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Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

global environmental solutions

Proposed Black Point Quarry Project
Guysborough County, Nova Scotia

Hydrogeological Technical Report

February 2015
SLR Project No.: 210.05913.00000

HYDROGEOLOGICAL TECHNICAL REPORT

PROPOSED BLACK POINT QUARRY PROJECT

GUYSBOROUGH COUNTY, NS

SLR Project No.: 210.05913.00000

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1.0 INTRODUCTION

SLR Consulting was retained by Vulcan Materials Group and Morien Resources Corporation to conduct a hydrogeological assessment of a proposed aggregate quarry in Guysborough County, Nova Scotia. The assessment and description of hydrogeological conditions within the vicinity of the site was conducted in accordance with and is a requirement outlined in the “Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia” (Nova Scotia Environment [NSE], 2009) and the guidelines provided for the site by the Canadian Environmental Assessment Agency (CEA Agency 2014).

1.1 Site Description

The proposed Black Point Quarry Project is located on a 354.5 ha property along the south shore of Chedabucto Bay, approximately 4.0 km west of the village of Fox Island in Guysborough County, Nova Scotia. The Project site location and study area is presented on Drawing 1.

The proposed quarry land is currently zoned by the Municipality of the District of Guysborough (MODG) as Heavy Industry (M-2).

The site is greenfield (undeveloped) and covered by thin soils, which sustain tall shrub and some coniferous forest. The site features numerous wetlands and a lake (Fogherty Lake). Topography on the site slopes in all directions away from a granite hill, located within the southern central part of the site. This granite is the target resource for the proposed quarry.

1.2 Proposed Development

The proposed quarry will extract the granite beneath the hill which has minimal overburden covering it. The quarry at full build out will be approximately 130 m deep and will occupy a footprint of 180 ha. Processing including secondary crushing, screening, washing will be undertaken on a 28 ha platform situated on lower land between the quarry and the coastline. The aggregate will be exported by ship via a marine terminal and load-out facility, to be constructed north of the processing platform.

1.3 Objectives

The objectives of this hydrogeological assessment are based on Section 6.1.1 and 6.1.3 of NSE (2009) and section 9.1.2 of CEA Agency (2014). These objectives include:

- Provide a general description of the geological features of the proposed pit or quarry site including the surficial geology and bedrock geology;
- If acid slates are present, provide additional information to determine if the material is net acid producing / consuming. Use acid rock drainage (ARD) / metals leaching (ML) prediction information to predict water quality for effects assessment and to determine mitigation requirements for the project;
- Discuss the predicted effects on the identified geological formations and how the effects will be avoided or minimized;
- Provide a description of the hydrogeology at the site and the local and regional study areas, which will include;

- A review of the physical geography and the geology of the area as it relates to local and regional groundwater flow and aquifer / aquitards;
- A conceptual hydrogeologic model in plan and cross-section;
- An inventory and analysis of existing information on the hydrogeological conditions / groundwater resources in the project area, including published reports, geological maps, well record data;
- A pre-development water well survey to establish baseline well water quality and quantity;
- Measurements of hydraulic conductivity for all hydrogeological units in the project area; and
- Baseline analysis of groundwater quality at the site and within the local and regional study area.

In order to achieve these objectives, this report is divided into two main sections, the first of which relates to the host geophysical environment and the second of which relates to the groundwater resources contained therein.

2.0 GEOPHYSICAL ENVIRONMENT

2.1 Physiography, Topography and Geomorphology

The Project site falls within the Atlantic Coast Ecoregion which is located along the southeastern coast of Nova Scotia (Drawing 2). Ecoregions are characterized by distinctive, large-order landforms or assemblages of regional landforms, small order climates, water, soils, vegetation, and regional human activity uses and patterns, and are usually influenced by groundwater conditions.

The coastline south of Canso is highly embayed, and fault lines have had a strong influence on shaping deep inlets along the eastern shore of Nova Scotia. West of Canso, along the south shore of Chedabucto Bay where the project is situated, the coastline is generally straight with few embayments (Drawing 2).

The surface is composed predominantly of Paleozoic metamorphic and granite bedrock, mantled by a discontinuous veneer of stony glacial till. The presence of a high water table, caused by abundant rainfall and underlying low permeability bedrock support numerous wetlands throughout the region. Common wetlands in this Ecoregion include fens, salt marshes, and raised and flat bogs (Webb and Marshall 1999). These may or may not be groundwater fed.

The Project site is located in the Eastern Shore Ecodistrict, a subdivision of the Atlantic Coast Ecoregion. The influence of the Atlantic Ocean provides a consistent coastal climate which is reflected in the forests of the Ecodistrict.

The Project site is located on a granite hill with a maximum elevation of approximately 97 metres (m) above sea level (asl). This is one of the highest elevations in the region and places the Project site at the top of the local watershed. Topography slopes gently in all directions from the peak of the granite hill; to the north an abrupt change in elevation is observed at 60 m asl. The northwest edge of the property (north of Fogherty Lake) forms a granitic cliff, which descends from 60 m asl to the sea over a distance of about 150 m. This cliff is lower in the north-central and northeast portions of the property between Fogherty Head and Black Point, where the topography levels off at approximately 20-30 m asl and gradually grades to the rocky coast (Drawing 3).

2.2 Soils and Sediment

Approximately 94% of the soils in Guysborough County have developed from glacial till, with the remainder being developed on alluvial or glaciofluvial deposits. Textures in the till soils range from sandy loam to loam in the upper layer, and in the parent material the soils range from gravelly sandy loam to clay loam. Textures in the alluvial and glaciofluvial soils range from gravelly sandy loam to silt loam in the surface layer and in the subsoil, the soils range from gravel to silt loam in the subsoil (Hilchey 1964).

Soils are thin to non-existent on the top of the granite hill that dominates the property. Soils thicken to the east and west at lower elevations where wetlands have developed. The soil map (Drawing 4) labels the Project site as “rockland”, defined as soil areas with 50% or more of rock outcrops or boulders. Isolated pockets of peat, defined as brown, poorly decomposed organic material 12 in. or more in depth, are shown adjacent to Fogherty Lake. A single occurrence of Wolfville Series soil is shown in the extreme southeast corner of the property. This soil consists of “moderately stony, dark brown friable loam over dark grayish brown sandy clay loam”. As noted above, this soil is developed from a parent material made of glacial till, in this case “firm dark reddish brown sandy clay loam glacial till” (SRI 1963).

2.3 Surficial Geology

Surficial geology in the vicinity of the Project site is described by the published geology maps (Stea *et al*. 1992; Stea and Fowler 1979). It is predominantly comprised of Pleistocene-age stony till up to 20 m thick which consists of a sandy matrix and material derived from local bedrock sources (Drawing 5). Three types of glacial till are found on the site. The granite till shown within the property boundary is yellow-brown in colour, loose and sandy. It averages 2 m thick but is up to 5 m thick in some areas. The quartzite till is bluish-greenish-grey in color, loose and coarser grained than the granite till; it averages 3 m thick but may be up to 20 m thick in some places. A thin band of red till developed on Halifax Formation bedrock is present along the coastal portion of the property.

Observations made on site indicate these tills are essentially absent on the top of the granite hill, but thicken on the slopes of the hill at lower elevations. The tills are well exposed along the coastline at Half Island Cove (Figure 1) and Fox Island Main. Dug wells, which are used more often than drilled wells in this area to provide potable water, are installed in these tills. Well records obtained from NSE indicate that surficial deposits are generally comprised of various mixtures of clay, sand, gravel and boulders and vary in thickness between approximately 1 m and 19 m, which is consistent with the geologic mapping.

Figure 1
Photo - View from the east side of Gaulman Point looking at glacial tills.

Glacial tills in the background of Figure 1 host dug wells along Half Island Cove Road. An outcrop of Halifax Formation bedrock and marine beach deposits are shown in the foreground.

Several drumlin[1] features are indicated along Highway 16 west of Hayden Lake; deposits in these areas are thought to be up to 30 m thick (Stea and Fowler 1979). Drumlin deposits are generally siltier than the rest of the stony till, as they incorporate material formed from the erosion and incorporation of older till units. An esker[2] feature comprising sand and gravel deposits is indicated north of Highway 16 in the vicinity of Hayden and Cavanaugh Lakes.

Core logs from on-site drilling of the granite aggregate resource indicate that surficial deposits over the majority of the Project site proposed for the quarry are thin (<2 m) or absent where granite outcrops at surface.

[1] Drumlin deposits are low, smoothly rounded, elongate mounds of glacial till, carved that way by the horizontal movement of glacial ice.

[2] Eskers are low, sinuous, elongate mounds of sand and gravel deposited in sub-glacial streams.

2.4 Bedrock Geology

2.4.1 Regional Geology Overview

Structurally, the Project site is located within the Meguma Terrane structural province, south of Chedabucto Bay. Chedabucto Bay lies on top of the Cobequid-Chedabucto Fault System, which separates the Meguma Terrane in the south from the Avalon Terrane in the north. The sedimentary rocks of the Meguma Terrane consist of primarily metamorphosed, fine-grained sandstones and shales, with minor amounts of volcanic and carbonate rocks in local areas. The Meguma Terrane was later intruded by younger granitic rocks (NSMNH 2014), including the granite that will be quarried as aggregate in the Black Point Quarry Project.

The regional geology at the Project site consists of Cambro-Ordovician age metamorphosed sedimentary rocks of the Goldenville and Halifax formations that were intruded by Devonian-age granite. Granite represents about 20-25 percent of the bedrock in Nova Scotia and is found throughout mainland Nova Scotia and Cape Breton. South of the Cobequid-Chedabucto Fault System, granite intrusions are found within sedimentary rocks of the Meguma Zone. The granite was generated during the Acadian Orogeny, when the Meguma sedimentary pile was squeezed against, and possibly over, the Avalon Zone (NSMNH 2014). The geology of the site and surrounding area is presented on Drawing 6.

2.4.2 Local Geology

The geology surrounding the Project site consists of Cambro-Ordovician age metamorphosed sedimentary rocks (metasediments) of the Goldenville and Halifax Formations. The Goldenville Formation is the oldest and is generally found to the south and west of the Project site, with some outcrop on the tip of the Fogherty Head / Black Point headland. The Goldenville Formation comprises a thickly bedded metawacke with minor metapelite (<5%). Photographs showing the Goldenville Formation in situ are presented in Figure 2.

Figure 2
Photo – Outcrop of Goldenville Formation showing vertical bedding and jointing.

Immediately to the south of the faulted boundary with the Goldenville Formation on the Fogherty Head / Black Point headland lies the Halifax formation, comprising a porphyroblastic, sulphide-bearing, graphite schist interbedded with thin layers of metawacke (Hill 1991). Figure 3 illustrates the highly deformed and sheared Halifax Formation in outcrop.

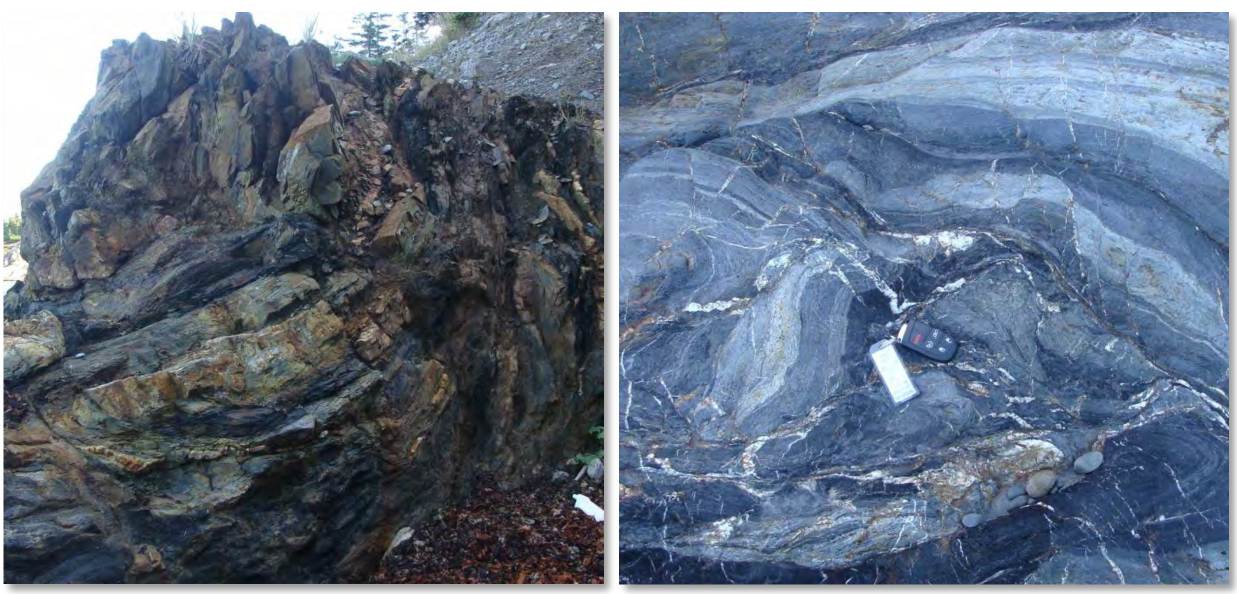


Figure 3
Photo - Outcrop of Halifax Formation (left) and shearing detail in closeup (right).

Based on provincial geologic mapping, the majority of the Project site, including the area to be quarried, is composed of a medium-grained, equigranular to slightly porphyritic granite with less than 4% biotite (Hill 1991). The granitic pluton has been intruded into the Goldenville Formation and the northern boundary with the Halifax Formation comprises a west-northwest to east-southeast trending, dextral strike-slip fault. This fault is consistent with the major structural fabric direction within the metamorphic rocks in the vicinity of the Cobequid-Chedabucto Fault System and is likely to be the dominant fracture orientation in the Halifax and Goldenville Formations. The boundary between the Halifax and Goldenville Formations between Fogherty Head and Black Point is also faulted.

Eleven core holes have been drilled in the Project site footprint in order to confirm the granite's suitability as a construction aggregate. Their drill logs are provided as Attachment A and locations shown on Drawing 7. The logs demonstrate a pinkish to greyish-white granite comprising 50% to 60% feldspar, 35% to 48% quartz and up to 10% biotite and muscovite mica.

The granite does not exhibit a structural fabric, i.e. it is massive as illustrated in the outcrop and core photographs in Figure 4, and is not sheared or deformed. The core logs indicate that the most frequent fracturing and jointing occurs in the upper 40 m as demonstrated by the fracture frequency plot in Attachment B. Two fault zones were noted in the core logs for BP-8 and BP-9 at 93 to 94 m bgs and 20 m to 25 m bgs respectively, and are shown on the fracture plots by fracture frequencies of >20 fractures per metre. Detailed topographic and LiDAR data of the site indicate a bifurcating lineament running from the northwest corner of Murphy's Lake to the minor watercourse to the northeast of Fogherty Lake. This northwest-southeast trend is consistent with known faulting in the area and may indicate the surface expression of a fault zone within the granite. Core holes BP-8 and BP-9 are located close to this lineament and intersect broken zones of rock which may be related to a fault or faults. This is of interest as these zones may provide preferential pathways for groundwater movement into the quarry in future.

Figure 4
Photo - Outcrop of granite (left) and core detail in closeup (right).

2.4.3 Acid Rock Drainage Potential

The granite at the Project site will be quarried to produce crushed-stone aggregate. Analytical testing was conducted in 2014 on the granite taken from three boreholes drilled in the granite resource (BP-7, BP-8 and BP-9) to confirm its suitability as construction aggregate. Testing included analysis of weight % sulphur and acid production potential as indicators of acid rock drainage (ARD) potential, since ARD has both structural and environmental implications. Testing indicated that the concentration of sulphur / sulphide in the granite is well below the threshold indicated in the Sulphide Bearing Material Disposal Regulations (N.S. Reg. 57/95) and is therefore considered non-acid producing (Attachment C). This is fully consistent with the chemical composition of aggregate quality granite: even limited ARD potential would render the rock un-useable as aggregate.

Halifax formation slates, which are often sulphide bearing, and Goldenville formation quartzite and greywacke, which is rarely sulphide bearing, are present within the proposed Project area at the northern end of the site. These rocks underlay the area proposed for the processing plant and aggregate stockpiles. Although they will not be quarried for aggregate, these formations may be disturbed for construction of the laydown area and excavated rock may be used to construct the marine terminal.

In October 2011, Black Point Quarry project geologists collected samples from these formations for ARD analysis. Five of the six surface samples collected have sulphide contents below the 0.4% threshold stipulated in the Regulations (Dalton 2011 in Attachment D). One sample had sulphide above the threshold (i.e., 0.935%); however, the material was found to contain some neutralizing capacity with a pH of 7.4. From all indications, the Goldenville Formation rock on site is sulphide free and is proposed to be used in construction of the rubble-fill for the wharf. The Halifax Formation, which likely contains sulphides appears to exist only in a small band across the site (Attachment D) and will be avoided to the extent possible. The Proponent will sample and test these rocks prior to any excavation in accordance with the guidance provided in the provincial Sulphide Bearing Material Disposal Regulations. Should sulphide bearing materials be disturbed, the Proponent will work with NSE and NSDNR to confirm that all regulatory requirements are met before excavation begins.

3.0 GROUNDWATER RESOURCES

The hydrogeological regime at the application site and the surrounding area is described in the following sub sections:

- groundwater wells and use;
- aquifer characteristics;
- recharge mechanisms;
- groundwater levels and flow; and
- groundwater quality.

The hydrogeological data has been used to develop a conceptual site model that has in turn been used to assess potential impacts associated with the proposed development. The model has also been used to determine appropriate mitigation measures.

3.1 Groundwater Wells and Use

The objectives of the residential well assessment were to establish baseline water quality conditions and to provide an assessment of the hydraulic parameters within the aquifers utilised by local residences adjacent to the Project site. Initially, a water well records search was undertaken by obtaining records from NSE, followed by a door-to-door survey of all residences within a 2 km radius of the Project site. A number of properties outside the 2 km radius were surveyed and sampled and/or yield tested in order to further assess the relevant aquifer units. At each residential well, a questionnaire was completed to determine the type of well (drilled or dug), well completion details, water levels and whether the well user has any issues with water quality or quantity. Details of the work undertaken at the residential wells are provided in Attachments E and F (AECOM 2014a and 2014b).

The majority of local wells (for which there are records) are utilized for domestic or commercial purposes. The NSE records indicated a total of 16 wells within the main settlements adjacent to the Project site; however 31 wells were identified by the door to door survey. These wells are located in the vicinity of the settlements of Half Island Cove (five well records) and Fox Island Main / Indian Cove (six well records) with several spread along Highway 16 (five well records) to the south of the site. Drawing 7 presents the locations of the wells identified from the records search and the door-to-door survey for which Table 1 summarizes the information collected.

The majority of drilled wells are between 30 m and 105 m below ground surface (bgs) and are screened within either the Goldenville or Halifax formations. There are no residential or commercial water wells drilled in the granite. The closest drilled well (BPRWA007) to the Project site is approximately 1 km to the south along Highway 16, however all of the other drilled wells recorded are greater than 2 km from the site.

Dug wells are between 1.8 m and 7.0 m deep according to measurements taken in the field. No lithological logs are available for the dug wells, however, based on their measured depth it is inferred that they are completed in the surficial deposits. Dug wells are by far the most common residential well type in the area, of which there are two (BPRWA008 and BPRWA013) within 1 km and five between 1 km and 2 km from the Project site.

Table 1
Water Wells Reportedly Within 2 km and Other Wells Tested

Drawing Ref [(1)]	Address	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
NSE10497	-	639500	5023500	85.26	Drilled	Unknown
NSE62059	79 Fox Island Road	648697	5022586	103.53	Drilled	2,740m E
NSE62061	2238 Highway #16	650111	5022018	85.26	Drilled	>2000m E
NSE71270	169 Fox Island Road	648809	5022942	74.6	Drilled	~3000 m E
NSE810105	-	641188	5022332	90.44	Drilled	Unknown
NSE820027	-	647717	5022481	75.46	Drilled	Unknown
NSE840028	-	641188	5022332	105.66	Drilled	Unknown
NSE840029	-	641188	5022332	46.28	Drilled	Unknown
NSE870892	-	640500	5022500	44.15	Drilled	Unknown
NSE891208	-	640500	5022500	48.72	Drilled	Unknown
NSE921506	-	649500	5022500	38.06	Drilled	Unknown
NSE980451	-	640500	5022500	60.9	Drilled	Unknown
NSE991271	Fox Island	649500	5021500	30.45	Drilled	Unknown
NSE111412	2290 Highway #16	649763	5022026	50.24	Drilled	>2000m E
NSE111413	3155 Highway #16 , Fox Island	644975	5019612	62.42	Drilled	~1500m SE
BPRWA001	257 Half Island Cove Road	642088	5023441	5.89	Dug	1,630m W
BPRWA002	272 Half Island Cove Road	642231	5023406	6.3	Dug	1,490m W
BPRWA003	267 Half Island Cove Road	642232	5023505	4.19	Dug	1,465m W
BPRWA004	230 Half Island Cove Road	642132	5023296	1.89	Dug	1,630m W
BPRWA006	155 Half Island Cove Road	641731	5023150	6.19	Dug	2,050m W
BPRWA007	3421 Highway 16, RR#1	644835	5021376	85.34	Drilled	1,050m S
BPRWA008	3596 Highway 16	643589	5021745	4.55	Dug	815m SW
BPRWA009	59 Fox Island Main, Canso	648615	5022586	n/a	Drilled	2,675m E
BPRWA011	235 Fox Island Main Rd; PO box 501 Canso	649335	5023096	n/a	Drilled	>3,000m E

Drawing Ref [1]	Address	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
BPRWA012	RR #1 Canso	648466	5022724	3.4	Dug	2,535m E
BPRWA013	3595 Upper Fox Island	643569	5021658	7.0	Dug	860m SW
BPRWA014	2823 Upper Fox Island RR#1			3.04	Dug	1,510m SE
BPRWA015	2574 Hwy 16, RR 1 Fox Island	648538	5022253	n/a	Dug	2,630m E
BPRWA016 / NSE62060	79 Fox Island Main Road	648680	5022576	85.26	Drilled	2,740m E
BPRWA017	2927 Highway 16	646643	5021585	n/a	Dug	~1500m SE

(1) NSE = wells recorded in the NSE Well Logs Database; BPR = wells sampled for this study. Well owner's names withheld to protect privacy.

3.2 Aquifer Characteristics

A number of different geological units with different hydraulic properties are present in the study area. The distinct units are discussed here in order of increasing geological age. The testing of several residential wells was undertaken and details of the work are provided in Attachments E and F (AECOM 2014a and 2014b). However, due to difficulty obtaining accurate discharge rates and interruptions in pumping and recovery tests due to household water system interference, any figures quoted for household wells BPWRA001 and BPRWA007 are approximations.

3.2.1 Surficial Deposits

Surficial deposits, where present, consist of stony till and related drumlin and esker deposits. Intergranular flow predominates in the sandy matrix and the hydraulic conductivity is locally highly variable, having low conductivity where clay rich material predominates and higher conductivity where interconnected sand is present. A number of dug wells, described in Section 3.1, are present in the area. These wells are installed into the surficial deposits for potable water supply domestic purposes, indicating that the surficial deposits are locally important aquifers. Such water supplies usually obtain their water from localized recharge of precipitation.

An in-situ variable head permeability test has been undertaken in residential well BPRWA001 by undertaking a short term pumping and recovery test. No other dug residential wells were available for yield testing. Test results were analysed using the Theis Recovery method as hosted by AquiferTest (v3.5) software to obtain hydraulic conductivity values. A copy of the analysis undertaken is presented in Attachment G. The test results show that the surficial deposits have an approximate hydraulic conductivity of 2×10^{-6} m/s with a transmissivity of 2×10^{-5} m^2/s. The hydraulic conductivity value obtained at this residential well is at the upper end of the generally recognized spectrum for glacial tills (10^{-6} to 10^{-12} m/s Freeze and Cherry, 1979). Given the sandy nature of this glacial till, such a result is expected.

3.2.2 Granite

The granite bedrock is a crystalline igneous rock, and as such has negligible primary (intergranular) porosity, so all groundwater storage and flow occurs within the joints and fractures. The fracture frequency plot in Attachment B indicates that the highest frequency of fractures within the granite occurs in the upper 40 m. These fractures are likely to represent various types of joints and discontinuities caused by tectonic stresses, cooling of the granite, the release of pressure upon the rocks due to overburden removal and chemical or physical weathering. Two fracture zones were noted in the core logs for BP-8 and BP-9 that may be evidence of faulting, and depending on their nature may act as preferential pathways or boundaries to groundwater flow. It is considered likely that the majority of groundwater flow in the granite takes place in the upper 40 m based on the fracture frequency.

Given the remote nature of this site and low risk of effects on private wells, packer testing was not undertaken on the core holes.[3] To provide initial hydraulic conductivity information, a number of slug, and pumping and recovery tests were undertaken on granite core holes BP-5, BP-7, BP-8 and BP-9 in 2014. Details of the work undertaken at the granite core holes are

[3] It is anticipated that further hydraulic conductivity testing would be undertaken as the monitoring network is developed as per Section 3.7.4.

provided in Attachments E and F (AECOM 2014a and 2014b). The slug tests were conducted using a solid slug with instantaneous head changes in the wells and the pumping and recovery tests were undertaken by pumping for between 25 minutes and 140 minutes. To obtain hydraulic conductivity values, the slug tests were analysed using the Bouwer-Rice method and the recovery tests were done using the Theis recovery method, both hosted in the AquiferTest (v3.5) software. A copy of the analysis undertaken is presented in Attachment G. Initial slug tests indicated hydraulic conductivities of approximately 6 x 10^{-7} m/s to 7 x 10^{-7} m/s, however, later pumping and recovery tests indicated hydraulic conductivities of 2 x 10^{-7} m/s to 6 x 10^{-7} m/s. It is considered that the longer pumping and recovery tests give a better idea of the bulk granite properties due to their larger water level changes and radius of influence around the wells. These values are typical of low yield wells.

3.2.3 Cambro-Ordovician (Meguma) Metasediments

The Cambro-Ordovician metasediments of the Goldenville and Halifax Formations are primarily comprised of slate, shale and quartzite and demonstrate low intergranular porosity due to their relatively high degree of metamorphism. Secondary fracture porosity is likely to be responsible for the yields obtained from residential wells in the vicinity of the site. A number of residential wells in the area are drilled into the Goldenville and Halifax Formations indicating that the aquifers are at least locally important for groundwater supplies.

Nova Scotia Environment records indicate two yield tests in wells in the vicinity of the Project site, with one in the Halifax Formation with a calculated hydraulic conductivity of 1 x 10^{-6} m/s and the second in the Goldenville Formation with a calculated hydraulic conductivity of 7 x 10^{-7} m/s. A yield test was completed in the drilled well BPRWA007; however, the pumping rate during the test is not known and was not possible to estimate because of the configuration of the water supply system (AECOM 2014a). The most complete recovery test was therefore analysed as a slug test using the KGS method in Aqtesolv. The analysis gave an estimated hydraulic conductivity of 6 x 10^{-8} m/s. A copy of the analysis undertaken is presented in Attachment G.

3.2.4 Summary

In summary these hydraulic conductivity values are compared here:

- the **surficial till** deposits had an approximate hydraulic conductivity of 2 x 10^{-6} m/s;
- the fractured **granite** hydraulic conductivities were 2 x 10^{-7} m/s to 7 x 10^{-7} m/s;
- the **Halifax Formation** had a measured hydraulic conductivity of 1 x 10^{-6} m/s; and
- the **Goldenville Formation** had a measured hydraulic conductivity of 7 x 10^{-7} m/s

While it is recognized that these measurements do not establish the full range for each unit, they do provide insight into the aquifer characteristics. It is commonly held (Freeze and Cherry, 1979; Fetter 2001) that useable aquifers have a hydraulic conductivity of greater than 1 x 10^{-6} m/s. Only low yield wells are possible below that value. The surficial till has a value higher than this, but not by much, due primarily to the fine grained soils entrained in the glacial till. This is not a regionally connected surficial aquifer, but rather pockets of localized aquifer material, that derives its water from localized recharge on the scale of the host lot.

All three bedrock types have hydraulic conductivities less than 1 x 10^{-6} m/s. The granite appears to have the lowest range. It must be kept in mind that these test results are for wells and boreholes where only the most permeable horizons were screened and tested (the granite boreholes are not screened at all). The host rock in all three formations will have hydraulic conductivities two or three orders of magnitude lower (10^{-9} to 10^{-8} m/s) than the calculated values. It is reasonable to conclude that there are no regional aquifers in these bedrock units, but rather fractured zones that locally provide water to isolated wells. Based on the fracture plots presented in Attachment B, the upper 40 m of the bedrock provides the best opportunity for such wells.

3.3 Aquifer Recharge

Precipitation falling onto a catchment either evaporates, is lost to plant transpiration, infiltrates to groundwater, or runs off as storm water to forests and wetlands. An estimate of the average recharge to groundwater in the area was calculated by applying infiltration factors based on topography, soils and vegetation (Main Report, Appendix C). Infiltrating water that is not taken up again by plants from the rooting zone migrates to the shallow water table, and at that point is considered to be aquifer recharge. An average annual infiltration of 351 mm was derived for the entire site. This varies from location to location on site, generally being more in the flatter areas with significant overburden, and less on the steeper rocky areas.

3.3.1 Definitions

There are a variety of terms used by the technical community when describing water balance mechanisms, depending upon the technical background of the user. For the reader's convenience the terms used in this report have been defined in the following manner:

Precipitation: Includes both rainfall and snowfall (as water).

Evapotranspiration: This is the water that is either evaporated from open surfaces, or is taken up by plant transpiration and returned to the atmosphere.

Potential Evapotranspiration: This is the amount of evapotranspiration that would occur if there was unlimited water available.

Actual Evapotranspiration: This is the amount of evapotranspiration that occurs based on the availability of water, and considers temporary storage in the soils above the water table.

Surplus: this is the difference between precipitation and the actual evapotranspiration. This water is available for run off or infiltration into the ground.

Infiltration: this is the water that soaks into the ground and does not runoff. It can be partly removed by plant uptake.

Recharge: This is the remaining infiltration that is not taken up by plants, and reaches the water table.

Surface Water Flow or Runoff: This is the portion of the water surplus that moves laterally on the ground surface and does not infiltrate.

Groundwater Flow: Once water has entered the subsurface it is deemed to be groundwater and moves under gravity and other natural groundwater pressures. It can subsequently re-emerge as groundwater discharge into surface water bodies. At this site groundwater flow occurs locally in the overburden and in the bedrock.

Subsurface Runoff: This term is not used in this report, but is occasionally used to describe the shallow movement of groundwater that rejoins the surface water system. Sometimes also called “interflow”, although that term is not used in this report.

3.3.2 Surficial Deposits

Where present, the glacial deposits influence recharge to the underlying bedrock aquifers. Recharge to groundwater relies on the retention time of surplus water (after evapotranspiration) on the landscape. The glacial deposits accept rainwater infiltration and act as a temporary storage reservoir (on a local scale) allowing it to recharge the less permeable bedrock below. Where the overburden is thin, infiltrating groundwater will deflect along the low permeability bedrock, and unless it intersects fractured rock, it will flow in the shallow groundwater ultimately discharging to the creeks or wetlands, or perhaps simply to thicker deposits of overburden further downhill.

3.3.3 Bedrock

Drawing 12 was prepared by partitioning the average annual water surplus based on soils/bedrock, topography and ground cover, in a GIS platform. It shows that recharge is typically less than 200 mm in the topographic high areas that exhibit exposed bedrock. Values of 200 to 300 mm are found in the areas of moderate overburden and less steep slopes. In the flatter areas, where the overburden is thickest, typically in the low lying areas, the recharge rates exceed 300 mm/yr and can locally approach 700 mm/yr. (The average annual surplus is 877 mm/yr, and this implies that only 177 mm will runoff in those areas.) Notwithstanding this wide variance across the site, the average annual recharge for the entire site is 351 mm/yr, as stated above.

3.4 Groundwater Levels and Flow

A total of eight granite core holes were installed at the Project site in late 2007 / early 2008, and three additional holes were drilled in early 2014. These core holes were left open with shallow surface casings and thus transect the whole quarry and provide a groundwater elevation representative of the most permeable horizon within the granite. The locations of these core holes are shown on Drawing 7.

The information from these wells has been supplemented with groundwater level information from the residential wells presented in Drawing 7 and a series of drive point piezometers installed within the wetland areas surrounding the site, the locations of which are presented on Drawing 8. Nine locations were instrumented with drive point piezometers which were installed in wetlands and streams to assess the vertical gradient of shallow groundwater. In the wetlands, the piezometers were installed as nested pairs with one deep and one shallow piezometer. The vertical gradient can be used to infer whether the wetlands are formed by groundwater discharge or whether they form an area of groundwater recharge. In the streams, a single piezometer was installed in the stream bed so a comparison between the groundwater level beneath and the surface water level can be made, and the stream defined as losing or gaining based on the direction of the vertical hydraulic gradient.

The groundwater monitoring points at the Project site have been subject to periodic groundwater elevation measurements between June and August 2014, with a previous round of water levels being collected in September 2011. Four of the granite core holes (BP-5, BP-7, BP-8 and BP-9) have been recording continuous groundwater levels using data loggers from 5 June

2014 to 28 August 2014 and two of the drive point piezometers (MP2 and MP6) have been monitoring groundwater and stream levels using data loggers since 24 July 2014. Groundwater hydrographs and summary tables of monitoring data to date are presented in Attachment H, a review of which shows:

- the highest groundwater elevations are recorded in on site borehole BP-4 (97.54 mASL) located at the high point of the Project site. This water level lies within the granite bedrock;

- the lowest groundwater elevations are recorded in residential well BPRWA012 (2.73 m asl) near the ocean in the settlement of Fox Island Main to the east of the Project site;

- groundwater elevations are all less than 6 m below ground surface in wells completed in granite, metasediments or surficial deposits and demonstrate that groundwater levels follow topography. This is probably due to the relatively lower hydraulic conductivity of the underlying bedrock, inhibiting drainage to depth;

- groundwater levels in those wells instrumented with data loggers have been declining since installation in June, which would fit with increasing evapotranspiration rates and lower infiltration during the summer months;

- all instrumented granite boreholes show a response to rainfall events to varying degrees, with groundwater levels in BP-8 and BP-9 increasing approximately 0.1 m during the most intense rainfall events whereas BP-5 and BP-7 increase by over 1 m during the same event. The upper part of the response curve in BP-5 is truncated at approximately ground level, which implies that this borehole is flooding from the surface during intense rainfall; and

- a small tidal influence in the order of 10 to 30 mm is seen in the granite boreholes as illustrated by the comparison of the daily high tide with the daily high groundwater level in Attachment H. The apparent lag between the daily high tide and the corresponding groundwater level high is approximately 8 hours. Given the wide topographical range found on site this small change over several hours on a measurement day does not affect the interpretation of the water table.

Using site groundwater observation data, Drawing 9 shows the regional potentiometric groundwater surface at site as recorded in July / August 2014. This interpretation incorporates site specific measurements in the bedrock boreholes, minipiezometer readings in the wetlands and creeks, and water levels estimated from the private water wells, as well as topographic lake levels and stream elevations. As such it is a general representation of the water table and is intended to give a sense of the horizontal direction of groundwater flow. Where no observation points exist, the level has been estimated from knowledge of the topography and the approximate depth to water table in similar settings across the site.

Drawing 9 demonstrates that the water table generally reflects the topographic pattern, as should be expected. Groundwater flows laterally from topographic highs towards the shallow lakes, creeks and valleys onsite. The dominant feature is the granitic pluton on site which drives lateral ground water flow either north or south. A groundwater divide is shown on Drawing 9. Groundwater in the ground to the north of this divide flows laterally towards Chedabucto Bay, and that south of the divide moves towards the creeks to the south. There are in addition local patterns created by local topographic highs and lows that cause easterly or westerly flow towards the local watercourses.

3.4.1 Groundwater / Surface Water Interactions and Wetland Function

As noted, drive point piezometers (sometimes called mini-piezometers because of their narrow diameter and shallow depth) were installed in selected creeks and wetlands to assess groundwater contributions to these features. Vertical hydraulic gradients within the drive point piezometer pairs can be used to indicate how the surface water bodies are gaining groundwater from or losing it to the ground.

The vertical gradients measured on 26 August 2014 indicate that five of the locations, including wetlands at MP1, MP2[4] and MP5, along with streams at MP6 and MP8 indicate downward gradients which suggest aquifer recharge is occurring at these locations. Upward vertical gradients measured at wetland areas MP3, MP4 and MP7, along with the stream at MP9 indicate that discharge from the underlying soil is occurring at these locations. There is no pattern to the upward or downward hydraulic gradients with respect to locations in streams or wetlands. It is noted that the upward gradients are weak and likely localized, ranging from just 0.01 to 0.11 m/m (mean of 0.05 m/m upwards). On the other hand, the downward gradients are relatively stronger, ranging from 0.13 to 0.61 m/m, with a mean of 0.35 m/m downwards. A number of these early readings may also reflect un-equilibrated piezometers, similar to MP2. The summer season is generally a season of low water levels and gradients may only seasonally be downward. Therefore these conclusions should be considered preliminary only until further data are collected.

Diurnal fluctuations of the groundwater levels can be seen in the hydrograph data for both MP2 and MP6, in the order of 0.5 to 2 cm. The effect is more pronounced in the stream at MP6. These diurnal fluctuations are due to the increased evaporative and transpirative uptake of water during the day, with replenishment at night. It is expected this effect will decline in the off season and dominate during the spring to early autumn period.

3.5 Groundwater Quality

Groundwater samples have been collected from the majority of nearest residential wells, from both drilled wells in the metasedimentary rocks and dug wells in the surficial deposits. Since there are no private wells in the granite, groundwater samples were also collected from granite boreholes BP-5, BP-7, BP-8 and BP-9 on two occasions. On the first occasion, samples were collected using a bailer with a minimal purge of ten bailer volumes (~10 L) being removed from each borehole prior to sampling. On the second occasion, the wells were purged using a submersible pump until groundwater chemistry parameters including pH, electrical conductivity (EC), dissolved oxygen and temperature were considered to have stabilized. The water quality samples from both residential wells and granite boreholes were analysed for general chemistry and total metals for comparison purposes. Results of the water quality sampling are provided in Tables 2 to 4. A Piper plot and Box and Whisker Plots are presented Figures 5 to 7 in order to compare groundwater quality from various aquifer types at and around the site.

Figure 5 is a Piper plot showing the relationship between the relative abundance of the major cations and anions in the sampled water. These plots are helpful in understanding the differences between water types. The “field” that shows the water quality from granitic rock is

[4] It is noted that the hydrograph for the deep piezometer at MP2 has been rising in a smooth curve. This indicates that the level in this piezometer has not yet reached a static equilibrium with the surrounding groundwater and therefore the apparent downward gradient may not be accurate.

shown in green on Figure 5. The field for the Meguma bedrock is shown in grey. These two fields overlap each other. This is because they are composed of similar mineralogies, even though their origin is different. The sandstone is composed of silicate minerals, as is the granite. The overburden water quality on the other hand overlaps in a small way, but lies on a mixing line that extends past the bedrock water fields. Since the local glacial till is composed of crushed local bedrock moved there by the glaciers, some similarity to the bedrock fields should be expected. The width of this field is probably due to mixing as discussed below.

On all three plots the stream water occupies a narrow field (shown in blue) exhibiting a sodium chloride rich water with little calcium or sulphate and with low alkalinity (expressed as HCO_3+CO_3). The typical field for clean meteoric water is shown in light blue on this figure for ease of comparison. The salty signature of the stream water is inferred to be due to the prevalence of salt spray at surface which then gets washed into the streams. The fact that many of the shallow overburden wells, which obtain their recharge from local meteoric water, lie on a mixing line from the stream water to the bedrock water, shows a mix of surface water and water influenced by the soil materials[5]. The part of the overburden field that extends to the left on the diagrams may be more greatly influenced by clean meteoric water with no salt spray content. The five wells to the left in the overburden field are wells that are well inland from the shore. The wells that plot to the right in the overburden field are generally within 200 m of the shore.

[5] There may be a contribution from road salt as wells often sit near the local road; however this has not been investigated as part of this assessment.

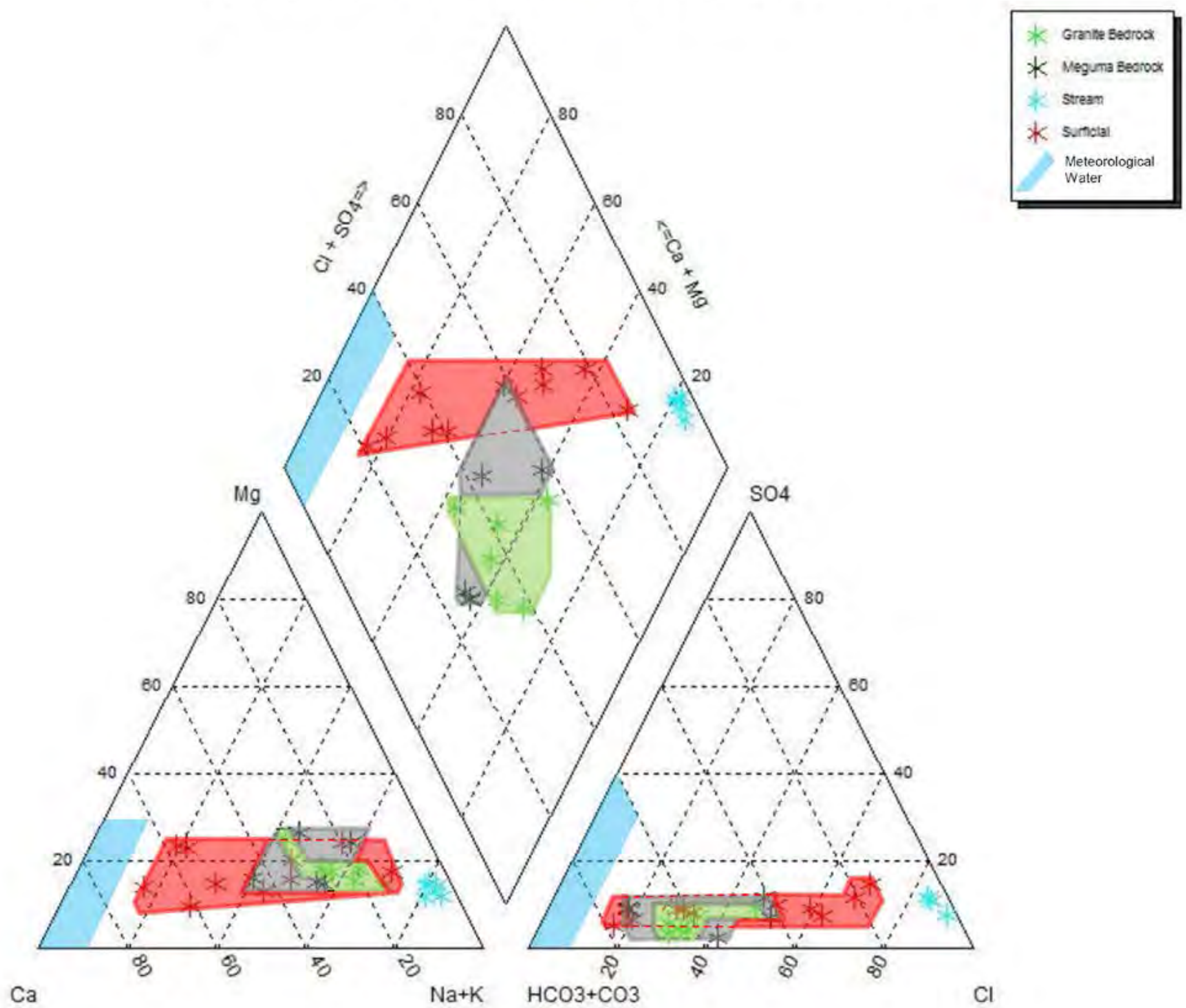


Figure 5
Piper Plot of Groundwater and Surface Water Quality Collected to Date

3.5.1 Surficial Deposits

Table 2 indicates that groundwater in the surficial deposits is of good quality for drinking, with the only exceedences of the Canadian Drinking Water Quality (CDWQ) guidelines occurring in the aesthetic objective parameters iron, manganese and pH, and a small number of exceedences of the turbidity CDWQ guideline. The groundwater quality in the surficial deposits is indicative of recharge from rainfall having a short residence time in the subsurface, where fewer parameters have time to dissolve in the groundwater. This is demonstrated on the Piper plot in Figure 5 which shows a distribution between Ca-HCO_3 waters typical of shallow, fresh groundwater and Na-Cl waters which are indicative of the influence of marine salinity provided in the recharge from precipitation (not saltwater intrusion). Concentrations of aluminium and iron as demonstrated in Figures 6 and 7 are low and consistent with the majority of recharge in the surficial deposits being provided by the infiltration of precipitation.

