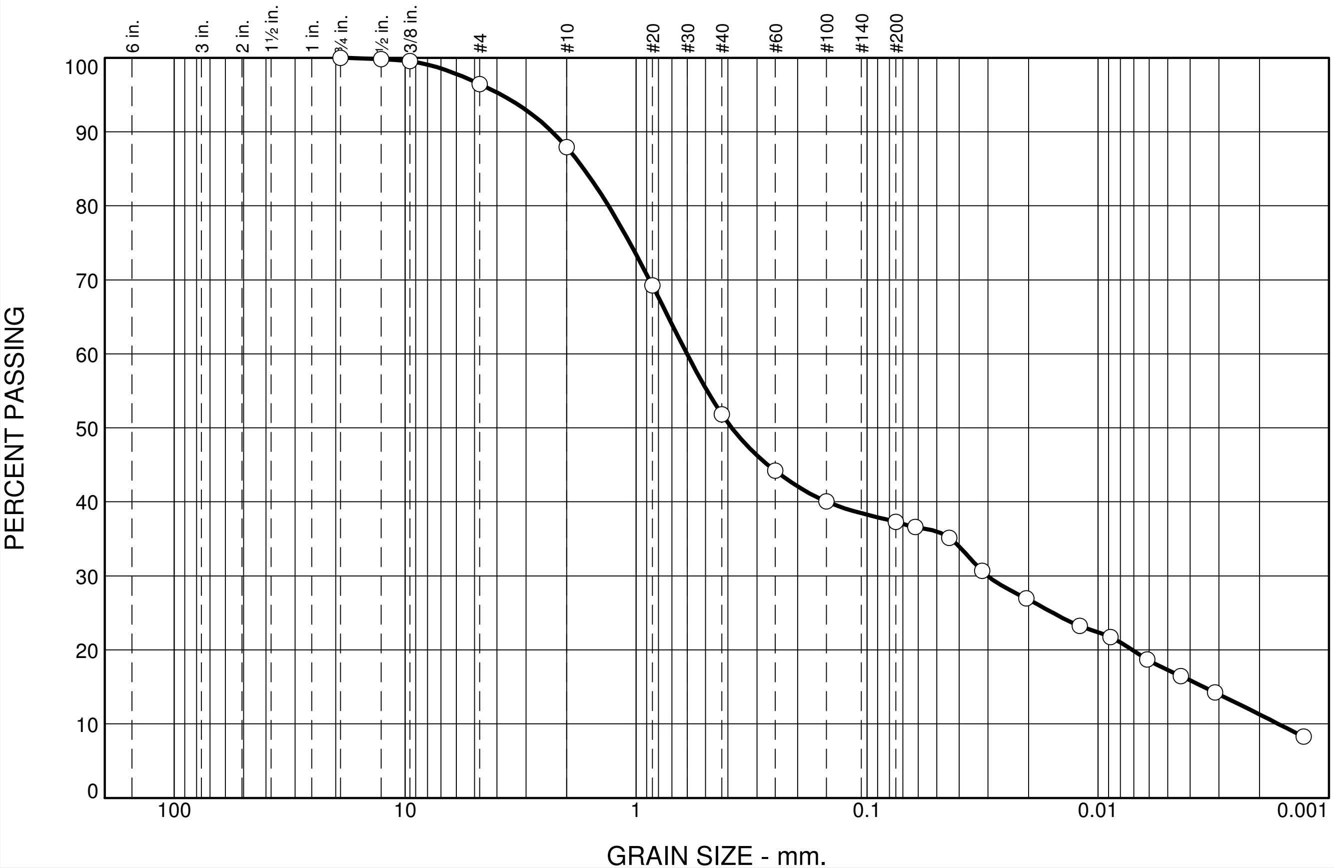
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.6	8.5	36.1	14.5	26.0	11.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	99.8		
0.375	99.5		
#4	96.4		
#10	87.9		
#20	69.2		
#40	51.8		
#60	44.2		
#100	40.0		
#200	37.3		
0.0618 mm.	36.6		
0.0440 mm.	35.1		
0.0318 mm.	30.7		
0.0204 mm.	27.0		
0.0120 mm.	23.3		
0.0088 mm.	21.7		
0.0061 mm.	18.7		
0.0044 mm.	16.5		
0.0031 mm.	14.3		
0.0013 mm.	8.3		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 24
LL= 36
PI= 12

Coefficients

D_{90}= 2.3110
D_{85}= 1.6852
D_{60}= 0.6022
D_{50}= 0.3851
D_{30}= 0.0300
D_{15}= 0.0035
D_{10}= 0.0017
C_u= 363.53
C_c= 0.91

Classification

USCS= SC
AASHTO= A-6(1)

Remarks

Location: DH15-24
Sample Number: Sump Sample
Depth: 0.5-0.7m
Date: 6/12/15

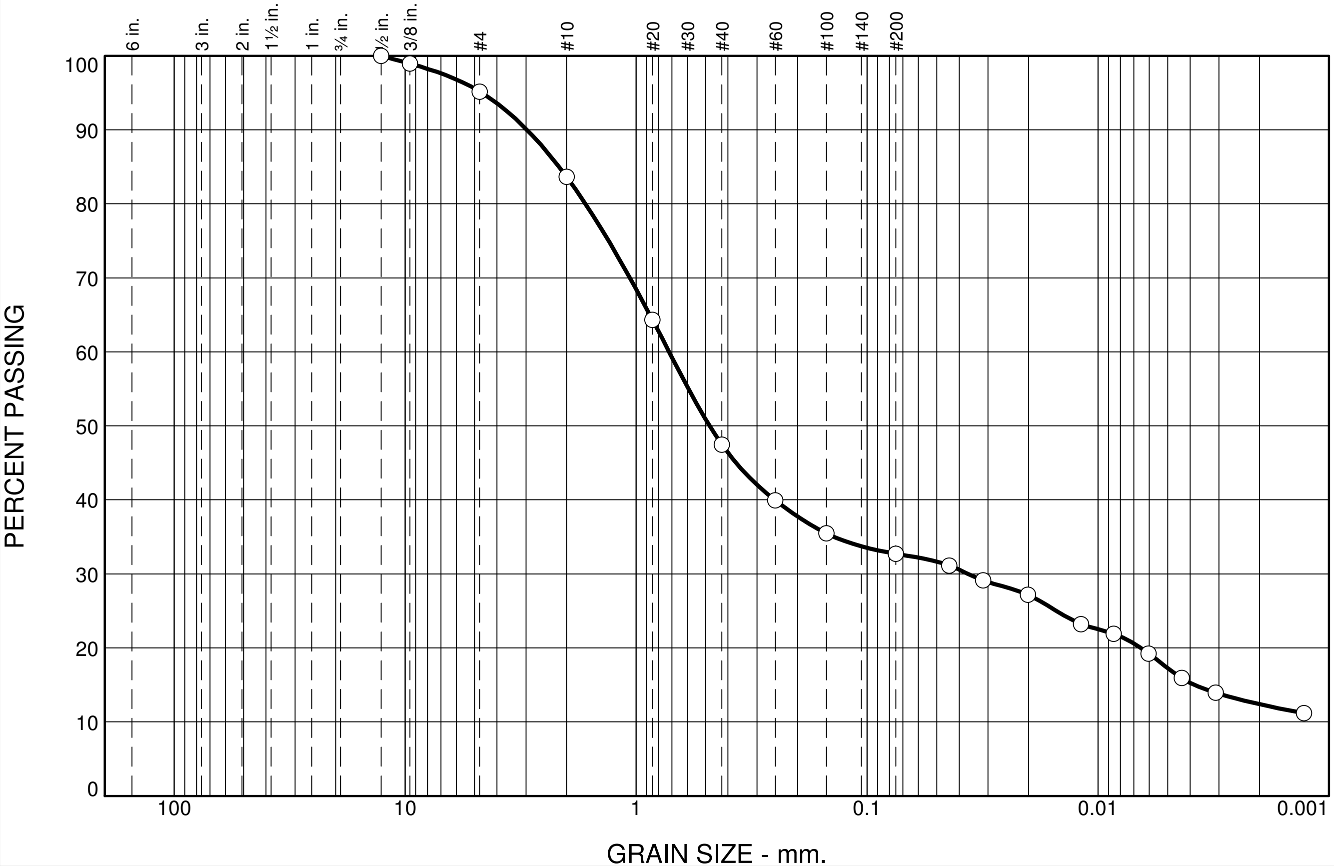
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03
Figure

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: JHK
Checked By: JDB

Particle Size Distribution Report



The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.8	11.6	36.1	14.8	20.3	12.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
0.375	98.9		
#4	95.2		
#10	83.6		
#20	64.3		
#40	47.5		
#60	40.0		
#100	35.5		
#200	32.7		
0.0440 mm.	31.1		
0.0315 mm.	29.1		
0.0201 mm.	27.2		
0.0118 mm.	23.2		
0.0086 mm.	21.9		
0.0060 mm.	19.2		
0.0043 mm.	15.9		
0.0031 mm.	14.0		
0.0013 mm.	11.2		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 22 LL= 33 PI= 11

Coefficients

D_{90}= 2.9726 D_{85}= 2.1580 D_{60}= 0.7204
D_{50}= 0.4805 D_{30}= 0.0365 D_{15}= 0.0038
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Location: TP15-2
Depth: 0.3-0.5m

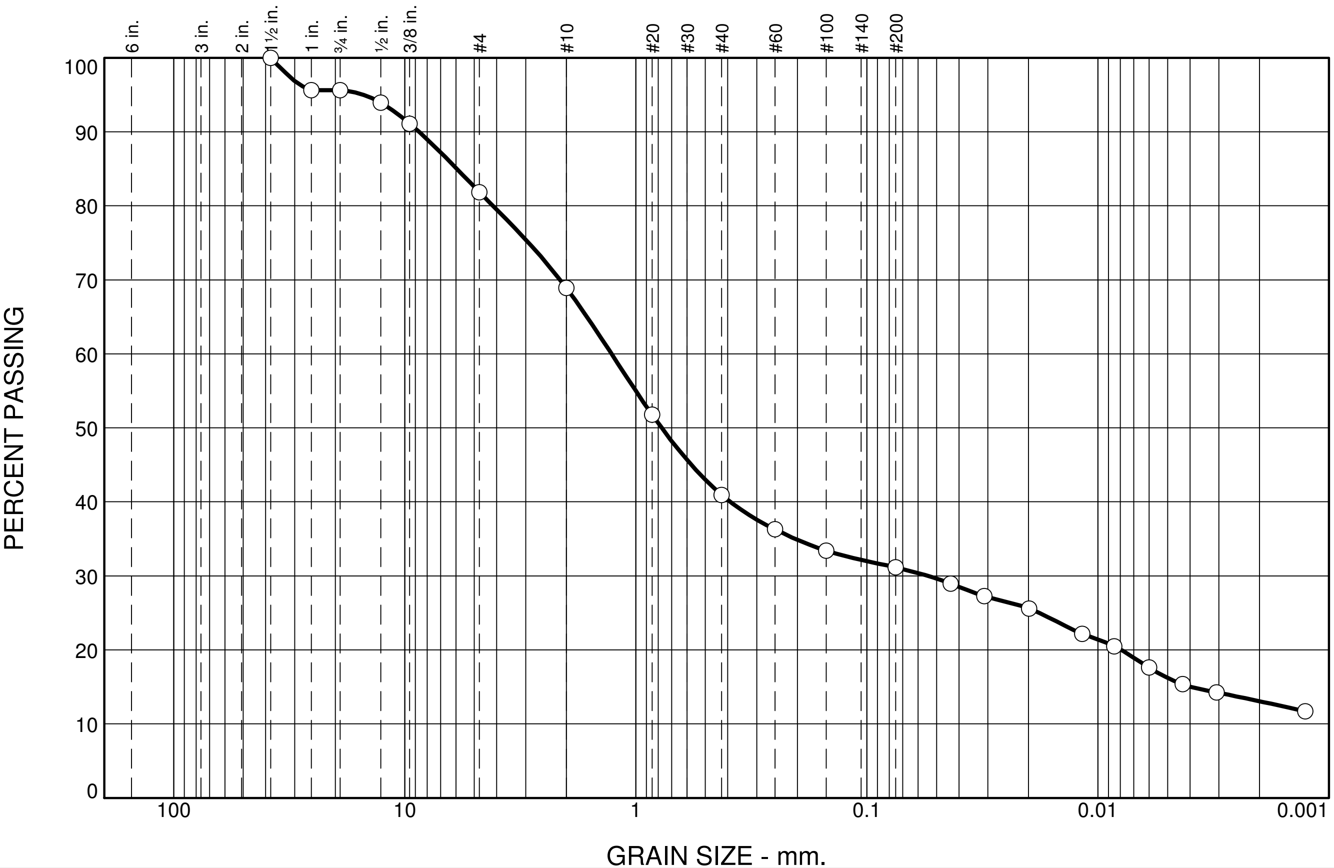
Date: 6/12/15

Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	13.8	12.9	28.0	9.8	18.0	13.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	95.6		
.75	95.6		
.5	93.9		
0.375	91.1		
#4	81.8		
#10	68.9		
#20	51.8		
#40	40.9		
#60	36.3		
#100	33.4		
#200	31.1		
0.0434 mm.	29.0		
0.0311 mm.	27.3		
0.0198 mm.	25.6		
0.0117 mm.	22.2		
0.0085 mm.	20.5		
0.0060 mm.	17.6		
0.0043 mm.	15.4		
0.0031 mm.	14.2		
0.0013 mm.	11.7		

* (no specification provided)

Soil Description

clayey SAND with gravel

Atterberg Limits

PL= 20 LL= 39 PI= 19

Coefficients

D_{90}= 8.6935 D_{85}= 5.9578 D_{60}= 1.2754
D_{50}= 0.7736 D_{30}= 0.0546 D_{15}= 0.0039
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(1)

Remarks

Location: TP15-8
Depth: 0.3-0.6m

Date: 6/12/15

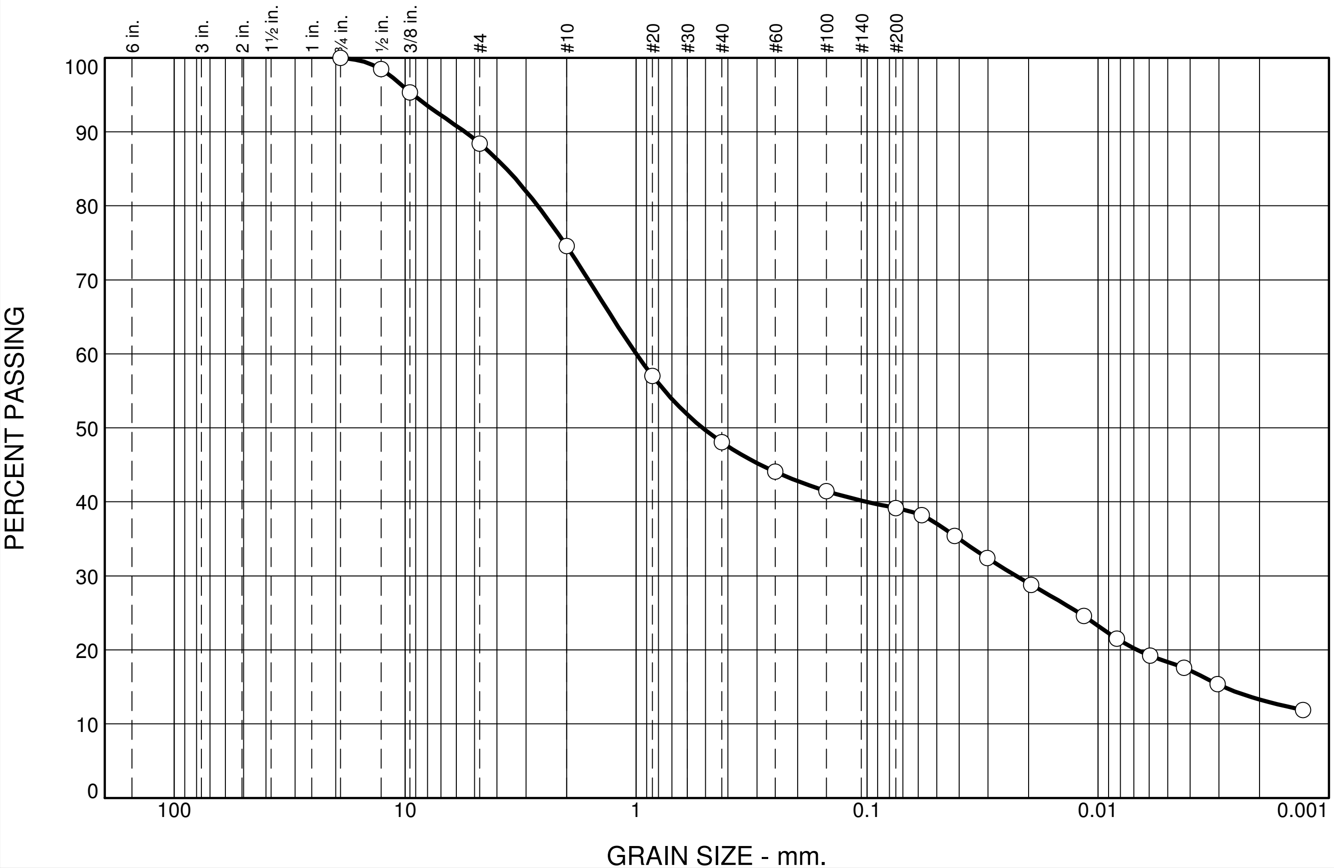
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.6	13.9	26.5	8.8	25.9	13.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.5		
0.375	95.3		
#4	88.4		
#10	74.5		
#20	57.0		
#40	48.0		
#60	44.1		
#100	41.4		
#200	39.2		
0.0581 mm.	38.2		
0.0418 mm.	35.4		
0.0301 mm.	32.4		
0.0195 mm.	28.8		
0.0115 mm.	24.6		
0.0083 mm.	21.5		
0.0059 mm.	19.2		
0.0042 mm.	17.6		
0.0030 mm.	15.4		
0.0013 mm.	11.9		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 18 LL= 33 PI= 15

Coefficients

D_{90}= 5.5246 D_{85}= 3.6480 D_{60}= 0.9987
D_{50}= 0.5153 D_{30}= 0.0227 D_{15}= 0.0029
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(2)

Remarks

Location: TP15-12
Depth: 0.4-0.6m

Date: 6/15/15

Knight Piésold CONSULTING

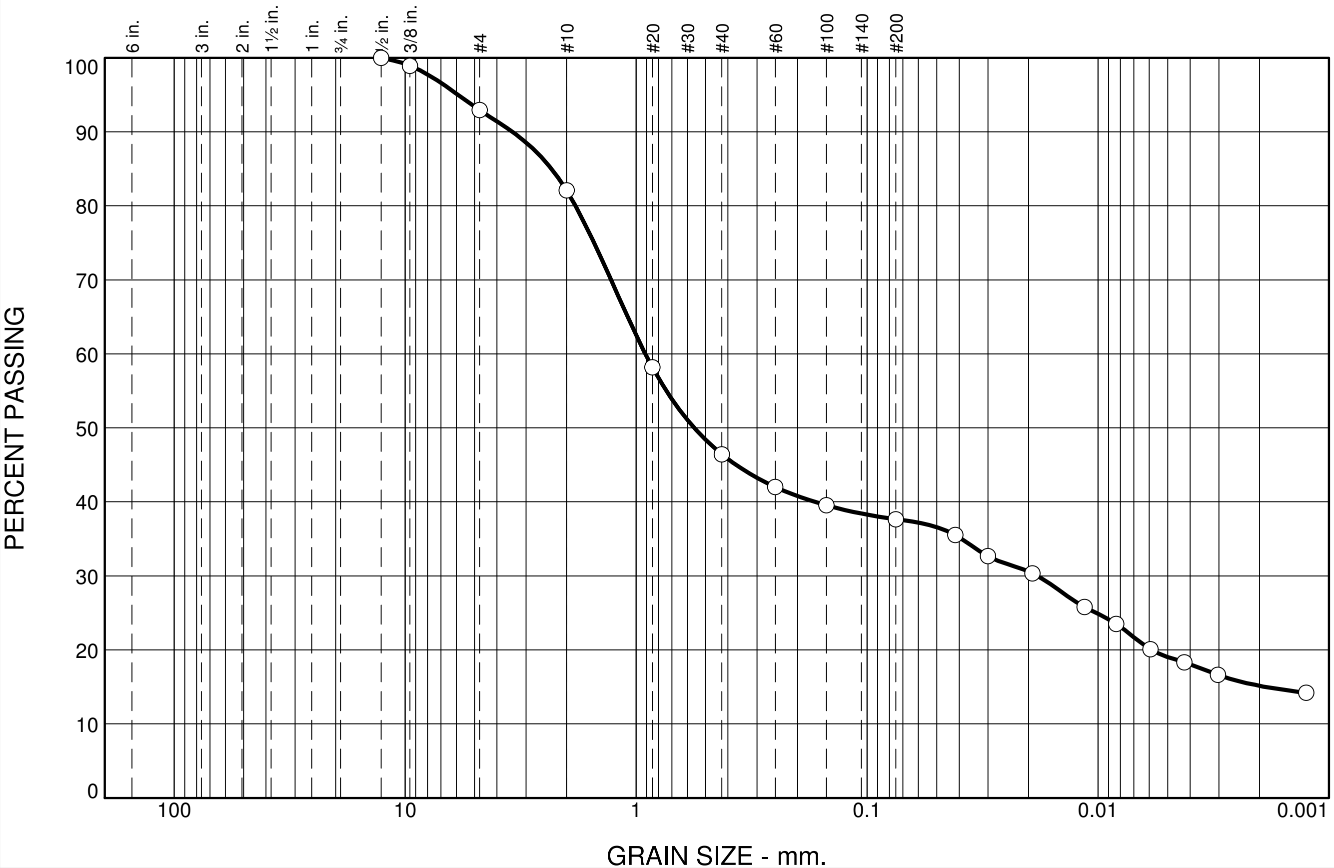
Client:
Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.1	10.8	35.7	8.7	22.5	15.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
0.375	98.9		
#4	92.9		
#10	82.1		
#20	58.2		
#40	46.4		
#60	42.0		
#100	39.5		
#200	37.7		
0.0416 mm.	35.5		
0.0300 mm.	32.7		
0.0193 mm.	30.4		
0.0114 mm.	25.8		
0.0083 mm.	23.5		
0.0059 mm.	20.1		
0.0042 mm.	18.3		
0.0030 mm.	16.6		
0.0013 mm.	14.2		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 19　LL= 35　PI= 16

Coefficients

D_{90}= 3.4363　D_{85}= 2.3269　D_{60}= 0.9118
D_{50}= 0.5603　D_{30}= 0.0183　D_{15}= 0.0019
D_{10}=　C_u=　C_c=

Classification

USCS= SC　AASHTO= A-6(2)