Table 2: Surficial (Dug) Residential Well Groundwater Quality Results

	Guideline (CDWQ)	Detection Limit	Units	BPRWA001 16-July-2014	BPRWA002 16-July-2014	BPRWA003 16-July-2014	BPRWA004[1] 17-July-2014	BPRWA006 17-July-2014	BPRWA008 17-July-2014	BPRWA012 18-July-2014	BPRWA013 22-July-2014	BPRWA014 25-July-2014	BPRWA015[5] 30-July-2014	BPRWA017 29-Aug-14
Aluminium[2]	200 (OG)	5.0	ug/L	33	17	9.9	16	12	94	46	15	83	6.3	20
Ammonia (total)	NV	0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050
Antimony	6 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10 (MAC)	1.0	ug/L	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0
Barium	1,000 (MAC)	1.0	ug/L	30	52	34	44	9.5	31	9	24	7.7	<1.0	19
Bicarbonate	NV	1	mg/L	31	94	30	6.4	16	49	10	51	36	99	98
Boron	5,000 (MAC)	50	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium	5 (MAC)	0.010	ug/L	0.048	<0.010	0.034	0.025	<0.010	0.022	0.075	0.043	0.036	<0.010	<0.010
Calcium	NV	100	ug/L	11000	26000	11000	2200	6100	15000	2300	18000	13000	<100	34000
Chloride	<250 (AO)	1.0	mg/L	37	15	32	12	12	16	25	15	9.8	94	12
Chromium	50 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Colour	<15 (AO)	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Copper	<1,000 (AO)	2.0	ug/L	38	<2.0	160	24	180	150	120	5.2	8.4	<2.0	<2.0
Iron	<300 (AO)	50	ug/L	160	<50	**1200**	<50	92	140	**2900**	<50	130	150	<50
Lead	10 (MAC)	0.50	ug/L	0.64	<0.50	1.9	<0.50	8.5	<0.50	2.1	<0.50	0.81	<0.50	<0.50
Magnesium	NV	100	ug/L	4000	6400	2900	1600	1100	2500	2000	4500	1200	<100	4100
Manganese	50 (AO)	2.0	ug/L	**210**	22	**330**	<2.0	2.3	3.3	**290**	<2.0	**320**	<2.0	<2.0
Molybdenum	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)	10 (MAC)	0.050	mg/L	0.082	<0.050	<0.050	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	0.16
Nitrite (as N)	1 (MAC)	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Potassium	NV	100	ug/L	1300	1100	5400	630	280	1200	660	930	2300	<100	1800
pH[3]	6.5 - 8.5	N/A	pH	6.76	8.1	6.55	**6.36**	6.73	7.12	**5.95**	7.68	6.83	7.41	7.90
Selenium	10 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	<200,000 (AO)	100	ug/L	17000	9500	14000	6800	7000	9900	15000	7700	5800	99000	8200
Sulphate	<500 (AO)	2.0	mg/L	5.6	6.4	6.5	2.7	3.1	5.1	7	5.6	3.9	6.2	4.9
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total dissolved solids (TDS-Calculated)[4]	<500 (AO)	1.0	mg/L	100	130	95	42	46	89	70	99	62	270	140
Turbidity	1 (MAC)	0.10	NTU	0.5	0.34	**3.1**	0.26	0.28	**1.2**	**13**	0.37	0.19	**1.2**	0.73
Uranium	20 (MAC)	0.10	ug/L	<0.10	0.25	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	0.65
Zinc	<5,000 (AO)	5.0	ug/L	11	8	19	8.8	52	27	20	20	13	5.7	<5.0

NOTES:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

1. Duplicate Sample is BPRWA005
2. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
3. pH Objective (CDWQ): 6.5 - 8.5
4. Calculated result only includes measured parameters. Actual TDS may be higher.
5. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Table 3: Granite Borehole Water Quality Results

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

Table 4: Meguma Metasedimentary Residential Well Groundwater Quality Results

	Guideline (CDWQ)	Detection Limit	Units	BPRWA007 17-July-2014	BPRWA007_A 28-Aug-14	BPRWA007_B 28-Aug-14	BPRWA009[2] 17-July-2014	BPRWA011 17-July-2014	BPRWA016[6] 31-July-2014	BPRWA016 29-Aug-14
Aluminium [3]	200 (OG)	5.0	ug/L	11	<5.0	<5.0	21	16	6.9	<5.0
Ammonia (total)	NV	0.050	mg/L	<0.050	0.051	<0.050	<0.050	<0.050	<0.050	0.38
Antimony	6 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10 (MAC)	1.0	ug/L	**50**	**46**	**46**	<1.0	<1.0	<1.0	<1.0
Barium	1,000 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	1.9	<1.0	<1.0	3.9
Bicarbonate	NV	1	mg/L	99	99	98	15	30	93	94
Boron	5,000 (MAC)	50	ug/L	60	58	60	<50	<50	<50	<50
Cadmium	5 (MAC)	0.010	ug/L	<0.010	<0.010	<0.010	0.026	0.044	<0.010	<0.010
Calcium	NV	100	ug/L	15000	15000	15000	5900	4200	<100	17000
Chloride	<250 (AO)	1.0	mg/L	14	14	14	10	21	21	40
Chromium	50 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Colour	<15 (AO)	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	<1,000 (AO)	2.0	ug/L	<2.0	<2.0	<2.0	260	51	2.7	<2.0
Iron	<300 (AO)	50	ug/L	82	<50	<50	<50	<50	<50	<50
Lead	10 (MAC)	0.50	ug/L	<0.50	<0.50	<0.50	6	<0.50	<0.50	<0.50
Magnesium	NV	100	ug/L	4500	4600	4600	1300	3400	<100	9500
Manganese	50 (AO)	2.0	ug/L	**66**	4.3	<2.0	16	13	4.9	**1100**
Molybdenum	NV	2.0	ug/L	7.1	7.3	7.4	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5
Nitrate (as N)	10 (MAC)	0.050	mg/L	0.059	0.066	0.065	1.3	<0.050	<0.050	<0.050
Nitrite (as N)	1 (MAC)	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Potassium	NV	100	ug/L	650	2100	2100	630	1200	<100	3700
pH[4]	6.5 - 8.5	N/A	pH	8.17	8.14	8.20	6.66	6.5	7.37	7.51
Selenium	10 (MAC)	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	<200,000 (AO)	100	ug/L	31000	33000	33000	5800	15000	57000	29000
Sulphate	<500 (AO)	2.0	mg/L	9.1	9.5	9.7	3.3	3.9	12	2.9
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total dissolved solids (TDS-Calculated)[5]	<500 (AO)	1.0	mg/L	150	150	150	46	89	160	170
Turbidity	1 (MAC)	0.10	NTU	0.82	0.42	0.69	<0.10	<0.10	<0.10	**170**
Uranium	20 (MAC)	0.10	ug/L	<0.10	0.10	<0.10	<0.10	1.2	<0.10	<0.10
Zinc	<5,000 (AO)	5.0	ug/L	15	8.1	7.9	30	170	12	<5.0

NOTES:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

1. Duplicate Sample is BPRWA005
2. Duplicate Sample is BPRWA010
3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

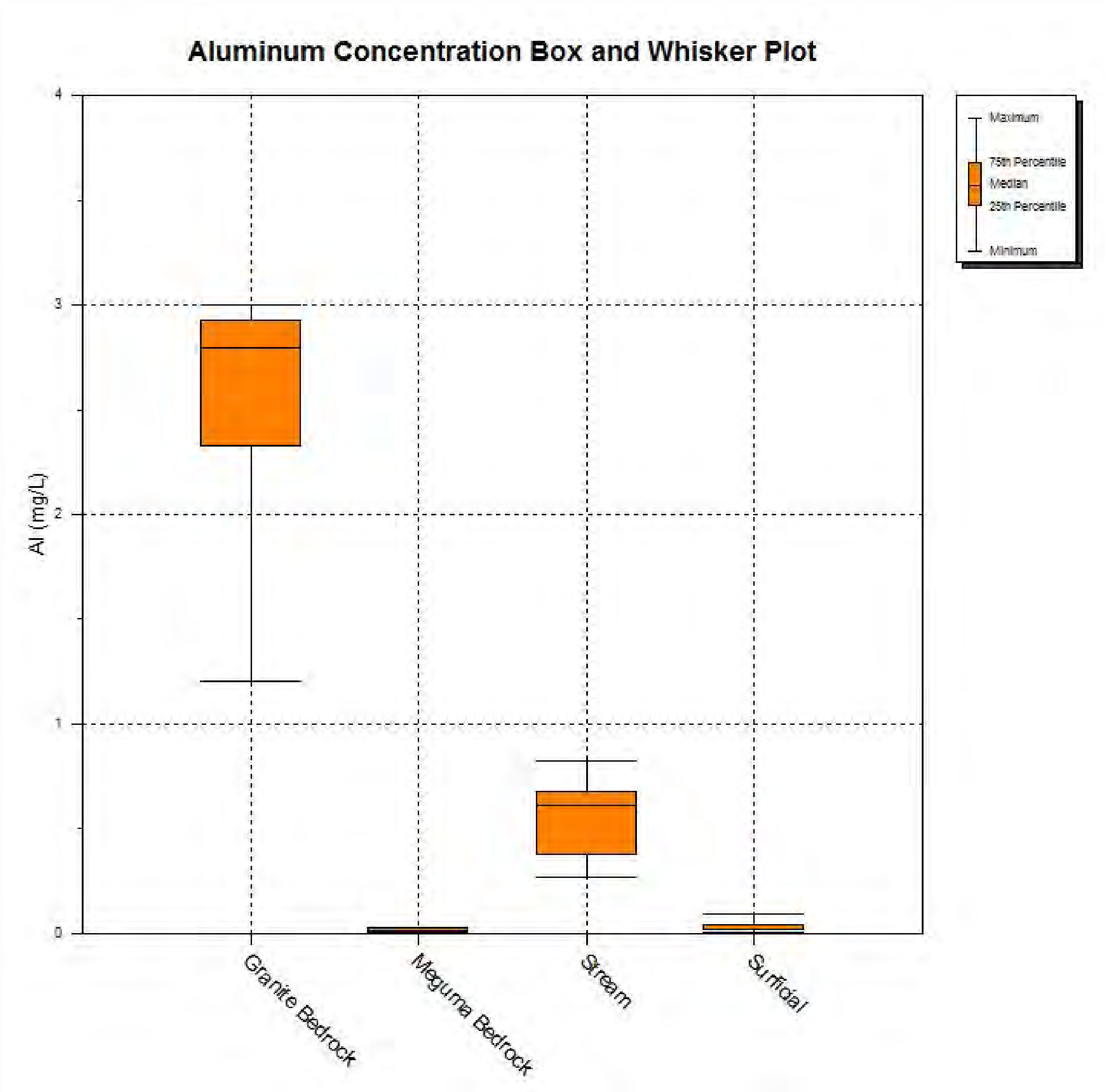


Figure 6
Box and Whisker Plot of Aluminium in Groundwater and Surface Water

3.5.2 Granite

Table 3 and Figures 6 and 7 indicate that groundwater in the granite has generally high concentrations of metals, with exceedences of aesthetic objectives for aluminium, colour, iron and manganese in the majority of samples, and exceedences of the maximum allowable concentrations within several samples for lead, arsenic and uranium. pH values were low in three of the eight samples, indicating slightly acidic conditions within the granite. We underline that the groundwater samples from within the granite have been assessed against the CDWQ

Guidelines for comparison purposes only: there are no residential or commercial wells in the granite bedrock and so, strictly speaking, these Guidelines do not apply. Regional maps indicate that concentrations of arsenic potentially exceeding national guidelines are considered very likely in the area (NSE 2005) and uranium is considered most likely to occur in areas containing granitic intrusions (NSE 2014).

The Piper plot in Figure 5 indicates that the majority of granite samples lie in a zone between Ca-HCO_3, Na-Cl, and Na-HCO_3 waters, which indicates a mixture of influences from shallow fresh water, marine water and deeper waters influenced by ion exchange. This would be consistent with the mixture of fresher waters from the upper fractured zone within the granite and water from deeper within the granite core holes.

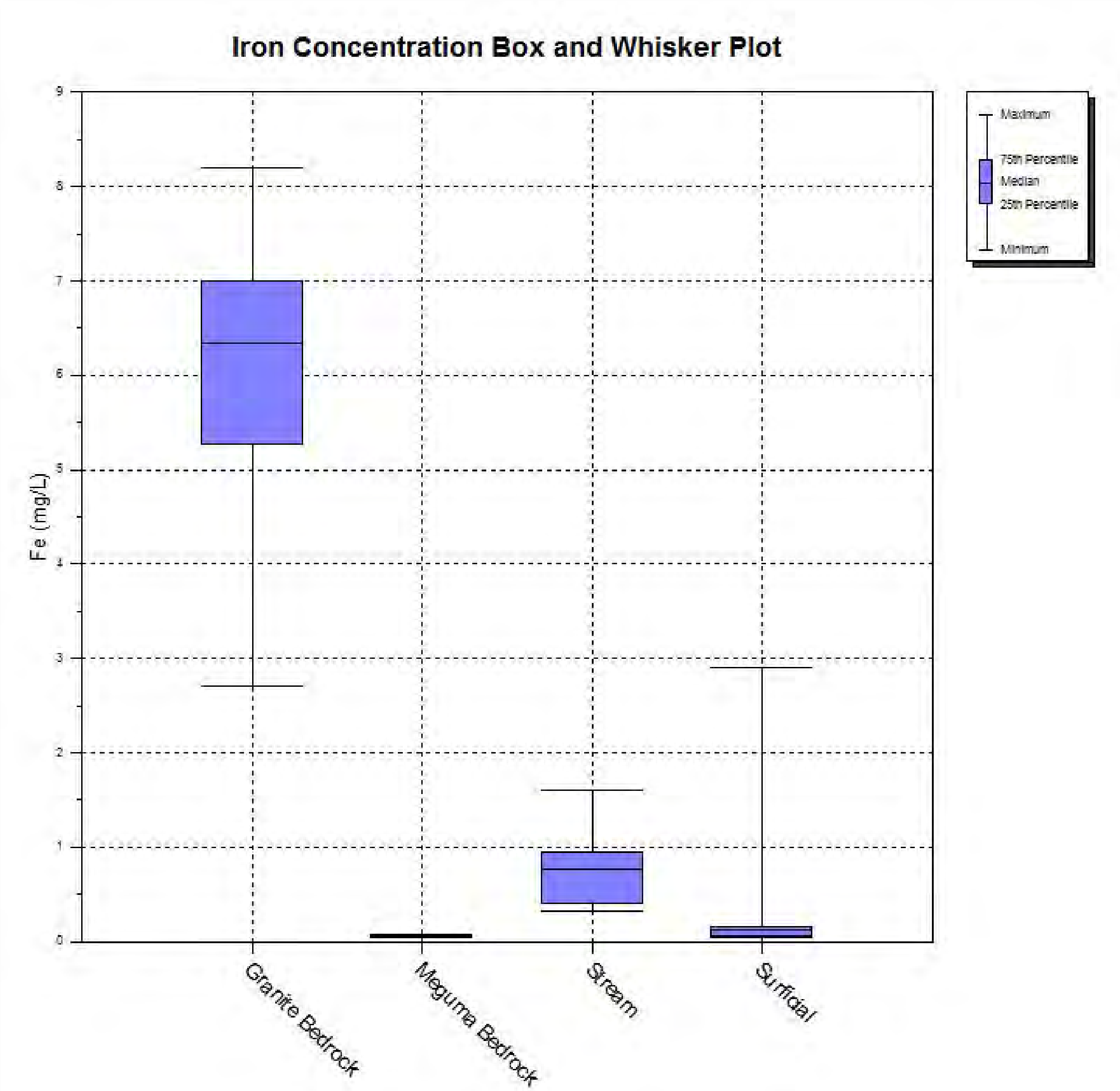


Figure 7
Box and Whisker Plot of Iron in Groundwater and Surface Water

3.5.3 Meguma Metasediments

Table 5 indicates that groundwater in the metasediments is generally of good quality with only one or two samples exceeding the aesthetic objectives for manganese and turbidity. However, two samples, plus a field duplicate, from residential well BPRWA007 demonstrated arsenic concentrations which exceed the CDWQ guideline. Generally, a higher probability of arsenic concentrations in water wells occurs in certain formations within the Meguma Terrane, including the Goldenville Formation which is associated with arsenopyrite, and a lower probability in others including the Halifax Group (Dummer et al. 2014). The Piper plot in Figure 5 indicates that the majority of metasediment samples lie in a zone between Ca-HCO_3, Na-Cl, and Na-HCO_3 waters which indicates a mixture of influences from shallow fresh water, marine water and deeper waters influenced by ion exchange. This would be consistent with the mixture of fresher waters from the upper metasediments and water from deeper within the bedrock residential wells. Although the influences on the general water chemistry are similar to those within the granite, it is comparison of the metal concentrations which demonstrates the true difference between the two distinct groundwaters. Metal concentrations, as illustrated by Figures 6 and 7 and Table 5, are relatively low within the metasediments and significantly higher within the granite.

3.6 Conceptual Model Discussion

The site is characterized by the topographic high created by an erosion resistant granitic pluton, some 95 m above sea level. This feature was intruded into metasediments of the Meguma Formation. These metasediments surround the site and host those few local residential wells that extend into the bedrock. (Most private wells are shallow and tap the more permeable glacial till overburden). Water quality in the two bedrock types (granite and metasediments) is similar with the exception of higher levels of dissolved metals (e.g., iron, aluminium and lead) in the granite. Uranium is also found in the granite but not in the other groundwater types. Arsenic is present in both the granite and the metasediments. This groundwater chemistry is entirely from natural mineral concentrations in the bedrock. The overburden groundwater is much more dilute, reflects local recharge of meteoric water, and exhibits a salt signature where close to the coast.

Drawings 10 and 11 are vertical cross-sections that run along the lines shown on Drawing 7. They have been prepared to illustrate the relationship between the various geological units, the site topography and the local wells. The likely groundwater flow paths shown on Drawing 10 demonstrate the relationship between recharge and discharge areas. The relative low permeability of the bedrock (even when fractured) is responsible for the high water table, which is generally never deeper than 6 m below ground surface. Groundwater recharge occurs in all the upland areas of the site, with lateral discharge occurring in localized low areas and in some creeks.

Drawing 9, discussed above, shows that horizontal groundwater flow under existing conditions is outward from the granite, primarily along the upper, more weathered bedrock. Fracture frequency analysis shows there is a stronger presence of fracturing in the upper bedrock, above the dashed line shown on Drawings 10 and 11, at a depth of about 40 m. This line is in fact gradational as fracturing occurs throughout the geologic profile. Deeper water is more mineralized and shows the effects of a longer presence of water at depth. Stream water quality shows little influence of the bedrock; the relatively low pH is attributed to inflows from nearby wetlands. The distinct difference in the metals concentrations between the granite and the Meguma Formation indicates there is little mixing of groundwater between the two rock types. There will however be exchange of the shallow groundwater along the boundary between the two units, based on the higher degree of fracturing at the bedrock surface. All local water wells are very far away from this boundary and there are many intervening wetlands and creeks that act as discharge zones.

From a conceptual model point of view most recharge joins the shallow system and moves laterally to onsite low areas and ultimately offsite by the creek systems. To test this statement the quantity of water can be examined. Drawing 12 shows that the granitic pluton has about 200 mm/yr (0.2 m/yr) of recharge. A representative strip, one metre wide and 300 m long to the edge of the hill is examined. Multiplying the recharge by the area yields an annual average recharge volume of 60 m^3. Using Darcy's principle the amount of water conveyed by a 40 m deep fractured bedrock pathway can be determined. The horizontal gradient (dh/dL), measured off the pluton on Drawing 9 is 0.065 m/m. Darcy states that the flow (Q) is equal to the hydraulic conductivity (K) multiplied by the hydraulic gradient and the cross-sectional area of flow (A = 40 m x 1 m = 40 m^2).

This can be rearranged to express K as a function of these parameters:

$$K = Q / (dh/dL \times A)$$

$$= 60\ m^3/yr\ /\ (0.065 \times 40\ m^2)$$

$$= 23.1\ m/yr\ \ (= 7.3 \times 10^{-7}\ m/s)$$

This compares well to the upper end of the measured range of bedrock hydraulic conductivity (7 x 10^{-7} m/s). Based on this favourable comparison it may be reasonably concluded that the conceptual model for the granite works well. A similar calculation can be conducted on the more permeable (but thinner) overburden areas, which Drawing 12 shows has recharge rates typically around 400 mm/a. That calculation derives an overburden hydraulic conductivity of about 4 x 10^{-5} m/s which is about twice the top end of the measured range for the overburden. This of course will be lower because the greater depth of underlying bedrock will take some of this water. What is important is that these values fall within a reasonable measure of each other, providing further assurance that the conceptual model is apt.

It is helpful to understand the water balance for the site. The Surface Water Resources Technical Report (Main Report, Appendix C) provides the water budget and water balance for the existing condition. During operational conditions the precipitation that falls on the site will generate runoff, which will be collected and discharged to Chedabucto Bay. Section 3.7.2 below provides insight on groundwater inflow. Calculations indicate a likely maximum groundwater inflow of 66.2 m^3/yr per lineal metre of the quarry face at full Project build out. Table 5 in that section shows that considering contributions from 4,040 m of lineal quarry face this represents 267,450 m^3 of groundwater per year, or about 8.5 L/s. Design of the water handling facilities (i.e., pit sumps) will consider this amount, which will be lower at earlier stages of the quarry[6], as part of quarry discharge to Fox Bay. Once the quarry is closed, this amount (which comes from the surrounding rock) plus the direct precipitation on the quarry area will begin to fill the quarry, which will take in the order of a decade. At that point the surface water will decant to Fox Bay. Since the inflow is dependent on driving head, and the quarry water level will be 50 m higher than the quarry floor at that time, there will be a reduced rate of groundwater inflow at this new equilibrium. Section 3.7.2 estimates this to be at a rate of 6.2 L/s (Table 5). This is in addition to contributions from direct precipitation.

3.7 Anticipated Effects of Quarry Development on Water Supply

It is useful to understand what potential effects the proposed quarry may have on nearby bedrock groundwater uses. Removal of the rock will mean the creation of a “sink” in the groundwater system, up to 130 m deep in places at full Project build out. This will create an inward groundwater flow towards the quarry. Drawings 13 and 14 show the quarry at full build out, in 50 years. They also show the expected maximum drawdown to the water table, based on the following discussion.

3.7.1 Quarry Drawdown

It is prudent to examine the extent of drawdown back from the quarry to understand if there is potential for any impact to neighbouring potable water wells. Consideration was given to using a three dimensional groundwater flow model to achieve this, however given the size of the facility, insufficient groundwater monitors are present to properly calibrate such a model. However the size of the facility means that there are extensively long sidewalls, in the order of 500 to 1500 m long. Therefore a two dimensional vertical section along such a wall has been analysed by the method[7] of Fetter, 2001 for a maximum quarry depth of 130 m. This method considers the hydraulic conductivity of the weathered and unweathered bedrock and of the overburden soils, and the amount of average annual recharge, and calculates the water table surface, assuming a 5 m seepage face at the quarry wall. It is calibrated by ensuring the water table lies below the ground surface and that the lateral groundwater flows (overburden, weathered rock and unweathered rock) sum to the amount of recharge entering the system. To help represent the variability of the system (fractured rock, variable recharge rates) a reasonable range in parameters is applied to help bracket the likely results.

Figure 8 presents the base case for this analysis taken at the average recharge rate of 351 mm/yr for the site. A range of hydraulic conductivity (K) for the bedrock has been used to show its effect on the extent of the drawdown cone. The maximum measured K was 7×10^{-7} m/s in the open boreholes. As this is believed to be contributed by the more weathered rock at the top of the boreholes, it is very likely that the deeper rock is less permeable. For this reason two other cases of $K = 7 \times 10^{-8}$ m/s and $K = 7 \times 10^{-9}$ have been calculated to determine a conservative estimate for drawdown. These two values represent unweathered bedrock that is 10 to 100 times less permeable than the weathered bedrock assessed by the testing. Inherent in the calculation is a 5 m thick layer of overburden at $K_{overburden} = 2 \times 10^{-6}$ m/s, which conveys part of the recharge laterally away[8] from the quarry

[6] It will be lower because of a smaller area of the quarry, meaning less contributing quarry face and lower driving heads until the quarry floor reaches its final depth.

[7] Fetter details this methodology in Chapter 4.14 for Steady Flow in an unconfined aquifer, as adapted from other authors. This technique is widely used and often un-cited.

[8] This is because the ground slopes away from the quarry at almost every point around its circumference.

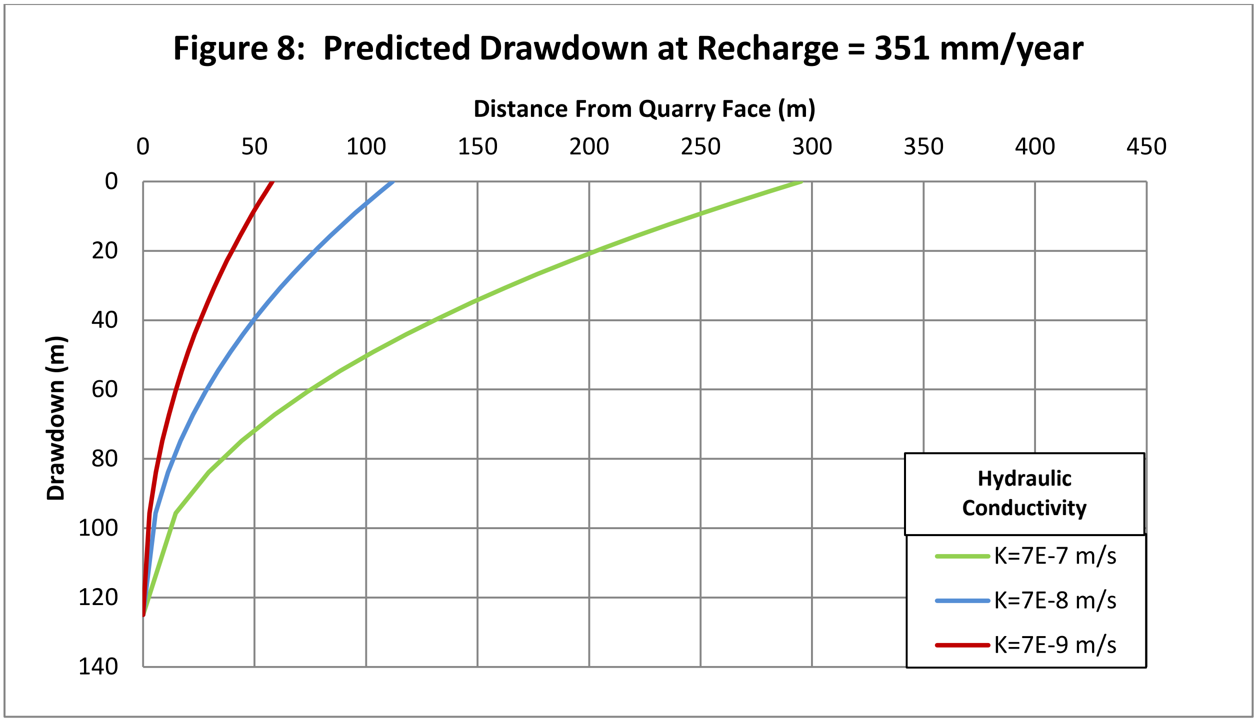
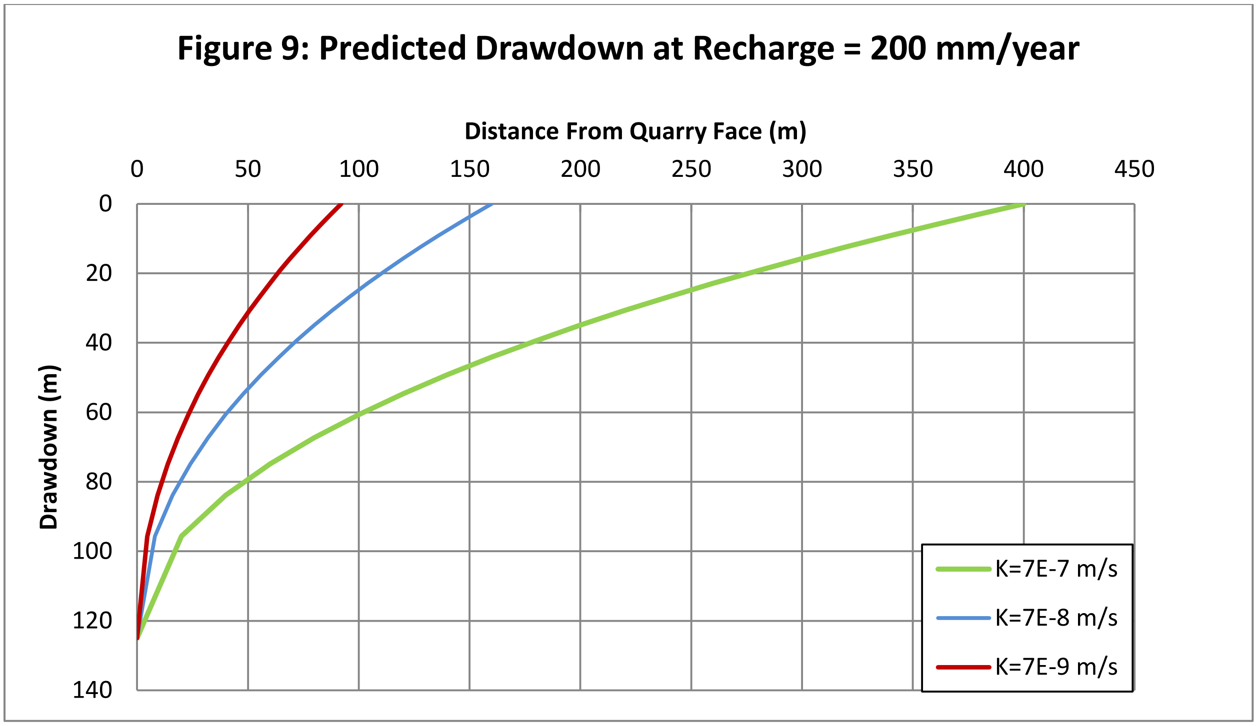


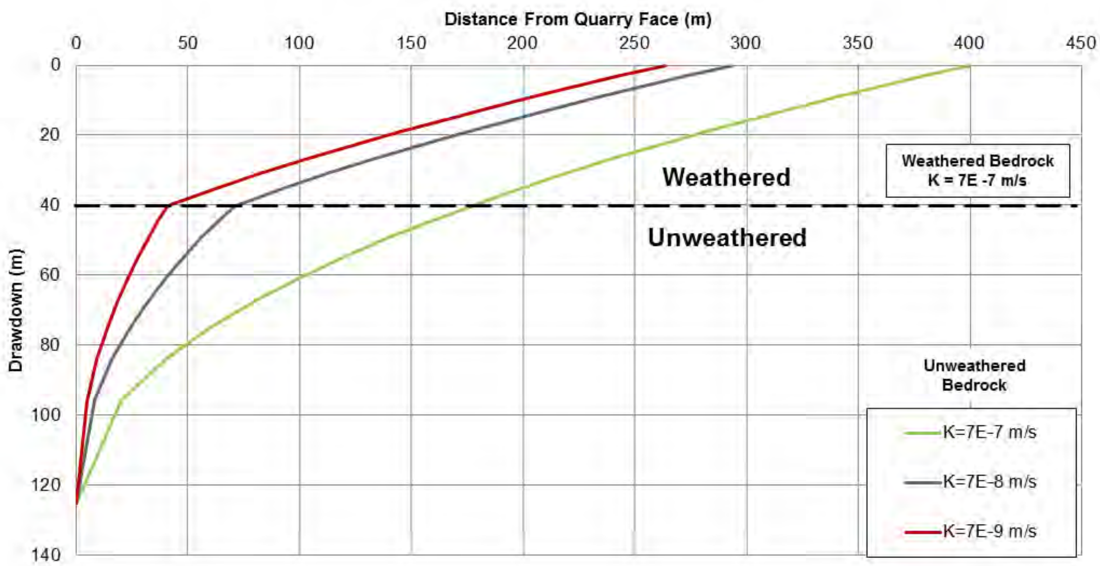
Figure 8 shows that the radius of drawdown reaches a distance from the quarry face of 300 m for the most permeable case of K = 7 x 10^{-7} m/s. Where the rock is less permeable this reduces to 115 m and then to 60 m where K = 7 x 10^{-9} m/s. This is intuitively correct as the rock is less capable of drainage at these lower values and thus affects less of an area of recharge.

The system is also sensitive to the amount of recharge. In the above example, a recharge rate of 351 mm/yr was selected as that is the average for the site. However, examination of Drawing 12 shows that around the edges of the quarry the recharge rate is locally around 200 mm/yr. Figure 9 has been prepared to show the effect of this lower recharge rate on the drawdown for the range of hydraulic conductivities considered. Since the bedrock can convey a certain amount of water, the extent of the area of drawdown can be greater if there is less recharge to convey. That is, the drawdown of the water table extends further from the quarry in the lower recharge scenario. The radius of drawdown reaches a distance from the quarry face of just about 400 m for the permeable case of K = 7 x 10^{-7} m/s. Where the rock is less permeable this reduces to 160 m and then to 90 m where K = 7 x 10^{-9} m/s. This recharge rate is adopted as the most conservative “base case”, as it reflects the lower recharge amounts at the top of the quarry walls.



Consideration must now be given to the horizon that appears to me more fractured generally above 40 m depth. Section 3.2.2 identified that the transition is gradational, but for the sake of computation a discrete boundary has been used in Figure 10 on the base case. Figure 10 shows that the drawdown will extend further back from the face in a weathered zone of K = 7 x 10^{-7} m/s (the upper end of the measured range on site). The most conservative case for impact assessment would therefore be to assume the bedrock is at the high end of the hydraulic conductivity range, and that this extends to depth. This is because the extent of the drawdown cone is reduced when the lower unweathered zone is of lower hydraulic conductivity.

Figure 10: Predicted Drawdown with Weathered bedrock, K_{weath} = 7E-7 m/s, Rechage = 200 mm/yr



It is important to understand the amount of water that would enter the quarry through the bedrock for this critical case. Considering a 1 m wide slice the amount of recharge is 0.200 m/yr X 1 m 410 X m = 82 m^3/year. For the water table position derived by the calculation, 15.8 m^3/year flows laterally in the overburden[9] (and away from the quarry since it is constructed at the height of land). The remainder, 66.2 m^3/year, flows laterally in the bedrock into the quarry.

It is often prudent to cross-check theoretical calculations against field observations to understand if the calculated results are reasonable. In this case a similar condition is observed in nature. The groundwater under the 80 m scarp above the shore drains naturally to the north and is about 60% of the size that may be created inside the quarry. The water table follows this scarp quite closely as seen on Drawing 9, with a horizontal gradient of about 0.25. That is, for the 70 m or so drop in the water table on Drawing 9, there is a lateral distance of about 280 m back from the toe of the slope. The analytical model predicts up to a 400 m extent of lateral quarry drawdown, that is a horizontal gradient of 400/130 = 0.33. This is considered in very close agreement to the naturally observed condition. (For example, to achieve the same extent as observed in nature would require a hydraulic conductivity of about 1.2 x 10^{-7} m/s, that is only 70% greater than what was found in the core holes. This is reasonable since a naturally weathered surface is more permeable than the quarry face will be.) It is concluded that the drawdown from the completed quarry will be felt at a drawdown distance of 400 m or less. The nearest wells are many times that distance away and the presence of intervening watercourses (which act as hydraulic boundaries) dictates that these wells cannot be affected by the quarry.

[9] This is based on a water table slope of 0.05 m/m, a saturated thickness of 5 m and a hydraulic conductivity of 2 x 10^{-6} m/s, and was calculated by the method of Darcy.

3.7.2 Quarry Inflow of Groundwater

The above section described the anticipated drawdown of the water table from the excavation of the quarry. The most conservative case estimated 66.2 m^3/year per lineal metre of quarry under the full mined out condition. Once the quarry recovers to just 75 m of drawdown (as the water level recovers to 20 m above sea level), this value is reduced to 48.2 m^3/year per lineal metre of quarry. Table 5 below summarizes what the inflow will be for each scenario along each quarry wall. The north wall is assumed to contribute nothing as it will have been removed by quarrying.

Table 5. Annual Maximum Groundwater Contributions into Quarry

Quarry Face	Length (m)	At Full Depth (@66.2 m^3/yr/m)		After Closure (@48.2 $m^{3/}$yr/m)	
		m^3/yr	**L/s**	**$m^{3/}$yr**	**L/s**
North	0	0	0	0	0
West	1,375	91,025	2.89	66,275	2.10
South	1,540	101,950	3.23	74,230	2.35
East	1,125	74,475	2.36	54,225	1.72
Total	**4,040**	**267,450**	**8.48**	**194,730**	**6.17**

These values are conservative in nature, as they are based on the most critical case of the bedrock being the same permeability for its entire depth. The inflow will be considerably lower for those portions where a lower hydraulic conductivity exists and the lateral extent of drawdown is smaller. In addition, as the quarry begins development the initial inflow amounts will be very small and will steadily build to the above estimates.as the quarry expands and deepens.

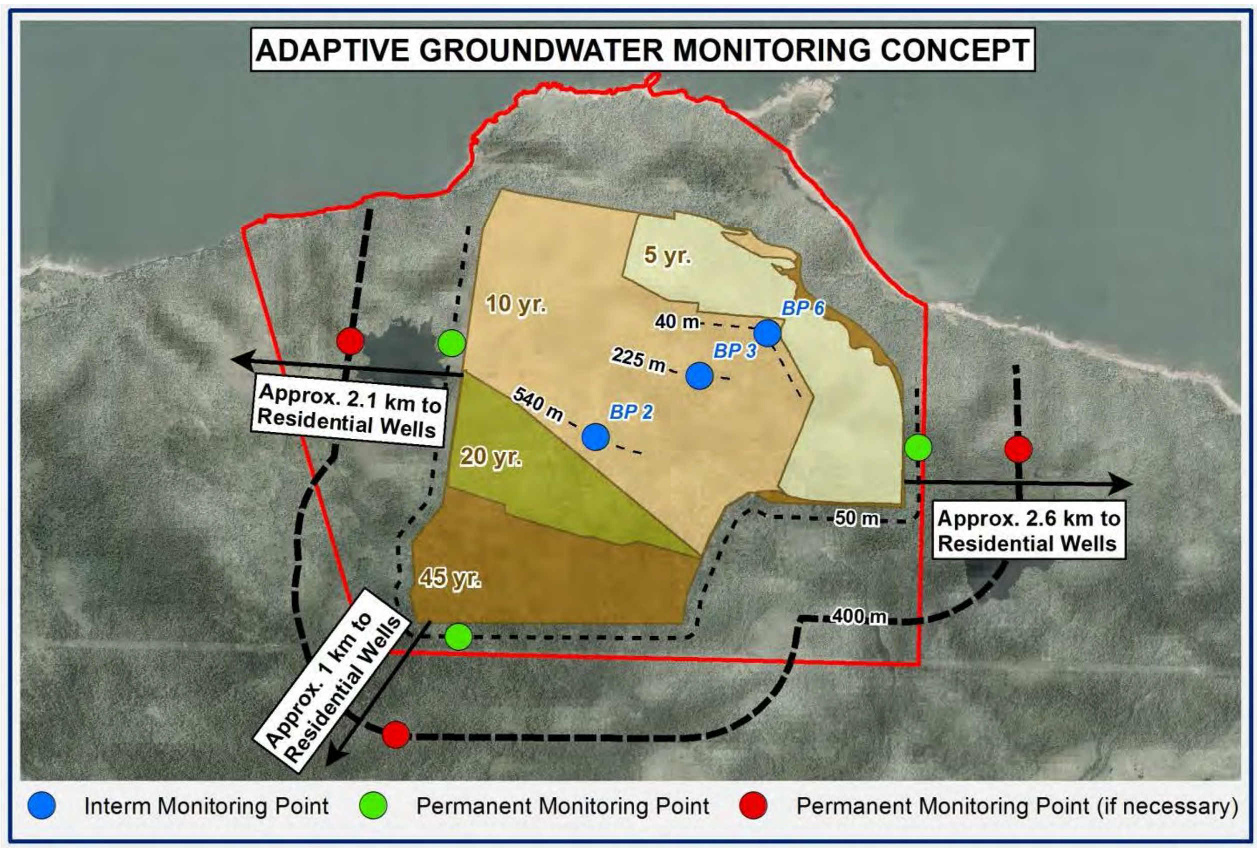
3.7.3 Potential Effects on Wetlands and Streams

The potential effects of quarry drawdown in the subsurface on the watercourses or wetlands that lie inside the area so affected is considered here. This section does not deal with the reduction of catchment area for Reynolds Creek and other watercourses, which is presented in Section 6.0 of the Main Report. Section 3.4.1 above identified that the wetlands and streams on this site are generally “losing” systems. That is, there is a loss of surface water to the groundwater. Downward gradients dominate and are strong, whereas those few places with an upward gradient have only a weak upward gradient. This implies that these systems are surface water fed and not fed by groundwater discharge from the bedrock. Based on this there should be no depletion of these features by lowering of the water table in the underlying bedrock. It will be important to monitor these features as the quarry operations expand, and should impacts occur, mitigation and/or compensation can be undertaken.

3.7.4 Future Groundwater Monitoring

This section presents the foundation for confirmatory and precautionary groundwater monitoring of the site. The proposed monitoring program is based on the predicted effects of the quarry, and will be adaptive to the conditions encountered as development proceeds and the quarry expands.

Due to the long term nature of the facility (50 year build out) the groundwater monitoring program will be phased in to establish background conditions as needed: the wells shown below would be installed over time, rather than all at once. As the results become known and actual quarry drawdowns are established and compared against predicted values, monitoring locations can be optimized or eliminated and monitoring frequency reduced if no effects are observed. It is anticipated that some monitoring locations will be temporary and will exploit existing boreholes (shown in blue, below) to help establish actual conditions, and that some will be permanent and newly installed (shown in green). The schematic below is intended to conceptually show what this would look like for the three areal phases of the Project.



Each groundwater monitoring station, both blue and green, would consist of at least a pair of drilled monitoring wells into the bedrock. One of the two wells will be equipped with a water level monitor in the upper 10 m of bedrock (the weathered zone), while the second well will be drilled to the anticipated final quarry depth. Packer testing would be used to select an appropriate permeable horizon within the deeper well to host the water level monitor. If the overburden is found to be substantive and water bearing, a shallow standpipe would be installed in the overburden for monitoring purposes.

The first blue sentry well pair would be drilled in year zero within the “10 yr zone”, 50 m or less from the 5 year pit face. They are intended to establish the drawdown condition to the south. The first green sentry well pair would also be drilled in year zero and would be placed 50 m east of the quarry face since quarry expansion between years zero and five will occur in an easterly direction. The objective of these wells is to monitor drawdown to the east. A third well pair (in red) would be installed 400 m east from the quarry face to test the predicted drawdown condition in year three or four, depending on the results recorded in the first well pair installed at 50 m. If no effects were measured at 50 m east, then no wells would be required at 400 m east.

All groundwater monitors would be tested for field permeability for comparison to the original studies. This information would be used to aid in the design of future monitoring stations. All other well pairs would be installed progressively over the years in keeping with quarry expansion. For example, the green well pairs to the west would be installed sometime after year five as the 10-year pit wall extent is approaching.

Groundwater monitoring would consist of seasonal (quarterly) water level measurements plus the use of dataloggers in key sentry wells in line with residential wells. Since no impacts are predicted on private wells over a kilometre away and there is a high level of confidence with this prediction, no private well monitoring program is proposed at this time. However, the groundwater monitoring program is adaptive and if drawdowns at the sentry wells were greater than predicted, additional sentry wells could be added and/or a private well monitoring program could be instituted if deemed necessary following discussions with NSE. Once seasonal baseline conditions (water quality and water level fluctuations) are established the results would be used to determine future seasonal water level monitoring frequency.

Two baseline water samples per year would be collected, one each in the wet and dry seasons. Samples would be analysed for a basic suite of water quality parameters. Water quality samples would be taken again if/when quarry effects are observed in the sentry wells to determine if the drawdown has had adverse effects on water quality. The need for future water quality sampling would be re-evaluated based on these initial results.

Each well location would undergo quarterly baseline monitoring for a minimum of two years to establish seasonal variations over differing meteorological conditions.

The monitoring of ground-to-surface water interaction will be achieved using the existing shallow drive point piezometers located in key wetlands plus in Fogherty and Murphys Lakes. The objective of this program is to establish if there is a drying out of wetlands from their baseline conditions. Water level monitoring would be undertaken at the same frequency as in the groundwater monitors but no water samples would be taken. This methodology is non-intrusive to the ecologic features and largely employs equipment already in place.

In summary, the groundwater monitoring approach is designed to verify the drawdown predictions described above. It will be progressively implemented as the quarry expands over time and has the additional advantage of being adaptive and flexible, in terms of well locations and monitoring efforts, to initial results. This in turn results in a groundwater monitoring program that is reflective of actual quarry expansion and measured Project effects on groundwater.

4.0 REFERENCES

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5.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR for Vulcan Materials Company and Morien Resources Corp. (the Proponents). It is intended for the sole and exclusive use of the Proponents and its authorized agents for the purpose(s) set out in this report. Any use of, reliance on or decision made based on this report by any person other than the Proponents for any purpose, or by the Proponents for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such other person or the Proponents. The Proponents and SLR make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

Any conclusions or recommendations made in this report reflect SLR's judgment based on the following limited investigations: visual site inspection(s) on the date(s) set out in this report; examination of public records; and interviews with individuals having information about the site. While efforts have been made to substantiate information provided by third parties, SLR makes no representation or warranty as to its completeness or accuracy.

This report has been prepared for specific application to this site. Unless otherwise stated, the findings cannot be extended to previous or future site conditions; portions of the site which were unavailable for direct investigation; subsurface locations which were not investigated directly; or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; and substances addressed by the investigation may exist in areas of the site not investigated or in quantities not ascertained.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or variations of conditions within the site that may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

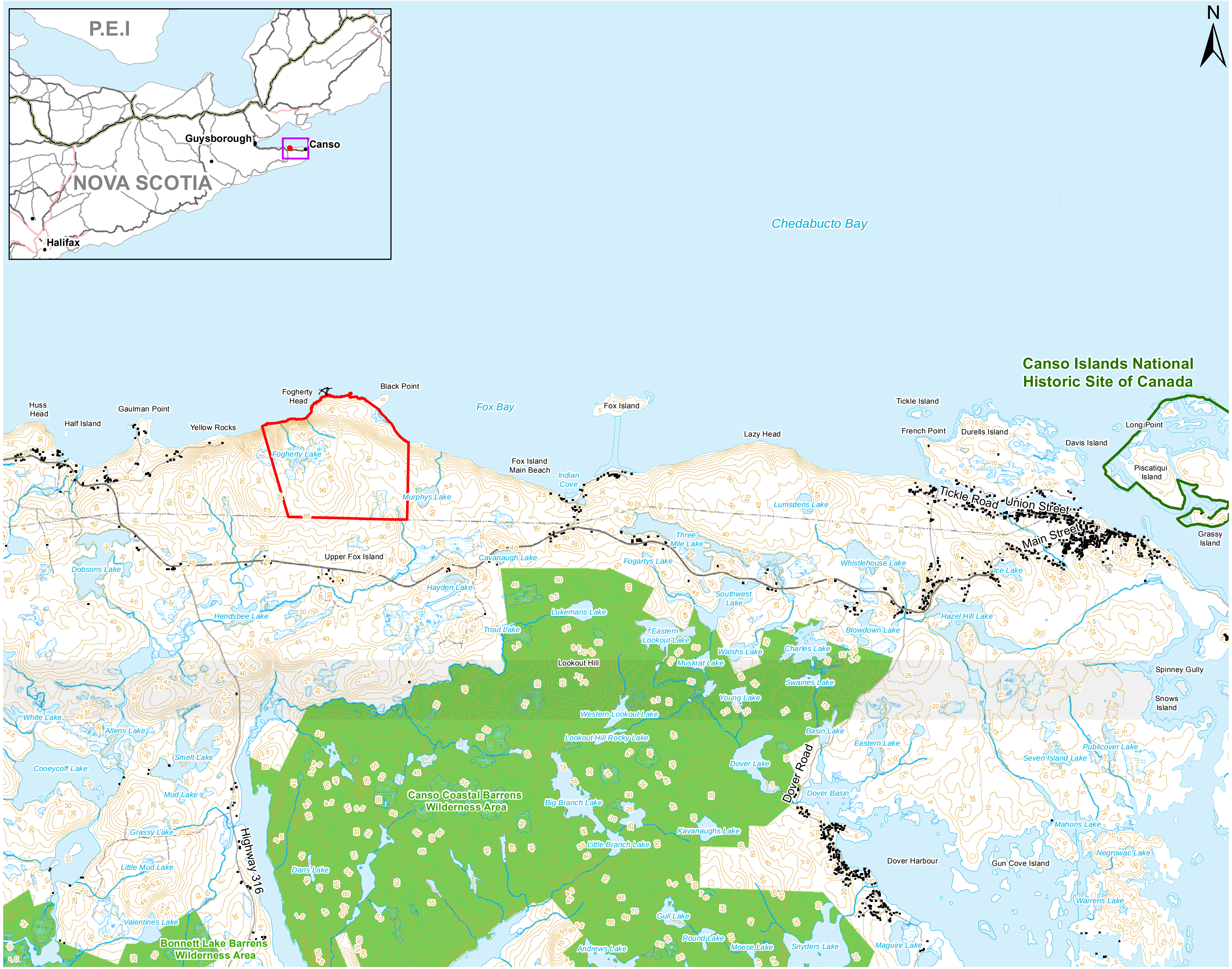
Nothing in this report is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by the Proponents and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

The Proponents may submit this report to Nova Scotia Environment and/or related environmental regulatory authorities or persons for review and comment purposes.

DRAWINGS
Hydrogeological Technical Study

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000



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LEGEND

- Building
- Property Boundary
- Wilderness Area
- NSDNR Wetland
- Waterbody
- Watercourse
- Contour (5m)
- Cut Line (>100m long & <20m wide)
- Utility Line

0 0.5 1 2 3 Kilometers

SCALE: 1:60,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

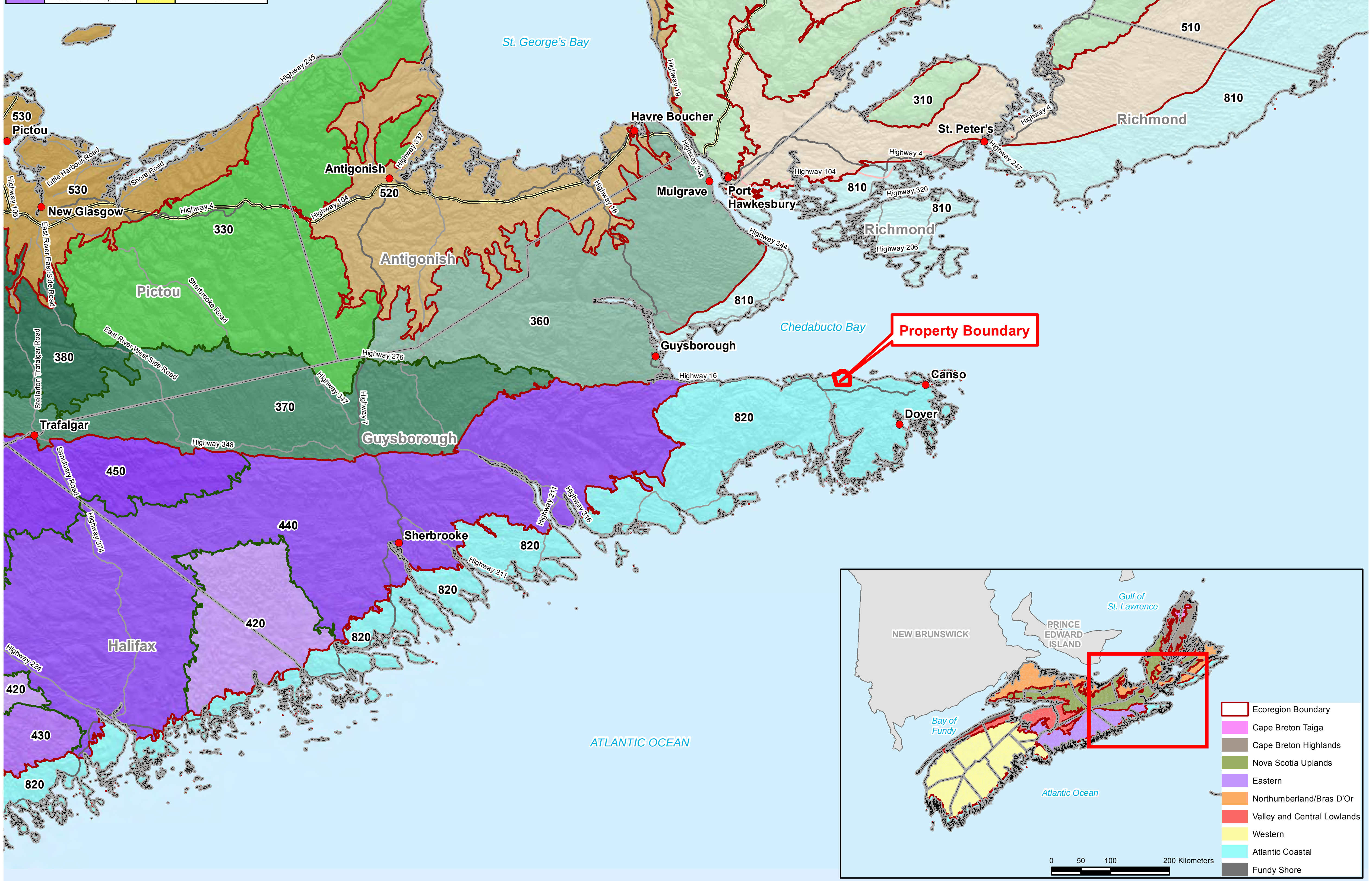
HYDROGEOLOGICAL ASSESSMENT REPORT

PROJECT LOCATION AND STUDY AREA

September 22, 2014	Rev	1.0	Drawing. 1
Project No.	210.05913.00000		

SLR Consulting (Canada) Ltd.

Ecodistrict Code	Description	Ecodistrict Code	Description	Ecodistrict Code	Description
100	Cape Breton Taiga	440	Eastern Interior	740	LaHave Drumlins
210	Cape Breton Highlands	450	Governor Lake	750	Rossignol
220	Victoria Lowlands	510	Bras d'Or Lowlands	760	Sable
310	Cape Breton Hills	520	St. Georges Bay	770	Western Barrens
320	Inverness Lowlands	530	Northumberland Lowlands	780	St. Margarets Bay
330	Pictou Antigonish Highlands	540	Cumberland Hills	810	Cape Breton Coastal
340	Cobequid Hills	550	Cumberland Marshes	820	Eastern Shore
350	Cobequid Slopes	560	Chignecto Ridges	830	South Shore
360	Mulgrave Plateau	610	Annapolis Valley	840	Tusket Islands
370	St. Marys River	620	Minas Lowlands	850	Sable Island
380	Central Uplands	630	Central Lowlands	910	Parrsboro Shore
410	Rawdon / Wittenburg Hills	710	Valley Slope	920	North Mountain
420	Eastern Drumlins	720	South Mountain		
430	Eastern Granite Uplands	730	Clare		



LEGEND

- Populated Place
- Property Boundary
- Ecoregion Boundary
- Ecodistrict Boundary
- County Boundary

0 5 10 20 30 Kilometers

SCALE: 1:600,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

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Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMNT REPORT

ECODISTRICTS OF NOVA SCOTIA

September 18, 2014	Rev 1.0	Drawing No. 2
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line
- Elevation Contours (2m, derived from LiDAR, 5m from CANVEC)

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

HYDROGEOLOGICAL ASSESSMENT REPORT

STUDY AREA TOPOGRAPHY

October 23, 2014	Rev 1.0	Drawing 3
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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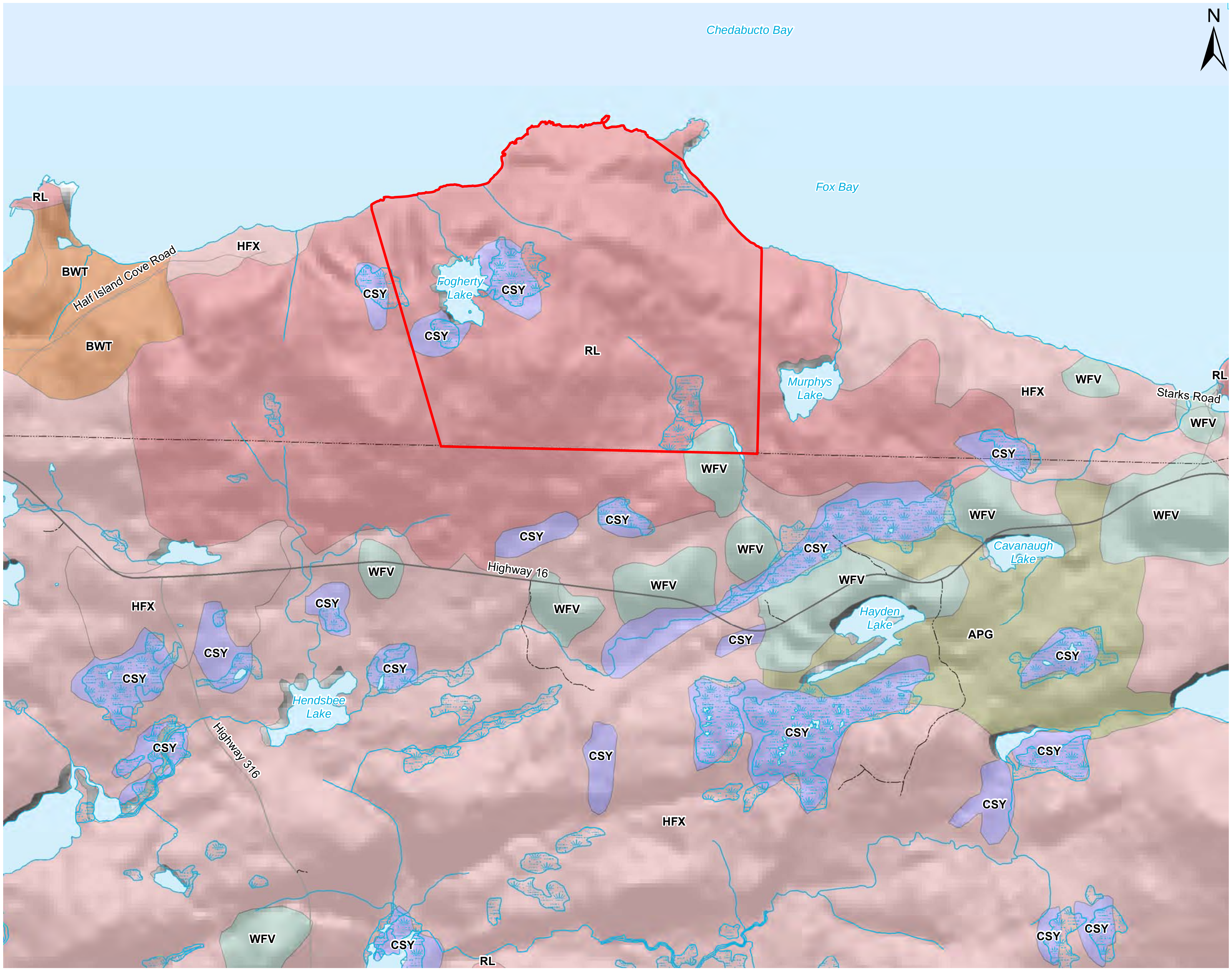

LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

Soil Cover

- APG - Aspotogan
- BWT - Bridgewater
- CSY - Castley
- HFX - Halifax
- RL - Rockland
- WFV - Wolfville

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

SOIL COVER

September 18, 2014	Rev 1.0	Drawing No.
Project No. 210.05913.00000		4

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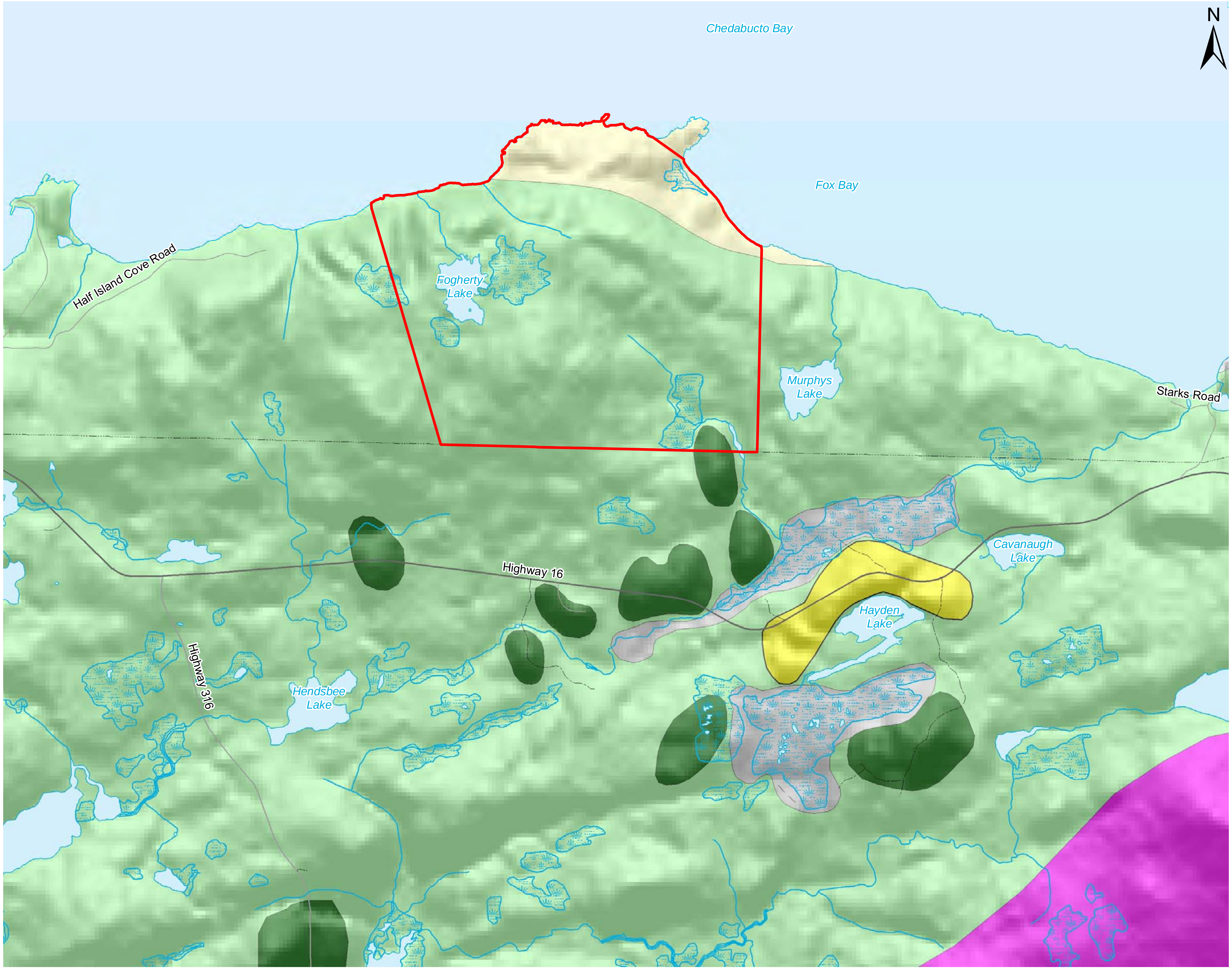

LEGEND
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line
- Organic Deposits
- Marine Deposits
- Stony Till Plain (Ground Moraine)
- Silty Drumlin (Drumlin Facies)
- Bedrock
- Esker

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 36, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, scale 1:500 000, by R. R. Stea, H. Conley and Y.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

SURFICIAL GEOLOGY

September 22, 2014	Rev 1.0	DrawingNo.
Project No.	210.05913.00000	5

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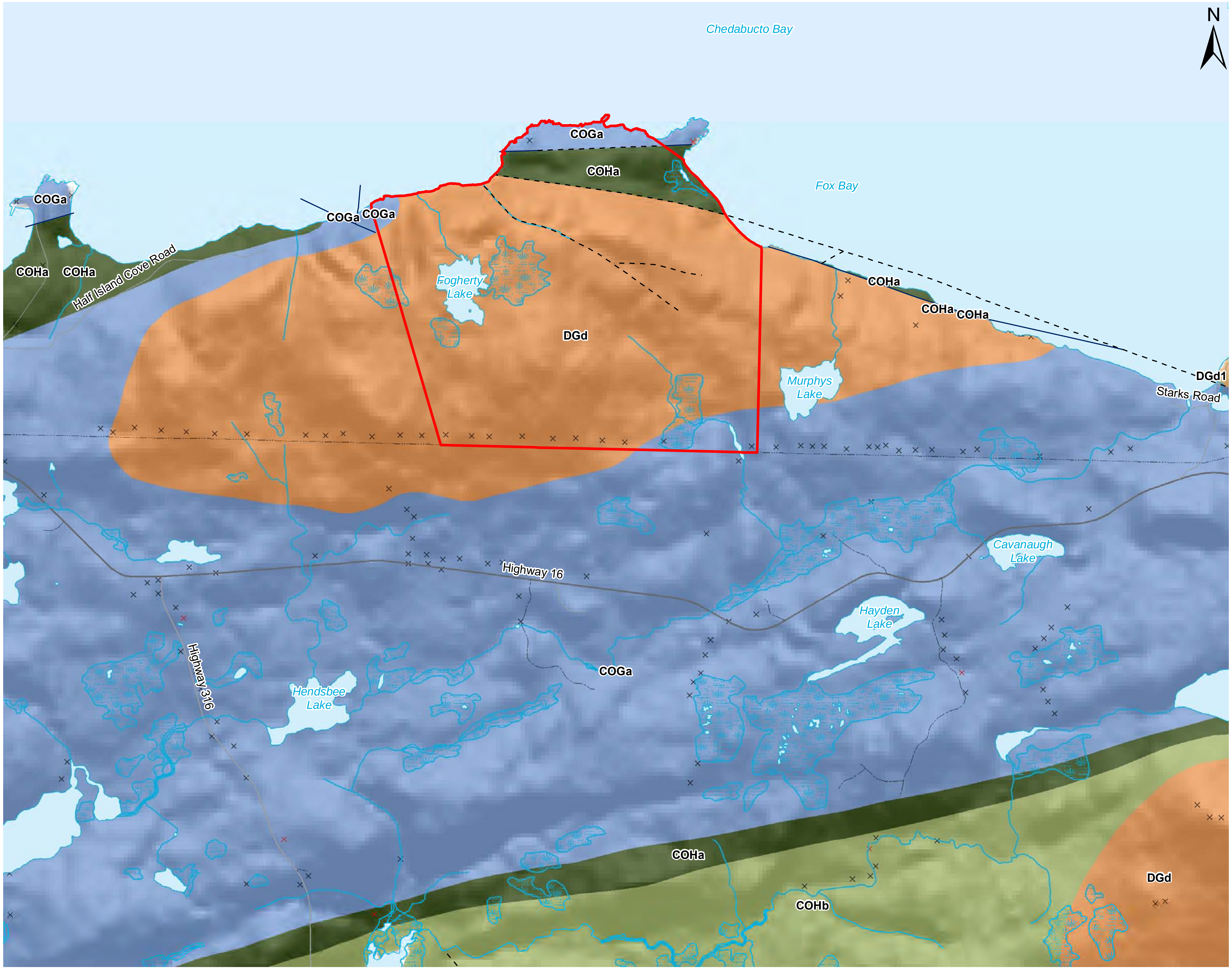

LEGEND

- Property Boundary
- Fault, Approximate
- Fault, Assumed
- Waterbody
- Wetland
- Watercourse
- Utility Line

Outcrops

- ▲ fault breccia, cataclasite
- × observed outcrop
- × porphyroblast occurrence
- ± xenolith concentration

Bedrock Geologic Units

Goldenville Formation

- COGa - Goldenville Formation thickly bedded

Halifax Formation

- COHa - Halifax Formation graphite schist
- COHb - Halifax Formation mica-quartz-garnet phyllite

Upper Devonian

- DGd - Upper Devonian med grained, equigranular to slightly porphyritic granite
- DGd1 - Upper Devonian med grained, equigranular to slightly porphyritic granite <4% biotite

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 350, Version 1, 2006, Digital Version of Geological Survey of Canada Bulletin 383, Figure 2. Geology of the Canso Area, Nova Scotia, parts of NTS 11F/02, 11F/03, 11F/06 and 11F/07, scale 1:50 000, by J. D. Hill, 1986

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

BEDROCK GEOLOGY

September 22, 2014	Rev 1.0	Drawing No. 6
Project No.	210.05913.00000	

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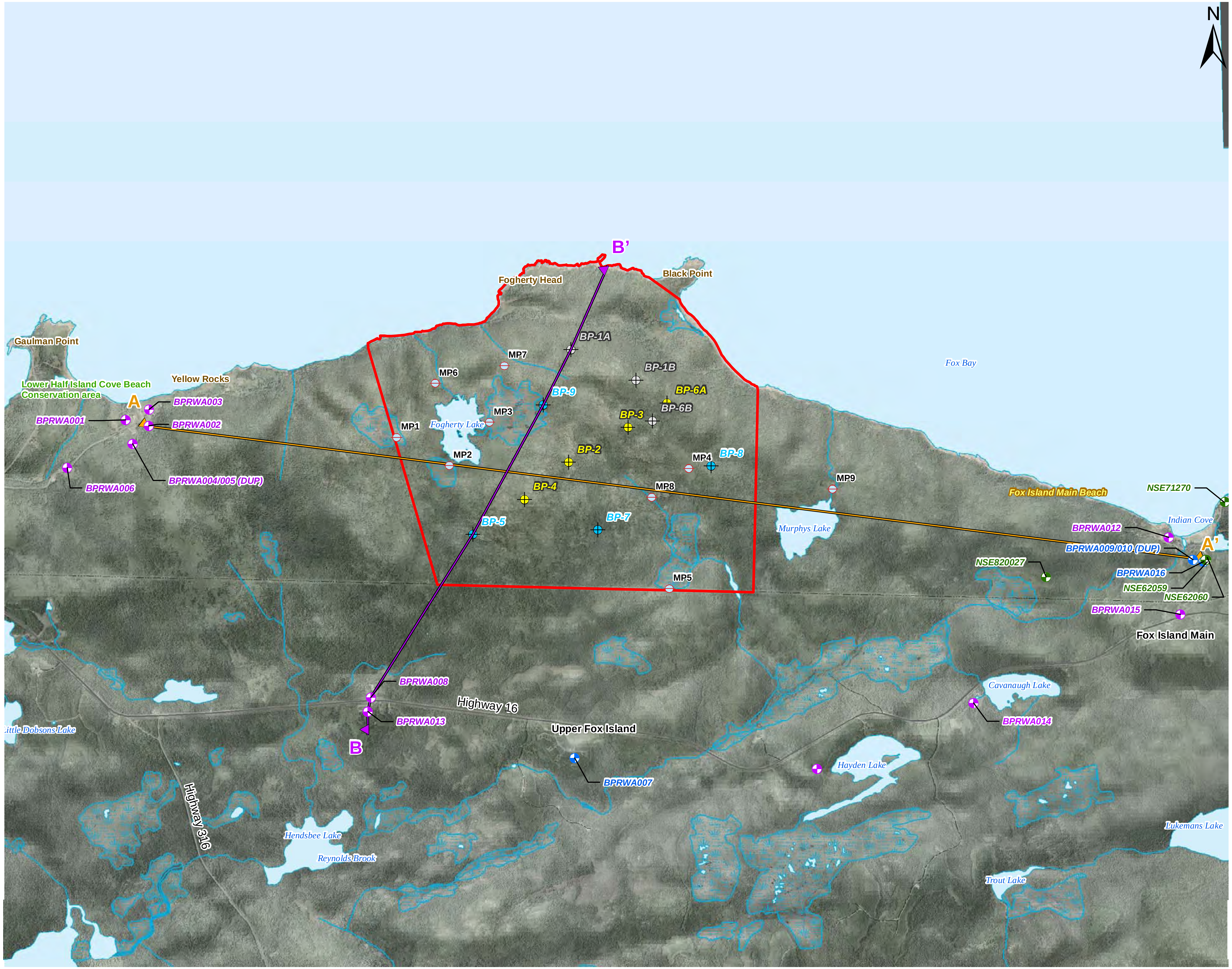

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LEGEND

- A-A'
- B-B'
- Drilled Nova Scotia Environmental Well Location
- Mini-Piezometers
- Drilled Residential Wells
- Dug Residential Wells
- Borehole (Unable to Locate)
- Borehole - Sampled with Water Level Logger
- Borehole Location
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS

February 9, 2015	Rev **1.0**	Drawing **7**
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

LEGEND

- Drive Point Piezometer Locations
- Drive Point Piezometer Locations with Water Level Loggers
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES CORP.

HYDROGEOLOGICAL ASSESSMENT REPORT

DRIVE POINT PIEZOMETER LOCATIONS

September 22, 2014	Rev 1.0	Drawing No. 8
Project No.	210.05913.00000	

SLR Consulting (Canada) Ltd.

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LEGEND

- Property Boundary
- Direction of Groundwater Flow
- Groundwater Contours (mASL)
- Waterbody
- Watercourse
- Drive Point Piezometer
- Drilled Residential Wells
- Dug Residential Wells
- Borehole (Unable to Locate)
- Borehole - Sampled with Water Level Logger
- Borehole Location

0 125 250 500 Meters

SCALE: 1:15,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

HYDROGEOLOGICAL ASSESSMENT REPORT

GROUNDWATER ELEVATIONS

September 26, 2014	Rev 1.0	Drawing No.
Project No. 210.05913.00000		9

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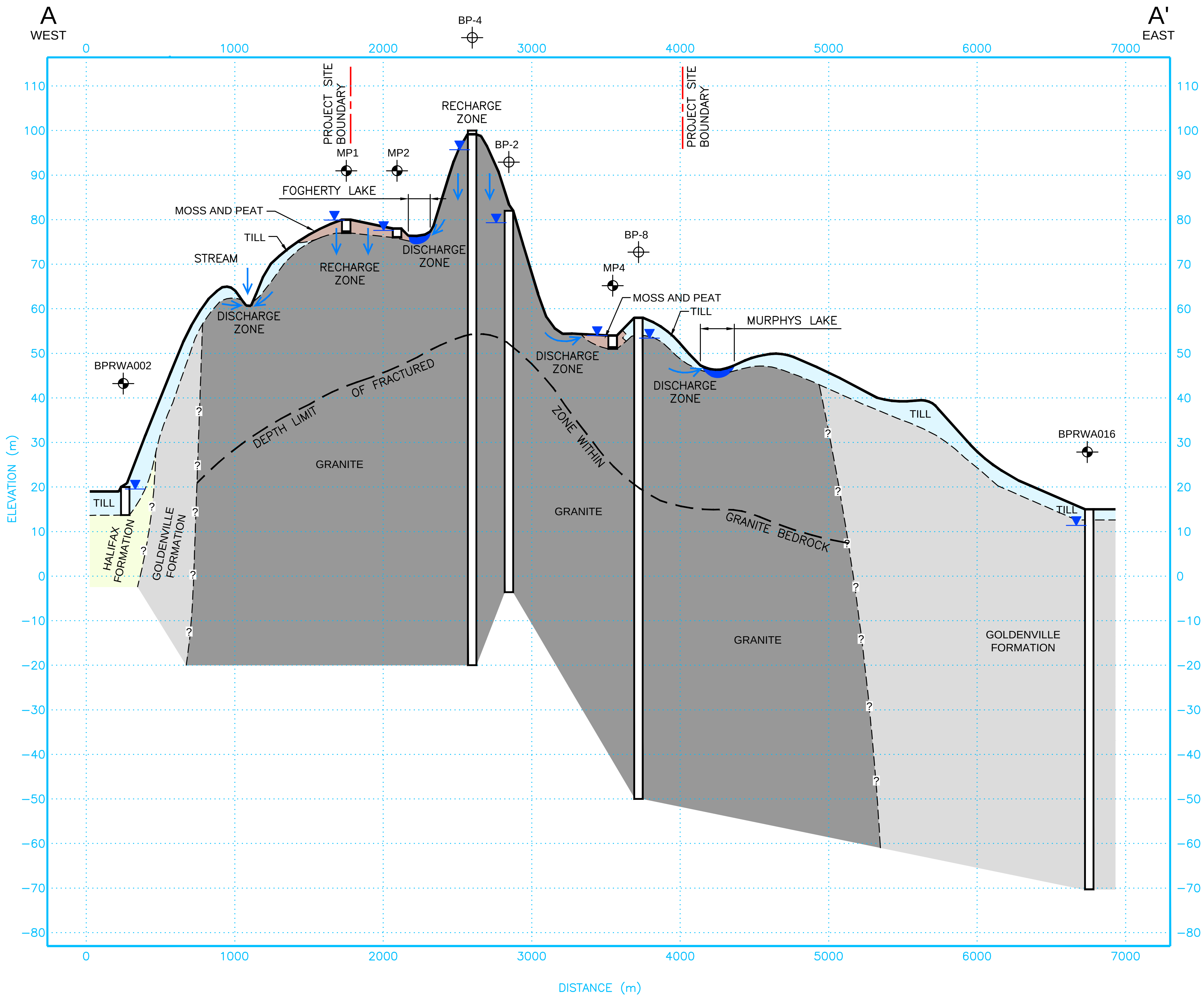


VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST

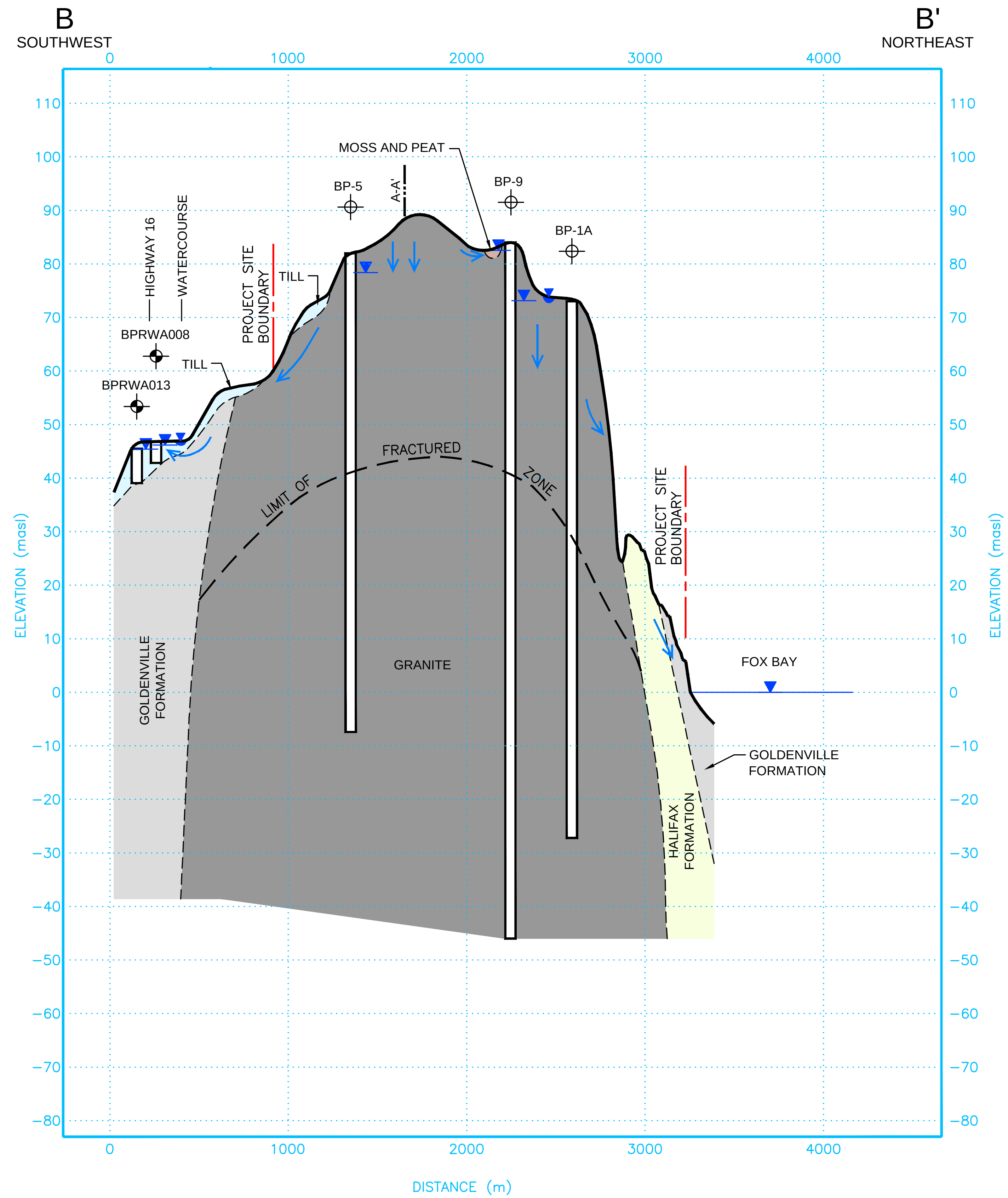
VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing
SCHEMATIC CONCEPTUAL CROSS SECTION A - A'

Date JANUARY 30, 2015	Scale AS SHOWN	Drawing No. 10
File Name S_210-05913-00000-A2-1	Project No. 210.05913.00000	

SLR



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing
SCHEMATIC CONCEPTUAL
CROSS SECTION B - B'

Date JANUARY 30, 2015	Scale AS SHOWN	Drawing No. 11
File Name S_210-05913-00000-A2-2	Project No. 210.05913.00000	

SLR

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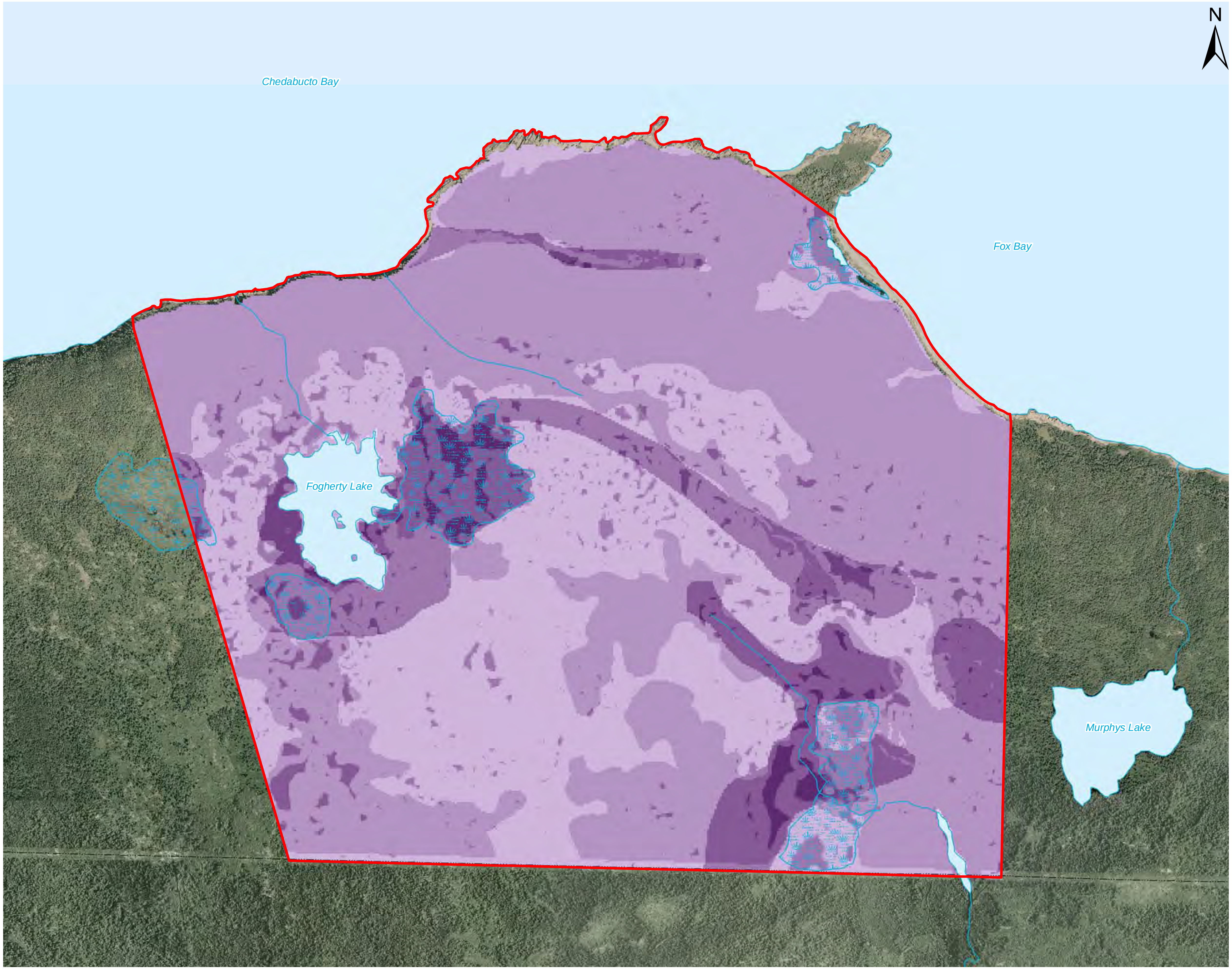


LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

Estimated Average Annual Rechage (mm/y)

- <=200 mm/y
- 200 - 300 mm/y
- 300 - 400 mm/y
- 400 - 500 mm/y
- 500 - 600 mm/y
- 600 - 700 mm/y
- >700 mm/y

Estimate Average Annual Recharge is 13.0 x 10^5 m^3. Water Surplus calculated at 878 mm based on meteorlogical data from Deming, NS Station 1975-2005,

0 125 250 500 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

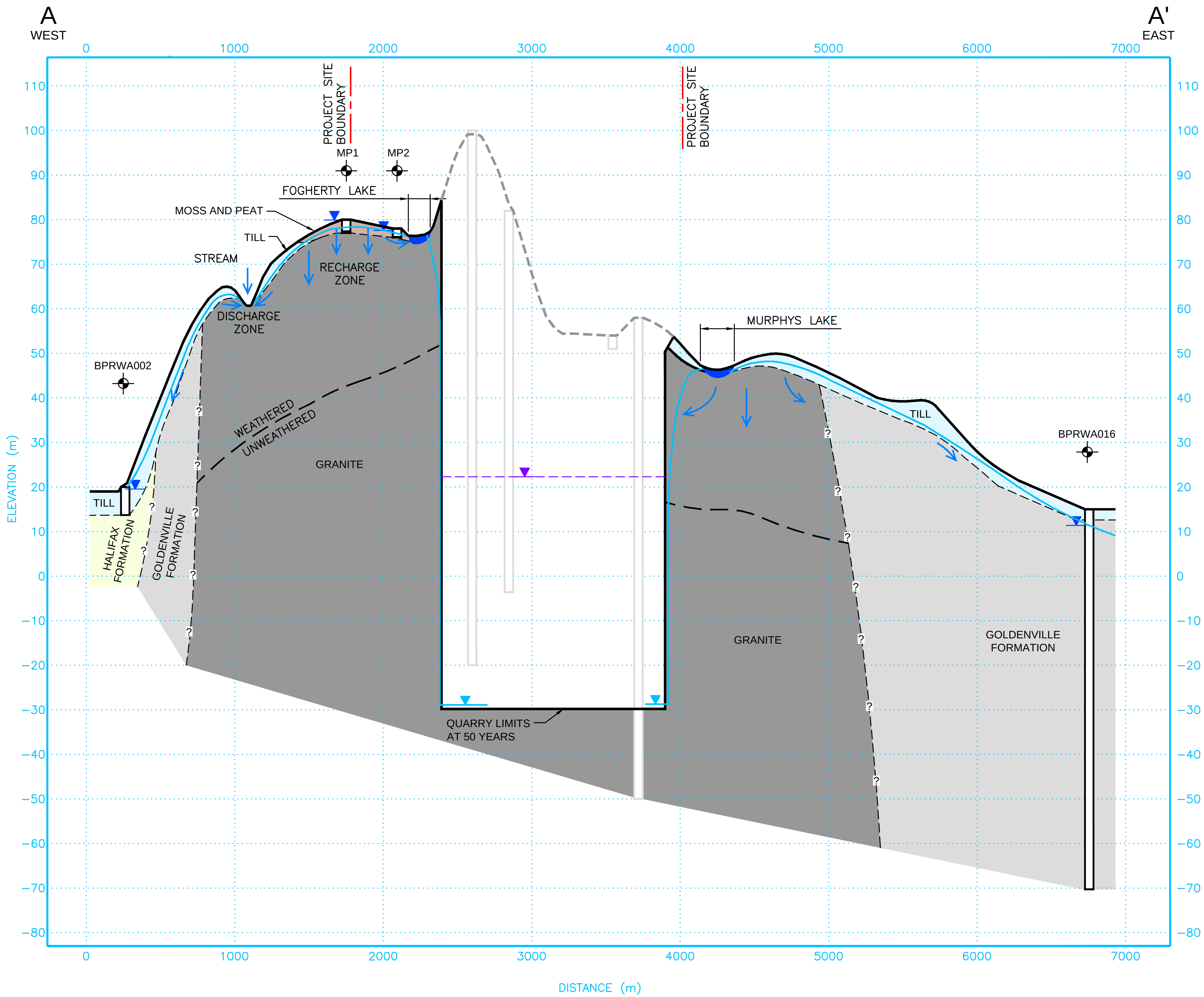
MORIEN RESOURCES AND VULCAN MATERIALS

HYDROGEOLOGICAL ASSESSMENT REPORT

ON SITE ESTIMATED AVERAGE ANNUAL RECHARGE

October 23, 2014	Rev	1.0	Drawing
Project No.	210.05913.00000		12

SLR Consulting (Canada) Ltd.