Remarks

Location: TP15-13
Depth: 0.4-0.5m

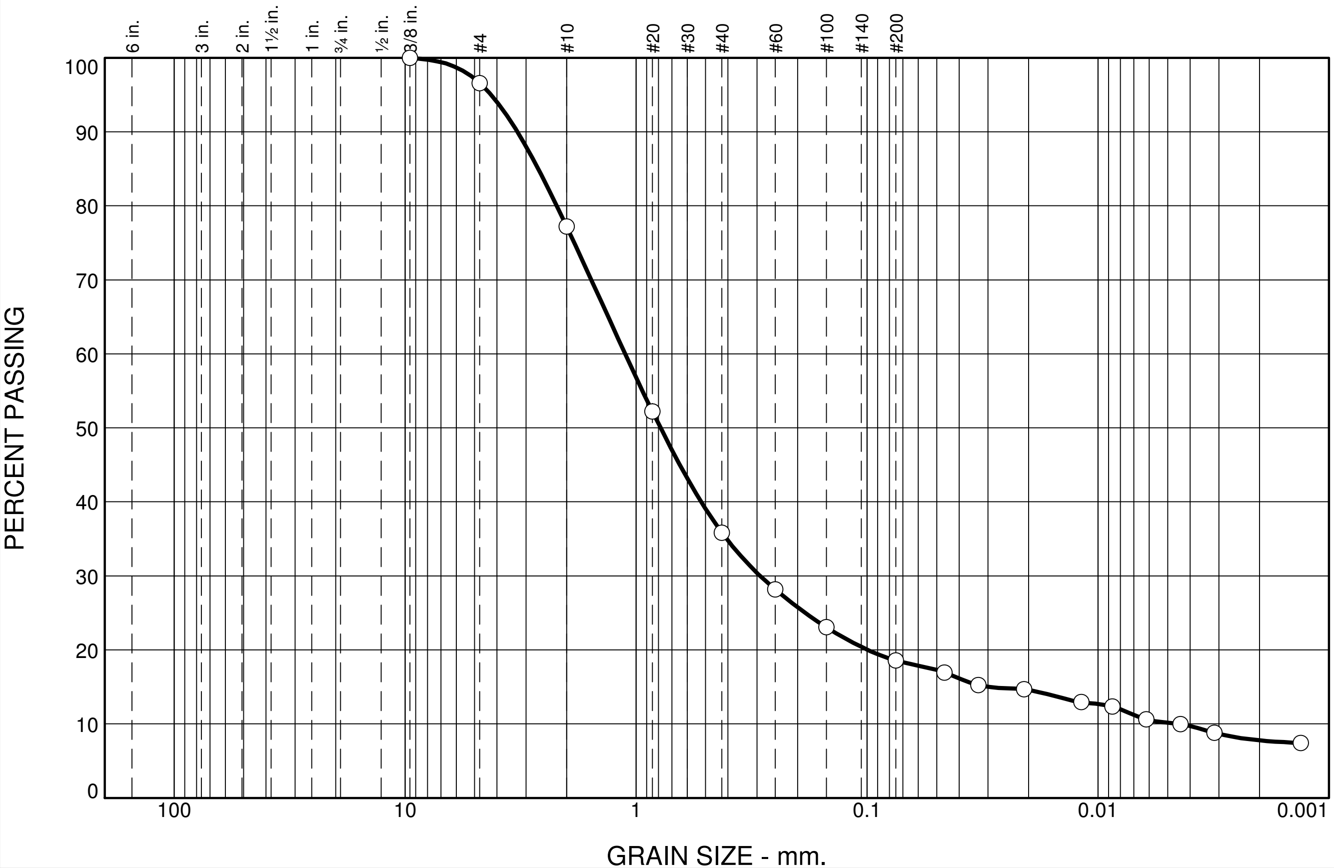
Date: 6/12/15

Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03　**Figure**

Tested By: JHK　**Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	19.4	41.4	17.2	10.8	7.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	96.6		
#10	77.2		
#20	52.2		
#40	35.8		
#60	28.2		
#100	23.1		
#200	18.6		
0.0462 mm.	16.9		
0.0330 mm.	15.2		
0.0209 mm.	14.7		
0.0118 mm.	12.9		
0.0087 mm.	12.3		
0.0062 mm.	10.6		
0.0044 mm.	10.0		
0.0031 mm.	8.8		
0.0013 mm.	7.4		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 21 LL= 29 PI= 8

Coefficients

D_{90}= 3.2687 D_{85}= 2.6561 D_{60}= 1.1162
D_{50}= 0.7842 D_{30}= 0.2903 D_{15}= 0.0299
D_{10}= 0.0044 C_u= 250.84 C_c= 16.97

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

Location: TP15-15
Depth: 0.74-1.0m

Date: 6/15/15

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

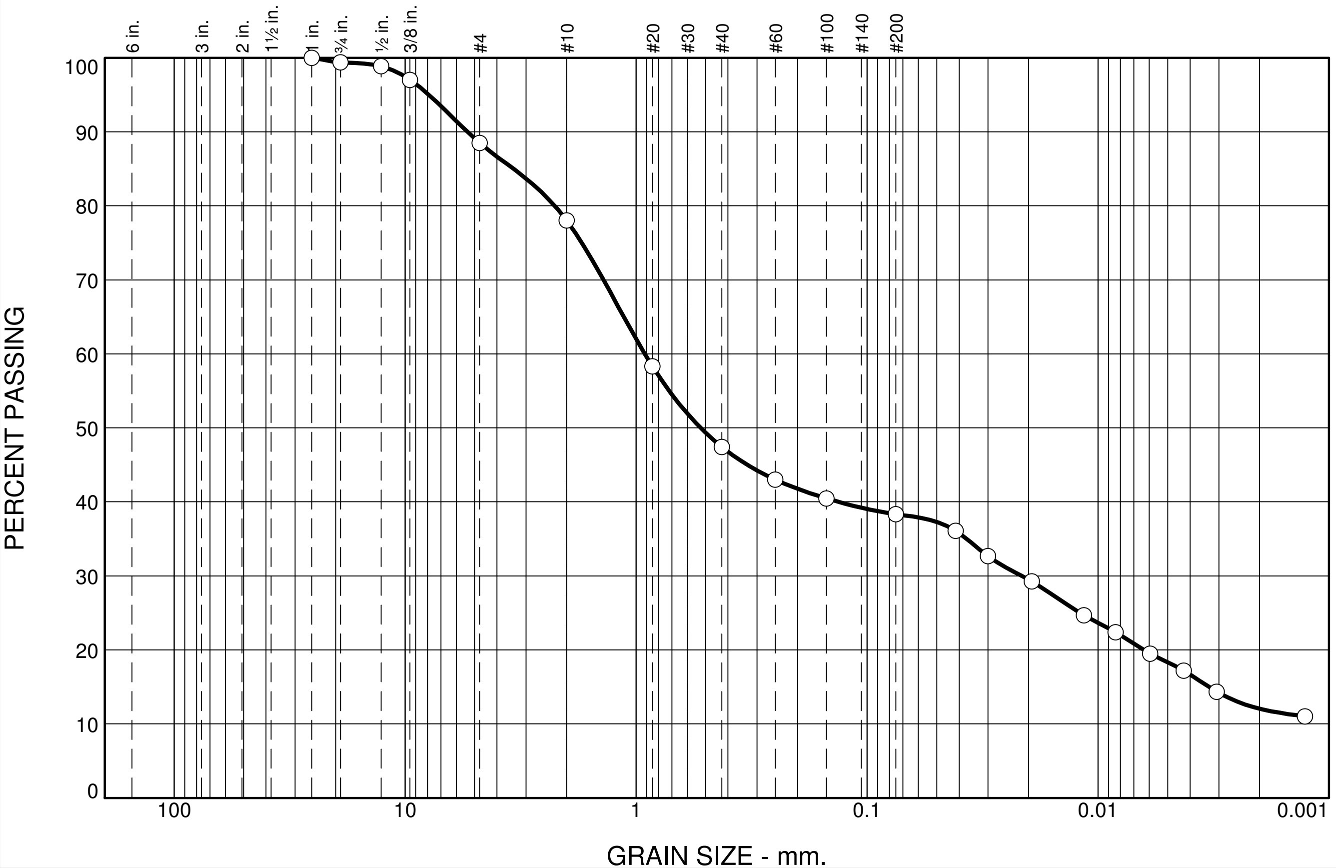
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.6	10.9	10.5	30.6	9.1	26.2	12.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	99.4		
.5	98.8		
0.375	97.0		
#4	88.5		
#10	78.0		
#20	58.3		
#40	47.4		
#60	43.0		
#100	40.5		
#200	38.3		
0.0414 mm.	36.1		
0.0300 mm.	32.7		
0.0194 mm.	29.2		
0.0115 mm.	24.7		
0.0084 mm.	22.4		
0.0059 mm.	19.5		
0.0043 mm.	17.2		
0.0031 mm.	14.4		
0.0013 mm.	11.0		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 18 LL= 29 PI= 11

Coefficients

D_{90}= 5.3686 D_{85}= 3.4043 D_{60}= 0.9177
D_{50}= 0.5255 D_{30}= 0.0214 D_{15}= 0.0033
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(1)

Remarks

Location: TP15-24
Depth: 0.3-0.5m

Date: 6/12/15

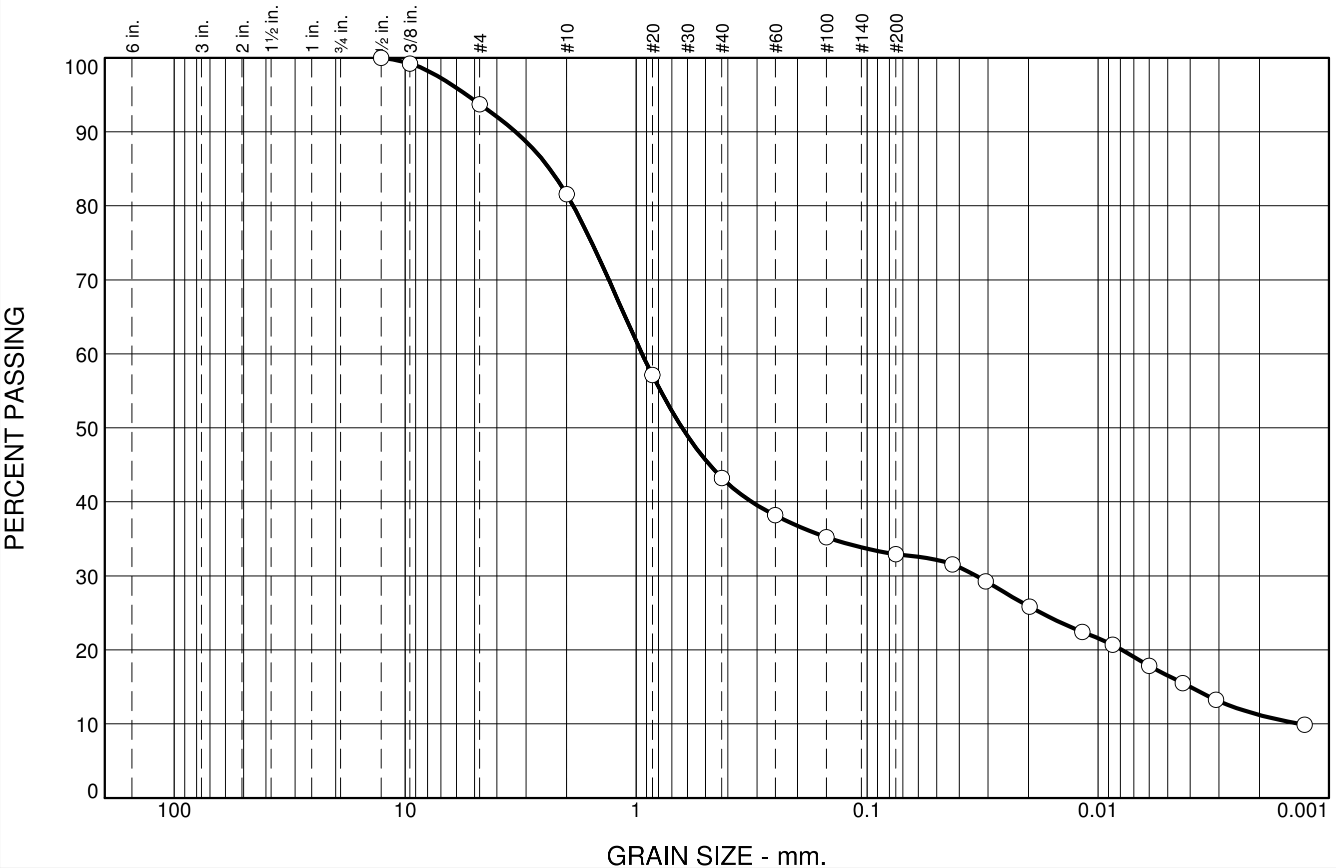
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.3	12.2	38.3	10.3	21.7	11.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
0.375	99.2		
#4	93.7		
#10	81.5		
#20	57.1		
#40	43.2		
#60	38.2		
#100	35.2		
#200	32.9		
0.0428 mm.	31.5		
0.0307 mm.	29.3		
0.0198 mm.	25.8		
0.0117 mm.	22.4		
0.0086 mm.	20.7		
0.0060 mm.	17.8		
0.0043 mm.	15.5		
0.0031 mm.	13.2		
0.0013 mm.	9.9		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 19 LL= 28 PI= 9

Coefficients

D_{90}= 3.3303 D_{85}= 2.3690 D_{60}= 0.9422
D_{50}= 0.6318 D_{30}= 0.0337 D_{15}= 0.0040
D_{10}= 0.0013 C_u= 704.70 C_c= 0.90

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

Location: TP15-25
Depth: 0.4-0.6m

Date: 6/12/15

Knight Piésold
CONSULTING

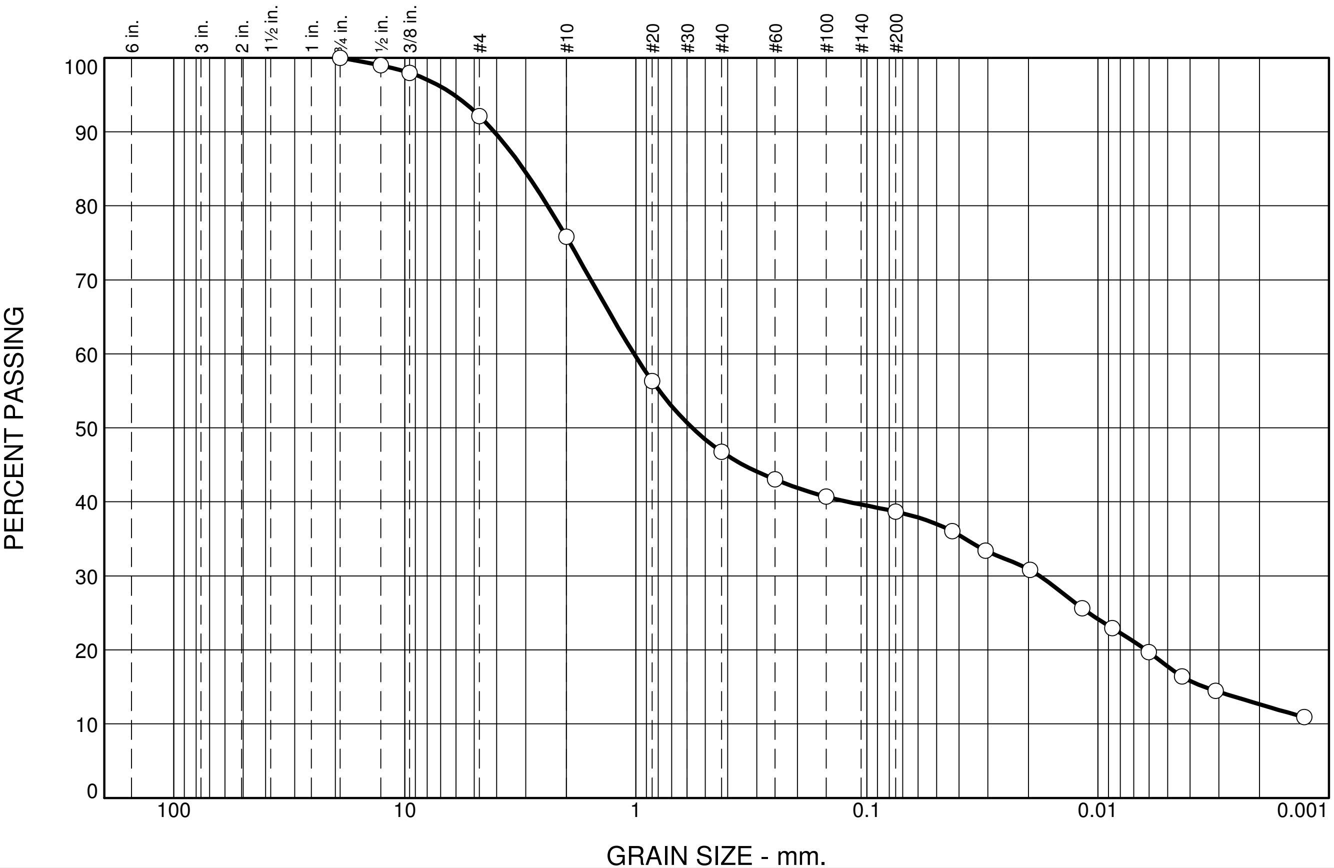
Client:
Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.9	16.3	29.0	8.1	26.1	12.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	99.0		
0.375	98.0		
#4	92.1		
#10	75.8		
#20	56.3		
#40	46.8		
#60	43.0		
#100	40.7		
#200	38.7		
0.0428 mm.	36.0		
0.0307 mm.	33.4		
0.0197 mm.	30.8		
0.0117 mm.	25.6		
0.0087 mm.	23.0		
0.0060 mm.	19.7		
0.0043 mm.	16.4		
0.0031 mm.	14.5		
0.0013 mm.	10.9		

* (no specification provided)

Soil Description

clayey SAND

Atterberg Limits

PL= 25 LL= 40 PI= 15

Coefficients

D_{90}= 4.0964 D_{85}= 3.0743 D_{60}= 1.0187
D_{50}= 0.5701 D_{30}= 0.0179 D_{15}= 0.0035
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(2)

Remarks

Location: TP15-30
Depth: 0.2-0.3m

Date: 6/12/15

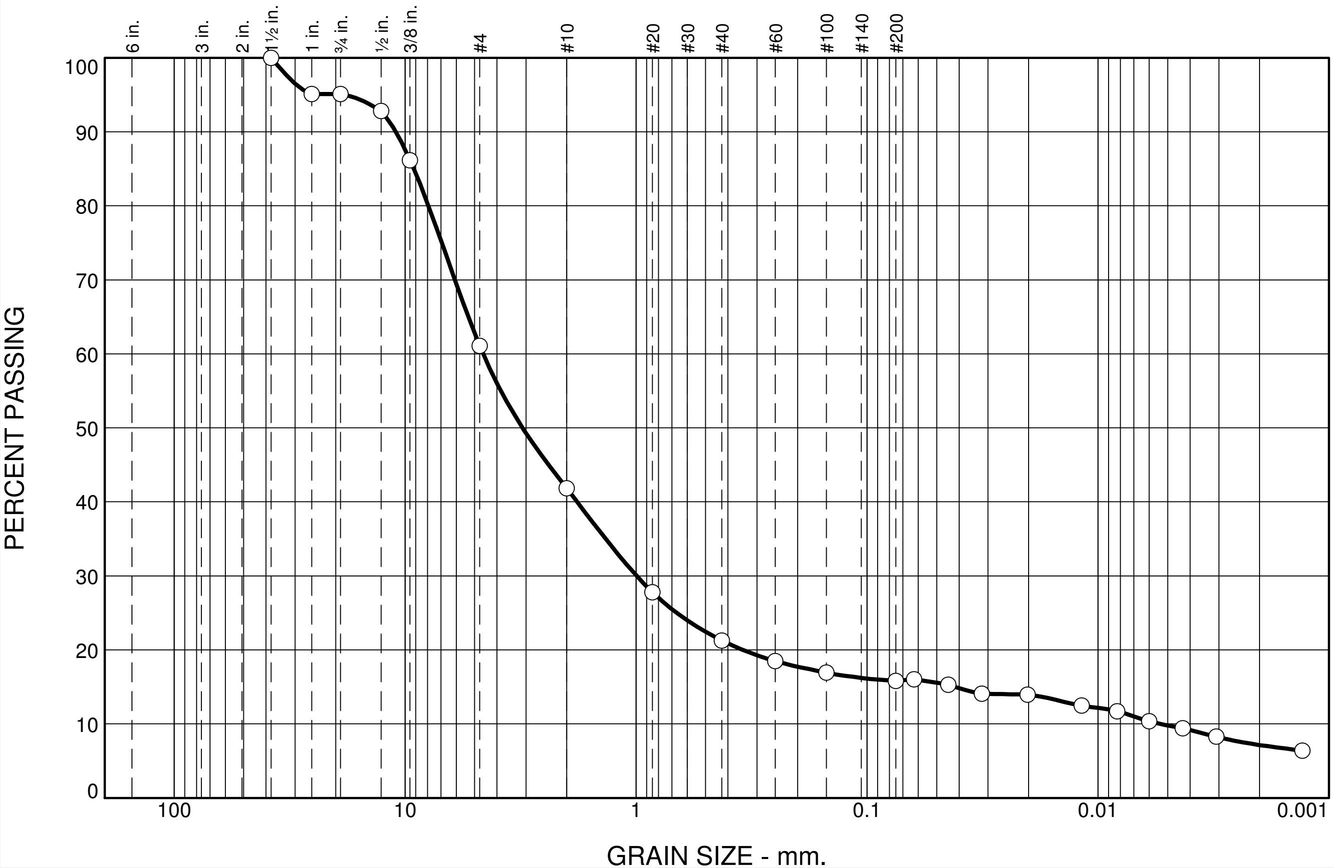
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Tested By: JHK **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.9	34.0	19.2	20.6	5.5	8.7	7.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	95.1		
.75	95.1		
.5	92.8		
0.375	86.1		
#4	61.1		
#10	41.9		
#20	27.8		
#40	21.3		
#60	18.5		
#100	16.9		
#200	15.8		
0.0625 mm.	16.0		
0.0445 mm.	15.3		
0.0318 mm.	14.1		
0.0202 mm.	14.0		
0.0118 mm.	12.5		
0.0083 mm.	11.7		
0.0060 mm.	10.4		
0.0043 mm.	9.4		
0.0031 mm.	8.3		
0.0013 mm.	6.4		

* (no specification provided)

Soil Description

clayey SAND with gravel

Atterberg Limits

PL= 19 LL= 34 PI= 15

Coefficients

D_{90}= 10.9882 D_{85}= 9.1790 D_{60}= 4.5918
D_{50}= 3.1039 D_{30}= 0.9945 D_{15}= 0.0415
D_{10}= 0.0054 C_u= 855.72 C_c= 40.14

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Location: TP15-30
Depth: 0.3-0.6m