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST
- WATER TABLE AT 50 YEARS
- POST CLOSURE WATER TABLE

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report

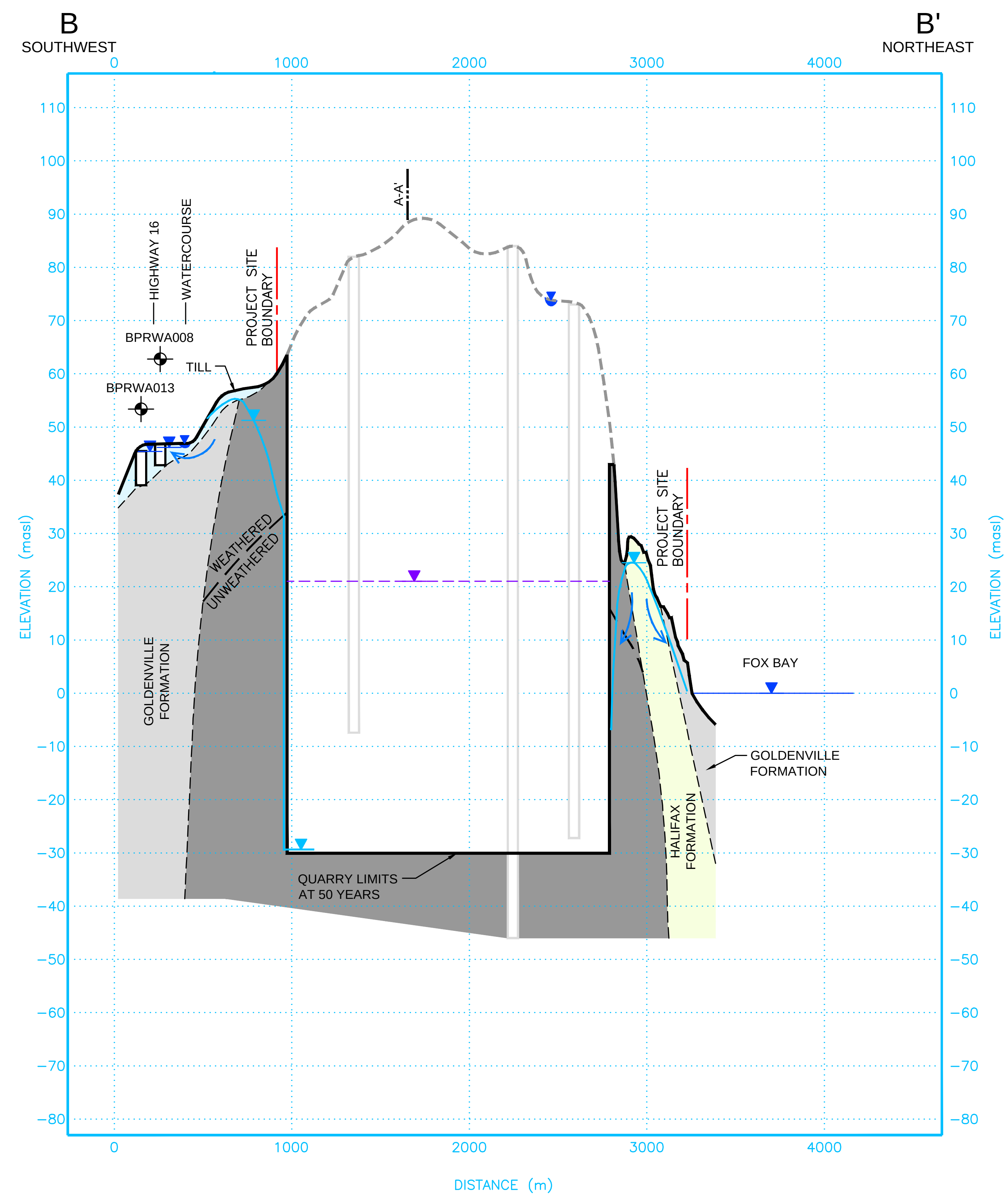
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing

QUARRY AND DRAW DOWN
CROSS SECTION A - A'

Date JANUARY 30, 2015	Scale AS SHOWN	Drawing No. 13
File Name S_210-05913-00000-A2-3	Project No. 210.05913.00000	

SLR



VERTICAL SCALE 1:1000

0 10 20 40 60 m

HORIZONTAL SCALE 1:30,000

0 500 1000 2000 m

WHEN PLOTTED AT 11 x 17 PAGE SIZE

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

NOTES

LEGEND

- PROJECT SITE BOUNDARY
- RESIDENTIAL WELL
- DRIVE POINT PIEZOMETER
- BOREHOLE
- WELL
- SCREENED INTERVAL
- END OF HOLE
- WATER LEVEL (AUGUST 2014)
- DIRECTION OF GROUNDWATER FLOW
- TILL
- MOSS AND PEAT
- GRANITIC INTRUSION
- GOLDENVILLE FM. – METAWACKE
- HALIFAX FM. – GRAPHITE SCHIST
- WATER TABLE AT 50 YEARS
- POST CLOSURE WATER TABLE

VULCAN MATERIALS COMPANY
BLACK POINT QUARRY
GUYSBOROUGH COUNTY
NOVA SCOTIA

Report
HYDROGEOLOGICAL ASSESSMENT REPORT

Drawing
QUARRY AND DRAW DOWN
CROSS SECTION B - B'

Date JANUARY 30, 2015	Scale AS SHOWN	Drawing No. 14
File Name S_210-05913-00000-A2-4	Project No. 210.05913.00000	

SLR

ATTACHMENT A
Site Borehole Logs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Collars

Hole_ID	Easting	Northing	Elev	TD	Az	Dip
BP-1A	644811	5023872	73	100.18		
BP-6A	645399	5023545	73	55.82		
BP-6B	645310	5023434	69	70.05		
BP-1B	645209	5023685	74	80.13		
BP-2	644798	5023183	82	85.61		
BP-3	645161	5023396	74	60		
BP-4	644527	5022955	100	119.8		
BP-5	644213	5022742	82	89.4		
BP-7	644975.	5022769	70	120		
BP-8	645668.	5023160	58	108		
BP-9	644642.	5023534	79	130		
BP-10	644556.	5024260	17	120	135	60
BP-11	644998.	5023990	27	120	135	60
Yellow highlighted holes are new holes						

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m		5023872mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-1A	AZM.: na	°		100.18: m	DATES:	Jan.16/08
DATE COLLARED:	Jan.11/2008	DIP: -90	°	644811mE		PAGE:	1 of 3
DATE COMPLETED:	Jan.13/2008	EOH: 100.18m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
Casing. No core	0	0.6								**BP-1A (1)**
0.6-5m Rubbeled and fractured core, poor recovery. Medium (fine) equigranular	0.6	5	Mf	Null	6	>10	90-40			**0.6-33.2m**
granite weakley pink in colour. 50% Fldspar, 45% Quartz, 5% Biotite with moderate										LA Abrasion
chlorite alteration of the biotite.										SG
5-9.81m Medium (fine) equigranular granite weakly pink in colour. 50% Fldspar, 45%	5	6	Mf	Null	6	1	90			Absorption
Quartz, 5% Biotite with moderate chlorite alteration of the biotite. Long competent core	6	7	Mf	Null	6	0	na			
sticks	7	8	Mf	Null	6	2	80			Sodium Sulphate
	8	9	Mf	Null	6	0	na			Soundness Loss
	9	9.81	Mf	Null	6	1	45			Magnesium Sulfate
9.81-15m Orangy grey, medium(fine) grained syenogranite, equigranular,	9.81	10	Mf	Null	6	0	na			soundness loss
55%Fldspar, 48% Quartz, 2% Biotite (chloritic) <1% muscovite. Note Mica has	10	11	Mf	Null	6	1	10			Alkali Reactivity
decreased and K-spar has increased. Fe/MnOx coating on fracture surfaces										14day
11-11.1m Quartz/Plag pegmatite pod. Phenocrysts 1cm long. Pod is associated with a	11	11.1	P	Null	6	2	5			Micro Deval
fracture which occurs from 11m to 11.3m at 5 deg. To CA Fe/MnOx staining on										PN
	11.1	12	Mf	Null	6	0	na			
	12	13	Mf	Null	6	1	40			
	13	14	Mf	Null	6	1	40			
	14	15	Mf	Null	6	0	na			
15-19.82m Greyish white (weak pink), Medium(fine) grained granite potential	15	16	Mf	Null	6	0	na			
decrease in potassic feldspar. 50% Fldspar, 45%Quartz, 5% Mica, MnOx on joint	16	17	Mf	Null	6	3	90			
planes	17	18	Mf	Null	6	0	na			
	18	19.82	Mf	Null	6	0	na			
19.82- 37m Orangey grey syeno-granite 60% Fldspar, 35% Quartz, 5% (moderate	19.82	20	Mf	Null	6	0	na			
chlorite Alt) Mica Note:Gradula decrease in Quartz from prior interval	20	20.1	Mf	Null	6	2	10			
20.1-23m Orangey grey medium(fine) granied syenogranite 50% Fldspar, 45%	20.1	21	Mf	Null	6	0	na			
Quartz, 5% Mica, MnOx along joint planes	21	22	Mf	Null	6	2	10			
	22	23	Mf	Null	6	1	10			
23-26m Shallow angle fractureing Fe/MnOx coating fracture surface	23	24	Mf	Null	6	2	40			
	24	25	Mf	Null	6	4	40			
	25	26	Mf	Null	6	4	80			
26-26.4m Shallow angle fracturing	26	27	Mf	Null	6	2	80			
	27	28	Mf	Null	6	3	80			
	28	29	Mf	Null	6	1 / 2 #3	30 / 80			
	29	30	Mf	Null	6	4	90			
30.22-31m Elongated fracturing over interval. Fe/MnOx and clay on fracture surface.	30	31	Mf	Null	6	2	40			
	31	32	Mf	Null	6	2	40			
	32	33	Mf	Null	6	4	20			
33.29-33.8 Several low angle silicified hairline fracures	33	34	Mf	Null	6	4	20			**BP-1A (2)**
34-35m Low angle re fracture along previous silicified fracture. 1cm wide mica pod at	34	35	Mf	Null	6	2	90			**33.2-66.39m**
35.88m	35	36	Mf	Null	6	1	10			
Biotite increase to 10%	36	37	Mf	Null	6	1	90			
37-49m Greyish Pink medium grained equigranular syenomonzogranite 50% Fldspar,	37	38	Mf	Null	6	0	na			
40% Quartz, 10% mica (biotite dominit, moderate chlorite alt.)	38	39	Mf	Null	6	2	80			

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m	m	5023872mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-1A	AZM.: na	°	644811mE	100.18: m	DATES:	Jan.16/08
DATE COLLARED:	Jan.11/2008	DIP: -90	°		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Jan.13/2008	EOH: 100.18m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity	
	39	40	Mf	Null	6	0	na			**LA Abrasion**
	40	41	Mf	Null	6	2	80			**SG**
	41	42	Mf	Null	6	0	na			**Absorption**
42.57-42.93m shallow angle hairline fracture. Dark FeOx crust on fracture surface.	42	43	Mf	Null	6	2 / 1 #3	20 / 80			
	43	44	Mf	Null	6	1	80			**Sodium Sulphate**
	44	45	Mf	Null	6	0	na			**Soundness Loss**
45-49m Colour change to whitish grey/green medium(fine) grained equigranular	45	46	Mf	Null	6	0	na			**Magnesium**
granite. 50% Fldspar, 40% Quartz, 10% Mica (biotite dominant, moderate chlorite alt.)	46	47	Mf	Null	6	0	na			**Sulfate soundness**
Note only 2 hairline fractures over entire interval with weak clay alteration along	47	48	Mf	Null	6	2	20			**Alkali Reactivity**
42.57-42.93m Biotite band	48	49	Mf	Null	6	1	90			**14day**
49-50m Pinkish K-spar beginning to increase over interval returning to syenogranite	49	50	Mf	Null	6	0	na			**Micro Deval**
50-60m Medium(fine) grained equigranular syenogranite with fine grained chloritic	50	51	Mf	Null	5	2	5			
	51	52	Mf	Null	6	2	40			
	52	53	Mf	Null	6	1	40			
53-54m FeOx on fracture plane	53	54	Mf	Null	6	4 / 2 #6	80 / 05			
	54	55	Mf	Null	6	3	40			
55-56m Interval has been fractured and "healed" through silicification, moderate clay	55	56	Mf	Null	5	4 / 1 #5	90 / 20			
alteration on certain fracture planes.	56	57	Mf	Null	6	1	30			
58-60m Fractures with siliceous healing (mm width) Base of this interval gradually	57	58	Mf	Null	5	3 / 1 #4	90 / 05			
depletes in quartz and mica with increase in feldspar. FeOx on fractured surfaces.	58	59	Mf	Null	6	1	90			
	59	60	Mf	Null	5	1 / 1 #2	90 / 05			
60-61.33m Quartz Syenite. 80%Kspar, 15%Quartz, 5%Biotite. Intenses low angle	60	61.33	M	Null	6	>10				
hairline fracturing. Biotite occurs as fine grained laths and medium grained clots. Mica										
and quartz increase gradually toward base of interval										
61.33-75m Pinkish grey medium(fine) grained equigranular syenogranite with 50%	61.33	62	Mf	Null	6	0	na			
Fldspar, 40-45% Quartz, 5-10% mica (dominant chloritite fine grained biotite)	62	63	Mf	Null	6	0	na			
	63	64	Mf	Null	6	2	40			
	64	65	Mf	Null	6	2	40			
	65	66	Mf	Null	6	2	40			
66.16m 1cm^2 Metasedimentary xenolith	66	67	Mf	Null	6	2	40			
	67	68	Mf	Null	6	2	40			**BP-1A (3)**
	68	69	Mf	Null	6	2	40			**66.39-100.18m**
	69	70	Mf	Null	6	0	na			
	70	71	Mf	Null	6	4	80			
71-72m Low angle hairline fracturing healed through silicification (mm width). Trace	71	72	Mf	Null	6	1	40	Pyrite	trace	
pyrite very fine grained observed in association with siliceous fracture healing.										
	72	73	Mf	Null	6	1	90			
72-74m Low angle silicified hairline fractures (mm width)	73	74	Mf	Null	6	1 / 1 #2	80 / 20			
	74	75	Mf	Null	6	1	30			
	75	76	Mf	Null	6	1	90			
75-82m Medium(fine granied equigranular syenogranite 50% Fldspar, 40% Quartz,	76	77	Mf	Null	6	2	90			
10% Mica (9% fine grained chloritic biotite, 1% muscovite) Kspar has darkened to a	77	78	Mf	Null	6	1	40			
dark orange.	78	79	Mf	Null	6	1	90			

Company 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m	m	5023872mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-1A	AZM.: na	°	644811mE	100.18: m	DATES:	Jan.16/08
DATE COLLARED:	Jan.11/2008	DIP: -90	°		% Recovery	PAGE:	3 of 3
DATE COMPLETED:	Jan.13/2008	EOH: 100.18m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
	79	80	Mf	Null	6	1	40			LA Abrasion
	80	81	Mf	Null	6	1	30			SG
81-82m Pinkish syenogranite grades into whitish grey at interval base.	81	82	Mf	Null	6	2	40			Absorption
82-83.2m Greenish white medium(fine) grained equigranular granite. Intense micro	82	83	Mf	Null	6	0	na			
hairline fractures at low angle to core axis	83	83.2	Mf	Null	6	0	na			Sodium Sulphate
83.2-90m Pink Kspar gradually returns to granite over interval.	83.2	84	Mf	Null	6	0	na			Soundness Loss
Biotite pod 1cm^2 at 84.54, metasediment 3cm^2 xenolith at 84.86m	84	85	Mf	Null	6	1 / 1 #2	40 / 80			Magnesium
	85	86	Mf	Null	6	1	40			Sulfate soundness
Intense silicified hairline fractures at 40deg to CA over interval	86	87	Mf	Null	6	1 / 1 #2	40 / 80			Alkali Reactivity
87.76m K-Spar phenocryst (5cm^2)	87	88	Mf	Null	6	0	na			14day
88.36m Mica pod	88	89	Mf	Null	6	0	na			Micro Deval
	89	90	Mf	Null	6	2	80			Chloride Content
90-92m Grey/green medium(fine) grained equigranular granite	90	91	Mf	Null	6	3	40			
91.08m Mica pod	91	92	Mf	Null	6	0	na			
92-95.18m Pinkish orange medium(fine) grained equigranular syenogranite. Intense	92	93	Mf	Null	6	1	90			
hairline fracturing at shallow angles to core axis.	93	94	Mf	Null	6	0	na			
	94	95	Mf	Null	6	0	na			
	95	95.18	Mf	Null	6	0	na			
	95.18	95.64	M-F	Null	6	0	na	Pyrite	trace	
95.64-98.55m Dark orange inequigranular medium to fine grained syenogranite	95.64	96	M-F		6	0	na			
	96	97	M-F		6	3	40			
	97	98	M-F		6	0	na			
	98	98.55	M-F	Null	6	0	na			
98.55- 100.18m EOH Inequigranular syenogranite	98.55	99	M-F	Null	6	0	na			
	99	100	M-F	Null	6	1	80			
	100	100.18	M-F	Null	6	0	na			

Company/Licensee	6531954 Canada Ltd
Drill Contractor	Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m	m		(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-2	AZM.: na	°	644798E	85.61: m	DATES:	Jan. 23
DATE COLLARED:	Dec.13/2007	DIP: -90	°	5023183N	% Recovery	PAGE:	1of 3
DATE COMPLETED:	Dec.14/2007	EOH: 85.61 m	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD Not done on hole
2 ft (.6m) casing No core	0	0.6								BP2(1)	
2-6.05m Pink to orange equigranular syenogranite. Highly jointed with rust staining on	0.6	2	M	W	6	3	40/70/40			0-28.54m	
either side of joints. Fe-Mn earthy coating on some fractures. Bt alteration to chl.	2	3				2	0/30			LA Abrasion	
Feldspar 50%, kspar > plag. Qtz 35-40%, bt, 3-5%, musc. 2-3% .	3	4				8	0/85/20/60/45/45/88/88			SG	
	4	5				6	80/30/80/80/70/85			Absorption	
	5	6.05				2	40/80			Sodium Sulphate	
6.05-9.38m Light Pink Syenogranite. Less chl. alteration of bt. Feldspar 50%,	6.05	7	M	W	6	8	85/85/70/80/40/30/40/5			Magnesium Sulfate	
kspar~= plag. Qtz 35-40%, bt, 3-5%, musc. 2-3% .	7	8				5	85/85//70/80/90			Microdeval	
	8	9.38				7	50&30/0/80/60/40/40/75&80			Petrographic No.	
9.38-11.38 m White/grey syenogranite. Feldspar change, plag > kspar, Feldspar	9.38	10	Mf	W	6	1	30				
50%, Qtz - 40%, Bt. 3-4%, Musc. 2-3%. Chl. on fracture, yellow alt. of feldspar on	10	11				4	35/35//30/30			Alkali Reactivity	
fracture surfaces Smokey grey chl. tinge.	11	11.38								14day	
11.38-13.85m Pale Pink syenogranite. Feldspar 50%, Qtz-40-45%, Bt, 3-4%, Musc.	11.38	12	Mf	W	6	6	50/20/30/45/40/80				
3-4%. Mnr. rust staining @ 12m.	12	13				4	70/15/70/88				
	13	13.85				7	40/40/40/30/40/0/30				
13.85-14.2 m White to pnk monzogranite Qtz decreases, feldspar increases.	13.85	14.2	Mf	W	5						
Feldspar 60-65%, Qtz 25-30%, Bt, 2-3%, Musc. 3-4%.											
14.2-18.80m. Smokey gry, syenogranite. Chl.veinlets give a swirly texture to the	14.2	15	Mf	W	6	>10	50/20/40/0	pyr. Xls	<1%		
section. Minor Fe staining from 16-82 - 17.12 m. Mnr. Sericite alt. Core is brittle.	15	16				>10	30/ etc				
Feldspar 35%, Qtz 40-45%, Bt, 3-4%, Musc. 2-3%. Silicification?	16	17				>10	0/70/60/60/60/40				
Section is broken. Chl. on frac. surfaces.	17	18				8	15/40/40/40/40/0/60/50				
Core is highly fractured 14-16m.	18	18.8				5	85/60/50/0/30				
18.8 m - 19.75 m Light pnk syenogranite Same chl. alt. with mnr smky gry.	18.8	19.75	Mf	W	6	4	20/80/88/40				
Mineralogy as above but plag ~= kspar											
19.75-20.25m Smokey grey to white syenogranite. Feldspar 50% - plag > kspar.	19.75	20.25									
Min. same as above. Fe stained.											
20.25 - 23.0m pale pnk syenogranite, chl veinlets.	20.25	21	Mf			7	88/10/20/0/50/0/20	pyr. Xls	<1%		
Feldspar 45%, Qtz 50%, Bt 3-4%, Musc. 2%. Pyr. xls on fract. Surfaces <1%	21	22				8	0/40/20/60/0/40/40/45	pyr. Xls	<1%		
Core is fractured 22.0-24.0m. Chl. also on fractures.	22	23				7+	0/25/20/80/50/25/0				
23.0 - 23.87m Smky grey syenogranite, Broken, Mnr.chl alt. along veinlets and	23	23.87	Mf	W	6	6+	0/10/40/50/40/30				
on fracture surfaces. Qtz 40%, micas 5%, Feldspar 55%											
	23.87	24									
	24	25				6	0/60/20/0/50/80				
	25	26				7	60/55/0/30/40/20				
23.87 - 28.22m Gry granite/white feldspar dominated. Pyrite xls coating some	26	27				5+	40/45/30/40/20				
fractures. Silicification between 24.60-25.03 m. Qtz - 40%, 50% feldspar, bt. 3-4%,	27	28				11	30/0/30/70/60/65				
musc. 3-5%. Biotite altered.	28	28.22									
28.22-28.80 Heavily chloritized, clay alt.,orange feldspar.	28.22	28.8	Mf	W	5	8+	20/0/80/30/45/40			BP2(2)	
28.80-30.46 Pale pnk, syenogranite, Qtz 35%, feldspar 55%, bt.3-4%, musc. 3-4%.	28.8	29	Mf							28.54 - 57.07m	
Chlorite veinlets ~ 45 CA Broken between 28-29m.	29	30				5	80/70/40/30				

Company/Licensee 6531954 Canada Ltd
Drill Contrator Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m		644798E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-2	AZM.: na	°	5023183N	85.61: m	DATES:	Jan. 23
DATE COLLARED:	Dec.13/2007	DIP: -90	°		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Dec.14/2007	EOH: 85.61 m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
Casing. No core										**BP2(2)**
	30	30.46	M	W	6	2	60/30			**28.54 - 57.07m**
	30.46	31	M	W						LA Abrasion
	31	32				1	80			SG
30.46- 33.55m White-gry monzogranite, Qtz 40%, Felds 55%, Musc. 5%, Bt. 5%, less chlorite. Hairline fracture with f.g. py. Coating some frac. Surfaces, rust stained.	32	33				3	0/20/30			Absorption
	33	33.55				7	0/50/80/70&85/60/20/10			
	33.55	34	M							Sodium Sulphate
	34	35		W	6	0				Soundness Loss
33.55 - 36.73 m White monzogranite, Muscovite increases in this unit and decreases near end from 10-5% at end of interval. Qtz 35%, feldspar 50%, bt. 3%	35	36				0				Magnesium Sulfate
	36	36.73				0				soundness loss
	36.73	37	M			0				Alkali Reactivity
	37	38		W	6	0				14day
36.73 - 39.40m Pale pink syenogranite, Qtz - 40%, Feldspar 50%, Kspar>plag., bt. 5%, musc. 4-5%. Few mm sized bt clots. Hairline alt. biotite rehealed fractures.	38	39			1	88				Micro Deval
	39	39.4								
	39.4	40	Mf	W	1	0				
39.40 - 41.95 m Pale pink syenogranite, grain size change, bt. content fluctuates, bt 4-7%, plag~=kspar 50%, musc. 2%, qtz 40%	40	41			0					
	41	41.95			2	75/70				
	41.95	42								
	42	43			1	75				
	43	44			1	0				
41.95 - 44.84m Kspar>plag, 50%, qtz 35%, musc. 3-4%, bt 5%. Bt. Is chloritized.	44	44.84			1	40				
	44.84	45	M							
	45	46			0					
44.84 -47.44 m Pale pink syenogranite, kspar~=plag50%m qtz 40%, bt 5-7%, musc. 2%.	46	47			0					
	47	47.44			2	80/0				
	47.44	48	M	W						
	48	49			2	70/0				
47.44 -49.95 m kspar>plag 55%, Qtz 40%, bt. 5-7%, musc. 2%.	49	49.95			0					
	49.95	50								
49.95 - 51.33 m~= plag 50%, qtz 40%, bt 3-5%, musc. 3%. Bt. clots range in size from mm to 1.5cm.	50	51			1					
	51	51.33			0					
	51.33	52	M	W	0					
	52	53			0					
51.33 -54.40 m kspar>plag 50%, qtz40%, bt 3-5%, musc. 3-4%. Bt. Is chloritized in places.	53	54			0					
	54	54.4			2	0-10/88				
	54.4	55								
	55	56			0					
	56	57			0					**BP-2 (3)**
	57	58			2	88/25				**57.07-85.61m**
	58	59			3	80/75/85				
54.40 - 61.0 m plag > kspar, pale pink to grey white. Chlorite hairline fractures 110CA, f	59	60			0					
	60	61			0					
61.0 - 64.46 m Grey monzogranite, plag > kspar.	61	62			5	88/88/85/88/85				

Company/Licensee 6531954 Canada Ltd
Drill Contractor Logan Drilling Company

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**
LICENSE INFORMATION:	**8372**	**ELEVATION: 82m**	**m**	**644798E**	**(P / H / N / B)**	**LOGGED BY** **Karen McNaulty**
DRILL HOLE NUMBER:	**BP-2**	**AZM.: na**	**°**	**5023183N**	**85.61: m**	**DATES:** **Jan. 23**
DATE COLLARED:	**Dec.13/2007**	**DIP: -90**	**°**		**% Recovery**	**PAGE:** **3 of 3**
DATE COMPLETED:	**Dec.14/2007**	**EOH: 85.61 m**	**m**	**NAD 83 Zone 20**		**SIGNED:**

Description	**From**	**To**	**Grain Size**	**Foliation**	**Strength**	**Structure**		**Mineralization**		**Sample Code**
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity	
61.0 -64.46 cont'd. 50% feldspar, qtz 40,%, musc. 3-4%, bt. 5%. Few biotote clots 1 cm. @ 62.62-64.15 m f.g. pyrite on fracture surfaces rust hue. Fe/Mn on some fracture surfaces.	62	63	Mf	W	6	1	0			LA Abrasion
	63	64				6	0/0/80/0/85/0			SG
	64	64.46								Absorption
	64.46	65	Mf	W	6					
	65	66				0				Sodium Sulphate
64.46 -66.42 m Plag ~=kspar 50%, bt 3-5%, Qtz 40%, musc. 2%.	66	66.42				2	75/85			Soundness Loss
	66.42	67	Mf	W	6					Magnesium Sulfate
	67	68				0				soundness loss
	68	69				1	75			Alkali Reactivity
	69	70				0				14day
	70	71				0				Micro Deval
	71	72				1	40			
66.42 - 76.37 m kspar>plag 50-55%, qtz 35-40%, bt. 3-5%, musc 4%. Pink to orange at bottom of interval. Core fractured along bt concentration and broke at these intervals as a result of this @71.56, 73.11, 73.15, 73,44 m. Bt increases to 8%. Between 70.63-71.26m qtz veining, coarser kspar. 73-74m chlite and clay coated fractures, <.5% f.g. pyrite on fracture surfaces.	72	73				0				
	73	74				3	65/75/60			
	74	75				0				
	75	76				0				
	76	76.37								
76.37 -78.0 kspar ~=plag pale pink,50-55% feldspar, qtz 40-45%, bt. 3-4%, musc.1-2%.	76.37	77	Mf	W	6	1	30			
	77	78				0				
	78	79	Mf	W	6	2	0/0			
78.0 - 80.1 plag >kspar grey white monzogranite. Feldspar, 50%, qtz 335%, bt. 5-7%, musc. 1-2@. Chl rehealed fractures.	79	80				1	0			
	80	80.1				2	55/0			
	80.1	82		W	6	1	40			
	82	83				0				
	83	84				1	0			
	84	85				2	0/85			
kspar~= plag, 45-50%, qtz 35%, bt. 3-5%, musc. 2-4%. Bt. is chloritized. Bt clots up to 3 cm. Pale pink	85	85.61				0				
	85.61	**EOH**								

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 60 m	m		(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-3	AZM.: na	°	645161m E	60: m	DATES:	Jan. 14-17
DATE COLLARED:	Dec. 20, 2007	DIP: -90	°	5023396m N	% Recovery	PAGE:	1 of 2
DATE COMPLETED:	Dec. 21, 2007	EOH: 60 m	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD Not done on hole
2 ft (.6m) casing No core	0	0.6								**BP3(1)**	
	0.6	2	M	M	6	8	90/85/90/85/90/85/85/88			**0-20.0m**	
.6 - 7.23 m Medium grained equigranular syenogranite. Gry-pnk. Feldspar 50%	2	3		M	6	5	90/85/85/85/85/88			LA Abrasion	
kspar>plag, qtz. 35%, musc 3-5%, bt 5-7%. Bt. Clots 1-3cm in size. Fractures in this	3	4				6	85/85/85/85/85/85			SG	
section are Fe-Mn coated in places, ground white alternation powder on others, mnr	4	5				5	85/90/90/88/85			Absorption	
Fe staining while other fractures broke along concentrations of biotite and muscovite.	5	6				3	90/80/88			Sodium Sulphate	
Core stained on either side of joints at .6-.77m, 1.2-1.43m, 1.48-2.16m, 3.15-3.835m,	6	7				5	85/88/85/88/90			Magnesium Sulfate	
4-4.13m, 4.21-4.67m, 5.0-5.1m, 5.18-5.49m, 6.4-6.61m.	7	7.23								Microdeval	
	7.23	8	Mf	M	6	4	88/88/88/88			Alkali Reactivity	
	8	9				2	88/88			14- day	
	9	10				2	60/90				
	10	11				3	88/40/50&55				
7.23 - 18 42 m Textural change finer grained. Kspar>plag. Feldspar 50%, qtz. 40%,	11	12		W	6	1	88				
bt. 3-5%, musc. 2-3%. Increase in the number of bt clots, Avg. 1cm in size. Core	12	13				6	10/70/85/90/85/90				
stained on either side of fractures @ 7.40-7.53m, 8.18-8.50m, 10.39-10.43m, 10.52-	13	14			6	2	80/80				
10.68m, 12.33-12.40m, 12.93-13.05m, 16.96-17.91m. Appears to be alteration of	14	15				2	88/88				
biotite discolouring core for the most part. Pervasive rust staining between series of 3	15	16				4	90/0/10/90				
folded joints@15.49-16.80m. Qtz and bt/chl? filled hairline fractures between 15.71-	16	17				7	90/0/85/80/85/90/0				
17.48m. Between 13-14 fractures due to breakage along biotite conc. Between 16	17	18				0					
and 17 m white clay alteration on joint surfaces also.	18	18.42									
18.42 -23.83m Back into lighter gry pnk syenogranite, equigranular. kspar >plag,	18.42	19	M		6	0					
feldspar50%, qtz 35-40%, bt. 5%, musc. 3%. Between 22.07 and 22.11 Silicification.	19	20				1	80				
Between 20.39-22.49m hairline fract. Bt/chl? & qtz filled hairline fractures rehealed.	20	21			6	2	90/15			**BP2(2)**	
Some hairline fractures have no surface alteration while others are Fe stained and	21	22				1	10			**20.00 - 40.00m**	
ready to break. Rust staining 18-93-18.24m, 20.75-21.45m, 21.88-22.77m. @22-	22	23				2	40/45			LA Abrasion	
23m Fe-Mn coating fract. surf.	23	23.83	M	W	6	3	30/88/88			SG	
	23.83	24								Absorption	
23.83 - 25.56m kspar>>plag. Pnk equigran. Syenogranite Mnr. Kspar xls 2-4mm in	24	25				0				Sodium Sulphate	
size. Mnr bt clots, Feldspar 50%, qtz. 35%, musc. 2-3%, bt. 7%. Bt increases.	25	25.6				1	70			Magnesium Sulfate	
	25.6	26			6					Microdeval	
	26	27				0				Alkali Reactivity	
	27	28				2	50/35			14-day	
	28	29				0					
	29	30				0					
	30	31				2	60/60				
	31	32				2	85/70				
25.56- 48.04m whiter to light pink granite kspar~=plag. Feldspar 50%, quz. 40%, bt, 5-	32	33				3	80/88/88				
7%, musc. 2-3%. Mnr. Biotite clots	33	34				0					

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:		ELEVATION: 74m		645161m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-3	AZM.: na	°	5023396m N	60: m	DATES:	Jan. 14 - 17
DATE COLLARED:	Dec. 20, 2007	DIP: -90	°		% Recovery	PAGE:	2 of 2
DATE COMPLETED:	Dec. 21, 2007	EOH: 60 m		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity	
										BP2(2)
25.56 - 48.04 continued.	34	35	M		6	1	80			**20.00 - 40.00m**
	35	36				0				continued
	36	37				2	80/50			
	37	38				0				
	38	39				2	70/90			
	39	40				0				
	40	41				0				**BP3 (3)**
	41	42				2	90/40			**40.00-60.00m**
	42	43				0				LA Abrasion
	43	44				1	70			SG
	44	45				0				Absorption
	45	46				0				Alkali Reactivity
	46	47				2	90/70			14day
	47	48				0				Micro Deval
	48	48.04								
	48.04	49	M			0				Sodium Sulphate
	49	50				0				Soundness Loss
	50	51				1	88			Magnesium Sulfate
	51	52				2	88/90			soundness loss
48.04 -53.37m. Orange equigranular syenogranite. Kspar>plag, 50% feldspar, qtz. 40%, bt. 5-7%, musc. 2-3%.	52	53				1	70			
	53	53.27								
53.37 - 54.50m, kspar~=plag, feldspar 50%, qtz. 40%, bt.5%, musc. 2-3%. Micas are weathering and stained core between 54-55.25m.	53.27	54	Mf			0				
	54	54.5				4	60/50/20/50			
	54.5	55	Mf							
	55	56				4	50/55/60/55			
	56	57				6	30/40/20/80/60/88			
54.50 - 58.28m plag > kspar, Feldspar 50%, qtz. 35-40%, bt.3-5%, musc. 2-3% White to yellow equigranular monzogranite.	57	58				4	20/0/80/10			
	58	58.28								
58.28m - 60.0 m kspar>plag, pink to light orange. feldspar 50%, qtz. 35-40%, bt.3-5%, musc. 2%. Between 55.52 -57.86 chlorite coated joints & veinlets. Qtz xls druse on surfaces, <1% pyr. Observed on some joint surfaces.	58.28	59	Mf			5	30-40/50/0-10/70/0-10			
	59	60				2	60/70			
	60	EOH								

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**	
LICENSE INFORMATION:	**8372**	**ELEVATION: 100 m**	**m**		**(P / H / N / B)**	**LOGGED BY**	**Karen McNaulty**
DRILL HOLE NUMBER:	**BP-4**	**AZM.: na**	**°**	**644527m E**	**119.8: m**	**DATES:**	**Feb. 8-22**
DATE COLLARED:	**Dec. 6, 2007**	**DIP: -90**	**°**	**5022955m N**	**% Recovery**	**PAGE:**	**1of 4**
DATE COMPLETED:	**Dec. 7, 2007**	**EOH: 119.80**	**m**	**NAD 83 Zone 20**		**SIGNED:**	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code		RQD
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity			
2 ft (.6m) casing No core	0	0.6								**BP4(1)**		
.6 -8.08 m Inequigranular pale pnk with rusty sections. Occ. bt clot up to 2 mm to 2cm. Scattered subhedral red orange kspar xls throughout section <5%. Kspar ~=plag, feldspar 50%, qtz 30-40%, bt. 7-10%, musc. 2-3%. Bt. chloritized in part giving a rusty appearance. F.g. pyrite along some fractures ~0 CA. Rusty either side of jnts. minor Mf sections as quartz % increase grain size decreases. Secondary quartz. Chloritized biotite.	0.6	2	M-Mf	M	6	5	90/85/75/88/?			**0-39.93m**	27	
	2	3				2	88/75			LA Abrasion	8	
	3	4				6	0/80/0/88/80/50			SG	26	
	4	5				8	70/0/0/85/88/85/10/85			Absorption	34	
	5	6				6	88/85/0/0&5/85/88			Sodium Sulphate		
	6	7				3	70/80/90			Magnesium Sulfate	9.5	
	7	8				2	10/20/1988			Microdeval		
	8	8.08								Petrographic No.		
8.08-8.74 m Or. Grad. change from unit above. Qtz incr. towards end of unit. Kspar>plag. Feldspar 45-55%, qtz 35-45%, musc. 2-3%, bt. 5-7%. Mnr clay alt.	8.08	8.74	M	W		4	90/80/80/85				10.5	
8.74 -10.1 m Salmon pnk, feldspar 50%, kspar>plag qtz 35-40%, bt 5-7%, musc. 3-4%. Rusty - bt chloritized, bt. Clots few mm in size. Pyr on fract. surf. f.g.	8.74	9	M	W	6							
	9	10				1	20			Alkali Reactivity 14day		
	10	10.1										
10.1 - 10.52 m. White plag>kspar, 50% feldspar, qtz 40%, bt 5-7%, musc. 2%. Angular contact with next unit.	10.1	10.52	M	W	6	3	10/30/1988					
10.52 -16.09 m Pale pnk, 50% feldspar, plag >kspar, qtz 35-40%, bt 5-10%, musc. 2-4%. Bt. clots few mm in size. Chloritized biotite. Equigranular	10.52	11	M	W	6						8.5	
	11	12				3	85/70/80					
	12	13				2	88/90				2	
	13	14				8	88 numerous all broken					
	14	15				0						
	15	16				3	88/85/20					
	16	16.09										
16.09 - 17.77m Rusty pale or. f.g. bt., Feldspar 50% plag >kspar, qtz. 35%, rare up to 40%, f.g. bt. 5%, musc. 3-5%. Rust caused by bt. weathering. Trace chl. veins.	16.09	17	M	W	6	5	60/35/40&65/55/55				3	
	17	17.77				10	10/10/0/15/85/15/20/25/70/80					
17.77 - 18.29 m Heavily chloritized, salmon pink but % of minerals variable. Feldspar 65%, kspar>plag, qtz 20-25%, bt. 5-7%, musc. 2-4%. Qtz varies from low of 20% at top . Num. rehealed hairline fractures.	17.77	18	M	W	6							
	18	18.29										
18.29 - 18.45m Rusty orange plag ~=kspar, 55%, qtz 35%, bt. 5%, musc. 2-4%. Numerous tiny hairline fractures parallel CA.	18.29	18.45	M	W	6							
18.45 -18.96 m Pale white to cream, highly chloritized. Feldspar 65-70%, qtz 25-35%, bt 7-10%, musc. 2%, plag>kspar. Pitted surf. chloritized bt.	18.45	18.96	M	W	6	7	50/80/35/80/70/30/40				17	
18.96 - 19.64 m Rusty or. Arbitrary cutoff. Feldspar 50%, qtz. 35%, bt.10, musc 2%. Heavily chloriitzed. Fractures along chlorite planes. Kspar >plag.	18.96	19	Mf	W	6							
	19	19.64				6	80/80/15/40/55/40					
19.64 - 22.0 m. Pale pnk, num. chl. veinlets in sect. Feldspar 50%, plag~=kspar, 5-10% bt., qtz. 40%, musc. 4-10%. Core broken along hairline frac. Chl on frac. Mnr section plag >kspar whiter grey arbitrary cut off.	19.64	20	M	W	6							
	20	21				11	10/50/75/50/30/75/55/80/40/45/30				26	
	21	22				10+	40/15/50/50/30&40/85/10/15/0				26.5	broken
22.0 - 22.91 Sal. Pnk broken, chl on jnt faces, feldspar 50%, qtz 35-40%, bt 5%, musc. 2-4%. Dirty white clay alt. Mnr rust on fracture surf. @28.88 end of pervasive chl alt. Section friable.	22	22.91	Mf	W	4	10+	0/25 broken				34	broken
22.91 - 23.80 m Gry and pale pnk angular contact with next unit. Feldspar 50%, plag>kspar qtz 40-50%, bt 7%, musc. 5-7%. Chlorite veins.	22.91	23	M	W	6							
	23	23.8				3	25/65/5					
23.80 - 24.48 m Pale pnk. Feldspar 40%, qtz 40%, bt 10%, musc 4-5%. Bt. is fine grained, rare bt clots.	23.8	24	Mf	W	6							
	24	24.48										
24.48 - 25.10 m pale pnk. feldspar, 45%, kspar >plag by a bit, qtz. 40$, bt 5-10%, musc. 3-4%. Rust on fractures due to alteration of bt.	24.48	25	M-Mf	W	6	5	80/85/25-30/40/10					
	25	25.1				0						
25.10-25.39 m Gry/white, feldspar 45%, qtz 40%, musc. 5%, bt. 10%	25.1	25.39	M	W	6	0					232	

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 100 m		644527m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		% Recovery	PAGE:	2of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80		NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	RQD cm	% RQD calculation
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity			
25.39 - 27.00 m Pale pnk. Feldspar 35%, qtz. 40-45%, bt. 7-10%, musc. 5%.	25.39	26	M	W	6	0						
Inequigranular, rare kspar xls 1-2mm. Brown earthy coating on frac. surf. Alt of bts.	26	27				4	85/85/90/90				6.5	
Chlorite veinlets mnr.												
	27	28	M-Mf	W	6	0				LA Abrasion		
27.0 -29.09 Salmon pnk. Kspar>plag. Felspar 55%, qt 40%, musc. 5%, bt. 10%.	28	29				2	25&50/80			SG	6	
Veinlets of chl. & qtz.	29	29.09										
	29.09	30	M-Mf	W	6	3	88/85/85			Absorption	2	
	30	31				0						
29.09 -32.31 Pale pnk. Feldspar 45%, plag ~=kspar, qtz 40%, bt. 10%, musc.5%, Fe	31	32		W	6	5	88/88/15/20/15			Sodium Sulphate	6.5	
stained 29.80-30.15m. Numerous fractures 20CA and chlorite coated.	32	32.31								Soundness Loss		
32.31 - 32.90 m Or. Fe stained, Feldspar 50%, kspar>plag., qtz 35%, musc. 2-3%, bt	32.31	32.9	Mf	W		4	70/40/80/40			Magnesium		
7-10%. Ang. contact with next unit. Chl &Fe Mn on fracture surfaces.										Sulfate soundness		
	32.9	33	M	W						loss		
32.90- 33.07 m Sal. pnk kspar>plag. 75% feldspar, qtz 20%, bt. 2-3%, musc. 1%.	33	33.07										
33.07 -34.78 m light orange/sal. pnk. Kspar>plag. Feldspar 50%, qtz, 35%, bt., 7-	33.07	34	M-Mf	W						Alkali Reactivity		
10%, musc. 3-4%. Mica clots 1-3cm, chl blebs & in fract, chl on fractures. Top of unit	34	34.78				4	20/10/20/40			14day		
more frac. Occ. kspar euhedral xls sev. mm in size. Qtz & fkspar veins. Fe-stained						4	10/30/60/70			Micro Deval		
from 34.53-34.79m. F.g. py. on fracture surfaces near 34 m.												
	34.78	35	M	W	6							
	35	36				0						
	36	37				1	70					
	37	38				1	30					
	38	39			4	4	85/80/70/25				3	24
	39	40				0				BP4(2)		
34.78 - 41.08 m Pale or. Kspar>plag. Feldspar 55%, qtz, 35%, bt. 5-10%, musc. 4%.	40	41				2	88/55			39.93 - 79.87m		
Bt. Clots several mm to several cm. Clay alteration on joints in this section	41	41.08				0				LA Abrasion		
41.08 - 43.38 m Cream grad change to salmon pnk. Feldspar 50%, qtz. 35%, bt. 10-	41.08	42	M	W	6	0				SG		
12%, musc. 5%. Changes from plag ~=kspar to plag dominated to kspar dominated	42	43				3	18/88/88			Absorption		
at end of interval. Drk grn to blk chl. on frac. Bt clots several mm to cm.	43	43.38										
43.38 - 44.1 Sal.pnk Kspar>plag, feldspar 50%, qtz 35%, bt.7-10%, musc. 5-7%. Chl.	43.38	44	M	W	6	4	20/70/0/0				3.5	
veinlets.	44	44.1										
44.1 - 45.47 m light sal. pnk kspar>plag. Feldspar 45%, qtz. 35%, bt. 7-10%, musc 3-	44.1	45	M	W	6	3	35/75/0			Sodium Sulphate	3.5	
5%. Several folded black chlorite veins.	45	45.47								Soundness Loss		
	45.47	46	M	W	6	5	88/82/20/10/80			Magnesium		
	46	47				0				Sulfate soundness		
	47	48				3	60/88/80			Alkali Reactivity		
45.57 - 49.98 m Cream to l. or. Feldspar 45%, Qtz. 40%, bt. 7-10%, musc. 5%.	48	49				1	40&60			14day		
Several linear flattened bt clots 2-8cm.	49	49.98				4	80/50&5/85/70					
49.98 - 51.52 m pale cream/sal. pnk. Feldspar 50%, qtz, 30-35%, bt. 10%, musc. 2-	49.98	50	M	W	6					Micro Deval		
5%. Subjective cut-ff gradational to lower unit, Bt. Is coarse and fine. Round bt. Clot	50	51				0				Petrographic No.		
at 51.32m.	51	51.52				0						
51.52 - 53.30 m White to pale sal. pnk. monzogranite. Plag>kspar. Feldspar 40-50%,	51.52	52	M-Mf	W	6	0						
qtz 30-40%, bt. 5-!0%, musc. 2-3%. Bt is fine. Grad. change to cream white, finer	52	53				1	20&5					
grained. Bt. clots <1cm. Equigran.	53	53.3										
	53.3	54	M	W	6	1	20&20					
53.30 -56.87 m Pale sal. pnk again grad. Change from last to next unit. Feldspar 45-	54	55				1	85					
50%, qtz 35-45%, musc. 5%, bt. 10%. Bt clot @ 54.37 m 2 cm in size. Mnr	55	56				0						
chloritized bt/musc. F.g. py on fracture @53 m <3%. Smaller bt. Clots <1 cm.	56	56.87				1	75					
56.87 - 58.94 m Drk gry to off white monzogranite. Plag>kspar. Qtz % decreases	56.87	57	M	W	6							
from top to bottom of interval. Feldspar 35-50%. qtz.50-35%, bt. 5-10%, cont'd	57	58				0						7

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 100 m	m	644527m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	119.8: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		% Recovery	PAGE:	3 of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	RQD cm	
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity			
musc. 2-5%, Qtz eyes. Hairline chl. veinlets. Micas chloritzed. F.g. bt.	58	58.94				2	80/9O&45 curved.			**BP4 (2)**		
	58.94	59	M	W	6					**39.93-79.87m**		
	59	60				2	90/45&60/85			LA Abrasion		
	60	61				0						
	61	62				0				**Sodium Sulphate**		
	62	63				0				**Soundness Loss**		
	63	64				1	88			Absorption		
58.94 - 65.57 m Beige/cream monzogranite. Feldspar, 55-35%, qtz 30-40%, bt 7-12%, musc. 2-3%, Bt. clots are smaller and fewer than previous unit. F.g. bt.	64	65				1	75					
	65	65.57				1	85			**Magnesium**		
	65.57	66	Mf	S	5					**Sulfate soundness**		
	66	66.09				0				**Alkali Reactivity**		
66.09 -67.68 m Beige to cream monzogranite. Plag>kspar. Feldspar 50-55%, qtz. 30-35%, bt. 7-10%, musc 2-3%. Good long sections of core, fracture along biotite	66.09	67.68	M	W	6	0				**14day**		
	67.68	67.98	M	M-S	5	1	60			**Micro Deval**		
	67.98	68	M-Mf	M	6					**Petrographic No.**		
	68	69				0						
	69	70				1	45					
	70	71				0						
	71	72				0						
	72	73				1	50					
67.98 - 75.18 m Cream monzogranite. Feldspar 60-45%, qtz. 35-40%, bt. 5-12%, musc. 2-4%. Bt. Clots linear, clot circles, mm to 5 cm in range. However good long core pieces. Odd break along bt. Concentrations.	73	74				1	50					
	74	75				0						
	75	75.18										
75.18 - 77.0 Gry white monzo. Feldspar 60-40%, qtz 30-40%,, bt. 5-15%, musc. 5%. Coarse mica. Chlorite blebs ~ par. CA. @75.69 fract. along mica concentration. Otherwise good solid section.	75.18	76	M	W	6	1	30&45					
	76	77				0						
						0						
	77	78	M-Mf	W	6	0						
77.0 - 79.655 Cream monzo. Feldspar 40-45%, qtz. 35-40%, bt. 15%, musc. 2-3%. Increase in fineness and decrease in coarse mica. Chlorite blebs.	78	79				0						
	79	79.655				0						7
	79.655	80	M-Mf	M	6	0				**BP 4 (3)**		
	80	81				0				**79.87 - 119.8 m**		
	81	82				0				**LA Abrasion**		
	82	**83**				0				**SG**		
	83	84				0				**Absorption**		
	84	85				0						
	85	86				0						
79.655 - 88.1 Light cream to white monzo. Feldspar 55-30%, qtz. 35-40%, bt, 5-25%, musc. 2-3%. Good long core sections. Local bt. concentrations 81.67-81.25m, 87.055-87.13 m. Bt. Clots wrapped around core axis at 85.54 - 85.94m.	86	87				0						
	87	88				0						
	88	88.1				0						
	88.1	89	M	W	6	3	35/70/45					
	89	90				1	88					
88.1 - 92.925 m light cream to white monzo. Feldspar 60-35%, qtz 25-40%, bt, 5-10%, musc. 2-3%. Chl. Blebs. Mnr Fe staining. Pervasive staining either side of jnt @ 89.535 m. 2 joints in this section broke along bt. Concentration	90	91				0						
	91	92				0						
	92	92.925				1	85			**Sodium Sulphate**		
	92.925	93	M	W	6					**Soundness Loss**		
92.925 - 94.085 m. White to gry monz. Feldspar 50-55%, qtz. 30-35%, bt. 10%, musc. 2-4%. One fracture in this section along bt. concentration.	93	94				1	60			**Magnesium**		
	94	94.085								**Sulfate soundness**		
	94.085	95	M-Mf	W	6	0				**Alkali Reactivity**		
	95	96				1	20			**14day**		
	96	97				1	80					
	97	98				0				**Micro Deval**		
94.085 - 100.92 m Light cream to cream monzogranite, In and out of medium to medium fine grained. Feldpar 60-40 plag., qtz. 25-35%, bt. 5-15%, musc. 3-5%. Core Fe stained from fracture at 95.40-96.67 m.	98	99				0						
	99	100				0						
	100	100.92				0				Chloride		
100.92 - 101.855 m Light cream, qtz. inc., 40-50%, grain size dec. plag 30%, bt. 10-15%, musc. 5-10%. Mnr mm sized bt clots.	100.92	101	Mf	W	6	0						
	101	101.855				0						

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION		CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION	8372	ELEVATION: 100 m	m	644527m E	N	(P / H / N / B)	LOGGED BY:	Karen McNa
DRILL HOLE NUMBER:	BP-4	AZM.: na	°	5022955m N	E	119.8: m	DATES:	Feb. 8-22
DATE COLLARED:	Dec. 6, 2007	DIP: -90	°		m	% Recovery	PAGE:	4 of 4
DATE COMPLETED:	Dec. 7, 2007	EOH: 119.80	m	NAD 83 Zone 20			SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation Null/W/M/S	Strength (S 1-6)	Structure Fractures/m	Structure Angle with CA	Mineralization Mineral	Mineralization Type	Mineralization Intensity	Sample Code	RQD	QRD cm
	101.855	102	M	W	6	0					LA Abrasion		
	102	103				0					SG		
101.855 - 104.86 m Cream monz. Grain size increase. Chl. blebs parallel CA. Plag 45-50%,	103	104				0					Absorption		
qtz. 30-35%, bt. 10-15%, musc 5-10%. Bt. Clots several cm elong perpendicular to 45 CA.	104	104.86				0							
104.86 - 105.845 m Pale cream monz. Qtz. 35-40, feldspar 50-40%, bt. 7-10%, musc. 3-5%.	104.86	105	M-Mf	W	6	0					Sodium Sulphate Soundness		
Fe staining either side of joint @105.23m	105	105.845				1	75				Loss		
105.845 - 106.1 m Small interval. Beige, plag coarser, chl blebs parallel CA. Plag 50%, qtz.	105.845	106	M	W	6								
35-40%, bt. 5-7%, musc. 5-7%.	106	106.1				0							
	106.1	107	M	W	6	0					Magnesium Sulfate soundness		
106.1 - 108.33 m Same beige as above, feldspar xls, Darker grey matrix, inequigranular.	107	108				0					loss		
Plag 45%, musc. 2-4%, qtz, 40%, bt. 7-10%. Chl blebls and f.g. bt & chlorite.	108	108.33				0							
108.33 - 110.79 m Dirty cream to dark gry. Feldspar 40-45%, qtz 35-40%, musc. 2-10%	108.33	109	M-Mf	W	6	2	35/30				Alkali Reactivity 14day		
(mnr), bt. 10%. Core break along joints of bt. concentration. @108.37-108.45m bt. Clot	109	110				1	85				Micro Deval		
@109.47. Rust stained on either side of joint.	110	110.79				1	30&85						
	110.79	111	M	W	6								
	111	112				1	85						
	112	113				1	88						
	113	114				2	65/85						
	114	115				0							
110.79 - 116.28 m Dirty cream, plag. 50-45%, qtz. 30-35%, bt 7-12%, musc. 5-7%. Coarse &	115	116				0							
fine bt. Fe stained core from 111.34-111.60m	116	116.28				0							
	116.28	117	M	W	6	0							
116.28 - 118.74 m Cream Plag 60-45%, qtz. 25-35%, bt 5-10%, musc 3-5%. Fe stained core	117	118				1	60&80 zig zag						
118.56-118.74m. Chl blebs. Series of folded mica/chl blebs, core broke along these planes.	118	118.74				1	88						
	118.74	119	Mf	W	6	0							
118.74 - 119.81 m Dirty beige. Plag. 45%, qtz 40%, bt 10-12%, musc. 2-3%, Bt. clots	119	119.81				0					chloride		
perpendicular CA.	119.81	EOH										RQD 100%	
This hole is unique on the lower half. Its mineralogy range is broader than other holes.													
Mica concentrations are higher. Plag dominated.													

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Drill Contractor **Logan Drilling Company**

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**
LICENSE INFORMATION:	**8372**	**ELEVATION: 82 m**	**m**		**(P / H / N / B)**	**LOGGED BY** **Karen McNaulty**
DRILL HOLE NUMBER:	**BP-5**	**AZM.: na**	**°**	**644213m E**	**89.40: m**	**DATES:** **Jan 29 -Feb. 7**
DATE COLLARED:	**Dec. 4, 2007**	**DIP: -90**	**°**	**5022742m N**	**% Recovery**	**PAGE:** **1of 3**
DATE COMPLETED:	**Dec. 6, 2007**	**EOH: 89.405**	**m**	**NAD 83 Zone 20**		**SIGNED:**

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD
2 ft (.6m) casing No core	0	0.6								**BP5(1)**	QRD not done on this interval
	0.6	2	M	M	6	4+	90/0			**0-29.80m**	
	2	3				2	0/0-10			LA Abrasion	
1.65 m recovered, assume a .35m loss. Pale pnk to white equigranular syenogranite with Fe staining on either side of fractures plag~= kspar, feldspar 45-50%, qtz 40-45. Occasional bt clot up to 1 cm in size.%, bt. 5-7%, musc. 2-4%,	3	4				2	85/60			SG	
	4	5				4	0-10/80/88/80			Absorption	
	5	5.51								Sodium Sulphate	
5.51 - 7.62 m kspar>plag, Feldspar 50%, qtz., 35-40%, bt. 3-5%, musc. 2-4%. pnk inequigranular. Bt. Clots 2mm-1.5cm, occasional perthitic textured large kspar xls 2cm, Fe staining in the section < than above. Chlorite filled rehealed hairline fractures 0 deg. to CA.	5.51	6	M	M	6	9	80/50/80/0/88/75/88/30/88			Magnesium Sulfate	
	6	7				2	80/88			Microdeval	
	7	7.62				2	90/90			Petrographic No.	
	7.62	8	Mf	M	6						
	8	9				1	75			Alkali Reactivity	
	9	10				0				14day	
7.62 - 12.62 m pale pnk. Increase in biotite and quartz. Feldspar 50%, plag ~=kspar, qtz 40%, bt.5-7%, musc. 5%. Biotite clots 4mm - 1cm.	10	11				0					
	12	12.62				3	0/0/75				
12.62 -13.37m kspar>plag pink equigranular syenogranite, 50% feldspar, 35-40% qtz, bt. 5-7%, musc. 3-4%.	12.62	13	M	W	6	0					
	13	13.37				0					
13.37 - 14.35m pnk equigranular as above, bt decreases. Feldspar 50%, qtz. 35%, bt 3-5%, musc. 3-4%. Fe staining on either side of jnts. Kspar >plag	13.37	14	M	W	6	0					
	14	14.35									
14.35 - 16.36 m kspar~=plag, pale pnk syenogranite, 45-55% feldspar, qtz 40%, bt, 5%, musc. 3%. Xenolith @16.12-12.25m 13cm in size. Chl filled rehealed hairline fract. ~45 CA. Fractures in this section are rust stained.	14.35	15	M	W	6	3	35/90/65				
	15	16				3	60/88/35				
	16	16.36									
	16.36	17	M	W	6	1	85				
	17	18				2	75/15				
	18	19				2	85/90				
16.36 -20.82 m kspar slightly>plag, orange to salmon pink, Feldspar 50%, qtz35%, bt 3-5%, musc. 3%.	19	20				3	85/90/15				
	20	20.82				1	5				
20.82 - 22.19m plag > kspar plag>spar, grey-white, Feldspar 50%, qtz. 45%, bt 5-10%, musc. 3-4%, Gradual increase in kspar at base of interval. Section is pervasively Fe stained.	20.82	21	M	W	6						
	21	22				4	40/40/40/85				
	22	22.19									
	22.19	23	M	W	6	2	88/80				
22.19 - 25.0m Salmon pink to orange, equigranular syenogranite, kspar 40%, plag 10%, qtz. 40%, bt 5-7%, musc 3-4%.	23	24				2	55/88				
	24	25				1	0-10				
25.0 -26.79 m kspar ~= plag, feldspar 35-55%, qtz. 35-55%, bt 3-5%, musc. 2-3%. Mnr bt clots avg. 3mm. Pnk. Greater range of percentages of feldspar and quartz.	25	26	M-Mf	W	6	1	0				
	26	26.79				2	20/0				
26.79 -27.24 m kspar>plag, feldpsar 50%, bt., 5%, musc. 3-5%, Between 27.06-27.74 it appears that kspar secondary has formed along hairline fractures. Pnk.	26.79	27	Mf	W	6						
	27	27.74				0					
	27.74	28	Mf	W	6	0					
26.79 -31.44 m plag>kspar, feldspar 50%, qtz. 45%, bt 5%, musc. 2-3%, white grey to weak pnk. Silica filled fractures, chloritized 30.70-31.10m. Fe staining from 30.30-31.1m	28	29				0					
	29	30				0				**BP5(2)**	
	30	31				3	15/30/30			**29.80 - 59.6m**	

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Drill Contractor Logan Drilling Company

PROJECT NAME:	Black Point	8372	COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:		ELEVATION: 82 m	644213m E	(P / H / N / B)	LOGGED BY	Karen McNaulty
DRILL HOLE NUMBER:	BP-5	AZM.: na °	5022742m N	: m	DATES:	Jan 29 -Feb. 7
DATE COLLARED:	Dec. 4, 2007	DIP: -90 °		% Recovery	PAGE:	2 of 3
DATE COMPLETED:	Dec. 6, 2007	EOH: 89.405	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code	QRD cm	% QRD
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Joints/m	Angle with CA	Type	Intensity			
										BP5(2)		
26.79 -31.44 m cont'd.	31	31.44		W	6	0				29.80 - 59.6m		
31.44 -32.94m Light pnk equigranular syenogranite. Kspar >plag., 50% feldspar, qtz. 40%, bt 3-5%, musc. 3-4%. Chlorite filled hairline veinlets cutting section.	31.44	32	M	W	6	0				LA Abrasion		
	32	32.94				1	85			SG		
	32.94	33	M-Mf		6							
	33	34				0				Absorption		
	34	35				1	10					
	35	36	M			0				Sodium Sulphate		
	36	37				0				Soundness Loss		
	37	38				0				Magnesium Sulfate		
	38	39				1	88			soundness loss		
	39	40				0				Alkali Reactivity		
	40	41				3	85/85/30			14day	18	QRD started
	41	42				0				Micro Deval		Assume 0 if
32.94- 44.41m Pale pink to orange syenogranite. Feldspar 50%, kspar>plag., qtz 35%, bt 7-10%, musc. 3-4%. Silicification in this section in addition to thin qtz veining at the top of the interval. Bt. Content changes. Sub parallel chl. Veining. Bt. clots more common.	42	43				0						no number present.
	43	44			6	0						
	44	44.41										
44.41- 46.90 m plag>kspar, 50% feldspar, qtz. 35%, bt. 5-7%, musc. 2-5%. Grey white. Bt. Clots 1mm - 2cm.	44.41	45		W		2	80/80				17.5	
	45	46				2	30/70					
	46	46.9				2	20/30					
46.90 - 47.35 m kspar~=plag. Pale pink, 50% feldspar, , bt 5-7%, musc. 2-4%, qtz. 40%. Kspar gradually increases downward.	46.9	47	M-Mf		6							
	47	47.35										
	47.35	48	M			2	30/80					
	48	49				0						
	49	50		N		0						
	50	51				2	80/88				9	
	51	52				0						
	52	53				0				Sodium Sulphate		
	53	54				0				Soundness Loss		
47.35 - 55.75m. Orange to pink, good solid secretions, kspar> plag, feldspar 55%, qtz., 35%, bt 5-7%, musc. 2-3%. Fine bt., bt clots 2mm-4cm in range.	54	55				0				Magnesium Sulfate		
	55	55.75		W		0				soundness loss		
55.75 - 56.15 m plag ~=kspar, pale orange to cream, feldspar 50%, qtz., 35-40%, bt 5%, musc. 2-4%. Gradual change to next unit.	55.75	56	M		6	0				Alkali Reactivity		
	56	56.15								14day		
	56.15	57	M			3	20/20/30					
56.15 - 57.49 m plag > kspar, gry to cream, feldspar 50%, qtz 35%, bt. 5-7%, musc. Chled bt., Py iron staining either side of jnts., hairline qtz veinlets 45 CA. Gradual change to next unit.	57	57.49			6					Micro Deval		
	57.49	58	Mf	W		4	30/30/25/0				7	
57.49 -59.40m plag~=kspar, 40% feldspar, qtz. 40%, bt. 7%, musc. 3-4%. Pale cream, numerous 2ndary qtz. Veinlets~ 45CA	58	59				7	0/40/30/30/0/30/30				41	
	59	59.4										
59.40 - 60.37 m Salmon pnk syenogranite, feldspar 50%, qtz. 40%, musc. 3-5%, bt. 4-7%. 5cm mica clot @ end of interval. Few chl veins parallel CA.	59.4	60	M	W		2	10/20				92.5	29.8
	60	60.37			6					BP5 (3)		
	60.37	61	M-Mf	W		1	20			59.60-89.405m		
	61	62				4	20/20/0/50			LA Abrasion		
60.37 -63.30 m pale orange to cream, plag~=kspar, 50% feldspar, qtz. 35-40%, bt 5%, musc. 5%. Medium to finer grained at bottom. Pyrite on joint surfaces.	62	63				2	30/60			SG		
	63	63.3			6					Absorption		
63.30 - 68.35 m kspar>plag, orange in colour.	63.3	64	M-Mf			4	60/70/30/30				10	

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Drill Contrator Logan Drilling Company

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 82 m	m	644213m E	(P / H / N / B)	LOGGED BY:	Karen McNaulty
DRILL HOLE NUMBER:	BP-5	AZM.: na	°	5022742m N	89.40: m	DATES:	Jan 29 -Feb. 7
DATE COLLARED:	Dec. 4, 2007	DIP: -90	°		% Recovery	PAGE:	3 of 3
DATE COMPLETED:	Dec. 6, 2007	EOH: 89.405	m	NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Fractures/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	QRD cm
	64	65				1	40			LA Abrasion	
	65	66				1	10			SG	
	66	67				1	45			Absorption	
cont'd. Unit goes in and out of medium to fine grain size. Musc.coarse 4-5%, bt. 5-7%,	67	68			6	3	85/75/10				
qtz 35%, 50% feldspar. Fine grained pyrite coating fracture surfaces <2%.	68	68.35								Sodium Sulphate	
68.35 -68.84 m kspar~=plag pale or./cream. Feldspar 45-50%, qtz. 40%, bt. 5-7%,	68.35	68.84	Mf	W	6	4	55/60/60/65			Soundness Loss	7
musc. 2-3%. Pyrite coating fracture surfaces.											
68.84 - 69.73 m kspar>plag 50% feldspar, qtz. 40-50%, musc. 3-4%, bt. 4-5%. Odd	68.84	69	Mf	W	6						
mica clot 2-3 cm. Salmon pnk.	69	69.73				3	50/40/?			Magnesium Sulfate	
	69.73	70		W	6					soundness loss	
69.73 -71.15 m cream to pale orange, secondary fine grained quartz veining with trace	70	71				4	20/20/10/0			Alkali Reactivity	
of chl. Feldspar 50%, qtz 35-40%, bt. 5%, musc. 2-3%. Trace of chl?	71	71.15								14day	
71.15 -72.30m Orange syenogranite, equigranular, kspar>plag. 50% feldspar, qtz.	71.15	72	M	W	6	1	45			Micro Deval	
35%, bt. 5-7%, musc. 5%. Fractured along concentration of bt.	72	72.3									
	72.3	72.54	M	W	6	1	60				
72.30 - 72.54 m plag>kspar, 50% feldspar, qtz. 40%, bt. 3-5%, musc. 2-3%. Drk gry											
72.54 - 73.40 m kspar>plag. Orange, feldspar 50%, qtz 40%, bt 5-7%, musc. 2-3%.	72.54	73	M	W	6						
Rare bt. clots 2mm.	73	73.4									
73.40 - 74.30 m kspar~=plag. Pale orange, cream, qtz 40%, bt. F.g. 3-5%, musc. 2-	73.4	74	Mf	W	6	1	85				
3%, feldspar 50%.chlorite on fractures and in veinlets through section.	74	74.3									
74.30-74.95 m kspar>plag, or., feldspar 50%, bt. 3-5%v.f., qtz 35-40%, musc. 2%.	74.3	74.95	M-Mf	W	6	2	20/25				
	74.95	75		W	6						
74.95 - 76.27 m cream.buff plag>kspar, feldspar 50%, qtz. 35%, bt, 5-7%, musc. 2-	75	76				4	75/30/65/75				15
4%. Trace of hairline qtz. and chl. Veinlets. Gradual change to lower unit.	76	76.27									
76.27 -77.22 m Or. f.g. bt. 7-10%, qtz 35%, musc. 3-4% feldspar 50%. Qtz inundated	76.27	77	M	W	6	1	85				
fracture on bottom of interval. Qtz veinlets cutting CA.	77	77.22									
77.22 - 77.38 m kspar ~=plag 60%, qtz 35%, bt 5%, musc 2%, cream to pale or.	77.22	77.38	M	W	6						
77.38 - 79.64 m kspar>plag50% feldspar, 35% qtz., bt 7-10%, musc. 2-4%.coarse,	77.38	78	M	W	6	3	25/30/35				
Orange syenogranite. Sev. bt clots mm to 4 cm. xenolith @78.87 3.5cm. Hairline chl	78	79				0					
veinlets ~ parallel CA.	79	79.64				1	75				8.5
	79.64	**80**	Mf	W	6						
79.64 - 80.6m cream, feldspar 45%, qtz. 35-40%, bt 5-10%, musc. 2-4%.	80	80.6				1	20				
80.6 - 81.60m or. Feldspar, 50%, qtz 30-35%, musc. 3-5%, bt f.g. 7%. Chl veinlets	80.6	81	Mf	W	6						
parallel CA. grad.change to next unit. Secondary bt?	81	81.6				1	30				
81.60 - 82.25 m Cream orange, <u>mica</u> clots sev. mm in size. Clay alt. of feldspar on	81.6	82	M								
jnt surfaces. Feldspar 50%, qtz 35%, bt. 7-10%, mica 2-3%.	82	82.25									
82.25 - 83.09 m Orange, kspar 45%, kspar>plag, qtz 40%, bt 5-7%, musc. 2-4%.	82.25	83	M			2	40/88				
Rare bt. Clots sev mm in size. Hairline fracture ~par. CA chl. and qtz filled.	83	83.09									
83.09 -84.25 m Cream to pale or. Plag ~=kspar, Feldspar 45%, qtz. 40%, bt 5-10%,	83.09	84	M	M		4	35/60/70/30				7
musc. 3-4%. Bt. clots sev mm and finge grained bt. Chl. on frac. surf.	84	84.25									
84.25-84.81m or. Feldspar 45%, kspar>plag, qtz. 40%, bt 7-10%, musc. 2-3%. Qtz	84.25	84.81				1	50				
clot @ 84.66.											
84.81-85.82m Cream to mnr org. feldspar 45%, qtz 40%, bt. 7-10%, musc. 2-4%.	84.81	85	M	W							
Hairline qtz veinlet ~45CA @ 85.63 m. Trace of clay alteration of feldspars.	85	85.82				1	40				
	85.82	86									
85.82 -87.22 m cream to mnr orange feldspar 40-50%, qtz 40%, musc. 2-5%	86	87				4	55/60/30/30				
concentrated in certain sec., bt. 5-7%. Chl blebs hairline qtz veins curved.	87	87.22									
87.22 - 88.0 or. Bt &chl clots & blebs parallel CA. Feldspar 45%, qtz 40%, bt. 7-10%,	87.22	88	M	W		0					
coarse musc. 2-4% Qtz & chl. veinlets.											
88.0 - 88.40 pale or. Cream, feldspar 50%, qtz 40%, musc. 2-4%, bt 7%. Qtz filled	88	88.4	M	W							
rehealed veinlets.											
	88.4	89	M	W		1	40				
88.40- 89.405 m Cream feldspar 55%, qtz 35%, bt. 5-7%, musc. 2%. Sericite?, pale	89	89.405				2	30/20				
green chlorite? V.f.g. silica on fracture surfaces.	89.405	EOH									37.5

10 page 2
47.5 .475/29.80x100 -100 98.41%

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:	8372	ELEVATION: 73m		5023545mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6A	AZM.: na	°		55.82: m	DATES:	Jan.23/08
DATE COLLARED:	Jan.6/2008	DIP: -90	°	645399mE	% Recovery	PAGE:	1 of 2
DATE COMPLETED:	Jan.7/2008	EOH: 55.82m		NAD 83 Zone 20		SIGNED:	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code
Casing. No core	0	0.6								**BP-6A (1)**
0.6-5.59m Medium grained, equigranular Pinkish grey syenogranite. 50% K-Spar	0.6	1	Mc	W	6	0				**0.6-18.6m**
30% Quartz 20% Mica (2% muscovite). Foliation planes observed in medium granied	1	2	Mc	W	6	1	80			LA Abrasion
biotite. Biotite has a "grungy" surface (chloritic). Note: a Yellowish amber colour on	2	3	Mc	W	6	2/2 #4	45 / 90			SG
feldspar surfaces (possible iron staining) Potential Smectite alteration of feldspar	3	4	Mc	W	6	6	90			Absorption
over 3-4m. High angle fracturing becomes frequent from 4-5.59m, moderate to	4	5	Mc	Wm	4	>10				
intense FeOx staining/mineralization on surficial fracture surfaces.	5	5.59	Mc	Wm	4	>10				Sodium Sulphate
5.59-31.93m Medium grained, equigranular pinkish grey syenogranite. 42% Kspar	5.59	6	M	Wm	6	0				Soundness Loss
42% Quartz 15% Mica (2-3% muscovite) Chloritic Biotite. 20-30cm Iron stained	6	7		W	6	2	90			
aureole around fracture/joints.	7	8	M	W	6	0				
	8	9	M	W	6	2	45			Alkali Reactivity
	9	10	M	W	6	1	20			14day
	10	11	M	W	6	0				Micro Deval
	11	12	M	W	4	>10				
Interval highly fractured (high and Low angle) with FeOx staining on surfaces	12	12.84	M	W	4	>10				
	12.84	13	M	Wm	6	0				
Metasedimentary Xenoliths at 13.03m and 13.22m size 1cm²	13	14	M	Wm	6	0				
Fracture over interval 0º to core axis. FeOx on fracture surface	14	14.39	Mc	Wm	6	1	0	Pyrite	Trace	
	14.39	15	Mc	Wm	6	4 / 1 #5	90 / 20			
	15	16	M	W	6	2	80			
Silicified hair line fracture 20º to core axis	16	17	M	W	6	0				
	17	18	M	W	6	1 / 1 #2	90 / 80			
	18	19	M	W	6	1	45			
	19	20	M	W	6	2	90			**BP-6A (2)**
	20	20.3	M	W	6	0	na			**18.6-37.2m**
20.3-21.0m Highly fractured low to high angle. Weak to moderate FeOx staining.	20.3	21	M	W	4	>10		Pyrite	1-2%	LA Abrasion
Disseminated pyrite mineralization on fracture planes. Pervasize clay alteration to										SG
host rock around fractures.										Absorption
FeOx and clay alteration on Fracture surfaces	21	22	M	W	4	1 / 1 / 1 #3	90 / 0 / 45			
Low angle silicified fractures (mm width)	22	23	M	W	4	1 / 2 #3	10 / 80			Sodium Sulphate
Low angle silicified fractures (mm width) FeOx on fracture-Joint planes.	23	24	M	W	6	2 / 1 #3	80 / 0			Soundness Loss
24-31.93m Medium grained, equigranular Pinkish grey syenogranite 45% K-spar 45%	24	25	M	W	6	3 / 1 / 1 #5	80 / 90 / 20			Magnesium Sulfate
	25	26	M	W	6	0				soundness loss
	26	27	M	W	6	3 / 3 #6	70 / 90			Alkali Reactivity
	27	28	M	W	6	4	80			14day
	28	29	M	Wm	6	1 / 1 / 1 #3	60 / 45 / 80			Micro Deval
Several short and thin silicified fractures 0º to core axis	29	30	M	W	6	7 / 1	80 / 10			
	30	30.26	M	W	6	1	80			
	30.26	31	M	Wm	6	6	70			
Intensely Jointed and iron stained feldspar foliation weak to moderate in biotite.	31	31.93	M	Wm	6	9 / 1	70 / 10			

Company/Licensee **6531954 Canada Ltd**
Drill Contrator **Logan Drilling Company**

PROJECT NAME:	Black Point	HOLE DESCRIPTION		COLLAR LOCATION	CORE TYPE (Q)	LOGGING DETAILS	
LICENSE INFORMATION:		ELEVATION: 73m	m	5023545mN	(P / H / N / B)	LOGGED BY	Peter Dalton
DRILL HOLE NUMBER:	BP-6A	AZM.: na	°	645399mE	55.82: m	DATES:	Jan.23/08
DATE COLLARED:	Jan.6/2008	DIP: -90	°		% Recovery	PAGE:	2 of 2
DATE COMPLETED:	Jan.7/2008	EOH: 55.82m	m	NAD 83 Zone 20		SIGNED:	

Description	From	To	Grain Size	Foliation	Strength	Structure		Mineralization		Sample Code
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity	
31.93-36.8m Medium grained inequigranular grey/green monzogranite. Highly fractured and jointed. 50% Feldspar 49% Quartz 1% mica. Smecitite alteration of feldspar moderate (soft and green). Sulphide mineralization on fracture planes (Marcasite?) trace-10%. trace hematite observed (steel grey). Sulphides are bronze with irridessent tarnish (twined and striated). Also noted dark circles with pyrititc rims (mm scale) All mineralization appears to be related to smecitite alteration and fracture planes. Potential fault at 33.12-33.25m	31.93	32	M	Wm	6	0	0			
	32	33	M	Wm	6	>10				
	33	34	M	W	6					
Smectite and Sulphide rich	34	34.28	M	W	6	4	90	Marcasite	10%	
Patches of intense smectite alteration (no sulphides)	34.28	35	M	W	6	4 / 3 #7	80 / 45			
	35	36	M	W	6	5 / 1 #6	80 / 90			
	36	36.71	M	W	6	3 / 2 #5	70 / 90			
Oxidized, intense iron staining	36.71	36.8	M	W	5	3	80			
36.8-41m Pyrite mineralization tends to be localized to fracture planes and also	36.8	37	M	W	6	2	80	Pyrite	trace	
occuring as rims to dark circular patches (mm scale) Note gradual colour change	37	37.77	M	W	6	6 / 1 / 1 #8	80 / 10 / 0	Pyrite	trace-2%	
over interval into a pinkish grey.	37.77	38	M	W	6	2	90			**BP-6A (3)**
Medium grained equigranular pinkish grey syenogranite 45% kspar 45% Quartz 10%	38	39	M	W	6	4 / 3 / #7	80 / 45			**37.32-55.82m**
Mica biotite weakly chloritic and moderately foliated.	39	39.2	M	W	6	1	10	Pyrite	5%	LA Abrasion
	39.2	40	M	W	6	1	0			SG
	40	41	M	W	6	3 / 1 #4	70 / 10			Absorption
41-42m Grey/green monzogranite	41	42	M	W	6	1 / 2 / 1 #4	80 / 90 / 45			
42-55.82(EOH) Medium grained equigranular syenogranite pinkish grey 40% K-spar	42	43	M	W	6	2 / 2 #4	70 / 90			Sodium Sulphate
35% Quartz 15% Mica. Foliation observed along mica planes.	43	44	M	W	6	1 / 1 #2	90 / 10			Soundness Loss
	44	45	M	W	6	2	80			Magnesium Sulfate
	45	46	M	W	6	3 / 1 #4	45 / 90			soundness loss
	46	47	M	W	6	2 / 1 #3	20 / 80			Alkali Reactivity
	47	48	M	W	6	2	90			14day
	48	49	M	W	6	1	90			Micro Deval
	49	49.7	M	W	6	1	10			
No return/core loss Bit Malfunction	49.7	50	M	W	6	0	0			
	50	51	M	W	6	1 / 1 / 2 #4	90 / 80 / 45			
	51	52	M	W	6	1 / 1 #2	10 / 90			
	52	53	M	W	6	1	80			
	53	54	M	W	6	1	80			
	54	55	M	W	6	3	90			
Forced to abandon hole due to stuck bit	55	55.82	M	W	6	3 / 1 #4	20 / 90			

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**	
LICENSE INFORMATION:	**8372**	**ELEVATION: 69m**		**5023434mN**	**(P / H / N / B)**	**LOGGED BY**	**Peter Dalton**
DRILL HOLE NUMBER:	**BP-6B**	**AZM.: na**	°		**70.05: m**	**DATES:**	**Jan.31/08**
DATE COLLARED:	**Jan.13/2008**	**DIP: -90**	°	**645310mE**	**% Recovery**	**PAGE:**	**1 of 2**
DATE COMPLETED:	**Jan.15/2008**	**EOH: 70.05m**		**NAD 83 Zone 20**		**SIGNED:**	

Description (Colour, Texture, Mineralogy%, etc.)	From m	To m	Grain Size (F/M/C/P)	Foliation (Null/W/M/S)	Strength (S 1-6)	Structure Joints/m	Structure Angle with CA	Mineralization Type	Mineralization Intensity	Sample Code	RQD	
0-4m Overburden, surficial boulders (granite/Metasediments)	0	4								**LA Abrasion**		
4-20m Medium grained equigranular pinkish off white granite. 50% Kspar, 45% Quartz 5%Mica (1-2% muscovite - 3-4% biotite) biotite is moderately chloritic. Feldspar can increase to 55-60% while quartz can decrease to 40-35%	4	5	M	Wn	6	2 / 3 #5	80 / 90			**SG** **Absorption** **Sodium/Magnesium**		
Trace sulphide "blebs" (mm scale) and FeOx on fracture planes Interval is Highly fractured.	5	6	M	Wn	3	>10		Pyrite	Trace	**Sulphate Soundness Loss**		
	6	7	M	Wn	6	3 / 1 #4	50 / 90					
Few low angle hairline fractures with clay alteration along fracture plane	7	8	M	Wn	6	1	40					
Fe staining of feldspar within a 5cm aurole of joint.	8	8.57	M	Wn	6	1 / 2 #3	80 / 45			**Alkali reactivity 14 day**		
8.57-14.0m Intense hairline fractures chloritic and silicified. Fractures are both high and low angles	8.57	9	M	Wn	6	1 / 1 / 1 / #4	30 / 70 / 80 / 9(					
	9	9.95	M	Wn	6					**Micro Deval**		
Missing/ lost core	9.95	10.55	M	Wn	6					**PN Number**		
	10.55	11	M	Wn	6	2 / 2 / 1 #5	90 / 80 / 10				92.35%	
	11	12	M	Wn	6	6 / 1 #7	80 / 40					
	12	13	M	Wn	6	3 / 1 / 1 #5	80 / 40 / 90					
	13	14	M	Wn	6	3	60					
Mica 5-7% slight increase in Quartz	15	16	M	Wn	6	2 / 2 #4	80 / 20					
	16	17	M	Wn	6							
17.5m 1cm² biotite pod	17	18	M	Wn	6	1	60					
	18	19	M	Wn	6	1 / 2 / 1 #4	10 / 60 / 40	Pyrite	Trace			
FeOx on shallow angle fracture planes associated trace pyrite.	19	20	M	Wn	6	4	40					
20-50m Medium grained equigranular syenogranite. Kspar is pinkish off white. Biotite	20	21	M	Wn	6	3	45					
is medium to fine grained weakly chloritic with a weak to null foliation. 47% Kspar	21	22	M	Wn	6							
47% Quartz 6% micas (1% muscovite) <1% Plag	22	23	M	Wn	6	1 / 1 #2	90 / 45					
23.47m Biotite pod	23	24	M	Wn	6					**BP6B(1) 0.6m- 23.4m**		
	24	25	M	Wn	6					**LA Abrasion**		
	25	26	M	Wn	6					**SG**		
	26	27	M	Wn	6					**Absorption**		
	27	28	M	Wn	6	1	90					
	28	29	M	Wn	6					**Sodium/Magnesium**		
	29	30	M	Wn	6					**Sulphate Soundness**		
	30	31	M	Wn	6					**Loss**		
	31	32	M	Wn	6					**Alkali Reactivity 14 Da**		
Increase to 10% biotite over interval	32	33	M	Wn	6	1	40			**Micro Deval**		
	33	34	M	Wn	6						95.51%	
	34	35	M	Wn	6	1	80					
Biotite has moderate chlorite alteration. Chlorite and clay on fracture surface	35	36	M	Wn	6	1 / 3 #4	20 / 70					
	36	37	M	Wn	6	1 / 1 #2	90 / 45					
	37	38	M	Wn	6	2	40					
Fractures have a soft bright yellow coating on feldspar faces (clay?)	38	39	M	Wn	6	2 / 1 / 1 #4	30 / 80 / 60					
	39	40	M	Wn	6	3	70					
	40	40.14	M	Wn	6							
Missing/Lost Core	40.14	40.77	M	Wn	6							

Company/Licensee **6531954 Canada Ltd**
Drill Contractor **Logan Drilling Company**

PROJECT NAME:	**Black Point**	**HOLE DESCRIPTION**		**COLLAR LOCATION**	**CORE TYPE (Q)**	**LOGGING DETAILS**	
LICENSE INFORMATION:	**8372**	**ELEVATION: 69m**	**m**	**5023434mN**	**(P / H / N / B)**	**LOGGED BY**	**Peter Dalton**
DRILL HOLE NUMBER:	**BP-6B**	**AZM.: na**	**°**	**645310mE**	**70.05: m**	**DATES:**	**Jan.31/08**
DATE COLLARED:	**Jan.13/2008**	**DIP: -90**	**°**		**% Recovery**	**PAGE:**	**2 of 2**
DATE COMPLETED:	**Jan.15/2008**	**EOH: 70.05m**	**m**	**NAD 83 Zone 20**		**SIGNED:**	

Description	**From**	**To**	**Grain Size**	**Foliation**	**Strength**	**Structure**		**Mineralization**		**Sample Code**	**RQD**	
(Colour, Texture, Mineralogy%, etc.)	m	m	(F/M/C/P)	(Null/W/M/S)	(S 1-6)	Fractures/m	Angle with CA	Type	Intensity			
Rounded and tumbled core (technical drill issues?)	40.77	41	M	Wn	6							
Few low angle fractures with clay altered surfaces	41	41.72	M	Wn	2	3	60					
	41.72	42	M	Wn	6	1	5					
Slight increase in grain size. Increase in clay alteration associated with joint planes	42	43	M	Wn	6	1 / 2 #3	10 / 30					
Yellow clay coating on feldspar associated with joint and fracture planes	43	44	M	Wn	6	2 / 1 / 1 #4	20 / 70 / 0					
Low angle fracturing with surficial intense clay alteration of feldspar. Trace pyrite mineralization as "blebs" smells of sulphur with HCL	44	45	M	Wn	6	1 / 1 #2	10 / 60	Pyrite	Trace			
	45	46	M	Wn	6	4 / 1 #5	70 / 40					
	46	47	M	Wn	6	2 / 3 #5	40 / 70			**BP6B(2) 23.4m-46.8m**		
	47	48	M	Wn	6	2 / 1 #3	40 / 90					
Chloritic clays on fracture surface	48	49	M	Wn	6	1 / 2 #3	10 / 70			**LA Abrasion**		
Top 20cm of interval is fractured and rubbled (note clay alteration on fracture and joint planes)	49	50	M	Wn	6	4	40			**SG** **Absorption**		
50-70.05m EOH Medium grained equigranular granite (syenogranite) Creamy off-white colour. 50% Kspar, 40% Quartz, 10% mica (3% muscovite). Biotite moderately to intense chloritic alteration. Feldspar is moderately altered to clay on fracture surfaces (yellowish green) fracture surfaces contain 7-10% very fine grained sulphide (pyrite) very grungy in appearance and restricted to surficial fracture planes.	50	51	M	Wn	6	2 / 1 / 1 #4	30 / 45 / 10	Pyrite	7-10%	**Sodium/Magnesium Sulphate Soundness Loss** **14 day Alkali Reactivit** **Micro Deval**		
	51	52	M	Wn	6	1	30					
	52	53	M	Wn	6							
Lithological composition remains constant. Increased clay and rock flour on joint planes may indicate greater movement along on joints.	53	54	M	Wn	6	3	40					
Sulphides restricted to fracture planes	54	55	M	Wn	6	4 / 1 #5	40 / 70	pyrite	trace-3%			
	55	56	M	Wn	6	2	45					
	56	57	M	Wn	6	2	90					
	57	58	M	Wn	6	1 / 1 #2	90 / 40				96.20%	
	58	59	M	Wn	6							
	60	61	M	Wn	6	1	90					
	61	62	M	Wn	6							
Mica decrease to 3%	62	62.53	M	Wn	6	1	45					
Mica increase back to 7-10%	62.53	63	M	Wn	6							
	63	64	M	Wn	6	2	30					
	64	65	M	Wn	6							
	65	66	M	Wn	6							
	66	67	M	Wn	6							
	67	67.3	M	Wn	6							
Decrease in Mica 3-5% (biotite)	67.3	68	M	Wn	6							
Mica 1%	68	68.13	M	Wn	6							
Medium grained equigranular pinkish off-white syenogranite 50% Kspar, 40% Quartz, 10% Mica (1% muscovite, 9% chloritic Biotite)	68.13	69	M	W	6							
69.72-70.05m Quartz vein 1.5cm thick 10º to Core Axis	69.72	70	M	W	6	1	10			**BP6B(3) 46.8m-70.27m**		
	70	70.27	M	W	6	1	10					

Drill Log Header Sheet

Hole: BP-7

Project	Black Point (6706)
Geologist	Peter Dalton, P.Geo.
Designed By	Vulcan Materials

Commenced	February.27 2014
Completed	March.1 2014
Drill Contractor	Logan Drilling Group
Drill Rig	Duralite 1000N
Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the southeastern portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting	0644981mE
Northing	5022750mN
Elevation	68m
Azimuth	0
Dip°	-90
Depth(m)	120
Core Size	NQ
RQD Ave. %	98.30%
RQD Range %	65% to 100%
Recovery Ave. %	98.80%
Recovery Range %	73% to 100%
Significant Core loss	0-0.54m