Date: 6/15/15

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

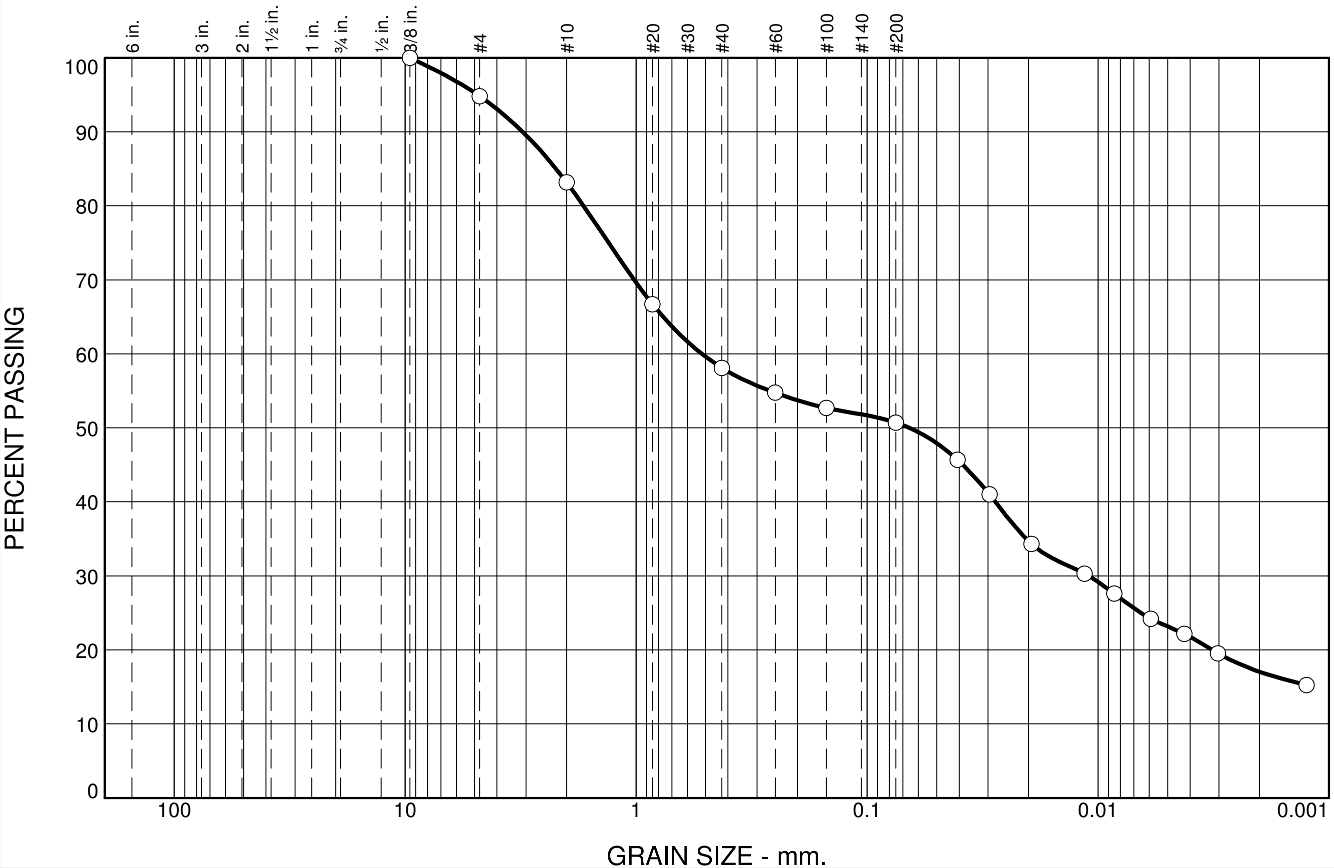
Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.2	11.6	25.1	7.4	33.6	17.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	94.8		
#10	83.2		
#20	66.7		
#40	58.1		
#60	54.7		
#100	52.7		
#200	50.7		
0.0406 mm.	45.7		
0.0295 mm.	41.0		
0.0194 mm.	34.3		
0.0114 mm.	30.3		
0.0085 mm.	27.6		
0.0059 mm.	24.2		
0.0042 mm.	22.2		
0.0030 mm.	19.5		
0.0013 mm.	15.3		

* (no specification provided)

Soil Description

sandy lean CLAY

Atterberg Limits

PL= 20 LL= 32 PI= 12

Coefficients

D_{90}= 3.1048 D_{85}= 2.2231 D_{60}= 0.5195
D_{50}= 0.0656 D_{30}= 0.0110 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(3)

Remarks

Location: TP15-37
Depth: 0.2-0.5m

Date: 6/12/15

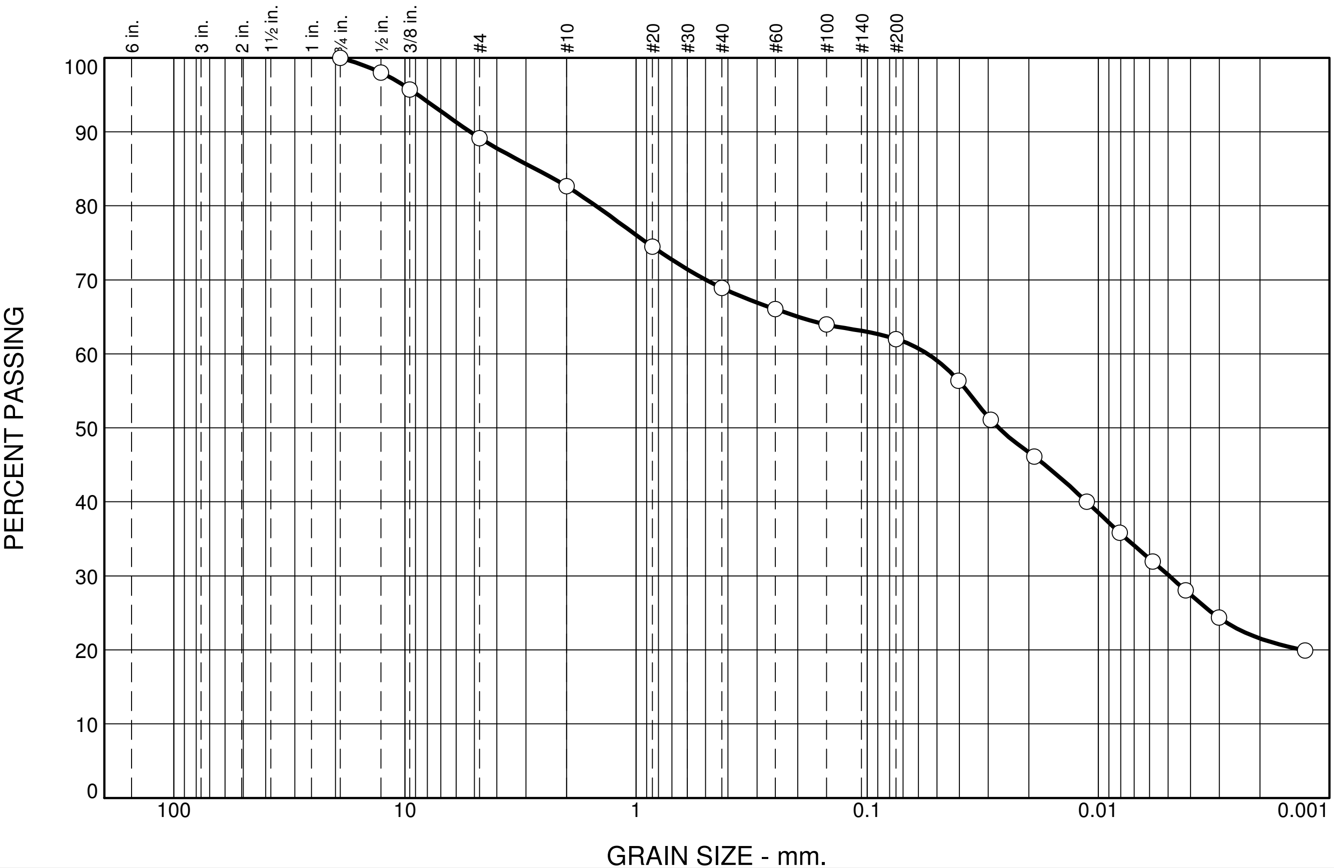
Knight Piésold CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.9	6.5	13.7	6.9	40.5	21.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.0		
0.375	95.7		
#4	89.1		
#10	82.6		
#20	74.5		
#40	68.9		
#60	66.0		
#100	64.0		
#200	62.0		
0.0403 mm.	56.4		
0.0292 mm.	51.1		
0.0189 mm.	46.1		
0.0112 mm.	40.0		
0.0081 mm.	35.8		
0.0058 mm.	31.9		
0.0042 mm.	28.0		
0.0030 mm.	24.4		
0.0013 mm.	19.9		

* (no specification provided)

Soil Description

sandy lean CLAY

Atterberg Limits

PL= 23 LL= 45 PI= 22

Coefficients

D_{90}= 5.2331 D_{85}= 2.7297 D_{60}= 0.0548
D_{50}= 0.0271 D_{30}= 0.0049 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(12)

Remarks

Location: TP15-40
Depth: 0.1-0.2m

Date: 6/15/15

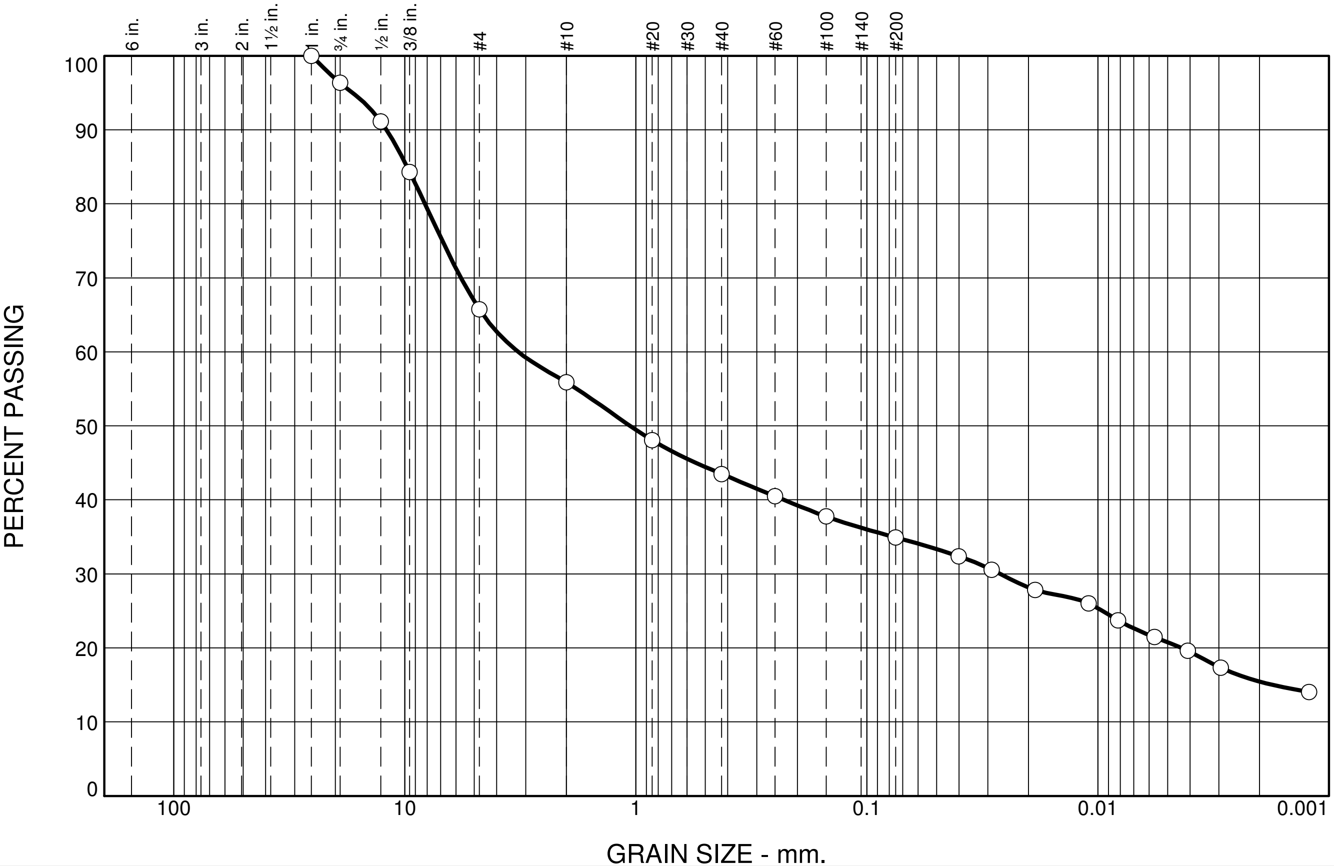
The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Knight Piésold
CONSULTING

Client:
Project: Black Butte Copper Project
Project No: VA101-00460/03 **Figure**

Tested By: STT **Checked By:** JDB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.7	30.6	9.8	12.4	8.6	19.5	15.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	96.3		
.5	91.1		
0.375	84.3		
#4	65.7		
#10	55.9		
#20	48.1		
#40	43.5		
#60	40.5		
#100	37.8		
#200	34.9		
0.0401 mm.	32.4		
0.0288 mm.	30.6		
0.0187 mm.	27.8		
0.0110 mm.	26.0		
0.0082 mm.	23.7		
0.0057 mm.	21.5		
0.0041 mm.	19.6		
0.0029 mm.	17.3		
0.0012 mm.	14.0		

* (no specification provided)

Soil Description

clayey GRAVEL with sand

Atterberg Limits

PL= 21 LL= 39 PI= 18

Coefficients

D_{90}= 11.9986 D_{85}= 9.7835 D_{60}= 3.2298

D_{50}= 1.0600 D_{30}= 0.0265 D_{15}= 0.0018

D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(2)

Remarks

Location: TP15-42
Depth: 0.45-0.65m

Date: 6/12/15

The USCS classification pertains only to the portion of sample that passes the 3" sieve as per ASTM D2487.

Knight Piésold
CONSULTING

Client:

Project: Black Butte Copper Project

Project No: VA101-00460/03 **Figure**

Tested By: JHK **Checked By:** JDB

Knight Piésold
CONSULTING

Moisture Content
ASTM D 2216

Project Black Butte Copper
Project No. VA101-00460/03
Lab No. L2015-032
Date of Test 3/30-4/8/15
Tested By JHK
Checked By JDB

Drying Conditions: 105 deg C
Method: Oven

Sample No.		SPT # 01	SPT # 02	SPT # 03	SPT # 04	Shelby # 1
Sample ID		SC15-181	SC15-181	SC15-181	SC15-181	SC15-181
Depth (ft)		5-7'	10-12'	15-17'	20-20.25'	17.5-18'
Tare No.		L28	L35	L12	L18	C53
Tare + Wet Soil	A	219.5	223.3	216.4	155.1	536.1
Tare + Dry Soil	B	202.8	206.5	201.8	149.6	457.5
Tare	C	119.3	119.7	115.3	121.1	118.7
Wt. of Water	D , A-B	16.7	16.8	14.6	5.5	78.6
Dry Soil, Ws	E , B-C	83.5	86.8	86.5	28.5	338.8
Moisture Content, (%)	(D / E) x100	20.0	19.4	16.9	19.3	23.2

Sample No.		SPT # 01	SPT # 02	Weathered Rock	SPT # 02	SPT # 01
Sample ID		SC15-184	SC15-184	SC15-191	SC15-192	SC15-192
Depth (m)		5-7'	10-12'	13.3-14'	10-12'	5-7'
Tare No.		L20	L37	P59	C51	C52
Tare + Wet Soil	A	230.4	223.7	374.8	350.6	242.2
Tare + Dry Soil	B	209.9	202.7	346.4	310.0	220.7
Tare	C	120.7	119.8	146.9	118.0	117.9
Wt. of Water	A-B, D	20.5	21.0	28.4	40.6	21.5
Dry Soil, Ws	B-C, E	89.2	82.9	199.5	192.0	102.8
Moisture Content, (%)	(D / E) x100	23.0	25.3	14.2	21.1	20.9

Sample No.		SPT # 03	SPT # 01	SPT # 02	SPT # 01	SPT # 02
Sample ID		SC15-192	SC15-193	SC15-193	SC15-196	SC15-196
Depth (m)		15-17'	5-7'	10-12'	3-5'	8-10'
Tare No.		P76	L36	C78	C60	DB
Tare + Wet Soil	A	332.2	229.9	324.0	294.4	343.4
Tare + Dry Soil	B	313.8	212.7	282.7	262.3	311.8
Tare	C	148.5	120.8	117.8	131.4	151.8
Wt. of Water	A-B, D	18.4	17.2	41.3	32.1	31.6
Dry Soil, Ws	B-C, E	165.3	91.9	164.9	130.9	160.0
Moisture Content, (%)	(D / E) x100	11.1	18.7	25.0	24.5	19.8

Knight Piésold
CONSULTING

Moisture Content
ASTM D 2216

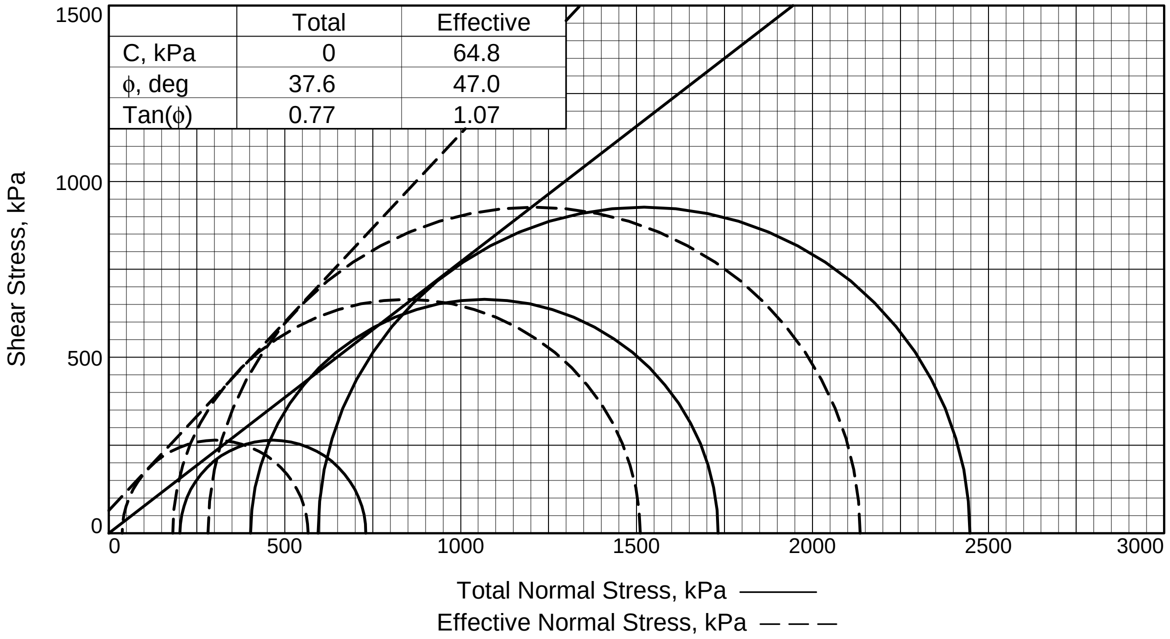
Project	Black Butte Copper	Project No.	VA101-00460/03
Lab No.	L2015-032	Date of Test	3/30-4/8/15
Tested By	JHK	Checked By	JDB

Drying Conditions: 105 deg C Method: Oven

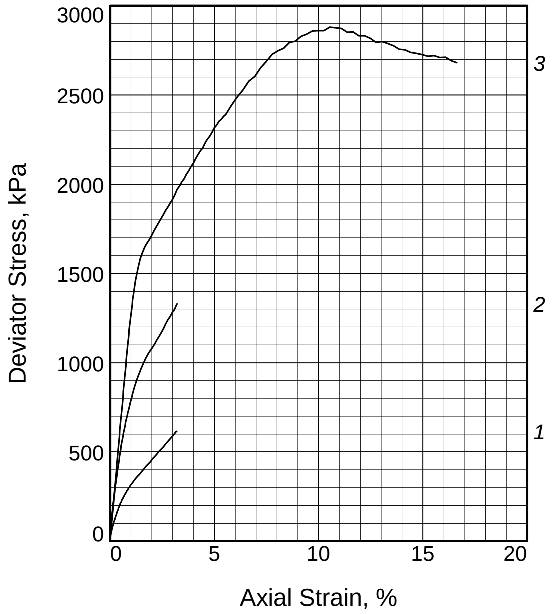
Sample No.		Grab Sump				
Sample ID		SC15-198				
Depth (ft)		4'				
Tare No.		P67				
Tare + Wet Soil	A	410.8				
Tare + Dry Soil	B	378.4				
Tare	C	148.9				
Wt. of Water	D , A-B	32.4				
Dry Soil, Ws	E , B-C	229.5				
Moisture Content, (%)	(D / E) x100	14.1				

Sample No.						
Sample ID						
Depth (m)						
Tare No.						
Tare + Wet Soil	A					
Tare + Dry Soil	B					
Tare	C					
Wt. of Water	A-B, D					
Dry Soil, Ws	B-C, E					
Moisture Content, (%)	(D / E) x100					

Sample No.						
Sample ID						
Depth (m)						
Tare No.						
Tare + Wet Soil	A					
Tare + Dry Soil	B					
Tare	C					
Wt. of Water	A-B, D					
Dry Soil, Ws	B-C, E					
Moisture Content, (%)	(D / E) x100					



	Total	Effective
C, kPa	0	64.8
ϕ, deg	37.6	47.0
Tan(ϕ)	0.77	1.07



	Specimen No.	1	2	3
Initial	Water Content, %	16.1	16.1	16.1
	Dry Density, pcf	118.8	118.8	118.8
	Saturation, %	103.6	103.6	103.6
	Void Ratio	0.4186	0.4186	0.4186
	Diameter, in.	2.81	2.81	2.81
	Height, in.	5.40	5.40	5.40
At Test	Water Content, %	13.0	10.9	9.9
	Dry Density, pcf	124.9	130.3	133.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3500	0.2940	0.2664
	Diameter, in.	2.77	2.77	2.80
	Height, in.	5.31	5.07	4.87
	Strain rate, %/min.	0.03	0.03	0.03
	Eff. Cell Pressure, kPa	202	403	595
	Fail. Stress, kPa	529	1329	1853
	Excess Pore Pr., kPa	164	221	313
	Strain, %	2.5	3.2	2.7
	Ult. Stress, kPa			
	Excess Pore Pr., kPa			
	Strain, %			
	$\overline{\sigma}_1$ Failure, kPa	566	1511	2135
	$\overline{\sigma}_3$ Failure, kPa	38	182	282

Type of Test:
CU with Pore Pressures

Sample Type: Trimmed from Shelby tube

Description:

Assumed Specific Gravity= 2.7

Remarks: Failure tangents drawn at peak principle stress ratio. Single specimen multistage test.

Figure _______

Client:

Project: Black Butte Copper Project

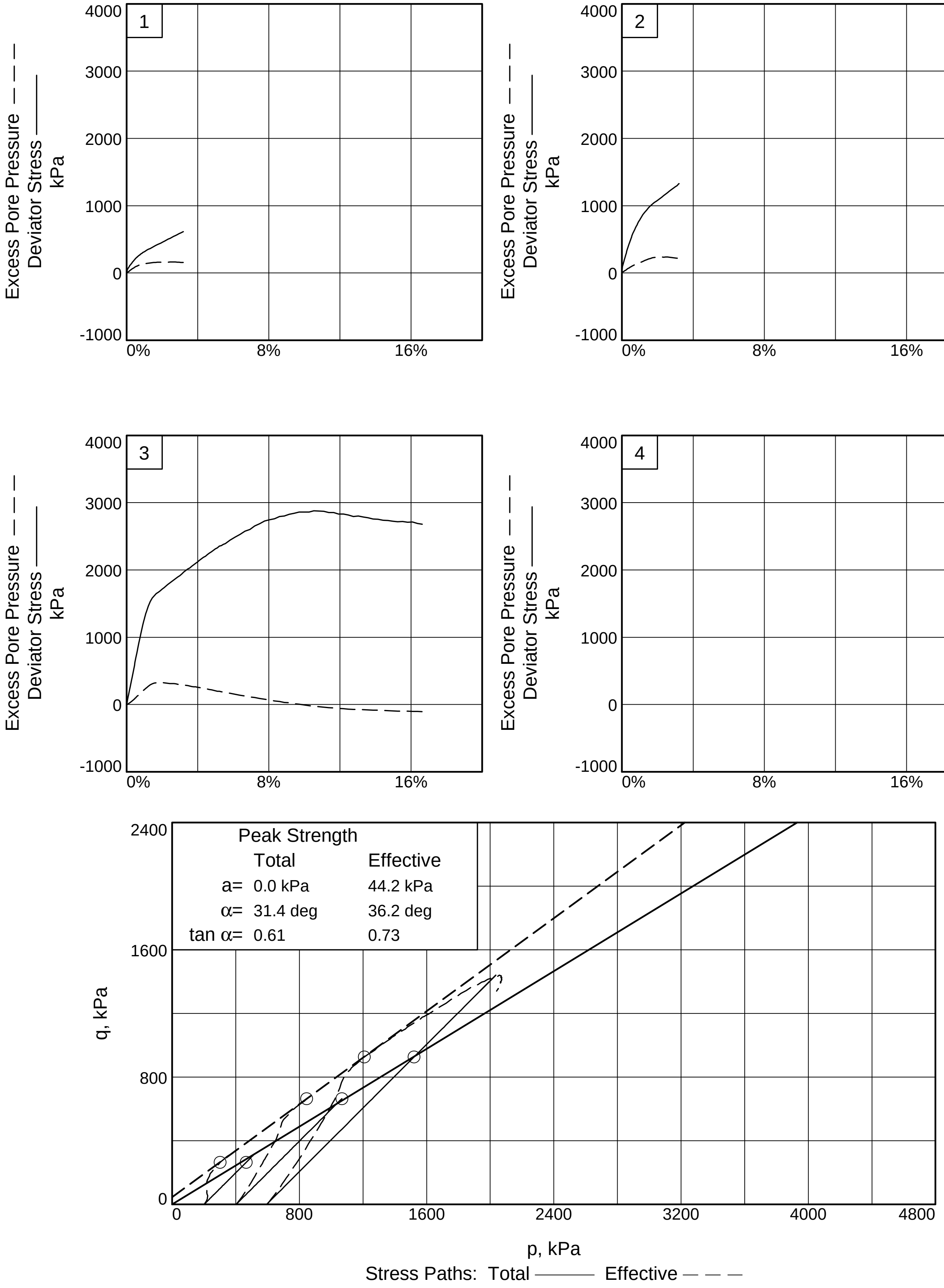
Location: SC15-184

Sample Number: SHELBY01 **Depth:** 12'-13'

Proj. No.: VA101-00460/03 **Date Sampled:** 4/8/15

Knight Piésold
CONSULTING

Tested By: JHK **Checked By:** JDB



Peak Strength

	Total	Effective
a=	0.0 kPa	44.2 kPa
α=	31.4 deg	36.2 deg
tan α=	0.61	0.73

Client:

Project: Black Butte Copper Project

Location: SC15-184 **Depth:** 12'-13' **Sample Number:** SHELBY01

Project No.: VA101-00460/03 **Figure** _______

Knight Piesold Geotechnical Lab.

Tested By: JHK **Checked By:** JDB

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

4/17/2015
11:55 AM

Date: 4/8/15
Client:
Project: Black Butte Copper Project
Project No.: VA101-00460/03
Location: SC15-184
Depth: 12'-13' **Sample Number:** SHELBY01
Description:
Remarks: Failure tangents drawn at peak principle stress ratio. Single specimen multistage test.
Type of Sample: Trimmed from Shelby tube
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**
Test Method: COE uniform strain (staged method triaxial test)

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	1214.000			1328.200
Moisture content: Dry soil+tare, gms.	1046.000			1163.800
Moisture content: Tare, gms.	0.000			117.770
Moisture, %	16.1	15.5	13.0	15.7
Moist specimen weight, gms.	1214.0			
Diameter, in.	2.81	2.81	2.77	
Area, in.²	6.21	6.21	6.01	
Height, in.	5.40	5.40	5.31	
Net decrease in height, in.		0.00	0.09	
Wet density, pcf	137.9	137.2	141.0	
Dry density, pcf	118.8	118.8	124.9	
Void ratio	0.4186	0.4186	0.3500	
Saturation, %	103.6	100.0	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.064 cm
Consolidation cell pressure = 59.43 psi (409.8 kPa)
Consolidation back pressure = 30.14 psi (207.8 kPa)
Consolidation effective confining stress = 201.9 kPa
Strain rate, %/min. = 0.03
Fail. Stress = 528.5 kPa **at reading no.** 55

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
0	0.0091	1.942	0.0	0.0	0.0	202.0	202.0	1.00	30.14	202.0	0.0
1	0.0105	32.652	30.7	0.0	35.2	196.6	231.8	1.18	30.92	214.2	17.6
2	0.0118	45.129	43.2	0.1	49.5	192.4	241.9	1.26	31.53	217.1	24.8
3	0.0132	56.977	55.0	0.1	63.1	188.2	251.3	1.34	32.13	219.8	31.6
4	0.0146	67.549	65.6	0.1	75.2	183.7	258.9	1.41	32.78	221.3	37.6
5	0.0159	76.403	74.5	0.1	85.3	178.9	264.2	1.48	33.49	221.5	42.7
6	0.0173	86.803	84.9	0.2	97.2	174.1	271.3	1.56	34.18	222.7	48.6
7	0.0186	95.238	93.3	0.2	106.9	169.3	276.2	1.63	34.87	222.8	53.4
8	0.0200	103.125	101.2	0.2	115.9	164.0	279.8	1.71	35.65	221.9	57.9
9	0.0213	110.533	108.6	0.2	124.3	157.3	281.6	1.79	36.62	219.4	62.2
10	0.0227	117.745	115.8	0.3	132.6	151.6	284.2	1.87	37.44	217.9	66.3
11	0.0240	126.521	124.6	0.3	142.6	146.7	289.3	1.97	38.15	218.0	71.3
12	0.0254	133.881	131.9	0.3	150.9	142.1	293.0	2.06	38.83	217.5	75.5
13	0.0268	142.209	140.3	0.3	160.4	137.6	298.1	2.17	39.47	217.9	80.2
14	0.0281	149.712	147.8	0.4	169.0	133.5	302.5	2.27	40.06	218.0	84.5
15	0.0295	156.154	154.2	0.4	176.3	129.6	305.9	2.36	40.63	217.7	88.1
16	0.0308	163.525	161.6	0.4	184.7	125.4	310.1	2.47	41.24	217.7	92.3
17	0.0322	169.963	168.0	0.4	192.0	121.1	313.0	2.59	41.87	217.0	96.0
18	0.0335	176.950	175.0	0.5	199.9	117.2	317.1	2.71	42.43	217.2	100.0
19	0.0349	183.839	181.9	0.5	207.7	113.5	321.2	2.83	42.97	217.3	103.9
20	0.0362	190.321	188.4	0.5	215.1	109.6	324.7	2.96	43.54	217.1	107.5
21	0.0376	195.677	193.7	0.5	221.1	106.1	327.2	3.08	44.04	216.7	110.6
22	0.0390	202.134	200.2	0.6	228.4	103.0	331.4	3.22	44.50	217.2	114.2
23	0.0403	207.811	205.9	0.6	234.9	99.9	334.8	3.35	44.94	217.4	117.4
24	0.0417	212.952	211.0	0.6	240.7	96.8	337.5	3.49	45.39	217.1	120.3
25	0.0430	217.470	215.5	0.6	245.8	93.7	339.4	3.62	45.85	216.5	122.9
26	0.0444	222.538	220.6	0.7	251.5	90.8	342.3	3.77	46.26	216.5	125.7
27	0.0457	228.619	226.7	0.7	258.3	88.2	346.5	3.93	46.64	217.4	129.2
28	0.0471	232.897	231.0	0.7	263.1	85.5	348.7	4.08	47.02	217.1	131.6
29	0.0484	237.158	235.2	0.7	267.9	82.9	350.8	4.23	47.41	216.9	134.0
30	0.0498	242.383	240.4	0.8	273.8	80.8	354.6	4.39	47.71	217.7	136.9
31	0.0512	246.940	245.0	0.8	278.9	78.6	357.5	4.55	48.03	218.1	139.5
32	0.0525	251.460	249.5	0.8	284.0	76.6	360.6	4.71	48.32	218.6	142.0
33	0.0539	255.282	253.3	0.8	288.3	74.8	363.1	4.85	48.58	218.9	144.1
34	0.0552	259.330	257.4	0.9	292.8	73.0	365.8	5.01	48.84	219.4	146.4
35	0.0566	264.452	262.5	0.9	298.6	71.6	370.1	5.17	49.05	220.8	149.3
36	0.0579	268.091	266.1	0.9	302.6	69.9	372.5	5.33	49.30	221.2	151.3
37	0.0593	271.786	269.8	0.9	306.7	68.6	375.3	5.47	49.49	221.9	153.4
38	0.0606	275.660	273.7	1.0	311.1	67.2	378.3	5.63	49.68	222.8	155.5
39	0.0620	279.952	278.0	1.0	315.9	66.1	381.9	5.78	49.85	224.0	157.9
40	0.0633	282.320	280.4	1.0	318.5	64.8	383.3	5.91	50.03	224.1	159.2
41	0.0688	298.203	296.3	1.1	336.2	61.2	397.4	6.49	50.55	229.3	168.1
42	0.0742	311.660	309.7	1.2	351.1	58.0	409.0	7.06	51.02	233.5	175.5
43	0.0796	324.063	322.1	1.3	364.8	52.9	417.7	7.89	51.76	235.3	182.4
44	0.0850	335.239	333.3	1.4	377.0	49.0	426.0	8.69	52.32	237.5	188.5
45	0.0904	348.005	346.1	1.5	391.1	47.2	438.2	9.29	52.59	242.7	195.5
46	0.0958	362.030	360.1	1.6	406.5	45.4	451.9	9.95	52.84	248.7	203.2

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
47	0.1012	375.489	373.5	1.7	421.3	43.9	465.1	10.60	53.07	254.5	210.6
48	0.1066	386.497	384.6	1.8	433.2	42.7	475.9	11.16	53.24	259.3	216.6
49	0.1120	398.328	396.4	1.9	446.1	41.8	487.8	11.68	53.37	264.8	223.0
50	0.1174	411.761	409.8	2.0	460.7	41.3	502.0	12.16	53.44	271.6	230.4
51	0.1228	423.605	421.7	2.1	473.5	41.3	514.9	12.46	53.44	278.1	236.8
52	0.1282	436.652	434.7	2.2	487.7	41.1	528.8	12.86	53.46	285.0	243.8
53	0.1336	451.003	449.1	2.3	503.3	41.1	544.3	13.26	53.48	292.7	251.6
54	0.1390	462.036	460.1	2.4	515.1	39.2	554.3	14.13	53.74	296.8	257.5
55	0.1444	474.517	472.6	2.5	528.5	37.7	566.2	15.02	53.96	302.0	264.3
56	0.1498	487.360	485.4	2.6	542.3	39.2	581.5	14.84	53.75	310.3	271.2
57	0.1552	499.998	498.1	2.8	555.8	40.2	596.1	14.81	53.59	318.2	277.9
58	0.1606	514.670	512.7	2.9	571.6	41.6	613.3	14.73	53.39	327.4	285.8
59	0.1660	526.173	524.2	3.0	583.8	43.1	627.0	14.54	53.18	335.0	291.9
60	0.1714	538.964	537.0	3.1	597.5	44.9	642.4	14.31	52.92	343.6	298.7
61	0.1768	552.491	550.5	3.2	611.9	46.7	658.6	14.10	52.66	352.6	305.9
62	0.1786	556.090	554.1	3.2	615.6	47.3	663.0	14.01	52.57	355.1	307.8

Parameters for Specimen No. 2

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	1214.000			1328.200
Moisture content: Dry soil+tare, gms.	1046.000			1163.800
Moisture content: Tare, gms.	0.000			117.770
Moisture, %	16.1		10.9	15.7
Moist specimen weight, gms.	1214.0			
Diameter, in.	2.81		2.77	
Area, in.²	6.21		6.03	
Height, in.	5.40		5.07	
Net decrease in height, in.		0.26	0.07	
Wet density, pcf	137.9		144.4	
Dry density, pcf	118.8		130.3	
Void ratio	0.4186		0.2940	
Saturation, %	103.6		100.0	

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²

Membrane thickness = 0.064 cm

Consolidation cell pressure = 88.47 psi (610.0 kPa)

Consolidation back pressure = 30.03 psi (207.0 kPa)

Consolidation effective confining stress = 402.9 kPa

Strain rate, %/min. = 0.03

Fail. Stress = 1328.9 kPa **at reading no.** 61

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
0	0.0198	1.903	0.0	0.0	0.0	402.9	402.9	1.00	30.03	402.9	0.0
1	0.0212	82.059	80.2	0.0	91.6	392.4	484.0	1.23	31.55	438.2	45.8
2	0.0226	104.979	103.1	0.1	117.8	387.6	505.4	1.30	32.25	446.5	58.9
3	0.0239	128.794	126.9	0.1	144.9	383.4	528.3	1.38	32.87	455.8	72.5
4	0.0253	152.227	150.3	0.1	171.6	378.9	550.5	1.45	33.52	464.7	85.8
5	0.0266	176.116	174.2	0.1	198.9	374.1	573.0	1.53	34.21	473.5	99.4
6	0.0280	197.579	195.7	0.2	223.3	369.5	592.8	1.60	34.87	481.2	111.6
7	0.0293	220.053	218.2	0.2	248.9	364.9	613.7	1.68	35.55	489.3	124.4
8	0.0307	240.862	239.0	0.2	272.5	360.0	632.6	1.76	36.25	496.3	136.3
9	0.0320	261.622	259.7	0.2	296.1	355.1	651.2	1.83	36.97	503.2	148.1
10	0.0334	281.430	279.5	0.3	318.6	350.4	669.0	1.91	37.66	509.7	159.3
11	0.0348	303.307	301.4	0.3	343.5	345.7	689.2	1.99	38.33	517.5	171.7
12	0.0361	322.802	320.9	0.3	365.6	340.9	706.5	2.07	39.02	523.7	182.8
13	0.0375	342.807	340.9	0.3	388.3	336.2	724.5	2.16	39.71	530.3	194.1
14	0.0388	361.466	359.6	0.4	409.4	331.5	741.0	2.24	40.39	536.2	204.7
15	0.0402	380.878	379.0	0.4	431.4	327.2	758.6	2.32	41.01	542.9	215.7
16	0.0415	399.028	397.1	0.4	452.0	322.8	774.7	2.40	41.66	548.8	226.0
17	0.0429	417.502	415.6	0.5	472.9	318.3	791.2	2.49	42.30	554.7	236.4
18	0.0442	435.206	433.3	0.5	492.9	314.2	807.1	2.57	42.89	560.7	246.4
19	0.0456	452.945	451.0	0.5	512.9	310.2	823.1	2.65	43.49	566.6	256.5
20	0.0469	470.260	468.4	0.5	532.5	305.8	838.2	2.74	44.12	572.0	266.2
21	0.0483	486.388	484.5	0.6	550.7	301.9	852.6	2.82	44.68	577.2	275.3
22	0.0496	502.486	500.6	0.6	568.8	298.2	867.0	2.91	45.22	582.6	284.4
23	0.0510	518.321	516.4	0.6	586.6	294.5	881.1	2.99	45.76	587.8	293.3
24	0.0524	531.819	529.9	0.6	601.8	290.9	892.7	3.07	46.28	591.8	300.9

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
25	0.0537	545.463	543.6	0.7	617.1	287.6	904.7	3.15	46.76	596.2	308.6
26	0.0551	560.333	558.4	0.7	633.8	284.3	918.1	3.23	47.24	601.2	316.9
27	0.0564	574.105	572.2	0.7	649.3	281.2	930.5	3.31	47.69	605.8	324.7
28	0.0578	588.609	586.7	0.7	665.6	278.1	943.7	3.39	48.13	610.9	332.8
29	0.0591	601.482	599.6	0.8	680.0	275.5	955.5	3.47	48.51	615.5	340.0
30	0.0605	613.967	612.1	0.8	694.0	272.8	966.7	3.54	48.91	619.7	347.0
31	0.0618	626.846	624.9	0.8	708.4	270.0	978.4	3.62	49.31	624.2	354.2
32	0.0632	637.456	635.6	0.9	720.2	265.2	985.5	3.72	50.00	625.3	360.1
33	0.0646	648.848	646.9	0.9	732.9	261.9	994.9	3.80	50.48	628.4	366.5
34	0.0659	660.874	659.0	0.9	746.4	259.4	1005.7	3.88	50.85	632.5	373.2
35	0.0673	673.553	671.6	0.9	760.5	257.0	1017.5	3.96	51.20	637.2	380.3
36	0.0686	684.005	682.1	1.0	772.1	254.5	1026.6	4.03	51.56	640.5	386.1
37	0.0700	694.825	692.9	1.0	784.2	251.8	1036.0	4.11	51.94	643.9	392.1
38	0.0713	705.546	703.6	1.0	796.1	249.3	1045.4	4.19	52.31	647.4	398.0
39	0.0727	717.597	715.7	1.0	809.5	246.6	1056.1	4.28	52.70	651.4	404.8
40	0.0740	727.641	725.7	1.1	820.6	243.7	1064.3	4.37	53.12	654.0	410.3
41	0.0795	766.866	765.0	1.2	864.1	231.1	1095.2	4.74	54.95	663.2	432.0
42	0.0849	803.190	801.3	1.3	904.1	218.9	1123.0	5.13	56.72	671.0	452.1
43	0.0903	833.296	831.4	1.4	937.1	207.0	1144.1	5.53	58.44	675.6	468.5
44	0.0957	862.468	860.6	1.5	968.9	196.8	1165.7	5.92	59.93	681.2	484.5
45	0.1011	888.097	886.2	1.6	996.7	188.1	1184.7	6.30	61.19	686.4	498.3
46	0.1065	914.306	912.4	1.7	1025.0	176.0	1201.1	6.82	62.94	688.5	512.5
47	0.1119	935.427	933.5	1.8	1047.6	171.2	1218.8	7.12	63.64	695.0	523.8
48	0.1173	953.585	951.7	1.9	1066.9	168.3	1235.2	7.34	64.06	701.7	533.4
49	0.1227	970.569	968.7	2.0	1084.7	167.0	1251.7	7.49	64.24	709.4	542.4
50	0.1281	990.500	988.6	2.1	1105.8	166.8	1272.7	7.63	64.27	719.8	552.9
51	0.1335	1011.635	1009.7	2.2	1128.2	166.9	1295.1	7.76	64.26	731.0	564.1
52	0.1389	1031.281	1029.4	2.3	1148.9	167.9	1316.9	7.84	64.12	742.4	574.5
53	0.1443	1051.669	1049.8	2.5	1170.4	164.2	1334.7	8.13	64.65	749.5	585.2
54	0.1497	1072.675	1070.8	2.6	1192.5	166.3	1358.8	8.17	64.35	762.6	596.3
55	0.1551	1095.571	1093.7	2.7	1216.7	168.3	1385.1	8.23	64.05	776.7	608.4
56	0.1605	1117.335	1115.4	2.8	1239.6	171.5	1411.0	8.23	63.60	791.2	619.8
57	0.1659	1134.530	1132.6	2.9	1257.3	175.2	1432.5	8.18	63.06	803.8	628.6
58	0.1713	1156.543	1154.6	3.0	1280.3	178.6	1458.9	8.17	62.57	818.8	640.2
59	0.1767	1174.902	1173.0	3.1	1299.2	182.7	1482.0	8.11	61.97	832.4	649.6
60	0.1821	1201.977	1200.1	3.2	1327.8	181.3	1509.1	8.32	62.17	845.2	663.9
61	0.1826	1203.133	1201.2	3.2	1328.9	181.7	1510.6	8.32	62.12	846.1	664.5

Parameters for Specimen No. 3

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	1214.000			1328.200
Moisture content: Dry soil+tare, gms.	1046.000			1163.800
Moisture content: Tare, gms.	0.000			117.770
Moisture, %	16.1		9.9	15.7
Moist specimen weight, gms.	1214.0			
Diameter, in.	2.81		2.80	
Area, in.²	6.21		6.14	
Height, in.	5.40		4.87	
Net decrease in height, in.		0.49	0.04	
Wet density, pcf	137.9		146.2	
Dry density, pcf	118.8		133.1	
Void ratio	0.4186		0.2664	
Saturation, %	103.6		100.0	

Test Readings for Specimen No. 3

Membrane modulus = 0.124105 kN/cm²

Membrane thickness = 0.064 cm

Consolidation cell pressure = 116.42 psi (802.7 kPa)

Consolidation back pressure = 30.18 psi (208.1 kPa)