Geological Summary

BP-7 consists of a medium grained, moderately foliated, micaceous monzogranite. Mineralology remains fairly consistent throughout the entire hole with 50% Plagioclase, 40% Quartz and 10% Mica (5% Biotite + 5% muscovite) although minor fluxuations in the mica component does occur. From 96m to 102m the monzogranite becomes realtivley more potassic with the presence of orthoclase; the increase in orthoclase is suffice enough to consider a lithology change to that of a syenogranite within this interval. This transition is subtle and represents mineralogical variations within the granite body and does not represent dyking or intrusive discontinuity. Alteration within BP-7 is limited to selective, weak chlorite alteration of biotite. The BP-7 monzogranite is a hard and competent rock with a limited structral component. A reoccuring, low angle joint + fracture orientation of 10-30° to core axsis is present. Minor quartz and chlorite veinlets of the same orientation suggest this particular fracture set was a preferred conduit for fluid flow after pluton crystalization. Reoccuring micaceous clusters ~ 1-2cm² may also contrubute to preferred zones of weakness within the granite as it was noted that mechanical fractures to the core during and post drilling tended to occur conicidently with these clusters. Evidence of groud water flow and oxidation was noted to a depth of 5m. Observed mineralization is limited to trace amounts of pyrite occuring as a crust along a joint plane at 106m.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-7
Date: Feb.28 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0.54	2	2	1.46	73.0	1.3	65.0	RUN1 Box 1 / 0-0.54 loss
2	5	3	3	100.0	2.73	91.0	RUN2 Box 1-2
5	8	3	2.79	93.0	2.73	91.0	RUN3 Box 2
8	11	3	3.07	102.3	2.9	96.7	RUN4 Box 3
11	14	3	2.95	98.3	2.81	93.7	RUN5 Box 3-4
14	17	3	3	100.0	3	100.0	RUN6 Box 4
17	20	3	2.98	99.3	2.98	99.3	RUN7 Box 4-5
20	23	3	3	100.0	2.91	97.0	RUN8 Box 5-6
23	26	3	3	100.0	2.8	93.3	RUN9 Box 6
26	29	3	3	100.0	3	100.0	RUN10 Box 6-7
29	32	3	2.97	99.0	2.97	99.0	RUN11 Box 7-8
32	35	3	2.93	97.7	2.84	94.7	RUN12 Box 8
35	38	3	3.13	104.3	2.96	98.7	RUN13 Box 8-9
38	41	3	3.02	100.7	2.96	98.7	RUN14 Box 9
41	44	3	3	100.0	3	100.0	RUN15 Box 10
44	47	3	3	100.0	2.98	99.3	RUN16 Box 10-11
47	50	3	3	100.0	3	100.0	RUN17 Box 11-12
50	53	3	2.97	99.0	2.95	98.3	RUN18 Box 12
53	56	3	3.04	101.3	3.04	101.3	RUN19 Box 12-13
56	59	3	2.98	99.3	2.98	99.3	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14
62	65	3	3.03	101.0	2.97	99.0	RUN22 Box 15
65	68	3	2.98	99.3	2.98	99.3	RUN23 Box 15-16
68	71	3	3.05	101.7	3.05	101.7	RUN24 Box 16-17
71	74	3	3.06	102.0	3.06	102.0	RUN25 Box 17-18
74	77	3	3.11	103.7	3.11	103.7	RUN26 Box 18
77	80	3	2.88	96.0	2.88	96.0	RUN27 Box 18-19
80	83	3	3.05	101.7	3.05	101.7	RUN28 Box 19
83	86	3	2.95	98.3	2.95	98.3	RUN29 Box 19-20
86	89	3	3.05	101.7	3.05	101.7	RUN30 Box 20-21
89	92	3	2.99	99.7	2.99	99.7	RUN31 Box 21
92	95	3	2.97	99.0	2.97	99.0	RUN32 Box 21-22
95	98	3	3	100.0	3	100.0	RUN33 Box 22-23
98	101	3	3.03	101.0	3.03	101.0	RUN34 Box 23
101	104	3	3.02	100.7	3.02	100.7	RUN35 Box 23-24
104	107	3	3.03	101.0	2.94	98.0	RUN36 Box 24-25
107	110	3	2.98	99.3	2.98	99.3	RUN37 Box 25
110	113	3	3	100.0	3	100.0	RUN38 Box 25-26
113	116	3	3	100.0	3	100.0	RUN39 Box 26-27
116	119	3	3	100.0	3	100.0	RUN40 Box 27
119	120	1	1.14	114.0	1.14	114.0	RUN41 Box 28
	EOH						

PROJECT NAME:	Black Point	LITHOLOGICAL LOG		Collar Survey Data		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION:	68m °Lat	5022750	mN	(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER: BP-7		AZM°:	-90 °Long	644981	mE	: m	DATES:
DATE open: Feb.27 2014		DIP:	120m			% Average Recovery	PAGE: 1 of
DATE closed: March 1 2014		EOH:120m	Drilling Contractor: Logan Drilling Group	NAD 83 Zone 20		% Average RQD	SIGNED:

Description	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fs>10, FxS>20, mf-mechanical fracture)					Veining				Mineralization (v-vein, D- Disseminated, M-massive)			Alteration (P/V/S - 1,2,3)					Notes
(Colour, Texture, Mineralogy, Structure etc.)	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°			Type	mm	v/m	Ơ	Min.	Occ.	Intensity	Type	Occ.	Intensity			
0-0.54m; Core loss/ 0.54-96m; Medium Grained, Equigranular, Micaceous Monzogranite. ~50% Plag, 40% Quartz, 5% Biotite, 5% Muscovite. Selective weak chlorite alteration of Biotite	0	1	MzGr	≈≈≈≈≈≈≈≈	M	Wm	2	5	J	3	90										Chl	S	1			
	1	2	MzGr	≈≈≈≈≈≈≈≈	M	Wm	2	5	J	2	90										Chl	S	1			
	2	3	MzGr	≈≈≈≈≈≈≈≈	M	Wm	2	5	J	2	90										Chl	S	1			
	3	4	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	4	90										Chl	S	1			
0.54-5m; Weak signs of weathering and oxidation (meteoric waters)	4	5	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	90										Chl	S	1			
	5	6	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	6	90										Chl	S	1			
	6	7	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	90										Chl	S	1			
	7	8	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	90										Chl	S	1			
	8	9	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
	9	10	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
	10	11	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	90	40									Chl	S	1			
	11	12	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	90	40									Chl	S	1			
	12	13	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	90										Chl	S	1			
	13	14	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	14	15	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90			QTZ	2	1	70				Chl	S	1			
	15	16	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	40										Chl	S	1			
Micaceous (biotite) Cluster ≤ 1cm	16	17	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0				QTZ	1	1	60				Chl	S	1			
Micaceous (biotite) Cluster 2 cm x 1cm	17	18	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	90										Chl	S	1			
	18	19	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
	19	20	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
Micaceous (biotite) cluster ≤ 1cm	20	21	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	21	22	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
Micaceous (biotite) cluster ≤ 1cm	22	23	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											Chl	S	1			
	23	24	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	24	25	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	25	26	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	26	27	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
	27	28	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	28	29	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	29	30	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	90										Chl	S	1			
	30	31	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	80										Chl	S	1			
	31	32	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											Chl	S	1			
	32	33	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	40										Chl	S	1			
	33	34	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
	34	35	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
35.08-35.17m; weak FeOx staining on joint plane surfaces	35	36	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	30	60									Chl	S	1			
	36	37	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	mf	0											Chl	S	1			
Foliation becoming slightly more pronounced	37	38	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1			
38.26m; K-Spar phenocryst 0.5cm / 38.43m; Biotite Cluster 1cm x 1cm	38	39	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1			
	39	40	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	1	50										Chl	S	1			
	40	41	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr	2	90										Chl	S	1			

	41	42	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	42	43	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr	1	90										Chl	S	1		
	43	44	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	44	45	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
44.0-47.0m; Biotite decreases to 3%	45	46	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr	2	90										Chl	S	1		
	46	47	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
47.32-47.43m Quartz vein	47	48	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	4	55	90		QTZ	1	1	20				Chl	S	1		
	48	49	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	3	40	10									Chl	S	1		
49.36m;Chlorite veinlet cluster / 49.9m; Micaceous cluster 1x2cm	49	50	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J	2	40			Chl	1	3	10				Chl	S	1		
	50	51	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr	2	90										Chl	S	1		
	51	52	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	52	53	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	53	54	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	54	55	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J	1	80										Chl	S	1		
	55	56	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
56m-62m; Muscovite 8% , Biotite 3%	56	57	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	57	58	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	58	59	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
59.53m; Plag phenocryst	59	60	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	60	61	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	Fr	1	80										Chl	S	1		
61.15m; Chloritized biotite clusters / 61.5-62m; Muscovite ≤1%	61	62	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J	1	50										Chl	S	1		
Biotite intensifies to 5%	62	63	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J/Fr	3	40	10									Chl	P	1		
62.6m; Quartz veinlets / 63.85m; Chlorite veinlets	63	64	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	2	40			QTZ / Chl	2	3	20/20				Chl	S	1		
	64	65	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	65	66	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	66	67	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
67.12m; micaceous cluster 2.5 x 0.5cm	67	68	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
68.72 - 69.71m; Quartzhealed fracture 0deg CA	68	69	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	69	70	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	70	71	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	71	72	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	72	73	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	73	74	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	74	75	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J	5	55	20									Chl	S	1		
	75	76	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	J	1	55										Chl	S	1		
	76	77	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	77	78	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	78	79	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	79	80	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	80	81	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	81	82	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	82	83	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	83	84	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	84	85	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	85	86	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
Rare 2cm x 1cm biotite clusters observed on mechanical fractures. Clusters may contribute to zones of weakness	86	87	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
87.7m; Mica cluster 1cm x 1cm	87	88	MzGr	≈≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		

88.1m; Mica cluster 1cm x 1cm	88	89	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
89.6 - 90.3m; Quartz-Chlorite veinlets (healed fractures) 20deg CA	89	90	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				QTZ/CHL	1	>5	20				Chl	S	1		
	90	91	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	2	55										Chl	S	1		
91.43m; Biotite cluster 1cm x 0.5cm	91	92	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
92.9m; Joint surfaces have weak carbonate precipitate on surface, Joints intersect	92	93	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	2	10	60									Chl	S	1		
	93	94	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	94	95	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	95	96	MzGr	≈≈≈≈≈≈≈≈	M	M	1	4.5	mf	0											Chl	S	1		
96.7m; Quartz veinlet / Monzogranite is becoming more potassic with increased K-spar(pink) being observed dominately as plag crystal centers	96	97	MzSyGr	≈X≈X≈X≈	M	M	1	5	mf	0				QTZ	2	1	20				Chl	S	1		
	97	98	MzSyGr	≈X≈X≈X≈	M	M	1	5	mf	0											Chl	S	1		
98m-101m;Plag has become nearly all pink-orange K-spar, enough to call syenogranite. Quartz and mica values remain consistent. Texture is weakly inequigranular with presence of K-spar phenocryts	98	99	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	99	100	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	100	101	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
Plag 40%, Quartz40%, Mica 10-15% Kspar 5-10%	101	102	MzSyGr	≈X≈X≈X≈	M	M	1	5	mf	0											Chl	S	1		
K-spar decreasing but still visable. Rare plag phenocryts	102	103	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	103	104	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
Trace K-spar	104	105	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	105	106	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	4	50	20						pyrite	massive	Trace	Chl	S	1		
	106	107	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	2		25									Chl	S	1		
	107	108	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	108	109	MzSyGr	≈X≈X≈X≈	M	M	1	5	mf	0											Chl	S	1		
	109	110	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	110	111	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	111	112	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	112	113	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
Potassic Monzogranite (Trace K-spar)	113	114	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
114.45m; Quartz-Chlorite healed fracture veinlets	114	115	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr	1	20			QTZ/CHL	1	1	20				Chl	S	1		
	115	116	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	116	117	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
117.08m; K-spar phenocryst	117	118	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
	118	119	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		
EOH	119	120	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl	S	1		

PROJECT NAME:	Black Point					GEOTECHNICAL LOG		Collar Survey Data			LOGGING DETAILS
LICENSE INFORMATION:						ELEVATION:	68m		°Lat	mN	LOGGED BY: P. Dalton
DRILL HOLE:	BP-7					AZM°: 000			°Long	mE	DATES: Feb.28 - Mar.3 2014
DATE COLLARED:	Feb.27 2014					DIP: -90				NAD 83 Zone 20	PAGE: of
DATE COMPLETED:	Mar. 1 2014					EOH: 120m		Drilling Contractor	Logan Drilling Group		SIGNED:

From	To		Rock	Weathering	Total	Fracture	Jointing											Comments
		Rock Type	Strength		Fracture	Type	J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness	Infill/Cement			
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0-2)	
0	1	MzGr	5	2	3	J	1	3			90			1.5				
1	2	MzGr	5	2	2	J	1	2			90			1.5				
2	3	MzGr	5	2	2	J	1	2			90			1.5				
3	4	MzGr	5	1	4	J	1	4			90			1.5				
4	5	MzGr	5	1	3	J	1	3			90			1.5				
5	6	MzGr	5	1	6	J	1	6			90			1.5				
6	7	MzGr	5	1	2	J	1	2			90			1.5				
7	8	MzGr	5	1	3	J	1	3			90			1.5				
8	9	MzGr	5	1	1	J	0.5	1			90			1.5				
9	10	MzGr	5	1	1	J	0.5	1			90			1.5				
10	11	MzGr	5	1	3	J	2				90	40		1.5				
11	12	MzGr	5	1	3	J	2				40	90		1.5				
12	13	MzGr	5	1	2	J	1				90			1.5				
13	14	MzGr	5	1	0	mf												
14	15	MzGr	5	1	1	J	0.5	1			90			1.5				
15	16	MzGr	5	1	3	J/Fr	1.5	2			40	90		1.5				
16	17	MzGr	5	1	0	mf												
17	18	MzGr	5	1	2	J	1	1			90			1.5				
18	19	MzGr	5	1	1	J	0.5	1			90			1.5				
19	20	MzGr	5	1	0	mf												
20	21	MzGr	5	1	0	mf												
21	22	MzGr	5	1	1	J	0.5	1			90			1.5				
22	23	MzGr	5	1	0													
23	24	MzGr	5	1	0	mf												
24	25	MzGr	5	1	0	mf												
25	26	MzGr	5	1	0	mf												
26	27	MzGr	5	1	1	J	0.5	1			90			1.5				
27	28	MzGr	5	1	0	mf												
28	29	MzGr	5	1	0	mf												
29	30	MzGr	5	1	1	J	0.5	1			90			1.5				
30	31	MzGr	5	1	1	J	0.5	1			80			1.5				
31	32	MzGr	5	1	0													
32	33	MzGr	5	1	2	J	1	2			40			3				
33	34	MzGr	5	1	0	mf												
34	35	MzGr	5	1	0	mf												
35	36	MzGr	5	1	3	J	2	1			30	60		3/1.5				
36	37	MzGr	5	1	0	mf												
37	38	MzGr	5	1	0	mf												
38	39	MzGr	5	1	0	mf												
39	40	MzGr	5	1	1	J	1	1			50			3				
40	41	MzGr	5	1	2	Fr					90			3				
41	42	MzGr	5	1	0	mf		1			90			3				
42	43	MzGr	5	1	1	Fr												
43	44	MzGr	5	1	0	mf												
44	45	MzGr	5	1	0	mf												
45	46	MzGr	5	1	2	Fr												
46	47	MzGr	5	1	0	mf												
47	48	MzGr	5	1	4	Fr/J	2	2	2		55	90		1.5				
48	49	MzGr	5	1	3	Fr/J	1.5	2	1		40	10		3				
49	50	MzGr	5	1	2	J	1	2			40			3				
50	51	MzGr	5	1	2	Fr	0.5				90			1.5				
51	52	MzGr	5	1	0	mf												
52	53	MzGr	5	1	0	mf												
53	54	MzGr	5	1	0	mf												
54	55	MzGr	5	1	1	J	0.5	1			80			1.5				
55	56	MzGr	5	1	0	mf												
56	57	MzGr	5	1	0	mf												

57	58	MzGr	5	1	0	mf											
58	59	MzGr	5	1	0	mf											
59	60	MzGr	5	1	0	mf											
60	61	MzGr	5	1	1	Fr	0.5	1			80			3			
61	62	MzGr	5	1	1	J	0.5	1			50			3			
62	63	MzGr	5	1	3	J/Fr	1.5	2	1		40	10		1.5			
63	64	MzGr	5	1	2	mf	0.5	1			40			1.5			
64	65	MzGr	5	1	0	mf											
65	66	MzGr	5	1	0	mf											
66	67	MzGr	5	1	0	mf											
67	68	MzGr	5	1	0	mf											
68	69	MzGr	5	1	0	mf											
69	70	MzGr	5	1	0	mf											
70	71	MzGr	5	1	0	mf											
71	72	MzGr	5	1	0	mf											
72	73	MzGr	5	1	0	mf											
73	74	MzGr	5	1	0	mf											
74	75	MzGr	5	1	5	J	2	3	2		55	20		1.5/3			
75	76	MzGr	5	1	1	J	0.5	1			55			1.5			
76	77	MzGr	5	1	0	mf											
77	78	MzGr	5	1	0	mf											
78	79	MzGr	5	1	0	mf											
79	80	MzGr	5	1	0	mf											
80	81	MzGr	5	1	0	mf											
81	82	MzGr	5	1	0	mf											
82	83	MzGr	5	1	0	mf											
83	84	MzGr	5	1	0	mf											
84	85	MzGr	5	1	0	mf											
85	86	MzGr	5	1	0	mf											
86	87	MzGr	5	1	0	mf											
87	88	MzGr	5	1	0	mf											
88	89	MzGr	5	1	0	mf											
89	90	MzGr	5	1	0	mf											
90	91	MzGr	5	1	2	J	1	2			55			1.5			
91	92	MzGr	5	1	0	mf											
92	93	MzGr	5	1	2	J	2	1	1		10	60		1.5/3			
93	94	MzGr	5	1	0	mf											
94	95	MzGr	5	1	0	mf											
95	96	MzGr	4.5	1	0	mf											
96	97	MzSyGr	5	1	0	mf											
97	98	MzSyGr	5	1	0	mf											
98	99	SyGr	5	1	0	mf											
99	100	SyGr	5	1	0	mf											
100	101	SyGr	5	1	0	mf											
101	102	MzSyGr	5	1	0	mf											
102	103	MzGr	5	1	0	mf											
103	104	MzGr	5	1	0	mf											
104	105	MzGr	5	1	0	mf											
105	106	MzGr	5	1	4	J	2	2	2		50	20		3			
106	107	MzGr	5	1	2	mf	1	2			25			1.5			
107	108	MzGr	5	1	0	mf											
108	109	MzSyGr	5	1	0	mf											
109	110	MzGr	5	1	0	mf											
110	111	MzGr	5	1	0	mf											
111	112	MzGr	5	1	0	mf											
112	113	MzGr	5	1	0	mf											
113	114	MzGr	5	1	0	mf											
114	115	MzGr	5	1	1	Fr	0.5	1			20						
115	116	MzGr	5	1	0	mf											
116	117	MzGr	5	1	0	mf											
117	118	MzGr	5	1	0	mf											
118	119	MzGr	5	1	0	mf											
119	120	MzGr	5	1	0	mf											

Project: Black Point
Drill Hole: BP-7
Date: Feb.28 - March 3

Picture ID/#	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-7-P1	1	0.54	4.93	0 to 0.54 core loss
BP-7-P2	2	4.93	9.34	
BP-7-P3	3	9.34	13.71	
BP-7-P4	4	13.71	18.13	
BP-7-P5	5	18.13	22.56	
BP-7-P6	6	22.56	26.93	
BP-7-P7	7	26.93	31.35	
BP-7-P8	8	31.35	35.84	
BP-7-P9	9	35.84	40.14	
BP-7-P10	10	40.14	44.42	
BP-7-P11	11	44.42	48.81	
BP-7-P12	12	48.81	53.17	
BP-7-P13	13	53.17	57.59	
BP-7-P14	14	57.59	62	
BP-7-P15	15	62	66.39	
BP-7-P16	16	66.39	70.9	
BP-7-P17	17	70.9	75.16	
BP-7-P18	18	75.16	79.44	
BP-7-P19	19	79.44	83.91	
BP-7-P20	20	83.91	88.39	
BP-7-P21	21	88.39	92.68	
BP-7-P22	22	92.68	97.1	
BP-7-P23	23	97.1	101.46	
BP-7-P24	24	101.46	105.86	
BP-7-P25	25	105.86	110.22	
BP-7-P26	26	110.22	114.57	
BP-7-P27	27	114.57	119	
BP-7-P28	28	119	120	EOH

Drill Log Header Sheet

Hole: BP-8

Project	Black Point (6706)
Geologist	Peter Dalton, P.Geo.
Designed By	Vulcan Materials

Commenced	March.2 2014
Completed	March.4 2014
Drill Contractor	Logan Drilling Group
Drill Rig	Duralite 1000N
Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the eastern portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting(m)	645658
Northing(m)	5023133
Elevation(m)	63
Azimuth	0
Dip°	-90
Depth(m)	108
Core Size	NQ
RQD Ave. %	95.30%
RQD % Range	78.5% to 100%
Recovery Ave. %	99.20%
Recovery % Range	82% to 100%
Significant Core loss	0-0.36m

Geological Summary

The lithology of BP-8 is dominated by a medium grained equigranular, micaceous syenogranite to potassic monzogranite. The granite has a pervasive weak to moderate foliation indicated by alignment of biotite and in some cases quartz clasts. Mineralogy consists of 50% (±10%) Feldspar, 40% (±5) Quartz and 7% (±5%) Biotite and ±3% Muscovite. The entire drill hole exhibits weak and selective chlorite alteration of the biotite. An oxidation zone occurs from 0-12m occurring as moderate to intense iron oxide staining associated along joint and fracture planes. Lithological variability within BP-8 occurs over two separate intervals: 20-21m and 34-39m; Both of these intervals represent zones of post crystalline, siliceous fluid flow within the granite body. These intervals are dominated by porphyritic textured quartz/feldspar breccia veins and stockworking. Breccia zone contacts with the syenogranite wall rock are abrupt at 50°CA. Abducted, angular clasts of wall rock and feldspar are visible within a aphanititc, siliceous quartz matrix suggesting a high energy emplacement. Vugs and cavities (3-9cm²) filled with euhedral quartz (1-3mm) associated with these intervals of breccia indicate high fugacity with this event. A pervasive low angle 10-30°CA vein and fracture set occurs throughout the entire hole represented by veins and fractures dominated by a combinations of ±quartz, ±chlorite alteration. Zones of intensified veining tend to exhibit orange iron oxide and limonite staining within vein salvage and joint planes suggesting oxidation of pyrite mineralization. Fresh pyrite mineralization (rare) was observed in trace concentrations along joint planes. Two zones of fault gouge were encountered between 93-95m. Granite from 95m to 108m(EOH) appears very fresh, hard and silicifed with minimal fracture/jointing.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-8
Date: March.4 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0.36	2	2	1.64	82.0	1.57	78.5	RUN1 Box1 /Core Loss 0-0.36
2	5	3	3.11	103.7	2.72	90.7	RUN2 Box 1-2
5	8	3	3.09	103.0	3.09	103.0	RUN3 Box 2-3
8	11	3	3	100.0	2.88	96.0	RUN4 Box 3
11	14	3	2.96	98.7	2.21	73.7	RUN5 Box 3-4
14	17	3	3	100.0	2.93	97.7	RUN6 Box 4
17	20	3	3	100.0	2.7	90.0	RUN7 Box 4-5
20	23	3	2.96	98.7	2.81	93.7	RUN8 Box 5
23	26	3	3	100.0	2.92	97.3	RUN9 Box 6
26	29	3	3	100.0	2.69	89.7	RUN10 Box 7
29	32	3	3	100.0	2.86	95.3	RUN11 Box 7-8
32	35	3	3	100.0	2.97	99.0	RUN12 Box 8-9
35	38	3	3	100.0	2.85	95.0	RUN13 Box 9
38	41	3	3	100.0	2.9	96.7	RUN14 Box 10
41	44	3	3	100.0	2.95	98.3	RUN15 Box 10-11
44	47	3	3	100.0	3	100.0	RUN16 Box 11
47	50	3	2.95	98.3	2.95	98.3	RUN17 Box 12
50	53	3	2.95	98.3	2.95	98.3	RUN18 Box 12-13
53	56	3	3	100.0	3	100.0	RUN19 Box 13
56	59	3	3	100.0	2.93	97.7	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14-15
62	65	3	3	100.0	3	100.0	RUN22 Box 15
65	68	3	3	100.0	3	100.0	RUN23 Box 15-16
68	71	3	3	100.0	3	100.0	RUN24 Box 17
71	74	3	3	100.0	3	100.0	RUN25 Box 17-18
74	77	3	2.98	99.3	2.9	96.7	RUN26 Box 18-19
77	80	3	2.96	98.7	2.96	98.7	RUN27 Box 19-20
80	83	3	3	100.0	2.95	98.3	RUN28 Box 20
83	86	3	3	100.0	2.95	98.3	RUN29 Box 19-20
86	89	3	3	100.0	3	100.0	RUN30 Box 21
89	92	3	3	100.0	2.15	71.7	RUN31 Box 21-22
92	95	3	3	100.0	2.33	77.7	RUN32 Box 22
95	98	3	2.92	97.3	3	100.0	RUN33 Box 22-23
98	101	3	3	100.0	3	100.0	RUN34 Box 23-24
101	104	3	3	100.0	2.92	97.3	RUN35 Box 24
104	107	3	3	100.0	3	100.0	RUN36 Box 24-25
107	108	1	1	100.0	1.06	106.0	RUN37 Box 25
	EOH						

PROJECT NAME:	Black Point (6706)	LITHOLOGICAL LOG		Collar Survey Data		CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION:	63m °Lat	5023133	mN	(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER: BP-8		AZM°:	0 °Long	645658	mE	: m	DATES:
DATE open: March.2 2014		DIP:	-90			% Average Recovery	PAGE: 1 of
DATE closed: March 4 2014		EOH:108m	Drilling Contractor: Logan Drilling Group	NAD 83 Zone 20		% Average RQD	SIGNED:

Description	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fs>10, FxS>20, mf-mechanical fracture)					Veining				Mineralization (v-vein, D- Disseminated, M- massive)			Alteration (P/V/S - 1,2,3)													Notes
(Colour, Texture, Mineralogy, Structure etc.)	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°			Type	mm	v/m	σ	Min.	Occ.	Intensity	Type				Occ.				Intensity					
0-0.36; Core loss/ Equigranular 50% Plag, 40%Quartz, 10% Mica (Biotite Dominant)	0	1	MzSyGr	≈X≈X≈X≈	M	M	2ox	5	J	5	80	30									Chl	FeOx			S	P			1	1				
Moderate FeOx staining giving a slightly orange appearance	1	2	MzSyGr	≈X≈X≈X≈	M	M	2ox	5	J	5	20	50	90								Chl	FeOx			S	S			2	2				
	2	3	MzSyGr	≈X≈X≈X≈	M	M	2ox	4	Fr/J	12	10	90		QTZ	5	5	10-30				Chl	FeOx	Ser	Lim	S	P	P	P	1	2	2	2		
Pervasive 20-30° CA closed fractures sometimes quartz and or chlorite filled	3	4	MzSyGr	≈X≈X≈X≈	M	M	2ox	5	Fr/J	5	30	90		QTZ	1	5	20				Chl	FeOx			S	S			1	2				
>20 closed fractures 20° CA, Quartz/Chlorite filled veins (1-2mm veinlets). FeOx-MnOx staining	4	5	MzSyGr	≈X≈X≈X≈	M	M	2ox	5	Fr/J	15	30	90	30	QTZ	2	>20	20				Chl	FeOx			S/V	P			1	1				
Pervasive and intense Quartz veining 0-10° CA (1-5mm) clay and limonite alteration in Quartz vugs	5	6	MzSyGr	≈X≈X≈X≈	M	W	2ox	5	Fr/J	5				QTZ/CHL	5	>10	0-10				Chl	FeOx	Lim	Clay	S	S	S	S	1	1	1	2		
Intense 10-20° closed fractures and veins (Quartz-Chlorite). Intense FeOx staining of Feldspar	6	7	MzSyGr	≈X≈X≈X≈	M	W	1ox	5	Fr/J	5	70	10		QTZ/CHL	5	>10	10-20				Chl	FeOx			S/V	P			1	2				
7.5m; Quartz vein (5mm)	7	8	MzSyGr	≈X≈X≈X≈	M	Wm	1ox	5	Fr	3	70			QTZ	5	1	10-20				Chl	FeOx			S	P			1	2				
8.5m; Quartz Vein (3mm)	8	9	MzSyGr	≈X≈X≈X≈	M	Wm	1ox	5	J	3	80	35		QTZ	3	1	20				Chl				S/V				1					
	9	10	MzSyGr	≈X≈X≈X≈	M	Wm	1ox	5	J	5	80	50	20	QTZ/CHL	2	>10	20				Chl				S/V				1					
FeOx Staining on joint planes; Pervasive 20° CA closed fracture/veinlets	10	11	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1ox	5	J	4	80	10	20	QTZ/CHL	1	5	20				Chl	FeOx	Lim		S	P	P		1	2	2			
11.2m; Sheeted veinlets and closed fractures 80°CA; FeOx/limonite staining (oxidized pyrite); Fresh pyrite on joint plane	11	12	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1ox	5.5	J	6	80	20		QTZ/CHL	3	3	80	Pyrite	M	T	Chl	FeOx	Lim		S	P	P		1	2	2			
Pervasive closed fractures/ Quartz-Chlorite veinlets 20° CA.	12	13	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	4	70	20		QTZ	5	>10	20				Chl	FeOx	Lim		S				1					
13.3m; Open cavity with euhedral quartz crystals. 13.5m; Open quartz-chlorite veins 10mm thick. Intense hematite and limonite staining associated with QTZ veining suggesting oxidized pyrite	13	14	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	80			QTZ/CHL	10	1	20				Chl				S/V	S	S		1	1	1			
14.05m; trace pyrite on 20°CA joint surface. Rock is hard and silicified	14	15	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	4	20	80		CHL	2	1	20	Pyrite	M	T	Chl				S/V				1					
	15	16	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	1	90										Chl				S				1					
16.2m; Hematite vein (10mm) 90°CA. 16.7m; Hematite vein (3mm) 90°CA. 16.9m; Quartz-Chlorite vein 20°CA (Hematite staining vein salvage)	16	17	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	2	90			HEM / QTZ-CHL	10-3 / 2	2 / 1	90 / 20				Chl	Hem			S	V			1	3				
17.9m; Quartz-Chlorite veinlets 20°CA	17	18	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr	3	90			QTZ-CHL	2	1	20				Chl				S/V				1					
18.2m; Quartz-Chlorite veinlets 20°CA	18	19	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr/J	1	80			QTZ-CHL	2	1	20				Chl				S/V				1					
19.1m and 19.6m; Quartz-Chlorite vein 30° (Heamitite staining halo around Veining) - 19.3m; Kspar phenocryts (rare)	19	20	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr/J	8	80			QTZ-CHL	2	1	30				Chl				S/V				1					
20.5m; Quartz-Chlorite veinlets with associated hemaitite staining; 20.9m to 21.25m Quartz-Kspar porphyritic breccia zone,	20	21	SyGrBx	######	M	W	1	5.5	Fr	5											Chl	QTZ			S/V	P/V			2	2				
	21	22	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr/J	1	40										Chl				S				1					
	22	23	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr/J	3	50	20									Chl				S				1					
	23	24	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	J	2	50										Chl				S				1					
24-24.3m; Quartz vein (2mm) 20°CA; 24.4m FeOx staining on 90°CA fracture	24	25	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr	2	90	10		QTZ	2	1	20				Chl				S				1					
	25	26	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	J	5	70			QTZ	2	5	20				Chl				S				1					
	26	27	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	3	60										Chl				S				1					
27-27.6m; Highly fractured zone stained hematitic	27	28	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	4	50	20		QTZ	20	3	80/50/20				Chl	Clay	FeOx		S	P			1	2				
	28	29	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	70			QTZ	3	1	40				Chl				S				1					
	29	30	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	70			QTZ	2	2	30				Chl				S				1					
	30	31	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	4	70	30		QTZ	5	2	30				Chl				S				1					
31.73m; Clay and Chlorite alteration on planer smooth 50°CA joint surfaces	31	32	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	50	80									Chl	Clay			S	S			1	1				
Hematite staining halos around joint planes	32	33	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	80										Chl				S				1					
Hematite stainig halos around joint planes	33	34	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J/Fr	2	30	70									Chl				S				1					
34-39m; Porphyritic textured Quartz-Feldspar breccia / stockwork zone 50° CA	34	35	SyGrBx	#######	M	Wm	1	5.5	Fr/J	3	30	70									Chl	QTZ			S	P			1	2				
	35	36	SyGrBx	#######	M	W	1	5.5	J/Fr	4	50	60	10								Chl	QTZ			S	P			2	2				
36.9m; 1.5x2cm cavity associated with quartz vein. Euhedral quartz crystal growth and chlorite alteration	36	37	SyGrBx	#######	M	W	1	5.5	J	2	70			QTZ-CHL	3	10	50				Chl	QTZ			S	P			2	2				
Abundant Quartz-Chlorite-clay cavities associated with breccia stockwork intervals	37	38	SyGrBx	#######	M	W	1	5.5	J	1	80										Chl				S				1					
Intense quartz-feldspar breccia stockwork. Angular wallrock fragments in breccia	38	39	SyGrBx	#######	M	W	1	5.5	Fr/J	5	80										Chl	QTZ			S	P			2	2				
	39	40	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	Fr/J	4	30			QTZ	2	5	30				Chl				S				11					
	40	41	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5.5	J	2	60			QTZ-CHL	5	1	20				Chl				S				1					
	41	42	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	40										Chl				S				1					
	42	43	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	30										Chl				S				1					
	43	44	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	30										Chl				S				1					
Mica fraction decrease to ≤5% combined. Plag25%, Kspar25%, Quartz45%, Biotite 2%, muscovite 3%	44	45	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	4	3	70	40	QTZ	1	5	50				Chl				S/V				1					
45.65m; Coarse granined Kspar clasts is QTZ-CHL vein	45	46	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	1				QTZ	1	5	20				Chl				S/V				1					
	46	47	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	50										Chl				S				1					
Biotite increasing to 5-7% with rare Kspar phenocryts	47	48	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	1											Chl				S				1					
	48	49	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J/Fr	2	70	30									Chl				S				1					
	49	50	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0											Chl				S				1					
	50	51	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	80										Chl				S				1					

	51	52	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	80										Chl				S				1					
	52	53	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0											Chl				S				1					
Weakly porphyritic textureed with Kspar phenocryts 1cm²	53	54	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	mf	0											Chl				S				1					
Chlorite on joint surface	54	55	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	J	1	20			QTZ-CHL	1	2	20				Chl				S/V				1					
Rare, euhedral Kspar phenocryts	55	56	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5.5	Fr/J	4	20	40	90								Chl				S				1					
Rare, euhedral Kspar phenocryts and Biotite clusters	56	57	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5	Fr	6	10	80									Chl				S				1					
	57	58	SyGr	≈≈≈≈≈≈≈≈	M	Mw	1	5	Fr	3	80	10	70								Chl				S				1					
	58	59	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr	1	10										Chl				S				1					
	59	60	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	3	70	20		QTZ-CHL	2	2	20				Chl				S				1					
Chlorite-Quartz veinlets and stockworking oriented 10-20°CA. 60.15m; Pyrite mineralization (weak) on 30°CA joint surface	60	61	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	3	70	30		QTZ-CHL	<1	10	10-20	Pyrite	M	1	Chl				S/V				2					
Biotite decrease to 5%	61	62	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				QTZ-CHL	1	1	30				Chl				S				1					
	62	63	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl				S				1					
	63	64	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				CHL	<1	1	30				Chl				S				1					
	64	65	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0				CHL	<1	7	30				Chl				S				1					
	65	66	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	mf	0											Chl				S				1					
	66	67	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	J	2	60	30									Chl				S				1					
	67	68	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/J	2	50	30									Chl				S				1					
Biotite 5-8%	68	69	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	40										Chl				S				1					
	69	70	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	30										Chl				S				1					
Becoming more monzogranitic	70	71	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	10										Chl				S				1					
71.1m; Biotite cluster 5 x 1cm	71	72	MzGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	30			QTZ	5	1	30				Chl				S				1					
	72	73	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	2	20	80									Chl				S				1					
	73	74	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	2	80	30									Chl				S				1					
	74	75	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	80										Chl				S				1					
Rare Kspar Phenocryts	75	76	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	76	77	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	77	78	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	4	80										Chl				S				1					
Mica 5%	78	79	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	40										Chl				S				1					
	79	80	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	70										Chl				S				1					
	80	81	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	90										Chl				S				1					
	81	82	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	mf	0											Chl				S				1					
	82	83	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	2	20	90									Chl				S				1					
	83	84	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J/Fr	3	20	90	30	QTZ-CHL	2	1	0				Chl				S				1					
	84	85	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	3	50	90									Chl				S				1					
85.5m; Biotite cluster 1cm²	85	86	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	30										Chl				S				1					
	86	87	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	3	50	20									Chl				S				1					
	87	88	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr	1	10			QTZ	3	1	10				Chl				S				1					
	88	89	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	1	50										Chl				S				1					
	89	90	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	J	5	70	30									Chl				S				1					
Nearing Fault	90	91	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5.5	Fr/J	7	70	30									Chl	Clay			S	S			1	2				
Nearing Fault	91	92	SyGr	≈≈≈≈≈≈≈≈	M	M	2	5.5	Fr/J	14	50	30									Chl	Clay			S	S			1	2				
	92	93	SyGr	≈≈≈≈≈≈≈≈	M	M	2	5	Fr	10	50	10									Chl	Clay			P	P			2	2				
93.25-93.57 Fault Gouge	93	94	SyGr FG	≈≈≈≈≈≈≈≈	M	M	3	3-5	F	>20	40										Chl	Clay			P	P			3	3				
94.17-94.2 Fault Gouge	94	95	SyGr	≈≈≈≈≈≈≈≈	M	M	1	5	Fr/F	1	70										Chl	Clay			S	S			2	2				
95-108m; Granite appears very fresh and hard, silicified. Mica ≤5%	95	96	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	96	97	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	97	98	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	98	99	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	40																							
	99	100	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J/Fr	3	50	70	10	CHL	2	1	10				Chl				V				1					
	100	101	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr	2	70			CHL-QTZ	2	4	20				Chl	Qtz			V	V			1	1				
	101	102	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	50			CHL-QTZ	2	1	10				Chl	Qtz			V	V			1	1				
	102	103	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	1	50																							
	103	104	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	2	50	70		CHL	≤1	5	20				Chl													
	104	105	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0				CHL-QTZ	3	1	40				Chl	Qtz			V	V			1	1				
	105	106	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	Fr/J	3	50	20	50	CHL	1	3	20				Chl								1					
	106	107	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	mf	0																								
	107	108	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5.5	J	2	60	40																						
EOH	EOH	EOH																																

PROJECT NAME:	Black Point (6706)	GEOTECHNICAL LOG	Collar Survey Data	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION: 63m	°Lat 5023133 mN	LOGGED BY: P. Dalton
DRILL HOLE:	BP-8	AZM°: 000	°Long 0645658 mE	DATES: Mar.4 - Mar.8 2014
DATE COLLARED:	March 2 2014	DIP: -90	NAD 83 Zone 20	PAGE: of
DATE COMPLETED:	March 4 2014	EOH: 108m	Drilling Contractor: Logan Drilling Group	SIGNED:

From	To	Rock Type	Rock Strength	Weathering	Total Fracture	Fracture Type	Jointing								Infill/Cement			Comments
							J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness				
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0-2)	
0	1	MzSyGr	5	2ox	5	J	2	2	3		80	30		3/1.5				0-0.36m core loss
1	2	MzSyGr	5	2ox	5	J	3	2	1	2	20	50	90	3/1.5/3				
2	3	MzSyGr	4	2ox	12	Fr/J	2	3	7		10	90		1.5/3				Highly fractured and broken core. FeOx/MnOx staining
3	4	MzSyGr	5	2ox	5	Fr/J	2	3	2		30	90		1.5/1.5				
4	5	MzSyGr	5	2ox	15	Fr/J	0.5	2	3	>10	30	90	30	1.5				>10 closed fractures
5	6	MzSyGr	5	2ox	5	Fr/J	2	2	3		30	80		1.5				
6	7	MzSyGr	5	1ox	5	Fr/J	1.5	4	1		70	10		3/1.5				
7	8	MzSyGr	5	1ox	3	Fr	1	3			70			1.5				closed fracture 10°CA
8	9	MzSyGr	5	1ox	3	J	2	2	1		80	35		1.5				
9	10	MzSyGr	5	1ox	5	J	3	2	1	1	80	50	20	1.5				
10	11	SyGr	5	1ox	4	J	3	2	1	1	80	10	20	1.5				
11	12	SyGr	5.5	1ox	6	J	2	5	1		80	20		1.5-1				
12	13	SyGr	5.5	1	4	J	2	3	1		70	20		3				
13	14	SyGr	5.5	1	3	Fr/J	1	3			80			1.5				
14	15	SyGr	5.5	1	4	Fr/J	2	2	2		20	80		3				
15	16	SyGr	5.5	1	1	Fr	0.5	1			90			3				
16	17	SyGr	5.5	1	2	Fr	0.5	2			90			3				
17	18	SyGr	5.5	1	3	Fr	0.5	3			90			3				
18	19	SyGr	5.5	1	1	Fr/J	1	1			80			1.5				
19	20	SyGr	5.5	1	8	Fr/J	1	3	4	1	80	30	70	1.5				
20	21	SyGrBx	5.5	1	5	Fr	1	5			70			1.5				
21	22	SyGr	5.5	1	1	Fr/J	0.5	1			40			3				
22	23	SyGr	5.5	1	3	Fr/J	1	2	1		50	20		1.5				
23	24	SyGr	5.5	1	2	J	1	2			50			1.5				
24	25	SyGr	5.5	1	2	Fr	0.5	1	1		90	10		3				
25	26	SyGr	5.5	1	5	J	1	5			70			1.5				
26	27	SyGr	5.5	1	3	J	1	3			60			3				
27	28	SyGr	5.5	1	4	Fr/J	2	2	2		50	20		1.5				All fractures occur from 27.0-27.6m
28	29	SyGr	5.5	1	3	Fr/J	1	3			70			1.5				
29	30	SyGr	5.5	1	3	Fr/J	1	3			70			3				
30	31	SyGr	5.5	1	4	J	2	3	1		70	30		3/1.5				
31	32	SyGr	5.5	1	3	Fr/J	2	2	1		50	80		1/3				
32	33	SyGr	5.5	1	1	J	0.5	1			80			3				
33	34	SyGr	5.5	1	2	J/Fr	0.5	1	1		30	70		1.5				
34	35	SyGrBx	5.5	1	3	Fr/J	2	2	1		30	70		3/1.5				
35	36	SyGrBx	5.5	1	4	J/Fr	1	3	1		50	60	10	3				
36	37	SyGrBx	5.5	1	2	J	1	2			70			3				
37	38	SyGrBx	5.5	1	1	J	0.5	1			80			3				
38	39	SyGrBx	5.5	1	5	Fr/J	0.5	5			80			1.5				
39	40	SyGr	5.5	1	4	Fr/J	1.5	2	2		30	80		1.5				
40	41	SyGr	5.5	1	2	J	1	2			60			1.5				
41	42	SyGr	5	1	2	J	1	2			40			3				
42	43	SyGr	5	1	2	J	1	2			30			1.5				
43	44	SyGr	5	1	1	J	0.1	1			30			3				
44	45	SyGr	5.5	1	4	J	1	3	1		70	40		3				
45	46	SyGr	5.5	1	1	Fr	1				90			1.5				
46	47	SyGr	5.5	1	1	J	0.5	1			50			3				
47	48	SyGr	5.5	1	1	Fr	0.5	1			80			3				
48	49	SyGr	5.5	1	2	J/Fr	0.5	1	1		70	30		3				
49	50	SyGr	5.5	1	0	mf								1.5				
50	51	SyGr	5.5	1	1	J	0.5	1			80			1.5				
51	52	SyGr	5.5	1	1	J	0.5	1			80			1.5				
52	53	SyGr	5.5	1	0	mf												
53	54	SyGr	5.5	1	0	mf								1.5				
54	55	SyGr	5.5	1	1	J	0.5	1			20			1.5				
55	56	SyGr	5.5	1	4	Fr/J	0.5	2	1	1	20	40	90	1.5				
56	57	SyGr	5	1	6	Fr	2	2	4		10	80		1.5				Low angle fracturing
57	58	SyGr	5	1	3	Fr	0.5	1	1	1	80	10	70	3				
58	59	SyGr	5	1	1	Fr	0.5	1			10			3				

59	60	SyGr	5	1	3	Fr/J	1	2	1		70	20		3				
60	61	SyGr	5	1	3	Fr/J	1	2	1		70	30		3				
61	62	SyGr	5	1	0	mf												
62	63	SyGr	5	1	0	mf												
63	64	SyGr	5	1	0	mf												
64	65	SyGr	5	1	0	mf												
65	66	SyGr	5	1	0	mf								1.5				
66	67	SyGr	5	1	2	J	0.5	1	1		60	30		1.5				
67	68	SyGr	5	1	2	Fr/J	0.5	1	1		50	30		1.5				
68	69	SyGr	5.5	1	1	J	0.5	1			40			3				
69	70	SyGr	5.5	1	1	Fr	0.5				30			3				
70	71	SyGr	5.5	1	1	Fr	0.5	1			10			1				
71	72	MzGr	5.5	1	1	J	0.5	1			30			3				Smooth joint surface along quartz vein
72	73	SyGr	5.5	1	2	Fr/J	0.5	1	1		20	80		1.5				
73	74	SyGr	5.5	1	2	Fr/J	0.5	1	1		80	30		1.5				
74	75	SyGr	5.5	1	1	J	0.5	1			80			1.5				
75	76	SyGr	5.5	1	0	mf												
76	77	SyGr	5.5	1	0	mf												
77	78	SyGr	5.5	1	4	J	1	4			80			1.5				
78	79	SyGr	5.5	1	1	Fr	0.5		1		40			3				
79	80	SyGr	5.5	1	1	J	0.5	1			70			3				
80	81	SyGr	5.5	1	1	Fr	0.5	1			90			3				
81	82	SyGr	5.5	1	0	mf												
82	83	SyGr	5.5	1	2	J	0.5	1	1		20	90		1.5				
83	84	SyGr	5.5	1	3	J/Fr	0.5	1	1	1	20	90	30	1.5				
84	85	SyGr	5.5	1	3	J	1	2	1		50	90		1.5				
85	86	SyGr	5.5	1	1	J	0.5	1			30			1.5				
86	87	SyGr	5.5	1	3	Fr/J	1	2	1		50	20		1.5				
87	88	SyGr	5.5	1	1	Fr	1	1			10			1.5				
88	89	SyGr	5.5	1	1	J	0.5	1			50			3				
89	90	SyGr	5.5	1	5	J	2	4	1		70	30		1.5				
90	91	SyGr	5.5	1	7	Fr/J	2	5	2		70	30		3				
91	92	SyGr	5.5	2	14	Fr/J	1	12	2		50	30		3				
92	93	SyGr	5	2	10	Fr	0.5	10			50	10		3				
93	94	SyGr FG	3-5	3	>20	F	0.5	20			40	90		3				Fault Gouge
94	95	SyGr	5	1	1	Fr/F	0.5	1			70			1.5				
95	96	SyGr	5.5	1	0	mf												
96	97	SyGr	5.5	1	0	mf												
97	98	SyGr	5.5	1	0	mf												
98	99	SyGr	5.5	1	1	J	0.5	1			40			1.5				
99	100	SyGr	5.5	1	3	J/Fr	0.5	1	1	1	50	70	10	1.5				
100	101	SyGr	5.5	1	2	Fr	0.5	2			70			3				
101	102	SyGr	5.5	1	1	J	0.5	1			50			1.5				
102	103	SyGr	5.5	1	1	J	0.5	1			50			1.5				
103	104	SyGr	5.5	1	2	J	0.5	1	1		50	70		1.5				
104	105	SyGr	5.5	1	0	mf												
105	106	SyGr	5.5	1	3	Fr/J	0.5	1	1	1	90	20	50	3/1.5				
106	107	SyGr	5.5	1	0	mf												
107	108	SyGr	5.5	1	2	J	0.5	1	1		60	40		3				
	EOH																	

Project: Black Point
Drill Hole: BP-8
Date: March 5- 8 2014

Picture ID/#	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-8-P1	1	0.36	4.63	0-0.36m core loss
BP-8-P2	2	4.63	8.66	
BP-8-P3	3	8.66	13	
BP-8-P4	4	13	17.29	
BP-8-P5	5	17.29	21.48	
BP-8-P6	6	21.48	25.96	
BP-8-P7	7	25.96	30.3	
BP-8-P8	8	30.3	34.74	
BP-8-P9	9	34.74	39.04	
BP-8-P10	10	39.04	43.54	
BP-8-P11	11	43.54	47.76	
BP-8-P12	12	47.76	52.32	
BP-8-P13	13	52.32	56.6	
BP-8-P14	14	56.6	60.96	
BP-8-P15	15	60.96	65.24	
BP-8-P16	16	65.24	69.61	
BP-8-P17	17	69.61	73.87	
BP-8-P18	18	73.87	78.18	
BP-8-P19	19	78.18	82.55	
BP-8-P20	20	82.55	86.72	
BP-8-P21	21	86.72	91.18	
BP-8-P22	22	91.18	95.28	
BP-8-P23	23	95.28	99.85	
BP-8-P24	24	99.85	104.13	
BP-8-P25	25	104.13	108	EOH

Drill Log Header Sheet

Hole: BP-9

Project	Black Point (6706)
Geologist	Peter Dalton, P.Geo.
Designed By	Vulcan Materials

Commenced	March.6 2014
Completed	March.8 2014
Drill Contractor	Logan Drilling Group
Drill Rig	Duralite 1000N
Drill Foreman	Andy McGinnis

Objective

Geological confirmation of the northwest portion of the projected Black Point granitic resource.