Consolidation effective confining stress = 594.6 kPa

Strain rate, %/min. = 0.03

Fail. Stress = 1853.3 kPa **at reading no.** 54

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
0	0.0133	1.877	0.0	0.0	0.0	594.6	594.6	1.00	30.18	594.6	0.0
1	0.0146	28.203	26.3	0.0	29.5	594.5	624.1	1.05	30.19	609.3	14.8
2	0.0160	72.329	70.5	0.1	79.0	589.0	668.0	1.13	30.99	628.5	39.5
3	0.0173	103.814	101.9	0.1	114.3	584.6	699.0	1.20	31.62	641.8	57.2
4	0.0187	135.324	133.4	0.1	149.6	579.9	729.6	1.26	32.31	654.7	74.8
5	0.0200	166.454	164.6	0.1	184.5	575.1	759.6	1.32	33.01	667.3	92.2
6	0.0214	199.353	197.5	0.2	221.3	570.0	791.3	1.39	33.75	680.7	110.6
7	0.0228	231.162	229.3	0.2	256.9	564.4	821.2	1.46	34.57	692.8	128.4
8	0.0241	262.203	260.3	0.2	291.5	558.8	850.4	1.52	35.37	704.6	145.8
9	0.0255	296.007	294.1	0.3	329.3	553.0	882.3	1.60	36.21	717.7	164.7
10	0.0268	330.159	328.3	0.3	367.4	547.4	914.8	1.67	37.03	731.1	183.7
11	0.0282	359.438	357.6	0.3	400.1	541.4	941.5	1.74	37.90	741.5	200.1
12	0.0295	392.353	390.5	0.3	436.8	535.3	972.2	1.82	38.77	753.8	218.4
13	0.0309	424.523	422.6	0.4	472.7	529.4	1002.1	1.89	39.63	765.8	236.3
14	0.0322	460.430	458.6	0.4	512.7	523.4	1036.1	1.98	40.51	779.7	256.3
15	0.0336	493.368	491.5	0.4	549.4	517.1	1066.4	2.06	41.43	791.7	274.7
16	0.0349	526.628	524.8	0.4	586.4	511.1	1097.4	2.15	42.30	804.3	293.2
17	0.0363	560.261	558.4	0.5	623.8	504.8	1128.6	2.24	43.20	816.7	311.9
18	0.0377	592.848	591.0	0.5	660.0	498.4	1158.4	2.32	44.13	828.4	330.0
19	0.0390	624.398	622.5	0.5	695.0	491.9	1186.9	2.41	45.08	839.4	347.5
20	0.0404	655.098	653.2	0.6	729.1	483.6	1212.7	2.51	46.28	848.1	364.6
21	0.0417	685.739	683.9	0.6	763.1	475.9	1239.0	2.60	47.40	857.5	381.6
22	0.0431	719.208	717.3	0.6	800.2	469.4	1269.6	2.70	48.34	869.5	400.1
23	0.0444	755.640	753.8	0.6	840.6	462.7	1303.3	2.82	49.31	883.0	420.3
24	0.0458	787.988	786.1	0.7	876.5	455.8	1332.3	2.92	50.31	894.0	438.2

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
25	0.0471	820.315	818.4	0.7	912.3	449.0	1361.3	3.03	51.29	905.2	456.1
26	0.0485	852.128	850.3	0.7	947.4	442.5	1389.9	3.14	52.24	916.2	473.7
27	0.0499	880.541	878.7	0.8	978.8	435.4	1414.3	3.25	53.27	924.8	489.4
28	0.0512	911.602	909.7	0.8	1013.1	428.5	1441.7	3.36	54.27	935.1	506.6
29	0.0526	944.441	942.6	0.8	1049.4	421.8	1471.2	3.49	55.25	946.5	524.7
30	0.0539	976.421	974.5	0.8	1084.7	414.9	1499.6	3.61	56.25	957.2	542.4
31	0.0553	1007.397	1005.5	0.9	1118.9	407.8	1526.6	3.74	57.28	967.2	559.4
32	0.0566	1035.915	1034.0	0.9	1150.3	400.8	1551.1	3.87	58.29	976.0	575.2
33	0.0580	1067.226	1065.3	0.9	1184.8	393.9	1578.7	4.01	59.28	986.3	592.4
34	0.0593	1093.385	1091.5	0.9	1213.6	387.2	1600.7	4.13	60.27	993.9	606.8
35	0.0607	1118.632	1116.8	1.0	1241.3	380.2	1621.5	4.26	61.27	1000.9	620.6
36	0.0620	1144.778	1142.9	1.0	1270.0	373.6	1643.6	4.40	62.23	1008.6	635.0
37	0.0634	1169.159	1167.3	1.0	1296.7	366.9	1663.6	4.53	63.20	1015.3	648.4
38	0.0648	1195.673	1193.8	1.1	1325.8	360.6	1686.4	4.68	64.12	1023.5	662.9
39	0.0661	1219.388	1217.5	1.1	1351.7	354.2	1706.0	4.82	65.05	1030.1	675.9
40	0.0675	1239.307	1237.4	1.1	1373.5	348.0	1721.5	4.95	65.95	1034.7	686.7
41	0.0729	1318.641	1316.8	1.2	1459.9	323.5	1783.4	5.51	69.50	1053.4	729.9
42	0.0783	1383.312	1381.4	1.3	1529.9	300.1	1830.0	6.10	72.90	1065.0	764.9
43	0.0837	1433.085	1431.2	1.4	1583.2	285.6	1868.8	6.54	75.00	1077.2	791.6
44	0.0891	1465.777	1463.9	1.6	1617.6	276.6	1894.1	6.85	76.31	1085.4	808.8
45	0.0945	1494.712	1492.8	1.7	1647.7	273.0	1920.7	7.03	76.82	1096.9	823.8
46	0.0999	1515.868	1514.0	1.8	1669.1	272.7	1941.9	7.12	76.87	1107.3	834.6
47	0.1053	1537.798	1535.9	1.9	1691.4	274.0	1965.4	7.17	76.68	1119.7	845.7
48	0.1107	1561.408	1559.5	2.0	1715.5	268.5	1984.0	7.39	77.47	1126.3	857.7
49	0.1161	1585.146	1583.3	2.1	1739.6	271.9	2011.5	7.40	76.98	1141.7	869.8
50	0.1215	1607.542	1605.7	2.2	1762.2	274.8	2037.0	7.41	76.57	1155.9	881.1
51	0.1269	1631.991	1630.1	2.3	1787.0	277.5	2064.5	7.44	76.17	1171.0	893.5
52	0.1323	1652.819	1650.9	2.4	1807.8	281.5	2089.2	7.42	75.60	1185.4	903.9
53	0.1377	1675.169	1673.3	2.6	1830.2	282.8	2112.9	7.47	75.41	1197.9	915.1
54	0.1431	1698.225	1696.3	2.7	1853.3	282.0	2135.3	7.57	75.52	1208.6	926.6
55	0.1485	1719.499	1717.6	2.8	1874.4	287.0	2161.4	7.53	74.80	1224.2	937.2
56	0.1539	1740.602	1738.7	2.9	1895.3	292.6	2187.9	7.48	73.98	1240.2	947.6
57	0.1593	1761.338	1759.5	3.0	1915.7	298.9	2214.6	7.41	73.07	1256.7	957.8
58	0.1647	1786.591	1784.7	3.1	1941.0	305.0	2245.9	7.36	72.19	1275.4	970.5
59	0.1701	1816.042	1814.2	3.2	1970.7	304.3	2275.1	7.48	72.28	1289.7	985.4
60	0.1755	1837.053	1835.2	3.3	1991.3	308.2	2299.4	7.46	71.73	1303.8	995.6
61	0.1809	1859.574	1857.7	3.4	2013.4	313.8	2327.1	7.42	70.91	1320.5	1006.7
62	0.1863	1877.695	1875.8	3.6	2030.7	320.3	2351.0	7.34	69.97	1335.6	1015.4
63	0.1917	1901.948	1900.1	3.7	2054.6	326.4	2380.9	7.30	69.09	1353.6	1027.3
64	0.1971	1924.626	1922.7	3.8	2076.7	332.7	2409.4	7.24	68.17	1371.0	1038.4
65	0.2025	1948.892	1947.0	3.9	2100.5	331.9	2432.4	7.33	68.28	1382.2	1050.3
66	0.2079	1968.306	1966.4	4.0	2119.0	337.2	2456.2	7.28	67.52	1396.7	1059.5
67	0.2133	1993.553	1991.7	4.1	2143.7	343.6	2487.3	7.24	66.58	1415.5	1071.9
68	0.2188	2015.657	2013.8	4.2	2165.0	350.1	2515.1	7.18	65.64	1432.6	1082.5
69	0.2242	2039.385	2037.5	4.3	2188.0	357.0	2545.0	7.13	64.64	1451.0	1094.0
70	0.2296	2054.871	2053.0	4.4	2202.1	364.4	2566.4	7.04	63.57	1465.4	1101.0
71	0.2350	2082.851	2081.0	4.5	2229.5	364.2	2593.7	7.12	63.60	1478.9	1114.7

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
72	0.2404	2105.411	2103.5	4.7	2251.0	370.2	2621.2	7.08	62.73	1495.7	1125.5
73	0.2458	2124.425	2122.5	4.8	2268.7	377.1	2645.8	7.02	61.73	1511.5	1134.4
74	0.2512	2147.145	2145.3	4.9	2290.4	383.6	2674.0	6.97	60.78	1528.8	1145.2
75	0.2566	2172.947	2171.1	5.0	2315.2	389.6	2704.8	6.94	59.91	1547.2	1157.6
76	0.2620	2189.690	2187.8	5.1	2330.3	396.0	2726.3	6.89	58.99	1561.1	1165.2
77	0.2674	2213.986	2212.1	5.2	2353.5	396.3	2749.8	6.94	58.94	1573.1	1176.7
78	0.2728	2225.991	2224.1	5.3	2363.5	403.2	2766.6	6.86	57.94	1584.9	1181.7
79	0.2782	2244.551	2242.7	5.4	2380.4	409.8	2790.2	6.81	56.98	1600.0	1190.2
80	0.2836	2256.953	2255.1	5.5	2390.8	416.3	2807.0	6.74	56.05	1611.6	1195.4
81	0.2971	2312.166	2310.3	5.8	2442.1	428.5	2870.6	6.70	54.27	1649.6	1221.1
82	0.3106	2363.297	2361.4	6.1	2488.8	442.3	2931.1	6.63	52.27	1686.7	1244.4
83	0.3241	2407.866	2406.0	6.4	2528.3	457.7	2986.0	6.52	50.04	1721.8	1264.2
84	0.3376	2461.293	2459.4	6.7	2576.8	466.8	3043.5	6.52	48.72	1755.1	1288.4
85	0.3511	2494.690	2492.8	6.9	2604.0	482.1	3086.1	6.40	46.49	1784.1	1302.0
86	0.3646	2548.827	2546.9	7.2	2652.7	490.4	3143.1	6.41	45.29	1816.7	1326.3
87	0.3781	2590.341	2588.5	7.5	2687.8	504.7	3192.5	6.33	43.22	1848.6	1343.9
88	0.3916	2637.311	2635.4	7.8	2728.4	514.4	3242.8	6.30	41.81	1878.6	1364.2
89	0.4052	2664.002	2662.1	8.0	2747.8	528.6	3276.4	6.20	39.75	1902.5	1373.9
90	0.4187	2685.096	2683.2	8.3	2761.2	542.4	3303.6	6.09	37.75	1923.0	1380.6
91	0.4322	2725.908	2724.0	8.6	2794.7	549.4	3344.2	6.09	36.73	1946.8	1397.4
92	0.4457	2741.542	2739.7	8.9	2802.2	562.1	3364.3	5.99	34.90	1963.2	1401.1
93	0.4592	2776.133	2774.3	9.1	2829.0	569.0	3398.0	5.97	33.89	1983.5	1414.5
94	0.4727	2797.017	2795.1	9.4	2841.6	581.2	3422.8	5.89	32.12	2002.0	1420.8
95	0.4862	2823.127	2821.3	9.7	2859.4	589.3	3448.7	5.85	30.94	2019.0	1429.7
96	0.4997	2832.950	2831.1	10.0	2860.5	600.6	3461.1	5.76	29.32	2030.8	1430.3
97	0.5132	2842.006	2840.1	10.3	2860.8	611.0	3471.8	5.68	27.81	2041.4	1430.4
98	0.5267	2870.235	2868.4	10.5	2880.3	617.5	3497.9	5.66	26.85	2057.7	1440.2
99	0.5402	2875.285	2873.4	10.8	2876.5	627.2	3503.7	5.59	25.45	2065.5	1438.2
100	0.5537	2880.245	2878.4	11.1	2872.5	633.6	3506.1	5.53	24.52	2069.9	1436.2
101	0.5672	2868.483	2866.6	11.4	2851.8	641.2	3493.0	5.45	23.42	2067.1	1425.9
102	0.5807	2879.291	2877.4	11.6	2853.6	646.1	3499.7	5.42	22.71	2072.9	1426.8
103	0.5943	2867.256	2865.4	11.9	2832.8	652.5	3485.3	5.34	21.78	2068.9	1416.4
104	0.6078	2875.390	2873.5	12.2	2831.9	657.0	3488.9	5.31	21.13	2073.0	1415.9
105	0.6213	2869.343	2867.5	12.5	2817.0	662.1	3479.1	5.25	20.39	2070.6	1408.5
106	0.6348	2855.874	2854.0	12.8	2794.9	666.4	3461.3	5.19	19.76	2063.9	1397.5
107	0.6483	2870.576	2868.7	13.0	2800.4	668.1	3468.5	5.19	19.52	2068.3	1400.2
108	0.6618	2867.558	2865.7	13.3	2788.5	671.6	3460.2	5.15	19.01	2065.9	1394.3
109	0.6753	2864.930	2863.1	13.6	2777.1	673.0	3450.0	5.13	18.81	2061.5	1388.5
110	0.6888	2852.830	2851.0	13.9	2756.5	676.9	3433.4	5.07	18.24	2055.1	1378.2
111	0.7023	2859.132	2857.3	14.1	2753.7	679.6	3433.2	5.05	17.86	2056.4	1376.8
112	0.7158	2852.702	2850.8	14.4	2738.6	682.8	3421.4	5.01	17.39	2052.1	1369.3
113	0.7293	2856.927	2855.1	14.7	2733.8	685.3	3419.1	4.99	17.03	2052.2	1366.9
114	0.7428	2857.466	2855.6	15.0	2725.4	688.3	3413.7	4.96	16.60	2051.0	1362.7
115	0.7563	2858.135	2856.3	15.2	2717.2	691.5	3408.6	4.93	16.13	2050.0	1358.6
116	0.7698	2870.547	2868.7	15.5	2720.0	692.0	3412.0	4.93	16.05	2052.0	1360.0
117	0.7833	2868.775	2866.9	15.8	2709.4	694.9	3404.4	4.90	15.63	2049.6	1354.7
118	0.7969	2881.112	2879.2	16.1	2712.1	695.4	3407.5	4.90	15.57	2051.4	1356.1

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress kPa	Minor Eff. Stress kPa	Major Eff. Stress kPa	1:3 Ratio	Pore Press. psi	P kPa	Q kPa
119	0.8104	2868.385	2866.5	16.4	2691.2	697.9	3389.2	4.86	15.20	2043.5	1345.6
120	0.8237	2866.833	2865.0	16.6	2681.0	699.1	3380.1	4.83	15.02	2039.6	1340.5

APPENDIX C2

ROCK LABORATORY TEST RESULTS

(Pages C2-1 to C2-5)

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June 04, 2015

Mr. Greg Magoon P.Eng
Knight Piesold Ltd.
Suite 1400 - 750 W. Pender St.,
Vancouver, BC V6C 2T8

Re: Rock mechanics lab testing of core samples (Tintina Project)

Mr. Magoon:

One shipment of seventeen (17) rock core specimens was received from which twelve were subjected to unconfined compression strength testing and five (being too short to test for UCS) were tested to point load failure.

Testing was performed within a Materials Testing System (MTS) Model 815 servo-controlled, electrohydraulic compression testing frame. Each unconfined compression specimen was subjected to a process of preparation that included:

-diamond sawing to prepare cylindrical samples having nearly parallel end faces
-diamond lathing, to prepare sample faces parallel to within + 0.025 mm
-testing to failure within the servo-controlled compression frame; all tests were performed under axial strain control at rates approximating 10-5 s-1, and simultaneous recording of axial force and axial deformation (and circumferential deformation conditions only for unconfined specimens) parameters was conducted, from which determination of standard failure parameters (Young's Modulus and Poisson's ratio, where feasible) was made.

Each point load specimen was manufactured to exhibit a length-to-diameter aspect ratio approximating 1.5-to-1 and was tested to diametral loading failure.

Failure test results, with typical pre- and post-test photographs of each unconfined test sample, are tabled and included.

Yours sincerely,

Peter Lausch, M.Sc., P. Eng.

Summary of Unconfined Compression Failure Test Results
(Tintina Project – May, 2015)

Sample – Hole (Depth, m)	Density (g/cm^3)	Young's Modulus E, (GPa)	Poisson's ratio (μ)	UCS (MPa)	Point Load Index (MPa)
SC15-182-UCS01 (14.00-14.10)	2.66	24.173	0.30	170.6	---
SC15-188 (17.25-18.25)	2.59	10.025	0.37	76.3	---
SC15-187-UCS01 (22.20-22.11)	2.60	19.273	0.15	124.3	---
SC15-183-UCS02 (34.10)	2.30	0.179	---	2.2 (f)	---
SC15-193-UCS01 (51.00-51.79)	2.74	16.537	0.17	106.7	---
SC15-198-UCS01 (55.60-56.20)	2.69	16.049	0.24	42.9	---
SC15-187-UCS02 (61.80-62.50)	2.67	20.782	0.22	56.8	---
SC15-181-UCS01 (72.35-73.25)	2.68	11.560	0.14	50.9 (pf)	---
SC15-198-UCS02 (75.00-75.83)	2.70	8.773	0.27	14.3 (f)	---
SC15-191-UCS01 (84.00-84.90)	2.69	12.050	0.14	36.1 (pf)	---
SC15-198-UCS03 (93.60-94.30)	2.62	0.592	---	1.8 (f)	---
SC15-197-UCS02 (95.00-95.80)	2.60	17.186	0.23	76.8	---
SC15-190-UCS01 (45.70)	---	---	---	---	1.38
SC15-198-UCS04 (27.80-28.60)	---	---	---	---	0.33
SC15-189-UCS01 (92.10)	---	---	---	---	0.32
SC15-197-UCS01 (76.60-77.30)	---	---	---	---	0.41
SC15-183-UCS01 (97.40-98.10)	---	---	---	---	0.21

(f) - indicates sample failure to occur fully along pre-existing foliation surface(s)
(pf) - indicates sample failure to occur partially along pre-existing foliation surface(s)

Pre-Test Specimen Photographs


UCS02
62'5"
UCS
MDT Tintina May 2015
Length
Diameter
SC15-197-UCS02(61.9-62.5)


UCS 01
72.35'-73.25'
UCS
MDT Tintina May 2015
Length
Diameter
SC15-181-UCS01(72.35-73.25)


VA101-46013 - SC15-198
UCS02
75'-75.83'
UCS
MDT Tintina May 2015
Length
Diameter
SC15-198-UCS02(75 -75.83)


UCS
MDT Tintina May 2015
Length
Diameter
SC15-191-UCS01(84 -84.9)


UCS
MDT Tintina May 2015
Length
Diameter
SC15-195-UCS03(93.5-94.3)


VA101-46013
SC15-197 UC
95'-95.8'
UCS
MDT Tintina May 2015
Length
Diameter
SC15-197-UCS02(95 -95.8)


MDT Tintina
POINT LOAD
SC15-190-UCS01-(45.7)


MDT Tintina
POINT LOAD
SC15-198-UCS01-(27.8-28.6)


SC15-189
UCS01
92.1 ft -8
MDT Tintina
POINT LOAD
SC15-189-UCS01-(92.1)

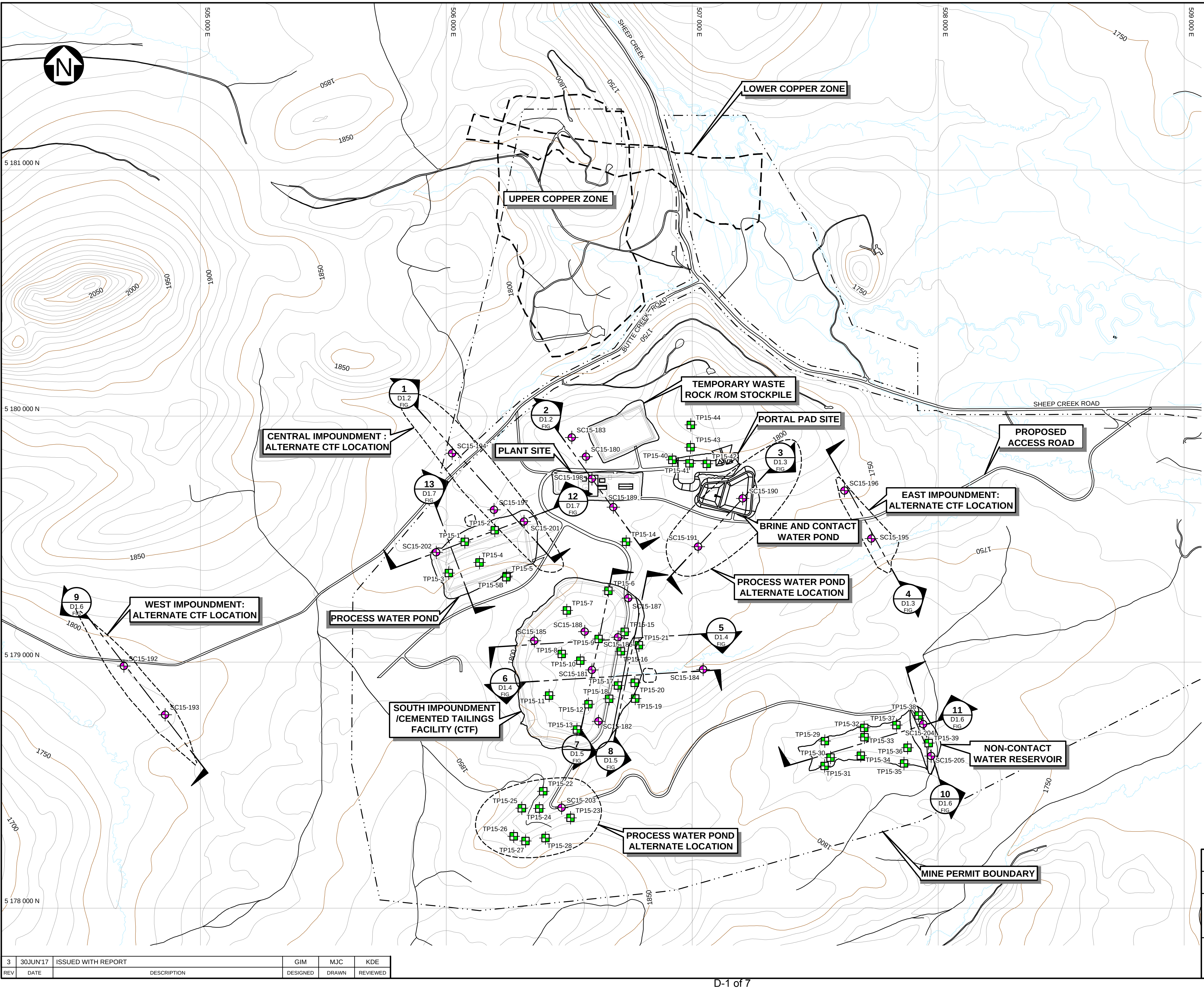

MDT Tintina
POINT LOAD
SC15-184-UCS01-(97.7-98.5)


MDT Tintina
POINT LOAD
SC15-197-UCS01-(76.6-77.3)

APPENDIX D

CROSS SECTIONS

(Pages D-1 to D-7)



LEGEND:

# ### FIG	CROSS-SECTION REFERENCE
⊕	DRILL HOLE
🟩	TEST PIT
– – – –	ALTERNATE CTF AND PWP LOCATION
— · — · —	MINE PERMIT BOUNDARY

NOTES:

1. TOPOGRAPHIC BASE MAP FROM 2011 AERIAL LIDAR SURVEY WITH MAP PROJECTION: UTM ZONE 12N AND MAP DATUM: NAD83.
2. CONTOUR INTERVAL IS 10 METERS.
3. ELEVATIONS ARE IN METERS, UNLESS NOTED OTHERWISE.

SCALE A 150 75 0 250 500 750 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

GENERAL ARRANGEMENT AND CTF OPTIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-460/3	1

FIGURE D1.1 REV 3

3	30JUN'17	ISSUED WITH REPORT	GIM	MJC	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B01_r3, 6/30/2017 10:53:34 AM , MCOUTTS PRINTED: 6/30/2017 11:03:59 AM, Layout1, MCOUTTS
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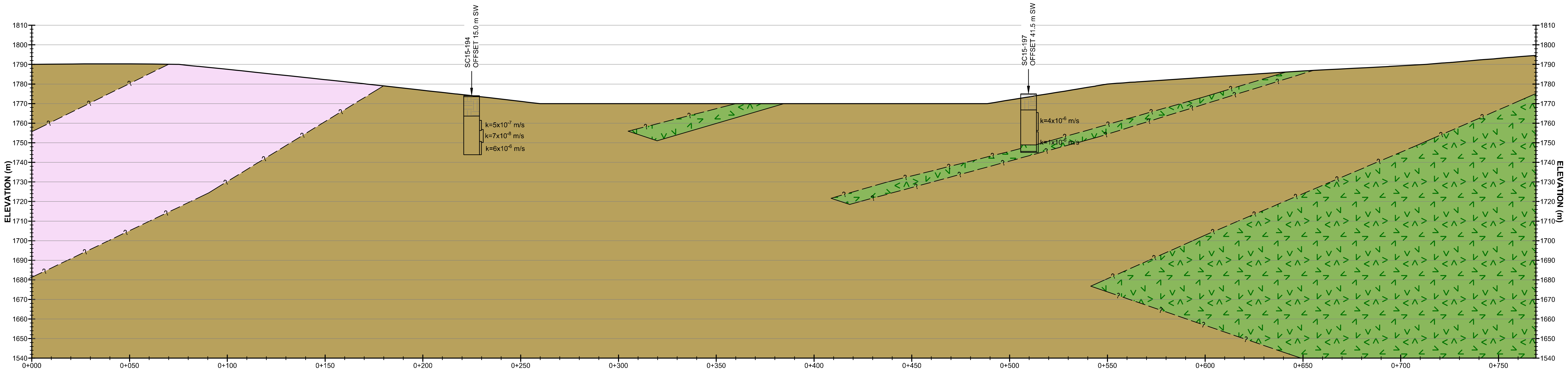
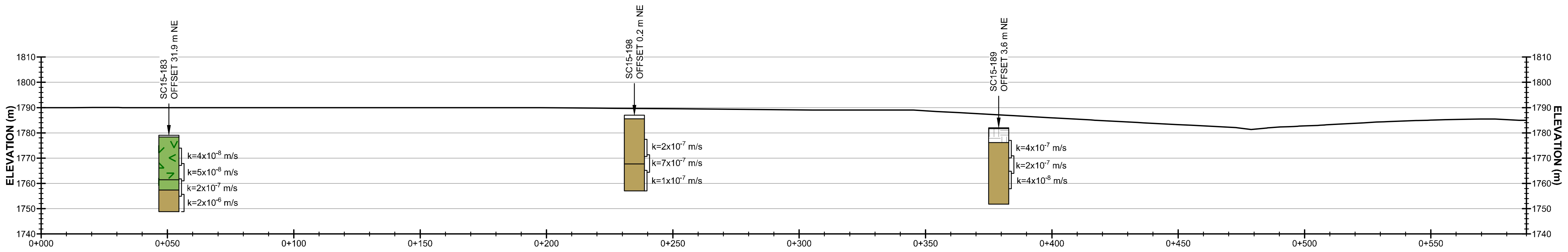


1 D1.1 FIG **SECTION**
SCALE A



2 D1.1 FIG **SECTION**
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▦	WEATHERED BEDROCK
▨	OVERBURDEN
🟪	SHEAR ZONE
🟫	SHALE
🟩	GRANODIORITE
🟦	LIMESTONE
]k=1x10^{-7} m/s	HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL
SITE INVESTIGATION
CROSS SECTIONS 1 & 2

Knight Piésold
CONSULTING

P/A NO. VA101-460/3
REF NO. 1

FIGURE D1.2
REV 0

0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B02, 4/19/2016 4:40:40 PM , RPENG PRINTED: 4/20/2016 2:27:17 PM, Sect 1 2, RPENG
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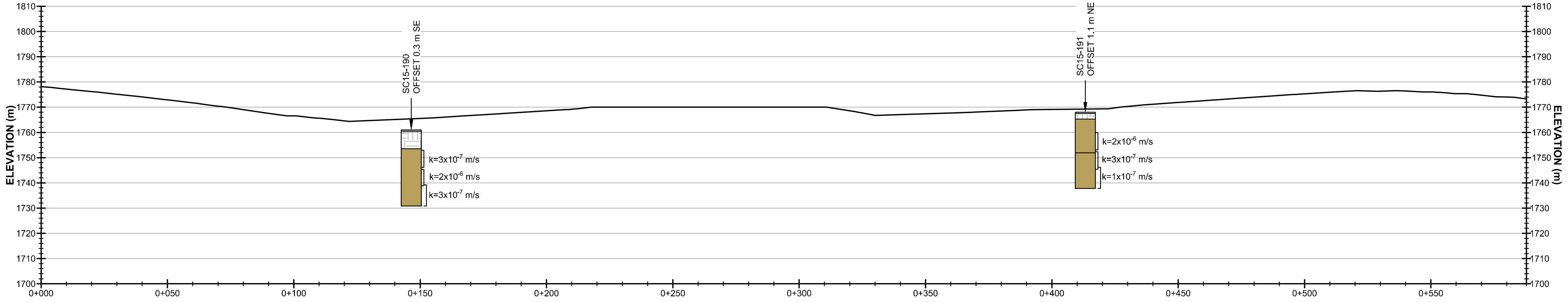
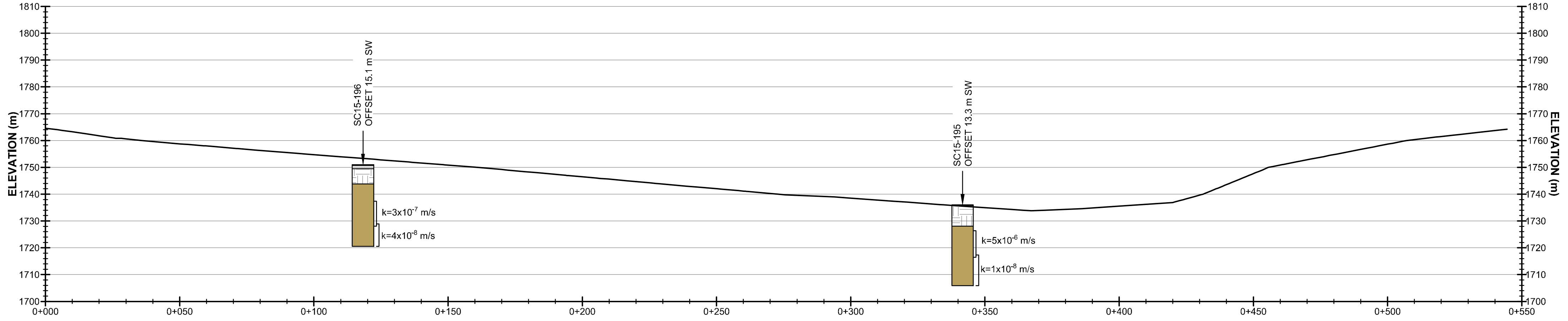


3
D1.1
FIG

SECTION
SCALE A



4
D1.1
FIG

SECTION
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▦	WEATHERED BEDROCK
▩	OVERBURDEN
🟪	SHEAR ZONE
🟫	SHALE
🟩	GRANODIORITE
🟦	LIMESTONE
]k=1x10^{-7} m/s	HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

SCALE A 20 10 0 20 40 60 80 100 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

**2015 GEOTECHNICAL
SITE INVESTIGATION
CROSS SECTIONS 3 & 4**

Knight Piésold
CONSULTING

P/A NO. VA101-460/3
REF NO. 1
FIGURE D1.3
REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B02_r0, 4/18/2016 2:27:40 PM , RPENG PRINTED: 4/18/2016 2:29:20 PM, Sect 3 4, RPENG
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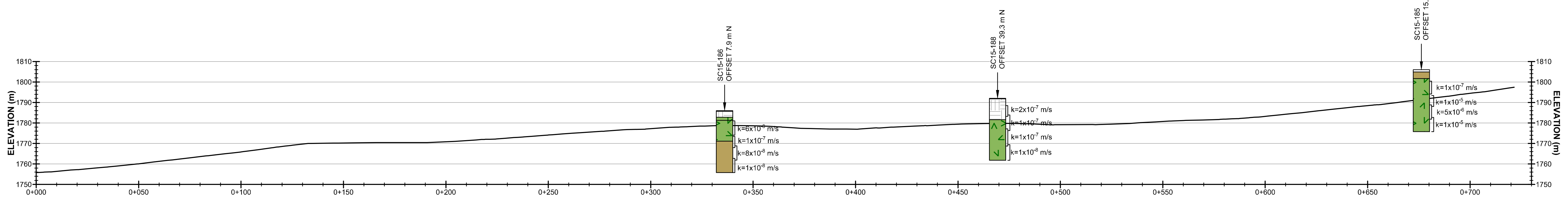
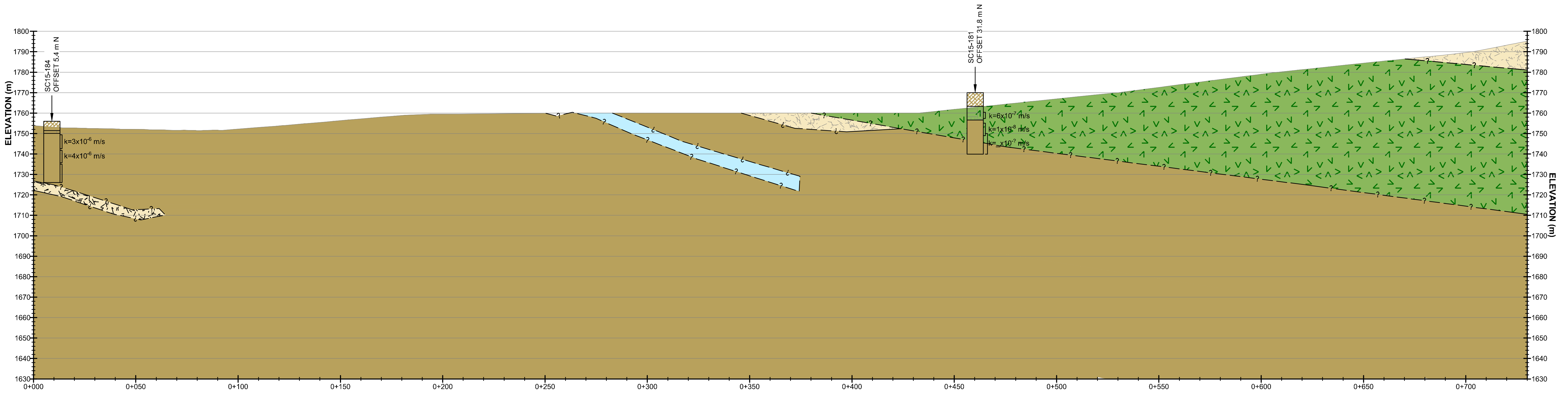


5 D1.1 FIG **SECTION**
SCALE A



6 D1.1 FIG **SECTION**
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▦	WEATHERED BEDROCK
▨	OVERBURDEN
🟪	SHEAR ZONE
🟫	SHALE
▨	CONGLOMERETE
🟩	GRANODIORITE
🟦	LIMESTONE
]k=1x10^{-7} m/s	HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

SCALE A 20 10 0 20 40 60 80 100 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL
SITE INVESTIGATION
CROSS SECTIONS 5 & 6

Knight Piésold
CONSULTING

P/A NO. VA101-460/3
REF NO. 1
FIGURE D1.4
REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B02_r0, 4/18/2016 2:27:40 PM , RPENG PRINTED: 4/18/2016 2:29:58 PM, Sect 5 6, RPENG
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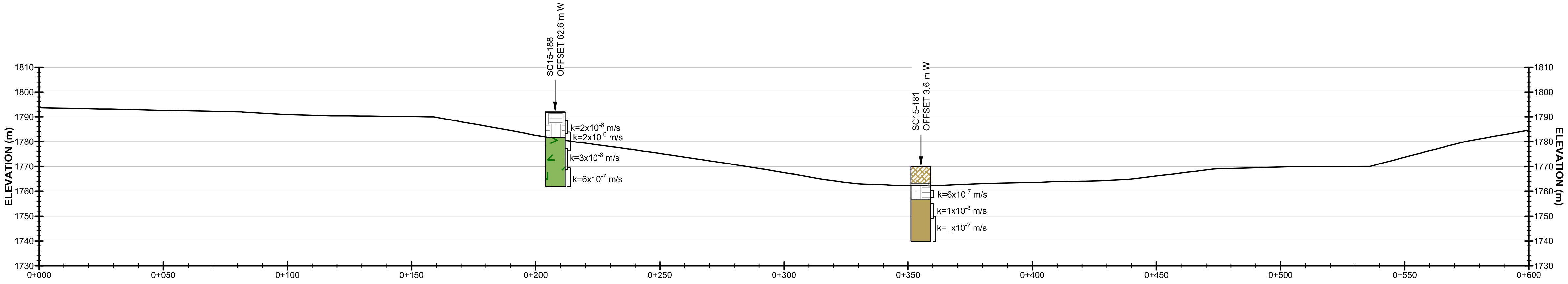
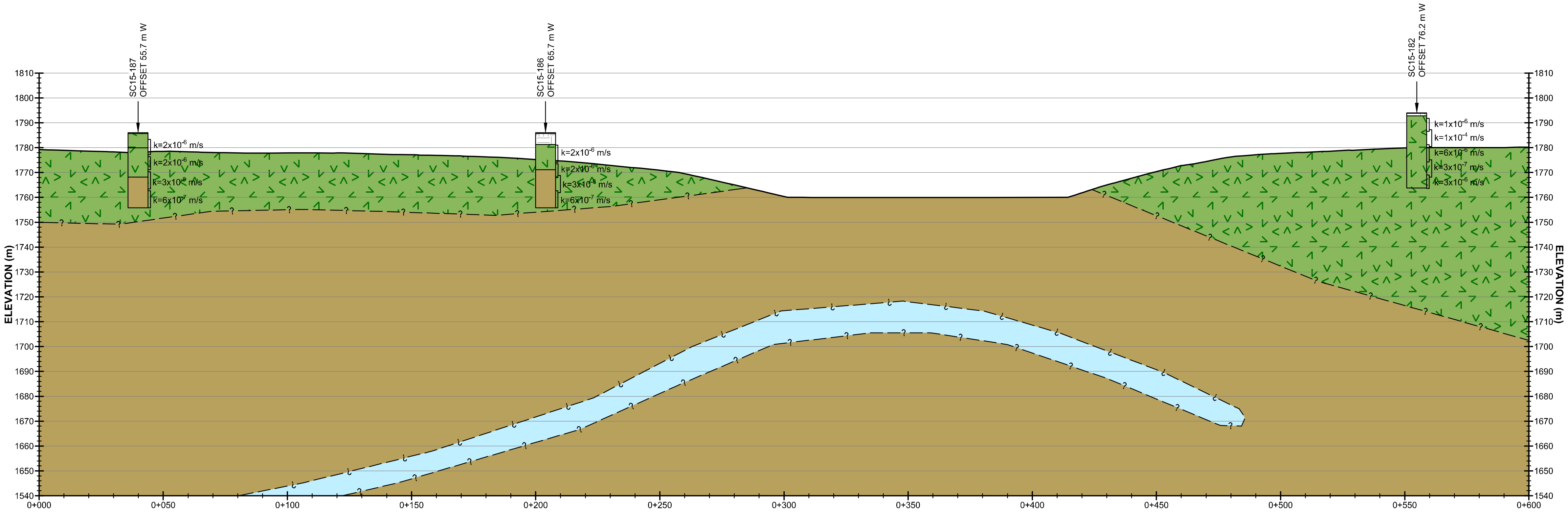


7 D1.1 FIG **SECTION**
SCALE A



8 D1.1 FIG **SECTION**
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▦	WEATHERED BEDROCK
▨	OVERBURDEN
🟪	SHEAR ZONE
🟫	SHALE
🟩	GRANODIORITE
🟦	LIMESTONE
]k=1x10-7 m/s	HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

SCALE A 20 10 0 20 40 60 80 100 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL
SITE INVESTIGATION
CROSS SECTIONS 7 & 8

Knight Piésold
CONSULTING

P/A NO. VA101-460/3
REF NO. 1
FIGURE D1.5
REV 0

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B02_r0, 4/18/2016 2:27:40 PM , RPENG PRINTED: 4/18/2016 2:30:29 PM, Sect 7 8, RPENG
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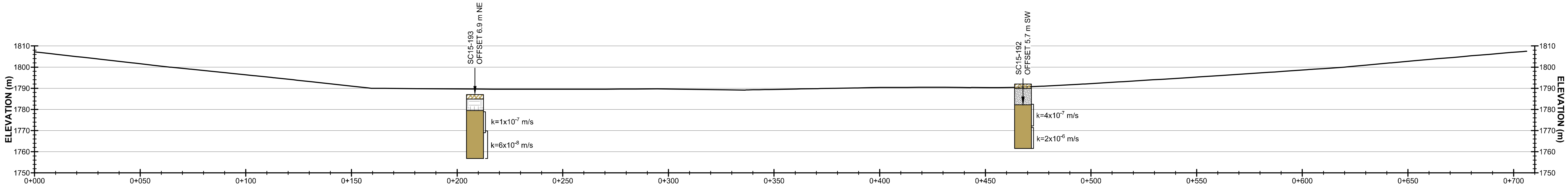
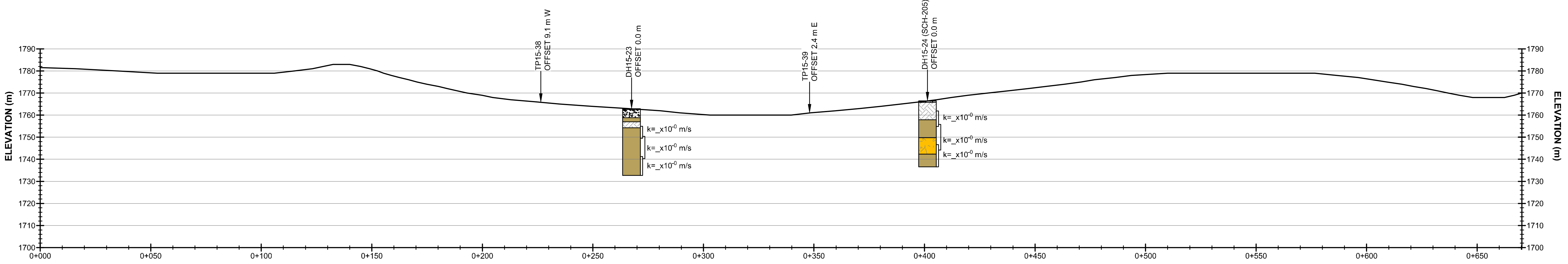
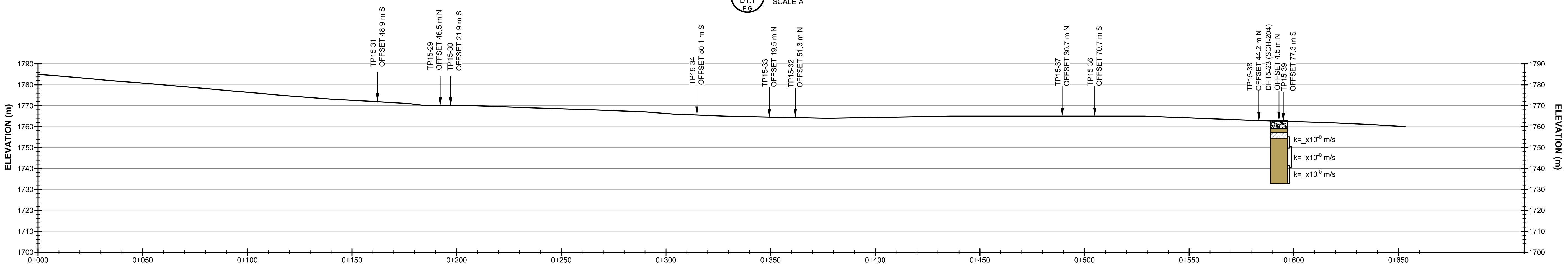
0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED



9 D1.1 FIG **SECTION**
SCALE A



10 D1.1 FIG **SECTION**
SCALE A



11 D1.1 FIG **SECTION**
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▦	WEATHERED BEDROCK
▨	OVERBURDEN
▢	SHEAR ZONE
■	SHALE
🟩	GRANODIORITE
▢	LIMESTONE
]k=1x10^{-7} m/s	HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

SCALE A 20 10 0 20 40 60 80 100 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

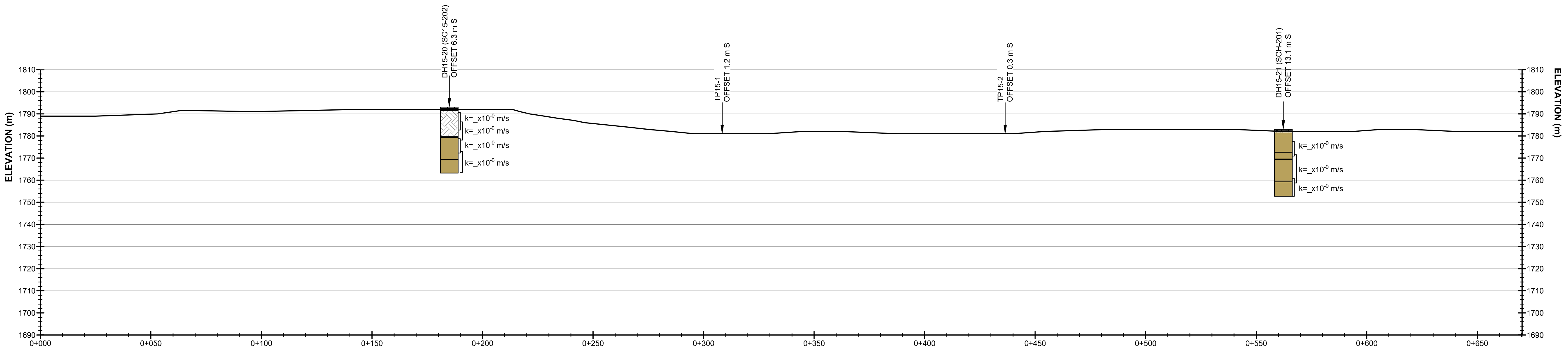
2015 GEOTECHNICAL
SITE INVESTIGATION
CROSS SECTIONS 9, 10 & 11