Location and Collar Detail

Datum	UTM NAD 83 Zone 20
Easting(m)	644665
Northing(m)	5023542
Elevation(m)	84
Azimuth	0
Dip°	-90
Depth(m)	130.13
Core Size	NQ
RQD Ave. %	96.80%
RQD % Range	47% - 100%
Recovery Ave. %	98.70%
Recovery % Range	57% - 100%
Significant Core loss	0-0.8 m

Geological Summary

The lithology of BP-9 is dominated by a medium grained equigranular, micaceous syenogranite to potassic monzogranite. The granite has a pervasive weak to moderate foliation indicated by alignment of biotite. Mineralogy consists of 50% (±10%) Feldspar, 40% (±5) Quartz and 7% (±5%) Biotite and ±3% Muscovite. The entire drill hole exhibits weak and selective chlorite alteration of biotite. Lithological variability within BP-9 occurs over two separate intervals: 9-11m and 27-30m; Both of these intervals represent zones of highly silicified quartz-chlorite-feldspar porphyritic breccia (60-70% quartz and feldspar phenocryts within an aphanitic quartz and chlorite matrix). Reoccurring low angle 5-30°CA vein and fracture sets dominated by combinations of ±quartz, ±chlorite alteration exist throughout the entire hole. The presence of iron oxide and limonite on various joint and fracture planes indicate the presence of oxidized pyrite. Rare, trace to weak intensity fresh pyrite mineralization was observed on various joint planes. Fault gouge was encountered between 20.32-20.72m. Granite from 102m to 130m(EOH) exhibits minimal fracture/jointing.

Drill Core Recovery and RQD Sheet

Project: Black Point
Drill Hole: BP-9
Date: March.9 2014

From (m)	To (m)	Drilled (m)	Recieved (m)	Recovery (%)	RQD (m)	RQD (%)	Comments
0	2	2	1.14	57.0	0.94	47.0	RUN1 Box1/ 0-0.8m Core Loss
2	5	3	3	100.0	3	100.0	RUN2 Box 1
5	8	3	2.93	97.7	2.64	88.0	RUN3 Box 2
8	11	3	2.97	99.0	2.92	97.3	RUN4 Box 2-3
11	14	3	3	100.0	2.9	96.7	RUN5 Box 3-4
14	17	3	3	100.0	2.76	92.0	RUN6 Box 4
17	20	3	3	100.0	2.83	94.3	RUN7 Box 4-5
20	23	3	2.97	99.0	2.47	82.3	RUN8 Box 5-6
23	26	3	3	100.0	2.8	93.3	RUN9 Box 6
26	29	3	3	100.0	3	100.0	RUN10 Box 6-7
29	32	3	3	100.0	3	100.0	RUN11 Box 7-8
32	35	3	3	100.0	3	100.0	RUN12 Box 8
35	38	3	3	100.0	3	100.0	RUN13 Box 9
38	41	3	3	100.0	2.91	97.0	RUN14 Box 9-10
41	44	3	3	100.0	3	100.0	RUN15 Box 10-11
44	47	3	3	100.0	2.93	97.7	RUN16 Box 11
47	50	3	3	100.0	3	100.0	RUN17 Box 11-12
50	53	3	3	100.0	2.98	99.3	RUN18 Box 12
53	56	3	2.96	98.7	2.96	98.7	RUN19 Box 13
56	59	3	3	100.0	3	100.0	RUN20 Box 13-14
59	62	3	3	100.0	3	100.0	RUN21 Box 14-15
62	65	3	3	100.0	3	100.0	RUN22 Box 15
65	68	3	3	100.0	2.9	96.7	RUN23 Box 15-16
68	71	3	3.08	102.7	3.08	102.7	RUN24 Box 16-17
71	74	3	3.06	102.0	2.86	95.3	RUN25 Box 17
74	77	3	2.95	98.3	2.95	98.3	RUN26 Box 18
77	80	3	2.96	98.7	2.93	97.7	RUN27 Box 18-19
80	83	3	3.12	104.0	3.12	104.0	RUN28 Box 19
83	86	3	2.95	98.3	2.95	98.3	RUN29 Box 20
86	89	3	3	100.0	2.9	96.7	RUN30 Box 20-21
89	92	3	3	100.0	2.65	88.3	RUN31 Box 21-22
92	95	3	3	100.0	3	100.0	RUN32 Box 22
95	98	3	3	100.0	2.92	97.3	RUN33 Box 22-23
98	101	3	2.95	98.3	2.95	98.3	RUN34 Box 23-24
101	104	3	3	100.0	2.89	96.3	RUN35 Box 24
104	107	3	3	100.0	3	100.0	RUN36 Box 25
107	110	3	3	100.0	3	100.0	RUN37 Box 25-26
110	113	3	3	100.0	3	100.0	RUN38 Box 26-27
113	116	3	3	100.0	3	100.0	RUN39 Box 27
116	119	3	2.95	98.3	2.95	98.3	RUN40 Box 27-28
119	122	3	2.96	98.7	2.96	98.7	RUN41 Box 28
122	125	3	3.05	101.7	3.05	101.7	RUN42 Box 29
125	128	3	3	100.0	3	100.0	RUN43 Box 29-30
128	130.13	2	2.13	106.5	2.13	106.5	RUN44 Box 30
EOH	EOH						

PROJECT NAME:	Black Point (6706)	LITHOLOGICAL LOG	Collar Survey Data	CORE TYPE (Q)	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION: 84m °Lat	5023133 mN	(P / H / N / B)	LOGGED BY: P.Dalton
DRILL HOLE NUMBER:	BP-9	AZM°: 0 °Long	645658 mE	: m	DATES:
DATE open:	March.6 2014	DIP: -90		% Average Recovery	PAGE: 1 of
DATE closed:	March.8 2014	EOH:130m	Drilling Contractor: Logan Drilling Group NAD 83 Zone 20	% Average RQD	SIGNED:

Description	From	To	Code	Graphic	Grain Size	Foliation	Weather	Strength	Structure (J-Joint F-Fault, Bx-Breccia, Fr- fracture, Fs>10, FxS>20, mf-mechanical fracture)					Veining				Mineralization (v-vein, D- Disseminated, M-massive)			Alteration (P/V/S - 1,2,3)												Notes
(Colour, Texture, Mineralogy, Structure etc.)	m	m			(F/M/C/P)	(Null/W/M/S)	W(1-6)	(R 0-6)	Type	F/m	α°			Type	mm	v/m	α	Min.	Occ.	Intensity	Type				Occ.				Intensity				
0-0.8m; Core loss	0	2	SyGr	≈≈≈≈≈≈≈≈	M	Wm	2	5	Fr	4	10	80		CHL	1	1	10				CHL	FeOx			S	S			1				
Syenogranite, equigranular: 40% Kspar, 40% Quartz, 10% Plag, 10% Mica (biotite dominant. FeOx staining on	2	3	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr/J	5	80	10									CHL	FeOx			S	S			1	1			
	3	4	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	10										CHL				S				1				
rare Kspar phenocryts	4	5	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr	1	80			CHL	1	1	10				CHL				S/V				1				
5.35m; Quartz-Feldspar breccia vein 5°CA. Oxidized pyrite (FeOx and Limonite) on fracture surfaces.	5	6	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr/J	7	80	5		CHL-QTZ	5	1	5				CHL	FeOx	Lim		S	S	S		1	1	1		
FeOx on fracture Surface	6	7	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr	3	80	60	10	CHL	1	6	5-10				CHL				S/V				1				
FeOx on fracture Surface	7	8	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	20	80		CHL	2	3	5-10				CHL	FeOx	Lim	Ser	S	S	s		1	2	2	2	
Chlorite veinlets and fracture fill 10°CA	8	9	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	4	30	10		CHL	1	6	10				CHL				S				1				
9.0m; 20°CA joint marks transition to new lithology (QTZ-CHL-Feldspar Breccia) Porphyritic texture	9	10	Bx	XXXXXXXX	M	Wm	1	5	J	5											CHL	Qtz			P	P			2	3			
	10	11	Bx	XXXXXXXX	Fm	null	1	5	Fr/J	1	30										CHL	Qtz			P	P			2	3			
Mica ≤ 5% (Chloritized biotite)	11	12	SyGr	≈≈≈≈≈≈≈≈	Fm	null	1	5	J	1	70			CHL	2	3	0				CHL				P				2				
	12	13	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr	3	80	30		CHL	2	5	20				CHL				P				2				
	13	14	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	30			CHL	1	3	20				CHL				P/V				1				
	14	15	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr	7	80	50		QTZ	1	1	0				CHL				S				1				
	15	16	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	3	80	5									CHL				S				1				
	16	17	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J/Fr	3	50	10	30	QTZ-CHL	20	1	30				CHL				P				2				
	17	18	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr	0				QTZ	2	1	20				CHL				S				1				
	18	19	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	40			CHL	1	2	20				CHL				S/V				2				
19.15m-19.2m; QTZ-Feldspar Breccia. FeOx, Sericite on fracture Surface	19	20	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	5	30	70	5								CHL	Qtz			P	P			2	2			
20.32m-20.72m; Fault Zone rubble, surfacesof rubble are smooth and slick. FeOx on Fracture Surfaces	20	21	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr/J	>20	10	90	FxS								CHL	FeOx			S	S			2	2			
FeOx and Sericite on Fracture Surfaces	21	22	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	5	60	80		CHL	2	1	10				CHL	FeOx	Ser		S	S			1	1	1		
Prone to fracture on 20°-30° CA Plane.	22	23	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	6	60	70	30	CHL	1	2	30				CHL				S				1				
	23	24	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	60	20									CHL				S				1				
24.63m-24.84m Fault rubble	24	25	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J/F	>20	80	20	Fx								CHL	FeOx	Ser		S	S			1	2	1		
	25	26	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr/J	6	80	5									CHL	FeOx			S	S			1	1			
26.45m-30.6m; Abundant low angle (0-5°CA) closed fracturing: Chlorite, FeOx and silicified	26	27	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J/Fr	4	80	5									CHL	Qtz	FeOx		P	P	P		2	2	2		
	27	28	Bx	XXXXXXXX	M	Null	1	5	Fr	5	10	70		QTZ-CHL	<1	>10	5				CHL	FeOx	Qtz		P	P	P		2	2	2		
Trace pyrite on 5-10°CA fracture surface	28	29	Bx	XXXXXXXX	M	Null	1	5	Fr	3	10	5						Pyrite	M	Trace	CHL	FeOx	Qtz		P	P	P		2	2	2		
Quartz-Chlorite veinlet stockworking and breccia	29	30	Bx	XXXXXXXX	M	W	1	5	Fr/J	4	70	90		QTZ-CHL	5	3	10				CHL	Qtz			P/V	P/V			2	2			
30.0m-30.45m; Chlorite veinlets	30	31	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	90	40		CHL	<1	4	40				CHL				S/V				1				
	31	32	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		2				CHL	<1	2	0				CHL				S				1				
	32	33	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0				CHL	2	2	0				CHL				S				1				
	33	34	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	4	30	90									CHL				S				1				
	34	35	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
	35	36	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr/J	5	40	3		QTZ	2	1	5				CHL				S				1				
	36	37	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	J/Fr	3	40	5		QTZ-CHL	3	1	10				CHL	Qtz			S/V	V			1				
	37	38	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	J/Fr	3	40	5		QTZ-CHL	2	2	5				CHL	Qtz			S/V	V			2	2			
	38	39	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	J/Fr	4	80	20		QTZ-CHL	1	2	5				CHL	Qtz			S/V	V			2	2			
	39	40	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	J/Fr	5	40	80		QTZ-CHL	2	4	0				CHL	Qtz			S/V	V			2	2			
40.15m; Quartz-Chlorite breccia and stockworking veins	40	41	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	Fr/J	2	40	80		QTZ-CHL	15	1	30				CHL	Qtz			S/V	V			2	2			
41.5m; becoming slightly monzogranitic	41	42	SyGr	≈≈≈≈≈≈≈≈	M	Wnull	1	5	Fr/J	1	20										CHL				S				1				
	42	43	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	30										CHL				S				1				
	43	44	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	5										CHL				S				1				
	44	45	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr	2	60	40									CHL				S				1				
	45	46	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J/Fr	2	40										CHL				S				1				
	46	47	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	40										CHL				S				1				
Monzogranitic with orange FeOx with pervasive FeOx staining	47	48	MzGr	≈≈≈≈≈≈≈≈	M	W	1	5	J/Fr	4	60	5	90	QTZ-CHL	6	1	5				CHL				S				1				
	48	49	MzGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr/J	2	90	10									CHL				S				1				
	49	50	MzGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	60										CHL				S				1				
	50	51	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	90										CHL				S				1				
51.8m; Schistous xenolith 1cm x 4cm coincident with 90°CA joint	51	52	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	90										CHL				S				1				
small (1-3cm long) discontinuous chlorite veinlets	52	53	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0				CHL	1	5	0				CHL				S				1				
	53	54	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
	54	55	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	55	56	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	20										CHL				S				1				
	56	57	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	20										CHL				S				1				
57.7m; Transition to monzogranite	57	58	SyMzGr	≈X≈X≈X≈	M	Wm	1	5	J	4	40	60	90								CHL				S				1				
58.5m; FeOx staining on 90°CA Joint Plane	58	59	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	90	20	50								CHL				S				1				
	59	60	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	30										CHL				S				1				
	60	61	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
	61	62	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	4	40	30	70								CHL				S				1				
	62	63	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	20										CHL				S				1				
	63	64	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	20			CHL	2	1	0				CHL				S/V				1				
	64	65	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	80			CHL	2	1	0				CHL				S/V				1				
FeOx/Sericite on joint planes	65	66	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	7	20	90	60	QTZ-CHL	3	1	40				CHL	FeOx	Ser		S	S	S		1	1	1		
rare Kspar phenocryts, 66.95m; Quartz phenocryts 1cm^2	66	67	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	70	30									CHL				S				1				
67.4-71m; Abundant Kspar, potassic	67	68	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	70			QTZ-CHL	2	1	30				CHL				S				1				
68.44m; Biotite cluster 3cm x 1cm	68	69	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	70										CHL				S				1				
	69	70	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	40	30									CHL				S				1				
	70	71	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	60			QTZ-CHL	3	2	40				CHL				S				1				
	71	72	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	20	60		CHL	<1	2	30				CHL				S				1				
	72	73	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		4				CHL	<1	2	30				CHL				S				1				
	73	74	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0				QTZ	3	1	30				CHL				S				1				
	74	75	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	75	76	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0				QTZ-CHL	1	1	20				CHL				S				1				
Biotite clusters 1cm^2 @ 76.35, 76.50 and 76.70m	76	77	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	77	78	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr	2	5	90									CHL				S				1				
	78	79	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	79	80	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	90										CHL				S				1				
Monzogranititc	80	81	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	20										CHL				S				1				
	81	82	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	40										CHL				S				1				
FeOx and Sericite on 40° CA joint plane	82	83	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	4	20	40									CHL	FeOx	Ser		S	S	S		1	1	1		
83.72m; Biotite cluster 1cm^2	83	84	MzSyGr	≈X≈X≈X≈	M	Wm	1	5	J	1	60										CHL				S				1				
84.8m; Biotite Cluster 1cm^2	84	85	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	10	80									CHL				S				1				
Trace pyrite on 20°CA joint plane surface	85	86	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	20							Pyrite	M	trace	CHL				S				1				
Trace pyrite on 10° CA joint plane surface, Mica 3%	86	87	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	7	10	40	20					Pyrite	M	trace	CHL				S				1				
	87	88	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	4	80	20									CHL				S				1				

88.5m; Xenolith 2cm x 2cm	88	89	MzSyGr	≈X≈X≈X≈	M	Wm	1	5	J	3	40	80									CHL				S				1				
	89	90	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	Fr/J	6	20	80	40								CHL				S				1				
	90	91	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	4	90										CHL				S				1				
	91	92	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	6	80										CHL				S				1				
	92	93	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	50										CHL				S				1				
	93	94	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	40	30		CHL	<1	2	50				CHL				S				1				
94.3m, 94.94; Biotite Cluster 1cm^2	94	95	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	50	70									CHL				S				1				
	95	96	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	5	50	20		CHL	<1	6	50				CHL				S/V				1				
	96	97	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		3	30			CHL	<1	7	30				CHL				S/V				1				
	97	98	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		4	20	50	90	CHL	1	8	30				CHL				S/V				1				
Trace pyrite on 30°CA joint plane	98	99	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	30	60						Pyrite	M	trace	CHL				S				1				
	99	100	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	80	50									CHL				S				1				
101.3m; Slickenside 40°CA joint plane	100	101	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	2	80	40		CHL	<1	3	40				CHL				S				1				
Weak pyrite mineralization on 5°CA fracture	101	102	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J/Fr	4	50	30						Pyrite	M	1	CHL				S				1				
	102	103	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	40										CHL				S				1				
	103	104	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	Fr	1	5										CHL				S				1				
	104	105	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	10										CHL				S				1				
105.02m; Biotite Cluster 1cm^2	105	106	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0				CHL	3	1	10				CHL				S				1				
	106	107	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
	107	108	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S/V				1				
	108	109	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	40			QTZ-CHL	3	1	40				CHL				S				1				
Rare Kspar Phenocryts	109	110	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	110	111	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	40										CHL				S				1				
	111	112	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0				QTZ	3	1	50				CHL				S/V				1				
Mica 3-5%	112	113	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
	113	114	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S				1				
114.77 Biotite cluster 1cm^2	114	115	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	1	10										CHL				S/V				1				
	115	116	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		1											CHL				S/V				1				
	116	117	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	30										CHL				S/V				1				
	117	118	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5		0											CHL				S/V				1				
	118	119	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	40	30									CHL				S/V				1				
	119	120	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	2	40	70									CHL				S				1				
	120	121	SyGr	≈≈≈≈≈≈≈≈	M	W	1	5	J	5	40	30	50								CHL				S/V				1				
	121	122	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	1	30										CHL				S/V				1				
	122	123	MzGr	≈≈≈≈≈≈≈≈	M	Wm	1	5	J	3	40										CHL				S				1				
	123	124	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S/V				1				
	124	125	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	125	126	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	126	127	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S/V				1				
127.18m; 1cm x 2cm Schistous xenolith	127	128	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	128	129	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				
	129	130	SyGr	≈≈≈≈≈≈≈≈	M	Wm	1	5		0											CHL				S				1				

PROJECT NAME:	Black Point (6706)	GEOTECHNICAL LOG	Collar Survey Data	LOGGING DETAILS
LICENSE INFORMATION:		ELEVATION: 84m	°Lat	LOGGED BY: P. Dalton
DRILL HOLE:	BP-9	AZM°: 000	°Long	DATES:
DATE COLLARED:	March 6 2014	DIP: -90	NAD 83 Zone 20	PAGE: of
DATE COMPLETED:	March 8 2014	EOH: 130.13m	Drilling Contractor: Logan Drilling Group	SIGNED:

From	To		Rock	Weathering			Jointing											
		Rock Type	Streng		Total Fracture	Fracture Type	J set	λ/m	λ/m	λ/m	α°	α°	α°	J roughness	Infill/Cement			Comments
m	m	Litho Code	R(0-6)	(1-6)	(/m)		0.5-20	set1	set2	set3	set1	set2	set3	0.5-5	Comp.	Width (mm	Strength (0	
0	2	SyGr	5	2	4	Fr	2	2	2		10	80		3				
2	3	SyGr	5	1	5	Fr/J	1.5	4	1		80	10		3				
3	4	SyGr	5	1	1	J	0.5	1			10			1.5				
4	5	SyGr	5	1	1	Fr	0.5	1			80			3				
5	6	SyGr	5	1	7	Fr/J	1.5	6	1		80	5		3				
6	7	SyGr	5	1	3	Fr	0.5	1	1	1	80	60	10	3				
7	8	SyGr	5	1	3	J	1.5	2	1		20	80		1.5				
8	9	SyGr	5	1	4	J	1.5	3	1		30	10		1.5/3				
9	10	Bx	5	1	5	Fr/J	2	3	2					3/1.5				
10	11	Bx	5	1	1	J	0.5	1			30			1.5				
11	12	SyGr	5	1	1	Fr	0.5	1	2		70			3				
12	13	SyGr	5	1	3	J	1.5	1			80	30		1.5				
13	14	SyGr	5	1	2	Fr	1	2			30			1.5				
14	15	SyGr	5	1	7	J	1.5	6	1		80	50		1.5				
15	16	SyGr	5	1	3	J/Fr	1.5	2	1		80	5		3				
16	17	SyGr	5	1	3	Fr	0.5	1	1	1	50	10	30	3/1.5				
17	18	SyGr	5	1	0													
18	19	SyGr	5	1	1	J	0.5	1			40			3				
19	20	SyGr	5	1	5	Fr/J	2.5	2	2	1	30	70	5	1.5/3				
20	21	SyGr	5	1	>20	Fx/Fr/J	1.5	2	>20		10	90	FxS	1.5-1				Fault Rubble 20.32-20.72m
21	22	SyGr	5	1	5	J	2	2	3		60	80		3				
22	23	SyGr	5	1	6	F	1.5	4	1	1	60	70	30	1.5				Closed fractures @ 30°CA
23	24	SyGr	5	1	2	J	0.5	1	1		60	20		1.5/2				
24	25	SyGr	5	1	>20	J/Fs/F	1.5	4	1	>20	80	20	Fx	1.5/2/3				Fault Rubble 24.63-24.84m
25	26	SyGr	5	1	6	Fr/J	1.5	5	1		80	5		1.5/3				
26	27	SyGr	5	1	4	J/Fr	1.5	3	1		80	5		3				
27	28	Bx	5	1	5	Fr/J	2	2	3		10	70		3-Jan				
28	29	Bx	5	1	3	Fr	0.5	2	1		10	5		3				
29	30	Bx	5	1	4	Fr/J	1.5	2	1	1	70	90		1.5/3				
30	31	SyGr	5	1	2	J	0.5	1	1		90	40		3				
31	32	SyGr	5	1	2													
32	33	SyGr	5	1	0													
33	34	SyGr	5	1	4	J	1.5	3	1		30	90		3				
34	35	SyGr	5	1	0													
35	36	SyGr	5	1	5	Fr/J	1.5	2	3		40	3		1.5				
36	37	SyGr	5	1	3	J/Fr	1.5	2	1		40	5		1.5				
37	38	SyGr	5	1	3	J/Fr	1.5	2	1		40	5		1.5				
38	39	SyGr	5	1	4	J/Fr	1.5	1	3		80	20		1.5				
39	40	SyGr	5	1	5	Fr/J	2	3	2		40	80		1.5				
40	41	SyGr	5	1	2	Fr/J	1.5	2	1		40	80		1.5				
41	42	SyGr	5	1	1	J	0.5	1			20			1.5				
42	43	SyGr			1	J	0.5	1			30			1.5				
43	44	SyGr			1	Fr	0.5	1			5			2				
44	45	SyGr			2	J/Fr	0.5	1	1		60	40		1.5				
45	46	SyGr			2	J	1	2			40			1.5				
46	47	SyGr			1	Fr	0.5	1			40			1.5				
47	48	MzGr			4	J/Fr	1.5	2	1	1	60	5	90	3				
48	49	MzGr			2	Fr/J	0.5	1	1		90	10		3				
49	50	MzGr			1	J	0.5	1			60			3				
50	51	SyGr			2	J	1	2			90			3				
51	52	SyGr			1	J	0.5	1			90			3				
52	53	SyGr			0													
53	54	SyGr			0													
54	55	SyGr			0													
55	56	SyGr			1	J	0.5	1			20			1.5				
56	57	SyGr			2	J	0.5	1	1		20			1.5				
57	58	SyMzGr			4	J	1.5	2	1	1	40	60	90	1.5				
58	59	MzGr			3	J	0.5	1	1		90	20	50	1.5				
59	60	SyGr			3	J	1	3			30			1.5				
60	61	SyGr			0													
61	62	SyGr			4	J	1.5	1	2	1	40	30	70	1.5				
62	63	SyGr			1	J	0.5	1			20							

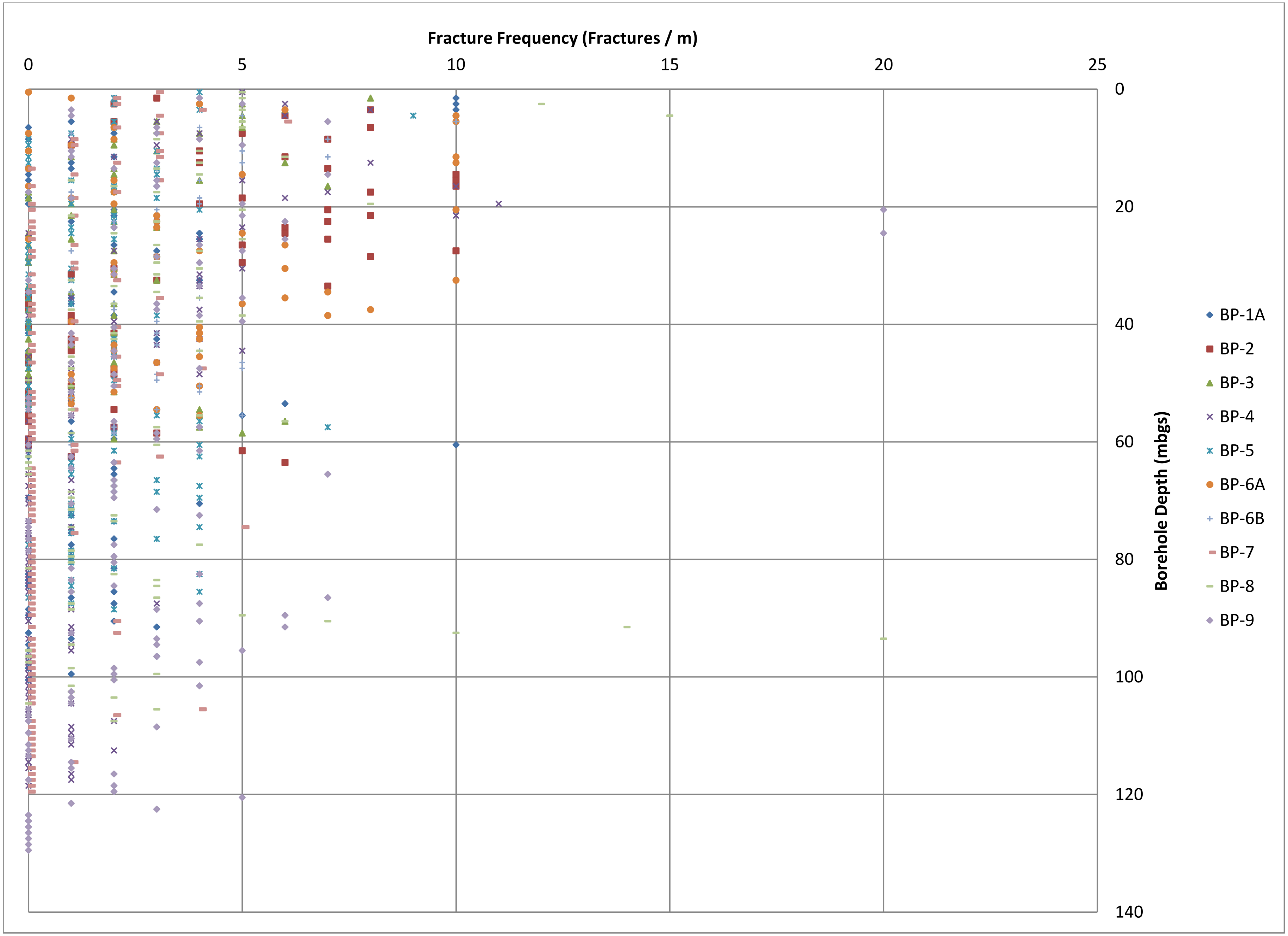
63	64	SyGr			2	J	1	2			20			1.5				
64	65	SyGr			1	J	0.5	1			80			3				
65	66	SyGr			7	J	1.5	4	2	1	20	90	60	1.5/3				
66	67	SyGr			2	J	0.5	1	1		70	30						
67	68	SyGr			2	J	1	2			70			1.5				
68	69	SyGr			2	J	1	2			70			1.5				
69	70	SyGr			2	J	0.5	1	1		40	30		1.5				
70	71	SyGr			1	J	0.5	1			60			1.5				
71	72	SyGr			3	J	1.5	2	1		20	60		1.5				
72	73	SyGr			4	J/Fr	1.5	2	1	1				1.5/3				
73	74	SyGr			0													
74	75	SyGr			0													
75	76	SyGr			0													
76	77	SyGr			0													
77	78	SyGr			2	Fr	0.5	2			5	90		3/1.5				
78	79	SyGr			0													
79	80	SyGr			2	J	1	2			90			1.5				
80	81	MzGr			2	J	1	2			20			1.5				
81	82	MzGr			1	J	0.5	1			40			1.5				
82	83	MzGr			4	J	1.5	3	1		20	40		1.5				
83	84	MzSyGr			1	J	0.5	1			60			3				
84	85	MzGr			2	J	0.5	1	1		10	80		3/1.5				
85	86	MzGr			1	J	0.5	1			20			3				
86	87	MzGr			7	J	2.5	1	4	2	10	40	20	3/1.5				
87	88	MzGr			4	J	2	2	2		80	20		3				
88	89	MzSyGr			3	J	1.5	1	2		40	80		1.5/3				
89	90	SyGr			6	J	2.5	1	3	2	20	80	40	1.5				
90	91	SyGr			4	J	1	4			90			1.5				
91	92	SyGr			6	J	1	6			80			1.5				
92	93	SyGr			1	J	0.5	1			50			1.5				
93	94	SyGr			3	J	1.5	1	2		40	30		1.5				
94	95	SyGr			3	J	1.5	1	2		50	70		1.5				
95	96	SyGr			5	J	2.5	2	2	1	50	20		1.5				
96	97	SyGr			3	J	1	3			30			1.5				
97	98	SyGr			4	J	1.5	1	2	1	20	50	90	1.5				
98	99	SyGr			2	J	0.5	1	1		30	60		1.5				
99	100	SyGr			2	J	0.5	1	1		80	50		3				
100	101	SyGr			2	J	0.5	1	1		80	40		3/0.5				Slickensided on 40° joint
101	102	SyGr			4	J/Fr	1.5	3	1		50	30		1.5/3				
102	103	SyGr			1	J	0.5	1			40			1.5				
103	104	SyGr			1	Fr	0.5	1			5							
104	105	SyGr			1	J	0.5	1			10			3				
105	106	SyGr			0													
106	107	SyGr			0													
107	108	SyGr			0													
108	109	SyGr			3	J	1	3			40			0.5				
109	110	SyGr			0													
110	111	SyGr			1	J	0.5	1			40			1.5				
111	112	SyGr			0													
112	113	SyGr			0													
113	114	SyGr			0													
114	115	SyGr			1	J	0.5	1			10			3				
115	116	SyGr			1	J	0.5	1						1.5				
116	117	SyGr			2	J	1	2			30			1.5				
117	118	SyGr			0													
118	119	SyGr			2	J	0.5	1	1		40	30		3/1.5				
119	120	SyGr			2	J	0.5	1	1		40	70		3				
120	121	SyGr			5	J	2.5	2	2	1	40	30	50	1.5-4				
121	122	SyGr			1	J	0.5	1			30			1				
122	123	MzGr			3	J	1	3			40			1				
123	124	SyGr			0													
124	125	SyGr			0													
125	126	SyGr			0													
126	127	SyGr			0													
127	128	SyGr			0													
128	129	SyGr			0													
129	130.1	SyGr			0													

Project: Black Point
Drill Hole: BP-9
Date: March 10-13 2014

Picture ID/	Core Box No.	Depth Interval		Comments
		From(m)	To(m)	
BP-9-P1	1	0.8	5.09	0-0.8 core loss
BP-9-P2	2	5.09	9.53	
BP-9-P3	3	9.53	13.83	
BP-9-P4	4	13.83	18.17	
BP-9-P5	5	18.17	22.48	
BP-9-P6	6	22.48	26.65	
BP-9-P7	7	26.65	30.71	
BP-9-P8	8	30.71	35.07	
BP-9-P9	9	35.07	39.5	
BP-9-P10	10	39.5	43.78	
BP-9-P11	11	43.78	48.08	
BP-9-P12	12	48.08	52.49	
BP-9-P13	13	52.49	56.84	
BP-9-P14	14	56.84	61.23	
BP-9-P15	15	61.23	65.44	
BP-9-P16	16	65.44	69.84	
BP-9-P17	17	69.84	74	
BP-9-P18	18	74	78.5	
BP-9-P19	19	78.5	82.88	
BP-9-P20	20	82.88	87.22	
BP-9-P21	21	87.22	91.55	
BP-9-P22	22	91.55	95.81	
BP-9-P23	23	95.81	100.17	
BP-9-P24	24	100.17	104.34	
BP-9-P25	25	104.34	108.77	
BP-9-P26	26	108.77	113.13	
BP-9-P27	27	113.13	117.51	
BP-9-P28	28	117.51	122	
BP-9-P29	29	122	126.33	
BP-9-P30	30	126.33	130.13	

ATTACHMENT B
Fracture Frequency Plot

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000



Fracture Frequency (Fractures / m)
0
5
10
15
20
25
0
20
40
60
80
100
120
140
Borehole Depth (mbgs)
BP-1A
BP-2
BP-3
BP-4
BP-5
BP-6A
BP-6B
BP-7
BP-8
BP-9

ATTACHMENT C
2014 Granite Analytical Chemistry Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Attachment C: On-Site Granite Boreholes Water Chemistry Results

Sample Name			**BPBH05**	**BPBH05_2**	**BPBH07**	**BPB07_2**	**BPBH08**	**BPBH08_2**	**BPBH09**	**BPBH09_2**
Location			**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**	**Unfiltered**
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---

Attachment C (con't): On-Site Granite Boreholes Water Chemistry Results

Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

ATTACHMENT D

Metasedimentary Rock and Surface Water Analytical Chemistry Results

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Stream and Lake Water Quality Analytical Results 2010

Sample Name				GRQ-1	GRQ-2	GRQ-3	GRQ-4
Location			CCME FWAL	Unnamed Watercourse 3 East Stream	Fogherty Lake	Unnamed Watercourse 2 North Stream	Unnamed Watercourse 1 Fogherty Lake Outflow
Parameter	**Unit**	**RDL**	**Guideline**	**24-Aug-10**	**27-Aug-10**	**22-Sep-10**	**22-Sep-10**
Field Parameters							
pH			6.5-9	3.41	2.94	3.15	2.95
Water Temperature	°C			21.4	22.7	14.9	16.0
Conductivity	µS/cm			62.0	43.0	91.0	53.0
% Dissolved Oxygen	%			79.2	100.6	79.8	47.0
Dissolved Oxygen	mg/L			6.67	8.67	8.47	4.52
General Chemistry							
pH			6.5-9	4.3	4.3	3.9	4.2
Reactive Silica as SiO2	mg/L	0.5		7.2	0.9	10.2	1.8
Chloride	mg/L	1		14.0	10.0	18.0	13.0
Fluoride	mg/L	0.1	0.12	<0.1	<0.1	0.4	<0.1
Sulphate	mg/L	2		<2	<2.0	<2.0	<2.0
Alkalinity	mg/L	5		<5	<5.0	<5.0	<5.0
True Color	TCU	5	Narrative	395	198.0	411.0	195.0
Turbidity	NTU	0.1	Narrative	1.0	0.7	2.8	0.7
Electrical Conductivity	umho/cm	1		59.0	52.0	102.0	61.0
Nitrate + Nitrite as N	mg/L	0.05		<0.05	<0.05	0.24	<0.05
Nitrate as N	mg/L	0.05	2.9	<0.05	<0.05	0.24	<0.05
Nitrite as N	mg/L	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L	0.03	Fact Sheet	<0.03	0.03	0.06	0.11
Total Organic Carbon	mg/L	0.5		35.6	15.4	46.6	17.5
Ortho-Phosphate as P	mg/L	0.01		<0.01	<0.01	0.02	<0.01
Total Sodium	mg/L	0.1		8.8	6.8	10.0	6.8
Total Potassium	mg/L	0.1		0.3	0.4	0.4	0.5
Total Calcium	mg/L	0.1		0.5	0.3	0.5	0.4
Total Magnesium	mg/L	0.1		0.7	0.6	1.1	0.6
Biarb. Alkalinity (as CaCO3)	mg/L	5		<5.0	<5.0	<5.0	<5.0
Carb. Alkalinity (as CaCO3)	mg/L	10		<10.0	<10.0	<10.0	<10.0
Hydroxide	mg/L	5		<5.0	<5.0	<5.0	<5.0
Calculated TDS	mg/L	1		26	19.0	33.0	22.0
Hardness	mg/L			4.1	3.2	5.8	3.5
Langelier Index (@ 20C)	NA			-6.84	-7.05	-7.25	-7.03
Langelier Index (@ 4C)	NA			-7.16	-7.37	-7.57	-7.35
Saturation pH (@ 20C)	NA			11.1	11.3	11.1	11.2
Saturation pH (@ 4C)	NA			11.5	11.7	11.5	11.5
Anion Sum	me/L			0.39	0.28	0.52	0.37
Cation Sum	me/L			0.68	0.47	0.84	0.49
% Difference / Ion Balance (NS)	%			26.2	25.2	23.3	14.8
Total Suspended Solids	mg/L	5	Narrative	n/a	n/a	<5.0	<5.0
Total Phosphorus as P	mg/L	0.002	Fact Sheet	0.157	0.035	0.03	0.012

Total Aluminum	ug/L	5	5	1050	335.0	1050.0	272.0
Total Antimony	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Arsenic	ug/L	2	5	<2.0	<2.0	5.0	<2.0
Total Barium	ug/L	5		<5.0	<5.0	16.0	<5.0
Total Beryllium	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Bismuth	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	5		14.0	11.0	20.0	14.0
Total Cadmium	ug/L	0.017	0.017	0.025	0.023	0.102	<0.017
Total Chromium	ug/L	1		4.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	1		<1.0	<1.0	<1.0	<1.0
Total Copper	ug/L	2	2	<2.0	<2.0	<2.0	<2.0
Total Iron	ug/L	50	300	976	319.0	936.0	415.0
Total Lead	ug/L	0.5	1	3.1	2.6	2.2	0.7
Total Manganese	ug/L	2		37	16.0	87.0	15.0
Total Molybdenum	ug/L	2	73	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2	25	<2.0	<2.0	<2.0	<2.0
Total Selenium	ug/L	1	1	1.0	<1.0	<1.0	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Total Strontium	ug/L	5		<5.0	<5.0	9.0	<5.0
Total Thallium	ug/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1
Total Tin	ug/L	2		<2.0	<2.0	<2	<2.0
Total Titanium	ug/L	2		5.0	2.0	5.0	<2.0
Total Uranium	ug/L	0.1		0.3	0.1	0.3	<0.1
Total Vanadium	ug/L	2		<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5	30	9.0	26.0	20.0	10.0
Mercury	mg/L	0.00005	0.000026	<0.00005	<0.00005	<0.00005	<0.00005

Stream and Lake Water Quality Analytical Results 2014

Sample Name				BPSTR06	BPSTR08	BPSTR09	BPSTR10	BPSTR11	BPSTR12
Location			CWQG PAL Freshwater	Watercourse 1 Fogherty Discharge	Watercourse 2	Watercourse 4 Murphy's Discharge	Fox Island Main Indian Cove Cr.	DUPLICATE Fox Island Main Indian Cove Cr.	Waterourse 3 Transmission Line East
Parameter	Unit	RDL	Guideline	24-Jul-14	24-Jul-14	31-Jul-14	25-Jul-14	25-Jul-14	31-Jul-14
Field Parameters									
pH		---	---	4.1	---	4.0	---	---	3.4
Water Temperature	°C	---	---	18.3	---	21.9	---	---	21.8
Conductivity	µS/cm	---	---	56.0	---	48.0	---	---	53.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	4.5	---	2.8	---	---	2.7
General Chemistry									
pH [15]		n/a	6.5-9.0	4.35	4.35	4.70	4.65	4.66	4.330
Reactive Silica as SiO2	mg/L	0.5	NV	2.3	9.7	<0.50	4.5	4.5	5.0
Chloride [6]	mg/L	---	NV	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	120	12.0	11.0	12.0	22.0	22.0	12.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	<2.0	<2.0	<2.0	2.4	2.4	<2.0
Alkalinity	mg/L	---	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
True Color	TCU	50.0	NV	300.0	220.0	91.0	350.0	320.0	300.0
Turbidity	NTU	0.1	NV	1.0	1.2	0.93	0.69	0.640	1.6
Electrical Conductivity	umho/cm	1.0	NV	57.0	57.0	54.0	84.0	84.0	60.0
Nitrate + Nitrite as N	mg/L	0.05	NV	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrate as N [12]	mg/L	0.050	3	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrite as N	mg/L	0.01	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N [5]	mg/L	0.05	0	0.086	<0.050	0.084	<0.050	<0.050	<0.050
Total Organic Carbon	mg/L	5.0	NV	11.0 [20]	13.0 [20]	7.300	17.0 [20]	14.0 [20]	24 [20]
Ortho-Phosphate as P	mg/L	0.01	NV	0.032	0.019	<0.010	0.011	0.011	<0.010
Total Sodium	mg/L	100.0	NV	5600.0	6000.0	6000.0	12000.0	11000.0	6400.0
Total Potassium	mg/L	100.0	NV	360.0	370.0	280.0	750.0	720.0	290.0
Total Calcium	mg/L	100.0	NV	320.0	240.0	220.0	1000.0	920.0	410.0
Total Magnesium	mg/L	100.0	NV	550.0	450.0	570.0	930.0	920.0	620.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	NV	---	---	---	---	---	---
Calculated TDS [19]	mg/L	1.0	NV	23.0	28.0	20.0	45.0	45.0	26.0
Hardness	mg/L	1.0	NV	3.0	2.4	2.9	6.3	6.1	3.6
Langelier Index (@ 20C)	NA	---	NV	---	---	---	---	---	---
Langelier Index (@ 4C)	NA	---	NV	---	---	---	---	---	---
Saturation pH (@ 20C)	NA	---	NV	---	---	---	---	---	---
Saturation pH (@ 4C)	NA	---	NV	---	---	---	---	---	---
Anion Sum	me/L	n/a	NV	0.35	0.31	0.34	0.66	0.67	0.33
Cation Sum	me/L	n/a	NV	0.39	0.38	0.36	0.73	0.71	0.44
% Difference / Ion Balance (NS)	%	n/a	NV	5.41	10.1	2.86	5.04	2.9	14.3
Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---

Total Phosphorus as P	mg/L	100.0	NV	110.0	<100.0	<100.0	110.0	<100.0	100.0
Total Aluminum [4]	ug/L	5.0	5	**370.0**	**680.0**	**270.0**	**610.0**	**610.0**	**820.0**
Total Antimony	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	5	1.7	2.0	<1.0	<1.0	<1.0	1.5
Total Barium	ug/L	1.0	NV	1.6	2.6	1.4	5.6	5.6	2.8
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	NV	<50.0	<50.0	<50.0	<50.0	<50	<50.0
Total Cadmium	ug/L	0.01	0.017	**0.021**	**0.018**	0.016	**0.032**	**0.026**	**0.019**
Total Chromium	ug/L	1.0	NV	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	0.7	0.690	<0.40
Total Copper	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron	ug/L	50.0	300	**760.0**	**390.0**	**320.0**	**1600.0**	**1500.0**	**950.0**
Total Lead [10]	ug/L	0.5	1	0.96	0.860	<0.50	**1.2**	**1.2**	**1.2**
Total Manganese	ug/L	2.0	NV	19.0	17.0	56.0	200.0	200.0	46.0
Total Molybdenum	ug/L	2.0	73	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel [11]	ug/L	2.0	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Selenium	ug/L	1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	4.2	2.8	2.8	7.5	7.4	4.2
Total Thallium	ug/L	0.1	0.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	3.1	4.9	<2.0	10.0	9.8	7.1
Total Uranium	ug/L	0.1	NV	0.1	0.490	<0.10	<0.10	<0.10	0.410
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	30	7.5	18.0	8.2	18.0	9.0	10.0
Mercury	mg/L	---	NV	---	---	---	---	---	---

Notes:

NV = no value

Canadian Water Quality Guidelines (CWQG) Protection for Aquatic Life (PAL) Freshwater Guidelines Update 7.0: Sep 2007

4. Aluminum Guideline (CWQG Aquatic Life - Freshwater): if pH < 6.5 then 0.005 mg/L (5 ug/L), else if pH >= 6.5 then 0.1 mg/L (100 ug/L)
5. Ammonia (CWQG Aquatic Life - Freshwater) - guidelines vary with pH and temperature. See fact sheet for details
6. Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L
7. Copper Guideline (CWQG Aquatic Life - Freshwater): if $CaCO_3$ < 120 mg/L then 0.002 mg/L (2 ug/L), if CaCO3 = 120-180 mg/L then 0.003 mg/L (3 ug/L), if CaCO3 > 180 mg/L then 0.004 mg/L (4 ug/L),
8. Dissolved Oxygen Guideline (CWQG Aquatic Life - Freshwater): Warm-water biota (WWB) early life stages 6000 ug/L, WWB other life stages 5500 ug/L, Cold-water biota (CWB) early life stages 9500 ug/L, other life stages 6500 ug/L
9. Dissolved Oxygen Guideline (CWQG Aquatic Life - Marinewater): > 8000 ug/L
10. Pb Guideline (CWQG A.L - Freshwater): if $CaCO_3$ < 60 mg/L then 0.001 mg/L, if CaCO3 = 60-120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.004 mg/L, if CaCO3 > 180 mg/L then 0.007 mg/L,
11. Ni Guideline (CWQG A.L. - Freshwater): if $CaCO_3$ < 60 mg/L then 0.025 mg/L, if CaCO3 = 60-120 mg/L then 0.065 mg/L, if CaCO3 = 120-180 mg/L then 0.110 mg/L, if CaCO3 > 180 mg/L then 0.150 mg/L
12. Nitrate Canadian Water Quality Guidelines (CWQG) for Aquatic Life represents lower value for "Long Term Exposure". Short Term exposure values are 124 and 339 for Freshwater and Marine respectively
15. pH Guideline (CWQG Aquatic Life): Freshwater 6.5 - 9, Marine 7.0 - 8.7
16. Salinity Guideline (CWQG Aquatic Life - Marinewater): < 10% fluctuation.
17. Taste Aesthetic Objective (CDWQ): "Inoffensive"
18. Temperature Aesthetic Objective (CDWQ): <= 15^{o}C
19. Calculated result only includes measured parameters. Actual TDS may be higher.
20. Elevated reporting limit due to sample matrix.