Knight Piésold
CONSULTING

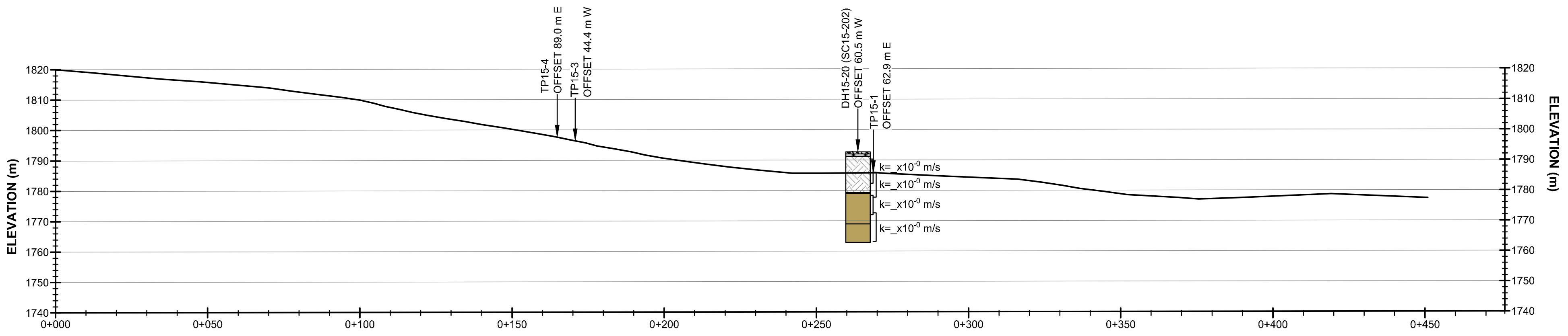
P/A NO.	REF NO.
VA101-460/3	1

FIGURE D1.6 REV 0

0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED



12 D1.1 FIG **SECTION**
SCALE A



13 D1.1 FIG **SECTION**
SCALE A

NOTES:

1. LITHOLOGICAL CROSS SECTION INFORMATION PROVIDED BY TINTINA RESOURCES INC. (APRIL 2015).

LEGEND:

▨ WEATHERED BEDROCK
▨ OVERBURDEN
▨ SHEAR ZONE
▨ SHALE
▨ GRANODIORITE
▨ LIMESTONE
]k=1x10^{-7} m/s HYDRAULIC CONDUCTIVITY FROM PACKER TESTS, SHOWN IN METRES PER SECOND

SCALE A 20 10 0 20 40 60 80 100 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION CROSS SECTIONS 12 & 13

Knight Piésold CONSULTING

P/A NO.	REF NO.
VA101-460/3	1

FIGURE D1.7 REV 0

0	18APR'16	ISSUED WITH REPORT	GIM	KJM	KDE
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED

SAVED: M:\1\01\00460\03\A\Acad\FIGS\B02_r0, 4/18/2016 2:27:40 PM , RPENG PRINTED: 4/18/2016 2:31:33 PM, Sect 12 13, RPENG
XREF FILE(S): IMAGE FILE(S):

APPENDIX E

PHOTOGRAPHS

Appendix E1	Core Photographs
Appendix E2	SPT Photographs

APPENDIX E1

DRILL CORE PHOTOGRAPHS

(Pages E1-1 to E1-72)

PHOTO 1 SC15-180_001_0.0 - 3.2 m

PHOTO 2 SC15-180_002_3.2 - 5.8 m

PHOTO 3 SC15-180_003_5.8 - 8.7 m

PHOTO 4 SC15-180_004_8.7 - 11.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-180_005_11.5 - 14.0 m

PHOTO 6 SC15-180_006_14.0 - 16.7m

PHOTO 7 SC15-180_007_16.7 - 19.3 m

PHOTO 8 SC15-180_008_19.3 - 21.9 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-180_009_21.9 - 24.7 m

PHOTO 10 SC15-180_010_24.7 - 27.3 m

PHOTO 11 SC15-180_011_27.3 - 30.2 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-181_001_6.7 - 9.2 m

PHOTO 2 SC15-181_002_9.2 - 11.9 m

PHOTO 3 SC15-181_003_11.9 - 15.2 m

PHOTO 4 SC15-181_004_15.2 - 18.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-181_005_18.0 - 20.95 m

PHOTO 6 SC15-181_006_20.95 - 24.0 m

PHOTO 7 SC15-181_007_24.0 - 26.5 m

PHOTO 8 SC15-181_008_26.5 - 29.2 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-181_009_29.2 - 30.1 m_TD

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-182_001_0.0 - 2.7 m

PHOTO 2 SC15-182_002_2.7 - 5.4 m

PHOTO 3 SC15-182_003_5.4 - 8.2 m

PHOTO 4 SC15-182_004_8.2 - 11.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-182_005_11.0 - 13.6 m

PHOTO 6 SC15-182_006_13.6 - 16.5 m

PHOTO 7 SC15-182_007_16.5 - 19.3 m

PHOTO 8 SC15-182_008_19.3 - 21.9 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-182_009_21.9 - 24.8 m

PHOTO 10 SC15-182_010_24.8 - 27.6 m

PHOTO 11 SC15-182_011_27.6 - 30.2m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-183_001_0 - 3.5 m

PHOTO 2 SC15-183_002_3.5 - 6.1 m

PHOTO 3 SC15-183_003_6.1 - 9.0 m

PHOTO 4 SC15-183_004_9.0 - 11.5 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-183_005_11.5 - 14.6 m

PHOTO 6 SC15-183_006_14.6 - 17.4 m

PHOTO 7 SC15-183_007_17.4 - 20.0 m

PHOTO 8 SC15-183_008_20.0 - 22.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-183_009_22.6 - 25.3 m

PHOTO 10 SC15-183_010_25.3 - 28.0 m

PHOTO 11 SC15-183_011_28.0 - 30.18 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-184_01-02_4.6 - 7.4 m

PHOTO 2 SC15-184_03-04_7.4 - 10.1 m

PHOTO 3 SC15-184_05-06_10.1 - 12.6 m

PHOTO 4 SC15-184_07-08_12.6 - 15.1 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-184_09-10_15.1 - 17.7 m

PHOTO 6 SC15-184_11-12_17.7 - 20.4 m

PHOTO 7 SC15-184_13-14_20.4 - 22.6 m

PHOTO 8 SC15-184_15-16_22.6 - 25.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-184_17-18_25.5 - 28.2 m

PHOTO 10 SC15-184_19-20_28.2 - 30.0 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-185_01-02_0 - 3.0 m

PHOTO 2 SC15-185_03-04_3.0 - 6.0 m

PHOTO 3 SC15-185_05-06_6.0 - 8.8 m

PHOTO 4 SC15-185_07-08_8.8 - 11.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-185_09-10_11.5 - 14.2 m

PHOTO 6 SC15-185_11-12_14.2 - 16.8 m

PHOTO 7 SC15-185_13-14_16.8 - 19.5 m

PHOTO 8 SC15-185_15-16_19.5 - 22.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-185_17-18_22.3 - 24.8 m

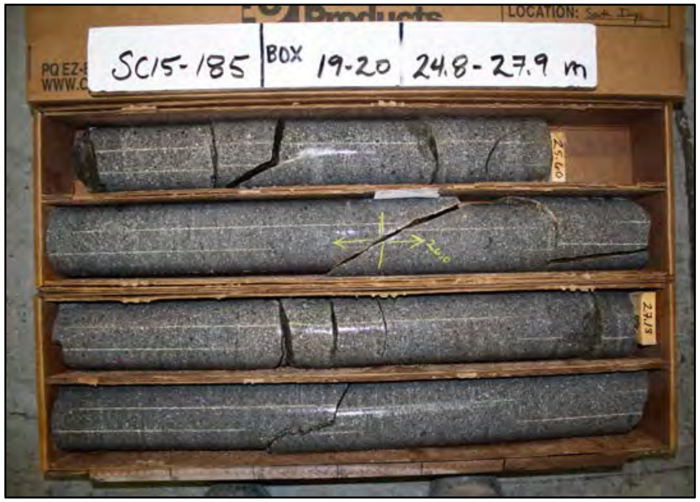


PHOTO 10 SC15-185_19-20_24.8 - 27.9 m

PHOTO 11 SC15-185_21-22_27.9 - 30.2m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-186_001_0 - 2.9 m

PHOTO 2 SC15-186_002_2.9 - 5.7 m

PHOTO 3 SC15-186_003_5.7 - 8.4 m

PHOTO 4 SC15-186_004_8.4 - 11.4 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-186_005_11.4 - 14.0 m

PHOTO 6 SC15-186_006_14.0 - 17.0 m

PHOTO 7 SC15-186_007_17.0 - 19.6 m

PHOTO 8 SC15-186_008_19.6 - 22.4 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-186_009_22.4 - 25.1 m

PHOTO 10 SC15-186_010_25.1 - 27.7 m

PHOTO 11 SC15-186_011_27.7 - 30.2 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-187_001_0 - 2.9 m

PHOTO 2 SC15-187_002_2.9 - 5.9 m

PHOTO 3 SC15-187_003_5.9 - 8.5 m

PHOTO 4 SC15-187_004_8.5 - 11.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-187_005_11.3 - 14.1 m

PHOTO 6 SC15-187_006_14.1 - 16.9 m

PHOTO 7 SC15-187_007_16.9 - 19.7 m

PHOTO 8 SC15-187_008_19.7 - 22.4 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-187_009_22.4 - 25.2 m

PHOTO 10 SC15-187_010_25.2 - 27.9 m

PHOTO 11 SC15-187_011_27.9 - 30.2m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-188_001_0 - 2.9 m

PHOTO 2 SC15-188_002_2.9 - 5.9 m

PHOTO 3 SC15-188_003_5.9 - 8.6 m

PHOTO 4 SC15-188_004_8.6 - 11.4 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-188_005_11.4 - 14.2 m

PHOTO 6 SC15-188_006_14.2 - 16.9 m

PHOTO 7 SC15-188_007_16.9 - 19.7 m

PHOTO 8 SC15-188_008_19.7 - 22.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-188_009_22.5 - 25.1 m

PHOTO 10 SC15-188_010_25.1 - 28.0 m

PHOTO 11 SC15-188_011_28.0 - 30.2 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-189_001_0 - 3.2 m

PHOTO 2 SC15-189_002_3.2 - 6.0 m

PHOTO 3 SC15-189_003_6.0 - 9.0 m

PHOTO 4 SC15-189_004_9.0 - 11.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-189_005_11.6 - 14.3 m

PHOTO 6 SC15-189_006_14.3 - 17.3 m

PHOTO 7 SC15-189_007_17.3 - 20.0 m

PHOTO 8 SC15-189_008_20.0 - 22.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-189_009_22.6 - 25.1 m

PHOTO 10 SC15-189_010_25.1 - 28.1 m

PHOTO 11 SC15-189_011_28.1 - 30.2 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-190_001_0 - 3.6 m

PHOTO 2 SC15-190_002_3.6 - 6.4 m

PHOTO 3 SC15-190_003_6.4 - 9.0 m

PHOTO 4 SC15-190_004_9.0 - 11.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-190_005_11.6 - 14.2 m

PHOTO 6 SC15-190_006_14.2 - 17.0 m

PHOTO 7 SC15-190_007_17.0 - 19.7 m

PHOTO 8 SC15-190_008_19.7 - 22.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-190_009_22.3 - 25.0 m

PHOTO 10 SC15-190_010_25.0 - 27.8 m

PHOTO 11 SC15-190_011_27.8 - 30.2 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-191_001_0 - 4.1 m

PHOTO 2 SC15-191_002_4.1 - 7.6 m

PHOTO 3 SC15-191_003_7.6 - 10.7 m

PHOTO 4 SC15-191_004_10.7 - 13.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-191_005_13.6 - 16.5 m

PHOTO 6 SC15-191_006_16.5 - 19.3 m

PHOTO 7 SC15-191_007_19.3 - 22.1 m

PHOTO 8 SC15-191_008_22.1 - 24.8 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-191_009_24.8 - 27.6 m

PHOTO 10 SC15-191_010_27.6 - 30.2 m_TD

PHOTO 1 SC15-192_001_5.2 - 8.4 m

PHOTO 2 SC15-192_002_8.4 - 11.3 m

PHOTO 3 SC15-192_003_11.3 - 14.1 m

PHOTO 4 SC15-192_004_14.1 - 16.9 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-192_005_16.9 - 19.8 m

PHOTO 6 SC15-192_006_19.8 - 22.5 m

PHOTO 7 SC15-192_007_22.5 - 25.0 m

PHOTO 8 SC15-192_008_25.0 - 28.1 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-192_009_28.1 - 30.5 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-193_001_3.7 - 6.4 m

PHOTO 2 SC15-193_002_6.4 - 9.1 m

PHOTO 3 SC15-193_003_9.1 - 11.9 m

PHOTO 4 SC15-193_004_11.9 - 14.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-193_005_14.6 - 17.4 m

PHOTO 6 SC15-193_006_17.4 - 20.2 m

PHOTO 7 SC15-193_007_20.2 - 23.1 m

PHOTO 8 SC15-193_008_23.1 - 26.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-193_009_26.0 - 28.7 m

PHOTO 10 SC15-193_010_28.7 - 30.2 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-194_01-02_0 - 4.2 m

PHOTO 2 SC15-194_03-04_4.2 - 6.6 m

PHOTO 3 SC15-194_05-06_6.6 - 10.0 m

PHOTO 4 SC15-194_07-08_10.0 - 13.1 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-194_09-10_13.1 - 15.7 m

PHOTO 6 SC15-194_11-12_15.7 - 18.5 m

PHOTO 7 SC15-194_13-14_18.5 - 20.8 m

PHOTO 8 SC15-194_15-16_20.8 - 23.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-194_17-18_23.6 - 26.3 m

PHOTO 10 SC15-194_19-20_26.3 - 28.6 m

PHOTO 11 SC15-194_21_28.6 - 30.1 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-195_001_0 - 3.8 m

PHOTO 2 SC15-195_002_3.8 - 6.8 m

PHOTO 3 SC15-195_003_6.8 - 9.5 m

PHOTO 4 SC15-195_004_9.5 - 12.1 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-195_005_12.1 - 15.1 m

PHOTO 6 SC15-195_006_15.1 - 17.7 m

PHOTO 7 SC15-195_007_17.7 - 20.6 m

PHOTO 8 SC15-195_008_20.6 - 23.8 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-195_009_23.8 - 26.6 m

PHOTO 10 SC15-195_010_26.6 - 29.8 m

PHOTO 11 SC15-195_011_29.8 - 30.1m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-196_001_2.4 - 6.0 m

PHOTO 2 SC15-196_002_6.0 - 8.7 m

PHOTO 3 SC15-196_003_8.7 - 11.8 m

PHOTO 4 SC15-196_004_11.8 - 15.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-196_005_15.0 - 17.5 m

PHOTO 6 SC15-196_006_17.5 - 20.3 m

PHOTO 7 SC15-196_007_20.3 - 23.1 m

PHOTO 8 SC15-196_008_23.1 - 25.8 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-196_009_25.8 - 28.6 m

PHOTO 10 SC15-196_010_28.6 - 30.5 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-197_001_0 - 3.3 m

PHOTO 2 SC15-197_002_3.3 - 5.9 m

PHOTO 3 SC15-197_003_5.9 - 8.8 m

PHOTO 4 SC15-197_004_8.8 - 11.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-197_005_11.6 - 14.9 m

PHOTO 6 SC15-197_006_14.9 - 17.8 m

PHOTO 7 SC15-197_007_17.8 - 20.5 m

PHOTO 8 SC15-197_008_20.5 - 23.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-197_009_23.3 - 26.1 m

PHOTO 10 SC15-197_010_26.1 - 28.9 m

PHOTO 11 SC15-197_011_28.9 - 29.9 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-198_001_0 - 3.6 m

PHOTO 2 SC15-198_002_3.6 - 6.2 m

PHOTO 3 SC15-198_003_6.2 - 9.1 m

PHOTO 4 SC15-198_004_9.1 - 11.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-198_005_11.6 - 14.6 m

PHOTO 6 SC15-198_006_14.6 - 17.6 m

PHOTO 7 SC15-198_007_17.6 - 20.4 m

PHOTO 8 SC15-198_008_20.4 - 23.1 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-198_009_23.1 - 26.2 m

PHOTO 10 SC15-198_010_26.2 - 28.9 m

PHOTO 11 SC15-198_011_28.9 - 30.0 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-201_01_0 - 4.1 m

PHOTO 2 SC15-201_02_4.1 - 6.7 m

PHOTO 3 SC15-201_03_6.7 - 9.5 m

PHOTO 4 SC15-201_04_9.5 - 12.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-201_05_12.3 - 14.9 m

PHOTO 6 SC15_201_06_14.9 - 17.5 m

PHOTO 7 SC15_201_07_17.5 - 20.3 m

PHOTO 8 SC15_201_08_20.3 - 23.0 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-201_09_23.0 - 25.7 m

PHOTO 10 SC15-201_10_25.7 - 28.4 m

PHOTO 11 SC15-201_11_28.4 - 30.3 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-202_001_0 - 4.2 m

PHOTO 2 SC15-202_002_4.2 - 6.7 m

PHOTO 3 SC15-202_003_6.7 - 9.3 m

PHOTO 4 SC15-202_004_9.3 - 11.8 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-202_005_11.8 - 14.7 m

PHOTO 6 SC15-202_006_14.7 - 17.3 m

PHOTO 7 SC15_202_007_17.3 - 20.4 m

PHOTO 8 SC15-202_008_20.4 - 23.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-202_009_23.5 - 26.2 m

PHOTO 10 SC15-202-010_26.2 - 29.1 m

PHOTO 11 SC15-202_011_29.1 - 29.8 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-203_001_0 - 5.4 m

PHOTO 2 SC15-203_002_5.4 - 8.9 m

PHOTO 3 SC15-203_003_8.9 - 11.7 m

PHOTO 4 SC15-203_004_11.7 - 14.4 m

TINTINA RESOURCES INC.

BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-203_005_14.4 - 17.1 m

PHOTO 6 SC15-203_006_17.1 - 19.8 m

PHOTO 7 SC15-203_007_19.8 - 22.7 m

PHOTO 8 SC15-203_008_22.7 - 25.5 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-203_009_25.5 - 28.1 m

PHOTO 10 SC15-203_010_28.1 - 30.1 m_TD

PHOTO 1 SC15-204_001_0 - 4.7 m

PHOTO 2 SC15-204_002_4.7 - 8.5 m

PHOTO 3 SC15-204_003_8.5 - 11.1 m

PHOTO 4 SC15-204_004_11.1 - 14.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-204_005_14.0 - 16.9 m

PHOTO 6 SC15-204_006_16.9 - 19.5 m

PHOTO 7 SC15-204_007_19.5 - 22.2 m

PHOTO 8 SC15-204_008_22.2 - 25.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-204_009_25.0 - 27.7 m

PHOTO 10 SC15-204_010_27.7 - 30.32 m_TD

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-205_001_0 - 4.5 m

PHOTO 2 SC15-205_002_4.5 - 7.1 m

PHOTO 3 SC15-205_003_7.1 - 10.0 m

PHOTO 4 SC15-205_004_10.0 - 12.8 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-205_005_12.8 - 15.5 m

PHOTO 6 SC15-205_006_15.5 - 17.9 m

PHOTO 7 SC15-205_007_17.9 - 20.7 m

PHOTO 8 SC15-205_008_20.7 - 23.3 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 9 SC15-205_009_23.3 - 26.0 m

PHOTO 10 SC15-205_010_26.0 - 28.4 m

PHOTO 11 SC15-205_011_28.4 - 29.87 m_TD

APPENDIX E2

SPT PHOTOGRAPHS

(Pages E2-1 to E2-8)

PHOTO 1 SC15-181 SPT01_1.5 - 2.1 m

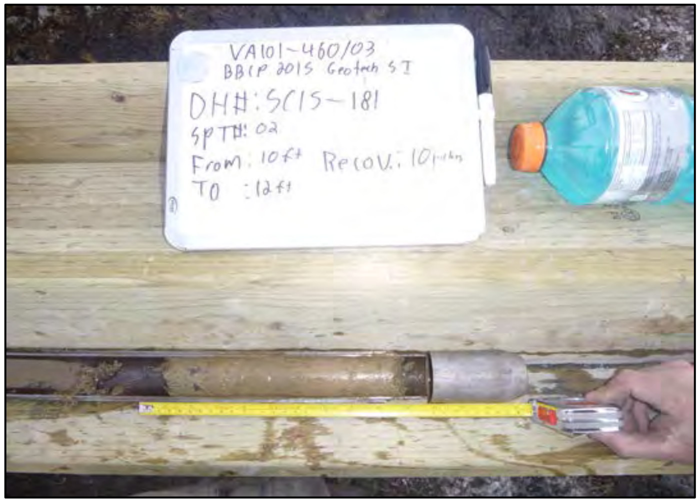


PHOTO 2 SC15-181 SPT02_3.0 - 3.7 m

PHOTO 3 SC15-181 SPT03_4.6 - 5.2 m

PHOTO 4 SC15-181 SPT04_6.1 - 6.2 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-184 SPT01_1.5 - 2.1 m

PHOTO 2 SC15-184 SPT02_3.0 - 3.7 m

PHOTO 3 SC15-184 SPT03_ 4.6 - 5.2 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-192_SPT01_1.5 - 2.1 m

PHOTO 2 SC15-192_SPT02_3.0 - 3.7 m

PHOTO 3 SC15-192_SPT03_4.6 - 5.2 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-193_SPT01_1.5 - 2.1 m

PHOTO 2 SC15-193_SPT02_3.0 - 3.7 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-196_SPT01_0.9 - 1.5 m

PHOTO 2 SC15-196_SPT01_2.4 - 3.0 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-198_SPT01_1.5 - 1.6 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 1 SC15-201_SPT01_0 - 0.61 m

PHOTO 2 SC15-202_SPT01_0 - 0.61 m

PHOTO 3 SC15-202_SPT02_1.52 - 2.12 m

PHOTO 4 SC15-203_SPT01_0 - 0.61 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

PHOTO 5 SC15-203_SPT02_1.52 - 2.12 m

PHOTO 6 SC15-204_SPT01_0 - 0.61 m

PHOTO 7 SC15-205_SPT01_0 - 0.61 m

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

APPENDIX F

KP LOGGING METHODOLOGY

Appendix F1	KP Soil Logging Methodology
Appendix F2	KP Rock Logging Methodology

APPENDIX F1

KP SOIL LOGGING METHODOLOGY

(Pages F1-1 to F1-2)

SOIL DESCRIPTION (VISUAL-MANUAL PROCEDURE)

<u>Typical Sequence</u>: Principal soil type, lithology (coarse and very coarse soils), particle shape, particle size, secondary soil constituents, gradation, plasticity, colour and odour, compactness/consistency, structure, inclusions, moisture condition (geological interpretation).

IDENTIFICATION OF SOIL TYPE

Group	Principal Soil Type	Particle Size (mm)	Identification
Very Coarse	BOULDERS COBBLES	>300 75 to 300	Particle Size Particle Size
Coarse	GRAVEL Coarse	19 -75	Particle Size
	Fine	4.75 -19	
	SAND Coarse	2.0 -4.75	Particle Size
	Medium	0.425 -2.0	
	Fine	0.075 -.425	
Fine Soils (>50% Clay/Silt)	SILT	0.002 to 0.075	Exhibits little plasticity and marked dilatancy, slightly granular or silky to the touch, disintegrates in water, lumps dry quickly, possesses cohesion (the particles stick together to give a relatively firm mass) but can be powdered easily between fingers. Plots below the A-Line on the Plasticity Chart (Plasticity Index verses Liquid Limit). Dilatancy test for identifying silt: Moisten soil sample on hand and then jar it against the other hand several times. Dilatancy is shown by the appearance of a shiny film of water. When the sample is squeezed or pressed with the fingers the surface dulls as it stiffens.
	CLAY	<0.002	Dry lumps can be broken but not powdered between the fingers, they also disintegrate under water but more slowly than silt; smooth to the touch; exhibits plasticity but not dilatancy; sticks to the fingers and dries slowly; shrinks appreciably on drying usually showing cracks. Plots above the A-Line on the Plasticity Chart.
Organic Soils	ORGANIC CLAY/SILT	Varies	Contains much organic material
	PEAT	Varies	Predominantly plant remains, low bulk density

COMPOSITE SOIL DESCRIPTION

Descriptive Term		Percentage Range
noun	CLAY, SILT, SAND, GRAVEL, COBBLES, BOULDERS	>35% and main fraction
"and"	and gravel, etc…	> 35%
adjective	gravelly, sandy, silty, etc…	20 – 35%
"some"	some gravel, cobbles, etc…	10 – 20%
"trace"	trace sand, trace silt etc…	1 – 10%

Notes:

(1) Composite soil descriptions should be checked from the results of particle size analyses and Atterberg Limits and any necessary changes should be made to the logs.

(2) For soils with between 20% and 35% cobbles and boulders, the log should read "many cobbles/boulders", as appropriate.

PARTICLE SHAPE

The shape of gravel, cobbles, and boulders are described using the following terms:

angular – sharp corners
subangular – slightly rounded corners
rounded – smooth rounded surface
subrounded – no angular corners
platy – flat, plate shaped

GRADATION

Well graded – having a wide range of grain sizes and substantial amounts of all intermediate sizes

Poorly graded – having a high proportion of particles predominantly of one grain size (uniformly graded) or having particles of large and small sizes with a relatively low proportion of intermediate sizes (gap-graded).

PLASTICITY (Clays and silts)

<u>Non Plastic</u>: a 1/8" (3 mm) thread cannot be rolled at any water content.
<u>Low Plasticity</u>: the thread can barely be rolled.
<u>Medium Plasticity</u>: the thread is easy to roll and not much time is required to reach the plastic limit (i.e. it starts to crumble).
<u>High Plasticity</u>: it takes considerable time rolling to reach the plastic limit.
Plasticity should be confirmed from the results of Atterberg Limits tests.

COLOUR AND ODOUR

Colour and odour of soils described. Odour may indicate organic inclusions or give evidence of soil contamination.

A typical description of colour might be "dark red brown". Descriptors can be added, such as mottled and spotted. Mottled soils are characterized by alternate streaks of oxidized zones (red, orange and yellow) and zones of insufficient oxygen (greys and blues).

COMPACTNESS/CONSISTENCY

Soil Group	Term	Identification
Very Coarse Soils (Cobbles & Boulders)	Loose	By inspection of voids and particle packing in the field
	Dense	
Coarse Soils (Sands & Gravels	Very Loose	SPT ‘N’ value 0 to 4
	Loose	SPT ‘N’ value 4 to10
	Compact	SPT ‘N’ value 10 to 30
	Dense	SPT ‘N’ value 30 to 50
	Very Dense	SPT ‘N’ value >50
Fine Soils (Clays & Silts)	Very Soft	Undrained Shear Strength (USS) <12 kPa; easily penetrated several cm by fist
	Soft	USS 12-25 kPa; easily penetrated several cm by thumb
	Firm	USS 25-50 kPa; can be penetrated several cm by thumb with moderate effort
	Stiff	USS 50-100 kPa; readily indented by thumb but penetrated only with great effort
	Very Stiff	USS 100-200 kPa; readily indented by thumb nail
	Hard	USS > 200 kPa; indented with difficulty by thumb nail
Organic Soils (incl. Peat)	Firm	Fibres already compressed together
	Spongy	Very compressible and open structure
	Plastic	Can be moulded in hand and smears fingers

STRUCTURE

Soil Group	Term	Descriptor
Coarse & Fine Soils	Massive	No evidence of layering
	Stratified	Layers of different soil types that are more than 20 mm thick
	Laminated	Layers are less than 20 mm thick
	Varved	(as above), with alternating clay and silt/fine sand layers
	Lenses	variable in thickness and shape
	Slickensided	Discontinuities in clay that are shiny and smooth due to shear displacement
	Blocky	The soil has a block-like structure
	Cemented	Minerals have precipitated from solution within the soil
	Leached	Minerals have been removed by percolating groundwater
Fine Soils	Fissured	Discontinuities associated with glacial unloading (spacing described as rock joints)
	Friable	Soil crumbles to small pieces when disturbed
	Nuggeted	Soil breaks into small cubes, often due to frost penetration
Organic Soils (including Peat)	Fibrous	Plant remains recognizable; retains some strength
	Amorphous	Recognizable plant remains absent

MOISTURE CONDITION

Condition	Description	Coarse Soils	Fine Soils
Dry	Looks and feels dry	Runs freely through hands	Hard, powdery or friable
Moist	Feels cool, darkened in colour	Tends to cohere	Weakened by moisture, no free water on hands when remoulded
Wet			Weakened by moisture, free water forms on hands when handling
Saturated	Feels cool, darkened in colour and free, and free water is present on the sample		

GEOLOGICAL INTERPRETATION

Where applicable a bracketed term is included to describe soil genesis e.g. Alluvium, Glacial Till, Fluvioglacial Deposits, Fill.

EXAMPLES

SAND, fine to medium, some gravel of quartzite, subangular to subrounded, fine to coarse, trace silt; poorly graded; grey, loose, stratified with trace layers (50 to 100 mm-thick) of silt, trace fine sand, soft, wet. (Alluvium).
PEAT, trace fine to medium sand; grey brown, organic odour, spongy, fibrous, saturated (Organic Swamp).
CLAY/SILT, trace fine sand, trace subrounded medium gravel of granodiorite; medium plasticity, grey, firm, varved with layers (2 to 10 mm-thick) of fine sand, trace roots, moist (Glacial Lake Deposit).
BOULDERS of granite, subangular, trace subangular cobbles; some silt, some subangular fine to coarse gravel, trace sand; orange brown, compact, moist (Colluvium).
SILT, trace fine to medium sand; low plasticity, red brown; stiff, with trace polished and slickensided shear surfaces with 1 to 2 mm of kaolin infill, dry (Residual Soil).
BOULDER sized fragments of sandstone, subangular, many cobble sized fragments, trace subangular to angular fine to coarse gravel size fragments, trace medium to coarse sand; brown grey, dense, some plant remains (Fill).

NOTES

(1) Additional details on logs: equipment used, progress, test results, groundwater observations, details of piezometer/monitoring well installations, ease of excavation and stability of test pits.
(2) Terms such as “CLAY and SAND” should be avoided - either describe as a cohesive or cohesionless soil.
(3) Coarse soils with a clay/silt content of greater than about 35% (e.g. clayey Sand) can exhibit the engineering behaviour of fine soils
(4) Frozen soils described in accordance with ASTM D4083, 2001.

KEY REFERENCES

ASTM D2488-93. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
Canadian Geotechnical Society, 2006. Canadian Foundation Engineering Manual, 4th Edition.

APPENDIX F2

KP ROCK LOGGING METHODOLOGY

(Pages F2-1 to F2-3)

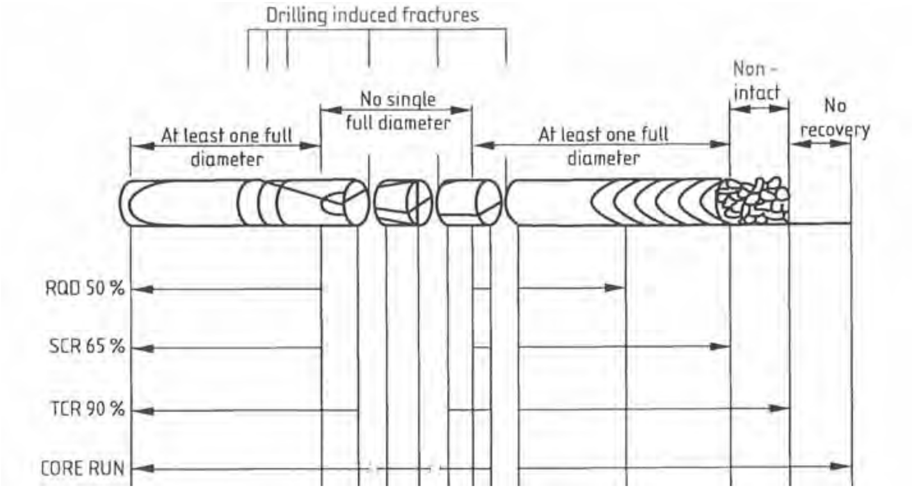
ROCK DESCRIPTION (VISUAL-MANUAL PROCEDURE)

FRACTURE LOG

Total Core Recovery (TCR) (%): Ratio of total length of core recovered (solid and non-intact) to length of the core run.
Solid Core Recovery (SCR) (%): Ratio of total length of solid core recovered to length of the core run.
Rock Quality Designation (RQD) (%): Ratio of total length of solid core pieces longer than 100 mm to length of the core run.
Fracture Index (FI): A count of the number of fractures over a length of rock core of similar intensity of fracturing. Reported as number of fractures/m.
Notes:

(1) 'Solid Core' has a full diameter, but not necessarily a full circumference.
(2) 'Non-intact' core is fragmented.
(3) TCR, SCR and RQD are applied to core runs; FI is applied to sections of core with similar fracture intensity.
(4) TCR applies to soil and rock; SCR, RQD and FI are only applicable to bedrock.
(5) Any drilling induced fractures and incipient fractures should be excluded from the description of the fracture state, but should be described in the text.

Application of Fracture State Terms For Rock Cores:



DESCRIPTION

Typical Sequence: ROCK NAME, grain size, texture, colour, strength, weathering, structure, discontinuities (geological interpretation).

ROCK NAME AND GRAIN SIZE

Sedimentary Rocks:
MUDSTONE/CLAYSTONE (<0.002 mm); SILTSTONE (0.002 – 0.06); SANDSTONE (fine-grained: 0.06 mm to 0.2 mm, medium-grained: 0.2 mm to 0.6 mm, coarse-grained: 0.6 mm to 2 mm); CONGLOMERATE and BRECCIA, (>2 mm); COAL, LIMESTONE, DOLOMITE, CHALK.
Igneous Rocks:
Intrusive Igneous Rocks:
SYENITE, GRANITE, QUARTZ MONZONITE< GRANODIORITE, DIORITE, GABBRO, PYROXENITE, PERIDOTITE, DUNITE (Batholiths, Stocks, Felsic to Mafic)..
PEGMATITE, APLITE, DOLERITE (Dykes, Sills – Felsic to Mafic).
Fine grained 0.06 – 2.0 mm, medium grained 2.0 – 6.0 mm, coarse grained 6.0 -20.0 mm, pegmatite – with crystals greater than 20 mm in size.
Extrusive Igneous Rocks:
TRACHYTE, RHYOLITE, DACITE, ANDESITE, BASALT (Felsic to Mafic).
Pyroclastic Rocks:
AGGLOMERATE/PYROCLASTIC BRECCIA (>60 mm rounded/angular fragments).
LAPILLI TUFF (2 to 60 mm fragments), coarse ash CRYSTAL(1)/LITHIC(2) TUFF (0.06 – 2.0 mm fragments), fine ash Tuff (<0.06 mm fragments),
VITRIC TUFF (predominantly composed of volcanic glass)
Notes (1) Crystal fragments predominate, (2) Rock Fragments predominate.
Metamorphic Rocks:
Foliated: MIGMATITE; GNEISS; SCHIST (>0.06 mm), PHYLLITE (<0.06 mm), SLATE, MYLONITE.
Non-Foliated: FAULT BRECCIA, MARBLE, QUARTZITE, GRANULITE, HORNFELS, AMPHIBOLITE, SERPENTINITE, ECLOGITE.

TEXTURE

Applicable mainly to igneous rocks.
Descriptors: Equigranular, inequigranular, megacrystic, porphyritic, crystalline, cryptocrtstalline, aphanitic

COLOUR

Value: e.g. Light, dark
Chroma: e.g. Reddish, yellowish
Hue: e.g. Brown, Grey
Descriptors: e.g. Mottled, spotted

STRENGTH

Term	Field Estimate of Strength	UCS (MPa)
Extremely Strong	Specimen can only be chipped with a geological hammer	>250
Very Strong	Many blows of a geological hammer required to fracture sample	100 - 250
Strong	More than one blow of a geological hammer required to fracture sample	50 - 100
Medium Strong	Cannot be scraped or peeled with pocket knife, sample fractures with a single blow from a geological hammer	25 - 50
Weak	Can be peeled with pocket knife with difficulty, shallow indentation made by firm blow with the point of geological hammer	5 -25
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled with pocket knife	1 - 5
Extremely Weak	Indented by thumb nail	0.25 - 1

WEATHERING

Rock is moderately strong or stronger in fresh state
(Most Igneous & Metamorphic Rocks & Sandstones)

Rock is moderately weak or weaker in fresh state
(Most fine grained Sedimentary Rocks)

1. CLASSIFICATION FOR UNIFORM MATERIALS

Grade	Classifier	Typical Characteristics
I	Fresh	Unchanged.
II	Slightly weathered	Slight discoloration, slight weakening.
III	Moderately weathered	Considerably weakened, penetrative discoloration. Large pieces cannot be broken by hand.
IV	Highly weathered	Can be broken by hand. Does not readily disaggregate (slake) when immersed in water.
V	Completely weathered	Can be crumbled, slakes, original texture apparent.
VI	Residual Soil	Soil derived by in situ weathering but retaining none of original texture or fabric.

2. CLASSIFICATION INCORPORATING MATERIAL AND MASS FEATURES

Class	Classifier	Typical Characteristics
A	Unweathered	Unchanged
B	Partially weathered	Slight brown oxidation, slight weakening and slightly reduced fracture spacing.
C	Distinctly weathered	Further weakened, much closer fracture spacing. Grey reduction.
D	Destructed	Greatly weakened, mottled, ordered lithorelicts in a matrix becoming weakened and disordered, bedding disturbed.
E	Residual or reworked	Matrix with occasional altered, random or 'apparent' lithorelicts, bedding destroyed. Classed as reworked when foreign inclusions are present as a result of transportation.

3. SPECIAL CASES e.g. karst; rocks in arid climates.

1b. ZONAL CLASSIFICATION FOR HETEROGENOUS MASSES WHERE APPROPRIATE **(Descriptions in test pits, excavations and exposures)**

Zone	Proportions of material grades	Typical Characteristics
1	100% G I to G III	Behaves as rock.
2	>90% G I to G III; <10% G IV to G VI	Weak materials along discontinuities, shear strength, stiffness and permeability affected.
3	50% to 90% G I to G III; 10% to 50% G IV to G VI	Rock framework still locked and controls strength and stiffness, matrix controls permeability.
4	30% to 50% G I to G III; 50% to 70% G IV to G VI	Rock framework contributes to strength; matrix or weathering products control stiffness and permeability.
5	<30% G I to G III; >70% G IV to G VI	Weak grades will control behaviour. Corestones may be significant for construction.
6	100% G IV to G VI	May behave as soil although relict fabric may still be significant.

Note: (1) For tropical weathering profiles, where chemical decomposition is the predominant weathering process, 'decomposed' is used instead of 'weathering'.

STRUCTURE

Term	Spacing (mm)
Thinly laminated (sedimentary), very narrowly flow banded (igneous), very narrowly foliated (metamorphic)	< 6
Thickly laminated (sedimentary), narrowly flow banded (igneous), narrowly foliated (metamorphic)	6 - 20
Very thinly bedded (sedimentary)	20 - 60
Thinly bedded (sedimentary)	60 - 200
Medium bedded (sedimentary)	200 -600
Thickly bedded (sedimentary)	600 - 2000
Very thickly bedded (sedimentary)	>2000

DISCONTINUITIES

Joint sets are described separately. The details of the discontinuities are described in the following order:

Spacing(1): Extremely wide (>6 m), very wide (2 to 6m), wide (600 mm to 2 m), moderately close (200 mm to 600 mm), close (60 mm to 200 mm), very close (20 mm to 60 mm), extremely close (<20 mm)

Persistence(2): Very high (>20 m), High (10 to 20 m), medium (3 to 10 m), low (1 to 3 m), very low (< 1 m).

Orientation: Angle of Dip/Dip Direction(1)(º).

Small-scale Roughness: Planar, undulating or stepped (qualified as rough, smooth, polished or slickensided, as a prefix).

Aperture(1): Very tight (<0.1 mm), tight (0.1 to 0.25 mm), partly open (0.25 to 0.5 mm), open (0.5 to 2.5 mm), moderately wide (2.5 to 10 mm), wide (>10 mm), very wide (1 to 10 cm), extremely wide (10 to 100 cm), cavernous (>1m).

Infilling: Clean, surface staining (colour), soil infilling (describe strength and composition), decomposed/disintegrated rock (describe strength and weathering grade), mineral coatings (calcite, quartz, chlorite, kaolin etc).

Notes: (1) Not always measurable in core samples. (2) Only measurable in excavations and exposures.

GEOLOGICAL INTERPRETATION

Where possible, a bracketed term is included to describe the rock formation.

EXAMPLES

Descriptions of Core Samples:

(i) SCHIST, green grey mottled orange brown, moderately weak, moderately weathered, very narrowly foliated; foliation planes extremely closely spaced, dipping 10º to 20º, smooth, undulating, open, with orange brown (iron oxide) staining penetrating about 20 mm, green (chlorite) staining and up to 1 mm of soft clay infill; Joints dip 60º to 70º, smooth, planar, partly open with iron oxide staining.

(ii) CRYSTAL TUFF, fine ash, greenish dark grey, very strong, slightly weathered; 2 joint sets: (1) widely-spaced, dipping 5º, rough, undulating with orange brown (iron oxide) staining penetrating 10 mm; (2) sub-vertical, rough, undulating, open, locally with black (manganese) and green (chlorite) staining.

Descriptions of Excavations/Exposures:

(i) SANDSTONE, fine to medium-grained, brownish grey, medium strong, slightly weathered, thickly bedded; bedding planes: widely-spaced, high persistence, dipping 20º/320º, rough, undulating, moderately wide with red brown (iron oxide) staining penetrating about 5 mm; two joint sets: (1) medium spaced, medium persistence, dipping 75º/045º, rough, planar, moderately wide with red brown (iron oxide) staining penetrating 10 mm; (2) closely to medium-spaced, low persistence, dipping 45º/270º, rough, undulating, tight, clean.

(ii) GRANITE, medium-grained, porphyritic, greyish red brown mottled orangish brown, very weak, highly decomposed; some boulder-sized corestones, brownish grey, moderately strong, moderately decomposed; widely-spaced relict joints, high persistence, dipping 20º/270º, smooth, planar, partly open with up to 5 mm of kaolin infill (Zone 5).

REFERENCES: ISRM 1981a: Rock Characterization, Testing and Monitoring, ISRM Suggested Method.
ISRM 1981b: Suggested Method for the Quantitative Description of Discontinuities in Rock Masses.
BS 5930 1999: Code of Practice for Site Investigations.

TABLE E2.1

TINTINA RESOURCES INC.
BLACK BUTTE COPPER PROJECT

2015 GEOTECHNICAL SITE INVESTIGATION
ROCK MASS RATING (RMR) CLASSIFICATION SYSTEM

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												VALUE	RATING
Intact Rock Strength	PLST	10	8	6.5	5.5	5	4.5	3	2	1	<1		
	UCS, MPa	250	200	160	140	125	110	75	50	25	< 25		
	Field Est.	chipped by hammer		many blows by hammer to break				single blow		pocket knife			
	RATING	15	14	13	12	11	10	8	6	4	< 3		
RQD	RQD %	100	90	80	70	60	50	40	30	20	0		
	RATING	20	18	16	14	12	10	9	5	4	3		
Joint Spacing	Js, cm	> 200	160	130	90	60	40	20	15	10	<6		
	RATING	20	18	16	14	12	10	9	8	7	5		

								Set 1	Set 2	Set 3	VALUE	RATING
							Orientation					
							J Spacing					
Joint Condition	**Persistence**	< 1 m	1 - 3m	3 - 10m	10 - 20 m	> 20m						
	RATING	6	4	2	1	0						
	Aperture	None	< 0.1 mm	0.1 - 1.0	1 - 5	5 - 10						
	RATING	6	5	4	1	0						
	Roughness	V Rough	Rough	SL Rough	Smooth	Slicks						
	RATING	6	5	3	1	0						
	Infilling	None	Hard Infilling		Soft Infilling							
			< 5 mm	> 5 mm	< 5mm	> 5 mm						
	RATING	6	4	3	2	0						
	Weathering	FRESH	SW	MW	HW	CW						
	RATING	6	5	3	1	0						
							Sub-Total					

							VALUE	RATING
Groundwater	**Inflow** l/min/10m	None	< 10	10 - 25	25 -125	> 125		
		Dry	Damp	Wet	Dripping	Flowing		
	RATING	15	10	7	4	0		

Adjustment for Joint Orientation	DIP OF ADVERSE JOINT SET				
	0 - 20	20 - 45	45 - 90		
Strike Perpendicular to Tunnel Axis drive with Dip	Unfavourable	Favourable	Very Favourable		
	-10	-2	0		
Strike Perpendicular to Tunnel Axis drive against Dip	Unfavourable	Unfavourable	Fair		
	-10	-10	-5		
Strike Parallel to Tunnel	Unfavourable	Fair	Very Unfavourable		
	-10	-5	-12		

RMR RATING	80 - 100	60 - 80	40 - 60	20 - 40	0 - 20
DESCRIPTION	**VERY GOOD**	**GOOD**	**FAIR**	**POOR**	**VERY POOR**
ROCK CLASS	1	2	3	4	5

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NOTE:

1. REFERENCE: BIENIAWSKI, 1989.

0	30MAR'15	ISSUED WITH REPORT VA101-460/3-1	JBC	GM
REV	DATE	DESCRIPTION	PREP'D	REV'D