BOLD RED Exceeds guideline

Dug and Drilled Well Water Results, Metasedimentary Bedrock, 2014

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	Unit	RDL	Guideline	16-Jul-14	16-Jul-14	16-Jul-14	17-Jul-14	17-Jul-14	17-Jul-14	17-Jul-14	28-Aug-14	28-Aug-14
Field Parameters												
pH		---	---	6.57	7.52	6.15	6.33	---	6.67	7.53	---	---
Water Temperature	°C	---	---	12.8	15.1	15.7	12.1	---	17.3	12.6	---	---
Conductivity	µS/cm	---	---	140.0	272.0	398.0	108.0	---	257.0	354.0	---	---
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---
General Chemistry												
pH[4]		n/a	NV	6.76	8.10	6.55	6.36	6.37	6.73	8.17	8.14	8.20
Reactive Silica as SiO2	mg/L	0.5	NV	6.9	9.1	4.6	6.9	6.9	5.7	11.0	10.0	10.0
Chloride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	NV	37.0	15.0	32.0	12.0	12.0	12.0	14.0	14.0	14.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	5.6	6.4	6.5	2.7	2.6	3.1	9.1	9.5	9.7
Alkalinity	mg/L	---	NV	31.0	95.0	30.0	6.4	6.6	17.0	100.0	100.0	100.0
True Color	TCU	50.0	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Turbidity	NTU	0.1	NV	0.5	0.34	3.1	0.26	<0.10	0.28	0.82	0.42	0.69
Electrical Conductivity	umho/cm	1.0	NV	190.0	230.0	180.0	67.0	67.0	76.0	250.0	250.0	260.0
Nitrate + Nitrite as N	mg/L	0.05	NV	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrate as N	mg/L	0.050	10	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrite as N	mg/L	0.01	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	NV	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	0.051	<0.050
Total Organic Carbon	mg/L	5.0	NV	0.71	0.56	1.4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ortho-Phosphate as P	mg/L	0.01	NV	<0.010	0.032	<0.010	0.025	0.027	<0.010	0.019	0.019	0.019
Total Sodium	mg/L	100.0	NV	17000.0	9500.0	14000.0	6800.0	6700.0	7000.0	31000.0	33000.0	32000.0
Total Potassium	mg/L	100.0	NV	1300.0	1100.0	5400.0	630.0	680.0	280.0	2300.0	2100.0	2100.0
Total Calcium	mg/L	100.0	NV	11000.0	26000.0	11000.0	2200.0	2200.0	6100.0	15000.0	15000.0	15000.0
Total Magnesium	mg/L	100.0	NV	4000.0	6400.0	2900.0	1600.0	1600.0	1100.0	4500.0	4600.0	4500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	31.0	94.0	30.0	6.4	6.6	16.0	99.0	99.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.4	1.3	1.5
Hydroxide	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	NV	100.0	130.0	95.0	42.0	42.0	46.0	150.0	150.0	150.0
Hardness	mg/L	1.0	NV	44.0	91.0	39.0	12.0	12.0	20.0	57.0	57.0	57.0
Langelier Index (@ 20C)	NA	---	NV	-2.06	0.128	-2.28	-3.79	-3.76	-2.57	-0.017	-0.049	0.009
Langelier Index (@ 4C)	NA	---	NV	-2.31	-0.122	-2.53	-4.04	-4.01	-2.82	-0.268	-0.299	-0.241
Saturation pH (@ 20C)	NA	---	NV	8.82	7.987	8.83	10.1	10.1	9.3	8.19	8.19	8.19
Saturation pH (@ 4C)	NA	---	NV	9.07	8.22	9.08	10.4	10.4	9.55	8.44	8.44	8.44
Anion Sum	me/L	n/a	NV	1.79	2.47	1.64	0.61	0.61	0.74	2.59	2.59	2.60
Cation Sum	me/L	n/a	NV	1.63	2.26	1.55	0.55	0.55	0.71	2.55	2.62	2.62
% Difference / Ion Balance (NS)	%	n/a	NV	4.68	4.44	2.82	5.17	5.17	2.07	0.78	0.58	0.38

Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	NV	<100.0	<100.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	NV	33.0	17.0	9.9	16.0	22.0	12.0	11.0	<5.0	5.7
Total Antimony	ug/L	1.0	6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	10	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	**50**	**46.0**	**48.0**
Total Barium	ug/L	1.0	1000	30.0	52.0	34.0	44.0	44.0	9.5	<1.0	<1.0	<1.0
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	5000	<50.0	<50.0	<50.0	<50	<50.0	<50.0	60.0	58.0	59.0
Total Cadmium	ug/L	0.01	5	0.048	<0.010	0.034	0.025	0.022	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper	ug/L	2.0	NV	38.0	<2.0	160.0	24.0	24.0	180.0	<2.0	<2.0	3.6
Total Iron	ug/L	50.0	NV	160.0	<50.0	1200.0	<50.0	<50.0	92.0	82.0	<50.0	76.0
Total Lead	ug/L	0.5	10	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	NV	210.0	22.0	330.0	<2.0	<2.0	2.3	66.0	4.3	65.0
Total Molybdenum	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	7.3	7.3
Total Nickel	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2
Total Selenium	ug/L	1.0	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	30.0	51.0	52.0	13.0	14.0	25.0	98.0	100.0	100.0
Total Thallium	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	20	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	NV	11.0	8.0	19.0	8.8	11.0	52.0	15.0	8.1	20.0
Mercury	mg/L	---	NV	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Dug and Drilled Well Water Results, Metasedimentary Bedrock, 2014

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
pH		---	6.79	6.56	---	6.28	5.99	6.72	6.62	---	7.46	---	7.68
Water Temperature	°C	---	19.7	12.6	---	14.3	18.9	16.4	17	---	10.7	---	14
Conductivity	µS/cm	---	---	---	---	104.0	260.0	240.0	165.0	---	249.0	---	197.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
General Chemistry													
pH[4]		n/a	7.12	6.66	6.80	6.50	5.95	7.68	6.83	7.41	7.37	7.51	7.9
Reactive Silica as SiO2	mg/L	0.5	9.6	4.9	4.9	22.0	8.0	11.0	5.7	13.0	19.0	4.8	11
Chloride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	16.0	10.0	9.9	21.0	25.0	15.0	9.8	94.0	21.0	40.0	12.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	5.1	3.3	3.4	3.9	7.0	5.6	3.9	6.2	12.0	2.9	4.9
Alkalinity	mg/L	---	49.0	15.0	14.0	30.0	10.0	52.0	36.0	100.0	93.0	94.0	99
True Color	TCU	50.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Turbidity	NTU	0.1	1.2	<0.10	0.54	<0.10	13.0	0.37	0.19	1.2	<0.10	170.0	0.73
Electrical Conductivity	umho/cm	1.0	140.0	75.0	75.0	120.0	120.0	170.0	100.0	490.0	260.0	320.0	230.0
Nitrate + Nitrite as N	mg/L	0.05	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrate as N	mg/L	0.050	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.38	<0.050
Total Organic Carbon	mg/L	5.0	60	0.99	1	0.52	1.4	0.64	1.2	0.95	0.79	3.6	0.75
Ortho-Phosphate as P	mg/L	0.01	<0.010	<0.010	<0.010	0.15	<0.010	0.012	<0.010	0.04	0.015	<0.010	0.012
Total Sodium	mg/L	100.0	9900.0	5800.0	5900.0	15000.0	15000.0	7700.0	5800.0	99000.0	57000.0		8200.0
Total Potassium	mg/L	100.0	1200.0	630.0	630.0	1200.0	660.0	930.0	650.0	<100.0	400.0		1800.0
Total Calcium	mg/L	100.0	15000.0	5900.0	6000.0	4200.0	2300.0	18000.0	13000.0	<100.0	<100.0	17000.0	34000.0
Total Magnesium	mg/L	100.0	2500.0	1300.0	1300.0	3400.0	2000.0	4500.0	1200.0	<100.0	<100.0	9500.0	4100.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	49.0	15.0	14.0	30.0	10.0	51.0	36.0	99.0	93.0	94.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	89.0	46.0	46.0	89.0	70.0	99.0	62.0	270.0	160.0	170.0	140.0
Hardness	mg/L	1.0	47.0	20.0	20.0	25.0	14.0	64.0	38.0	<1.0	<1.0	82.0	100.0
Langelier Index (@ 20C)	NA	---	-1.36	-2.7	-2.58	-2.73	-4.02	-0.696	-1.81	---	---	-0.65	0.061
Langelier Index (@ 4C)	NA	---	-1.61	-2.96	-2.83	-2.99	-4.27	-0.947	-2.06	---	---	-0.9	-0.188
Saturation pH (@ 20C)	NA	---	8.48	9.36	9.38	9.23	9.97	8.37	8.64	---	---	8.16	7.84
Saturation pH (@ 4C)	NA	---	8.73	9.62	9.63	9.49	10.2	8.62	8.89	---	---	8.41	8.09
Anion Sum	me/L	n/a	1.54	0.74	0.72	1.28	1.07	1.66	1.07	4.78	2.69	3.08	2.44
Cation Sum	me/L	n/a	1.41	0.67	0.68	1.17	1.05	1.63	1.04	4.32	2.48	3.04	2.44
% Difference / Ion Balance (NS)	%	n/a	4.41	4.96	2.86	4.49	0.94	0.91	1.42	5.05	4.06	0.65	0

Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	110.0	<100.0	<100.0	280.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	94.0	21.0	21.0	16.0	46.0	15.0	83.0	6.3	6.9	<5.0	20.0
Total Antimony	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0	<1.0	<1.0
Total Barium	ug/L	1.0	31.0	1.9	2.0	<1.0	9.0	24.0	7.7	<1.0	<1.0	3.9	19.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
Total Bismuth	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	---
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.022	0.026	0.028	0.044	0.075	0.043	0.036	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.63	---
Total Copper	ug/L	2.0	150.0	260.0	280.0	51.0	120.0	5.2	8.4	<2.0	2.7	<2.0	<2.0
Total Iron	ug/L	50.0	140.0	<50.0	<50.0	<50.0	2900.0	<50.0	130.0	150.0	<50.0	<50.0	<50.0
Total Lead	ug/L	0.5	<0.50	6.0	7.0	<0.50	2.1	<0.50	0.81	<0.50	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	3.3	16.0	13.0	13.0	290.0	<2.0	320.0	<2.0	4.9	1100.0	<2.0
Total Molybdenum	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5	<2.0
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
Total Strontium	ug/L	2.0	33.0	44.0	45.0	24.0	15.0	46.0	29.0	<2.0	<2.0	57.0	93.0
Total Thallium	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	0.11	<0.10	<0.10	1.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.65
Total Vanadium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	27.0	30.0	28.0	170.0	20.0	20.0	13.0	5.7	12.0	<5.0	<5.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

ATTACHMENT E
AECOM Technical Memo – June / July 2014 Fieldwork

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

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Memorandum

To	Russell Dmytriw	Page	1
CC	Robert Till, Steve Usher		
Subject	Technical Memorandum: Black Point Hydrogeology June and July, 2014 Field Program		
From	Timothy Bachiu		
Date	September 23, 2014	Project Number	60323234

In support of an Environmental Assessment, hydrological and hydrogeological field work was completed by AECOM and SLR Consulting (Canada) staff at the Black Point Quarry site (the Site) in June and July, 2014. This memo documents field activities and presents data compiled from field tests and measurements completed during these field visits.

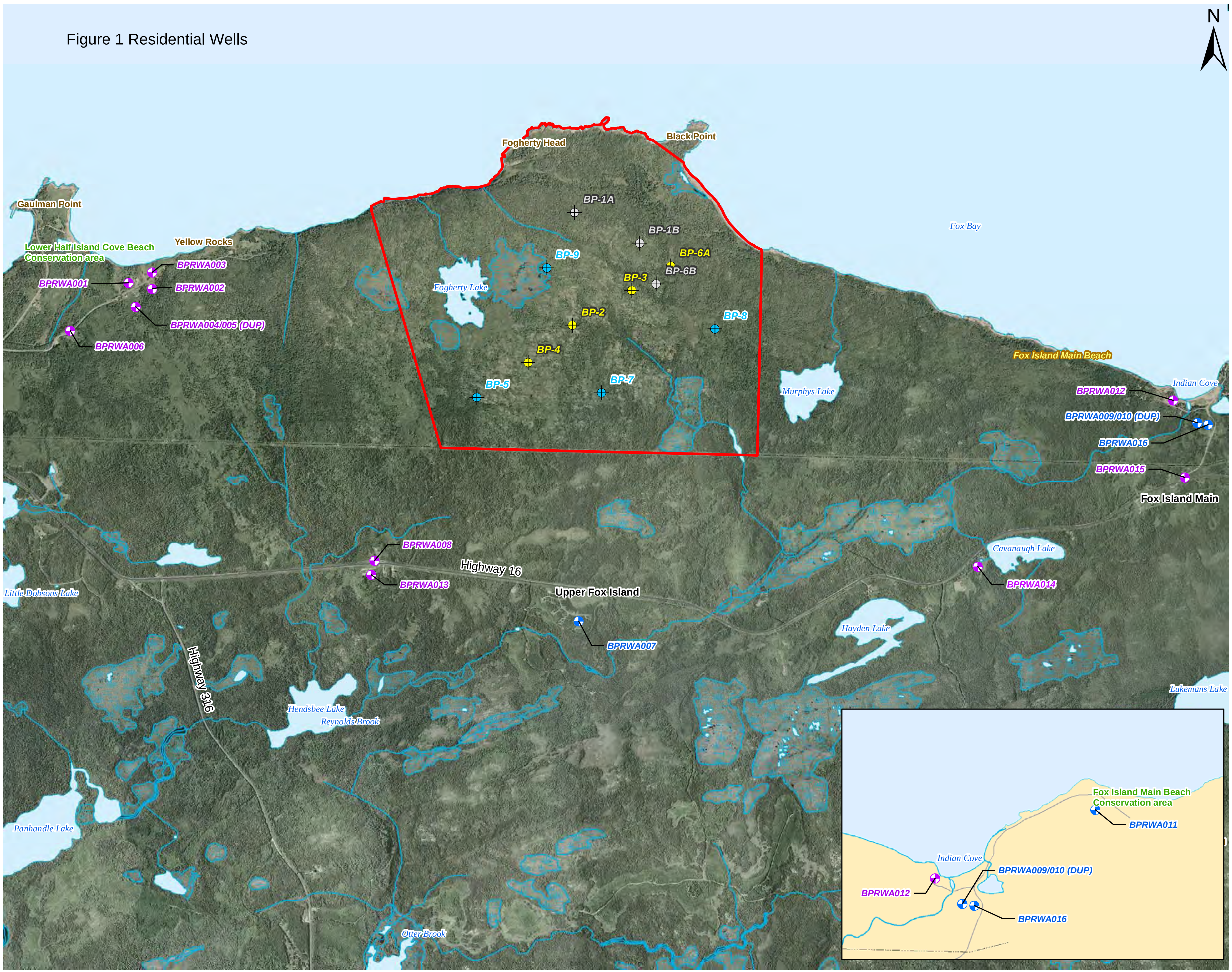
1. Residential Well Assessment

The objectives of the residential well assessment are:

- To establish baseline water quality.
- To determine the aquifer units used by residences for potable water supply.
- To provide a preliminary assessment of hydraulic parameters of aquifers near the proposed quarry.

A total of 14 residential wells within 4.0 km of the Site boundary were sampled and a subset of these wells was subjected to drawdown tests. At each residential well, a questionnaire was completed to document the type of well (drilled or dug), well completion details, water levels and whether the well user reported any issues with water quality or quantity. A yield test was completed on two wells, and two data loggers were deployed to monitor long term water levels.

Figure 1 identifies the locations of the residential wells and **Table 1** summarizes the information collected from the questionnaires.



SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES CORP.

REPORT NAME

RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS

August 8, 2014	Rev 1.0	Figure No.
Project No. 210.05913.00000		1

SLR Consulting (Canada) Ltd.

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Figure 2 Stream Sample Locations and Drive Point Piezometer Locations

N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\3.WRKG\210_05913_StreamAndMPLocations.mxd

LEGEND

- Drive Point Piezometer Locations
- Drive Point Piezometer Locations with Water Level Loggers
- Stream Sample
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

DRAFT

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES CORP.

REPORT NAME

STREAM SAMPLE AND DRIVE POINT PIEZOMETER LOCATIONS

August 8, 2014	Rev	1.0	Figure No.
Project No.	210.05913.00000		2

SLR

SLR Consulting (Canada) Ltd.

Table 1: Summary of the Residential Well Assessment Questionnaires

Sample ID	Sample Date	Well Type	Water Level (mTOC)*	Total Depth (mTOC)	Stick up (m)	Quality or Quantity Concerns
BPRWA001[1]	16-Jul-14	Dug	2.89	5.89	0.6	None
BPRWA002[2]	16-Jul-14	Dug	2.06	6.3	0.6	None
BPRWA003	16-Jul-14	Dug	1.82	4.19	0.7	None
BPRWA004	17-Jul-14	Dug	0.55	1.89	0.3	None
BPRWA006	17-Jul-14	Dug	2.86	6.19	0.8	None
BPRWA007[1,3,5]	17-Jul-14	Drilled	12.13	85.34[a]	0.3	None
BPRWA008	17-Jul-14	Dug	1.99	4.55	0.6	Quantity
BPRWA009	17-Jul-14	Drilled	n/a	n/a	n/a	None
BPRWA011	17-Jul-14	Drilled	n/a	n/a	n/a	None
BPRWA012	18-Jul-14	Dug	2.27	3.4	0	Quantity
BPRWA013	22-Jul-14	Dug	3.7	7	0.6	Quantity
BPRWA014	25-Jul-14	Dug	1.79	3.04	0.6	None
BPRWA015	30-Jul-14	Dug	n/a	n/a	n/a	None
BPRWA016[5]	31-Jul-14	Drilled	n/a	n/a	n/a	Unknown
BPRWA017	29-Aug-14	Dug	2.69	n/a	n/a	Unknown
1 - Well yield test completed.						
2 - Location has two dug wells. The unused dug well was instrumented with a data logger.						
3 - Location has two drilled wells. The unused drilled well was instrumented with a data logger.						
4 - Well cover could not be removed.						
5 – Resampled in August 2014						
a - Depth not measured. Depth estimated from resident's recollection of well record						
mTOC* = meters below top of casing						

As shown on **Figure 1**, the area west of the Site along Half Island Cove Road utilizes dug wells for potable water. In July, water levels were within 3.0 m of the ground surface and no concerns of water quantity or quality were expressed. Two residents (BPRW003 and BPRW004) reported that springs emerge from the hill to the south of Half Island Cove Road.

A cluster of three residences is located southwest of the Site and utilize dug wells for potable water. Two of these residential wells were sampled and questionnaires were completed (BPRWA008, BPRWA013). Yield tests were not permitted at these residences due to concerns regarding temporary water supply shortages during the dry summer months.

A set of four cottages and one residence are located south of the Site. These dwellings are serviced by a drilled well completed in the Goldenville Formation metasedimentary bedrock. A yield test was completed on the drilled well. An unused drilled well is located ~30 m from the water supply well. The unused drilled well was monitored during the yield test and following the yield test was instrumented with a data logger recording at 15 minute intervals to monitor water levels over the longer term.

One well was sampled (BPRWA014) near Cavanaugh Lake. This shallow dug well has a reportedly high yield that may be related to the permeable sand and gravel associated with a nearby esker mapped on the provincial surficial geology map (Stea et al. 1992).

In the Fox Island Main area east of the Site, both dug and drilled wells are utilized for potable water supplies. The drilled wells are completed in the metasedimentary bedrock.

Results of the water quality analyses are presented in Table A1 (**Appendix A**). The water quality results indicate the water quality of dug and drilled wells meets the Canadian Drinking Water Quality Guidelines (CDWQ) for all parameters, with one exception. The drilled well sampled as BPRWA007 arsenic concentration (50 µg/L) exceeds the CDWQ for arsenic (10 µg/L).

Two yield tests were completed to provide a preliminary assessment of the hydraulic conductivity of the surficial deposits and the metasedimentary bedrock.

Yield Test 1

A yield test was completed at the sampling location BPRWA001 on Half Island Cove Road. Prior to the initiation of the yield test, the static water level and total depth were measured (**Table 1**), the dimensions of the well were measured (0.92 m diameter) and a data logger was installed to monitor the changes in water level. The well was pumped using the resident's jet pump and pressure tank system that provides water to the residence. An exterior tap was opened to allow water to flow for 1 hour. The flow rate (0.28 L/sec) was estimated by monitoring the length of time required to fill a container of known volume. The estimated total volume pumped from the well in 1 hour was 1,028 L. This volume would displace 1.55 m of water in the well, if no recovery occurred.

The data recorded during the test is presented in **Figure 3**. The maximum drawdown was 0.495 m. Recovery of 0.198 m of recovery was observed over a period of 1,110 minutes (18.5 hours). The data were analyzed using the Theis equation in Aqtesolv software and the results are presented in **Appendix B**. The curve was matched to the late recovery period. The drawdown data have considerable uncertainty because the true pumping rate in the well is not known and the pump may have been turned off and on intermittently during the pumping portion of the test as governed by the pressure tank. The initial recovery data appear to be influenced by the pump coming on from household use. The time of day corresponding to early recovery data is the early evening when household water use is expected. The portion of the data used to match the Theis curve corresponds to the overnight period when water usage is expected to be minimal. The estimated transmissivity of the unconsolidated surficial deposits that provide water to the well is 2.5×10^{-6} m^2/sec, corresponding to a hydraulic conductivity of 8×10^{-7} m/sec. These values are consistent with glacial till deposits in Nova Scotia and appear to represent a reasonable order of magnitude approximation.

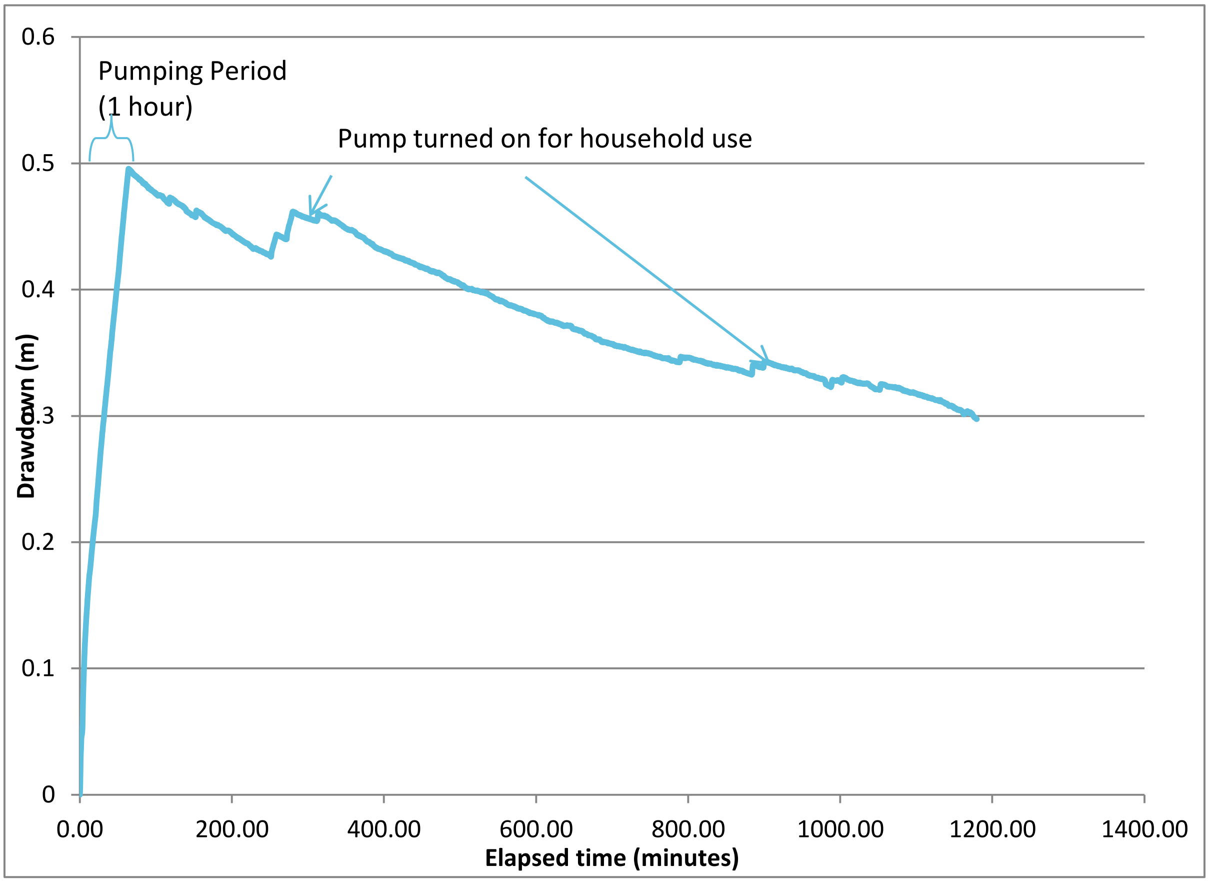


Figure 3: BPRWA001 Yield Test Observations

Yield Test 2

A yield test was completed in the drilled well at the sampling station BPRWA007 located south of the site (**Appendix B**). A second drilled well is located approximately 30 m from the pumping well and was used as an observation well during the yield test. Both wells have a casing diameter of 15.2 cm and the total depth is estimated from the recollection of the residents. Prior to the yield test, the water levels of each well were measured. The water level in the pumping well was 11.83 meters below ground surface (mbgs) and the water level in the observation well was 9.21 mbgs at 13:00 on July 17, 2014.

A data logger (10 m depth range) was installed in the observation well at a depth of ~5 m below the water level and a second data logger (10 m depth range) was installed in the pumping well at a depth of ~ 9 m below the water level. The water supply system consists of a submersible pump in the well that transfers water to a holding tank. Water supply to the cottages/residence is drawn from the holding tank and when the holding tank water level is drawn down to a particular level, the pump in the well is turned on. Therefore, during the yield test, the pump was turned on several times. The data logger information from the yield test is presented in **Figure 4**.

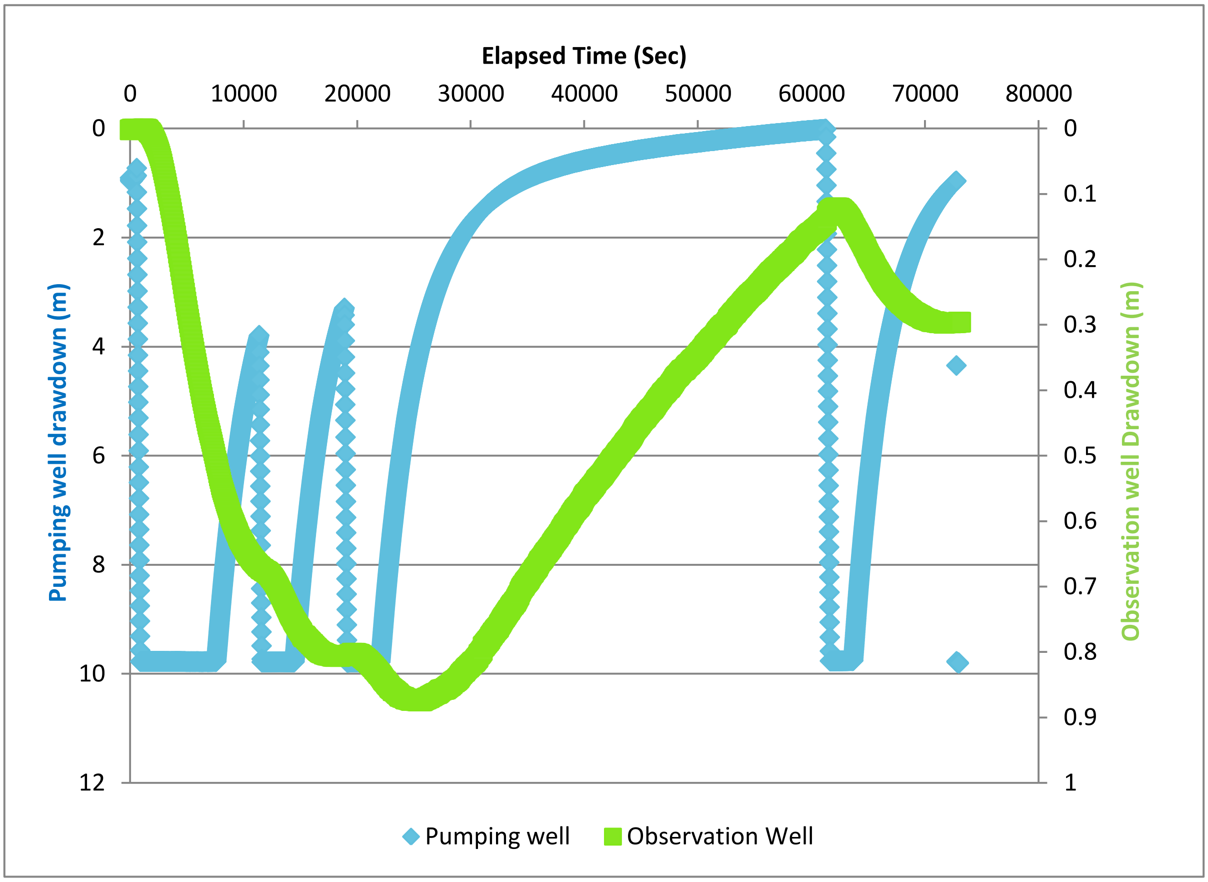


Figure 4: BPRWA007 Yield Test observations

The well was pumped by the resident turning on the pump at the electrical board to measure the water level response. Drawdown in the pumping well exceeded 9 m within 300 seconds (5 minutes) of pumping. The water level was below the level of the data logger for 121 minutes from the initiation of the pumping. The data loggers were left in the wells overnight and retrieved the next morning. The most complete recovery occurred during the overnight hours. The observation well experienced a maximum drawdown of 0.87 m and displayed recovery of 0.77 m during the overnight period. The observation of drawdown at a well 30 m from the pumping well indicates the wells are hydraulically connected, likely through fractures in the bedrock.

The pumping rate during the test is not known and was not possible to estimate because of the configuration of the water supply system. Also, portions of the drawdown during the pumping were not captured by data logger because the depth range of the data logger did not allow for proper positioning. For these reasons, it is impractical to evaluate the data as a pumping test. To provide an approximation of the hydraulic conductivity, the most complete recovery curve is treated as a slug test. The recovery data was analyzed using the KGS method in Aqtesolv and results in a hydraulic conductivity of 5.8 x10^{-8} m/sec (**Appendix B**).

2. Granite Hydrogeology

The hydrogeology of the granite for the proposed quarry was investigated by:

- Completing two water level (piezometric) surveys,
- Long term monitoring of water levels with data loggers,
- Completing four slug tests to estimate hydraulic conductivity, and
- Collecting water quality samples from four existing boreholes.

Boreholes locations are shown on **Figure 1**.

2.1 Piezometric Surveys

Eight exploration boreholes installed between 2007 and 2014 to assess the granite aggregate resource were used to complete piezometric surveys on June 5, 2014 and July 21, 2014. Results of the surveys are summarized in **Table 2**. The meters above sea level (masl) elevations in **Table 2** are from the borehole logs.

Table 2: Borehole Piezometric Surveys

Borehole ID	Elevation (masl)[1]	Total depth (m)	Stick up (m)[2]	Water Level (mTOC)[3]	Water Level (mbgs)[4]	Water level elevation (masl)[1]	Water Level (mTOC)[3]	Water Level (mbgs)[4]	Water level elevation (masl)[1]
				5-Jun-14			21-Jul-14		
BP-1A	73	100	-	-	-	-	-	-	-
BP-6A	73	56	n/a	n/a	3.73	69.27	n/a	4.01	68.99
BP-6B	69	70	n/a	-	-	-	-	-	-
BP-1B	74	80	-	-	-	-	-	-	-
BP-2	82	86	n/a	n/a	2.51	79.49	n/a	2.64	79.36
BP-3	74	60	n/a	n/a	3.12	70.88	n/a	3.27	70.73
BP-4	100	120	n/a	n/a	2.46	97.54	n/a	3.37	96.63
BP-5	82	89	n/a	n/a	2.33	79.67	n/a	2.33	79.67
BP-7	70	120	0.68	5.56	4.88	65.12		-0.68	70.68
BP-8	58	108	0.7	5.31	4.61	53.39	5.36	4.66	53.34
BP-9	79	130	0.68	6.17	5.49	73.51	6.3	5.62	73.38
1 – masl: meters above sea level									
2 – Stick up of casing above ground surface.									
3 – mTOC: meters below the top of casing									
4 – mbgs: meters below ground surface									

2.2 Long Term Data Loggers

Pressure transducer data loggers were installed on June 5 in boreholes BP-5, BP-7, BP-8 and BP-9. The data loggers were programmed to collect readings at 15 minute intervals. Data were downloaded on July 21, compensated for barometric pressure and plotted in **Appendix C**.

Figure C1 displays fluctuations in water levels in BP-5 are up to 1.6 m and closely follow precipitation events, suggesting surface water enters the borehole at surface. This is consistent with observations from the field and the borehole completion. Bedrock is exposed at the surface at BP5 and the casing is not securely installed in the borehole.

Fluctuations in water levels of BP-7 are up to 4.0 m and also closely follow the precipitation events **(Figure C1**). Offsets in fluctuations and precipitation may be a result of a delayed response or the offsets may be a potential artifact produced from using daily precipitation data combined with relatively high frequency water level recordings (15 minute intervals). Field observations indicate the well is properly cased and no obvious pathways for surface water to enter the borehole were observed.

The long term water level data for BP-8 are presented on **Figure C2** to allow for a water level scale range that displays water level variations. The fluctuations in water level in BP-8 are a maximum of 0.16 m and are influenced by precipitation events in the same pattern as BP-7

The long term water level data for BP-9 are presented on **Figure C3** to allow for a water level scale range that displays water level variations. The fluctuations in water level in BP-9 are a maximum of 0.3 m and are influenced by precipitation events in a similar pattern as observed with BP-7.

These loggers will remain at these locations to collect long term data. Monthly manual water will be collected from all the boreholes to provide information on the seasonal variations of the groundwater table.

2.3 Granite Borehole Hydraulic Conductivity Tests

Preliminary hydraulic conductivity (k) tests were completed on four boreholes (BP-5, BP-7, BP-8 and BP-9) in the granite bedrock. The tests were completed using a 1.82 m long by 0.0381 m diameter slug with a total displacement volume of 2.07 L. The boreholes were drilled using NQ bits, resulting in a borehole diameter of 0.0757 m. The water displacement in the boreholes is calculated to be 0.47 m. The tests were completed using the following steps:

- Manual water level measurement.
- Preliminary testing of response using the slug and water level tape.
- Programming and installing data loggers at appropriate time interval and depth.
- Complete submersion (injection) of slug.
- Manual water level measurements to assess recovery.
- Removal (withdrawal) of slug from the borehole.
- Manual water level measurements to assess recovery.
- Retrieval of data logger and download of data.

BP-5 k-test

The static water level and total depth of BP-5 are included in **Table** 2. The maximum displacement recorded during the slug test was 0.44 m. The slug-out test was used to assess the hydraulic conductivity using the KGS method in Aqtesolv (**Appendix D**). The analysis indicates the hydraulic conductivity of BP-5 is 4 x10^{-7} m/s.

BP-7 k-test

The static water level and total depth of BP-7 are included in **Table 2**. The maximum displacement recorded during the slug test was 0.05 m. The slug-out test was used to assess the hydraulic conductivity because the data logger was not installed during the slug in test. The small displacement recorded suggests the slug may not have been fully submerged or that the re-deployment of the data logger was not fast enough to record the initial part of the recovery. Using the limited data from the test, the Bouwer-Rice method in Aqtesolv was used to estimate a hydraulic conductivity of 2 x10^{-6} m/s (**Appendix D**).

BP-8 k-test

The static water level and total depth of BP-8 are included in **Table 2**. The maximum displacement recorded during the slug test was 0.27 m. A rapid recovery was observed with static water level reached within 20 seconds. The slug withdrawal data were used assess the hydraulic conductivity with Bouwer-Rice method in Aqtesolv. The hydraulic conductivity of BP-8 is estimated to be 1x10^{-5} m/s.

BP-9 k-test

The maximum displacement recorded during the BP-9 slug test was 0.47 m. Recovery to static water level occurred within 300 seconds. The slug injection portion of the test was used for analysis because the data logger became tangled with the slug rope when the slug was removed. The data were analyzed in Aqtesolv using the Bouwer-Rice method to estimate a hydraulic conductivity of 6 x 10^{-7} m/s.

The results of the slug test are documented in **Appendix D** and summarized in **Table 3**. These results provide a preliminary estimate of the bulk hydraulic conductivity of the granite. The results suggest some of the granite may be highly permeable, at least near surface, as represented by BP-8 and suggests the granite has a general hydraulic conductivity of 10^{-7} m/s. The hydraulic conductivity tests do not provide any insight to where the water is entering the well, but it is assumed the water entering the boreholes are from fractures intersecting the boreholes. The estimates of hydraulic conductivity do not provide any indication of the connectivity of the granite aquifer through the fracture network.

Table 3: Summary of Hydraulic Conductivity Tests

Borehole ID	Hydraulic conductivity (m/s)
BP-5	4 x 10^{-7}
BP-7	2 x 10^{-6}
BP-8	6 x 10^{-5}
BP-9	6 x 10^{-7}

2.4 Granite Groundwater Quality

Groundwater samples were collected from BP-5, BP-7, BP-8 and BP-9 using a bailer. Ten bailer volumes (~10 L) were removed from each borehole prior to sampling. The water quality samples were analyzed for general chemistry and total metals. Results of the water quality sampling are provided in Table A2 (**Appendix A)**. The granite groundwater is high in aluminum and iron compared to the water samples collected from the bedrock wells completed in the metasedimentary bedrock (**Table A1**). The granite groundwater also contains dissolved total uranium concentrations ranging from 14 to 260 µg/L. These uranium values merit further investigation including re-sampling with a more thorough purge of the borehole and review of core logs and core bulk chemistry.

3. Surface Water and Wetlands

The surface water and wetlands at the Site were investigated by completing:

- Stream flow measurements.
- Stream water sampling.
- Installation of mini-piezometers in wetlands.

3.1 Stream Flow Measurements

The stream locations investigated during the hydrogeology field program are identified on **Figure 2.**

Stream flows were measured July 25, 30 and 31, 2014 and are representative of dry (baseflow) conditions (no precipitation for the three days preceding discharge measurements). The area-velocity method was used to determine stream discharge. Discharge (Q) is calculated as the product of the mean stream velocity (V) and the cross-sectional area (A) of the channel; or Q=VA. Velocity measurements were taken at selected intervals across the channel cross-section. Stream velocity was measured using a Marsh McBirney Flo-Mate current meter. At each interval, the current meter operator measured water depth and mean velocity. Mean velocity measurements were taken at 0.6 of the depth and were observed for 40 seconds.

3.1.1 Stream Descriptions

BPSTR06
The discharge measurement at BPSTR06 was measured approximately 10 m downstream from the discharge of Fogherty Lake. The channel width varied from approximately 0.50 to 1.0 m, depth up to 0.3 m and had a moderate slope. The stream bed substrate consisted of gravel and boulders scattered throughout. The discharge measurement section was 0.50 m wide, well-defined with boulders at each bank, and had consistent flow throughout the entire section as shown in **Appendix E**.

BPSTR08
No discharge measurement was completed at BPSTR08 due to marginal/zero-flow conditions. BPSTR8 is located in a small headwater stream with sand, gravel and cobbles in the stream bed.

BPSTR09
The discharge measurement at BPSTR09 was measured approximately 20 m downstream of the discharge from Murphys Lake. The typical channel width was 1.0 m or less and had a moderate slope. The stream bed was muddy with fine gravel. The discharge measurement section was 0.80 m

wide, had well-defined banks on each side, and had consistent flow throughout the entire section. The cross section of the stream flow measurement location is shown in **Appendix E**.

BPSTR10

The discharge measurement at BPSTR10 was located 2.0 km east of the Site boundary and was measured approximately 10.0 m upstream from the bridge crossing at Starks Road. The typical full-bank channel width was approximately 3.0 m wide and a moderate slope. The stream was in low-flow conditions at the time of measurement. The stream bed substrate consisted of a mix of gravel, cobbles and boulders. The discharge measurement section was 1.1 m wide, well-defined with boulders at each bank, with flow concentrated primarily in middle of the cross-section and negligible at the banks.

BPSTR12

The discharge measurement at BPSTR12 was measured where a wetland (WL1) on the southeast portion of the Site outflows and crosses an ATV trail. The channel was 2.0 to 10.0 m wide with low, gradual banks, and moderate slope. The stream bed consisted primarily of a mix of sand, cobbles and boulders. The discharge measurement was located at a narrow, well-contained section 1.0 m wide with boulders on each side, and consistent flow throughout the section.

Table 4 presents a summary of the stream discharge measurements.

Table 4: Stream Discharge Summary

ID	Location Description	Discharge (L/s)	Date Measured
BPSTR06	Fogherty Lake Outflow	0.031	July 30
BPSTR08	Wetland 17 Inflow	n/a	n/a
BPSTR09	Murphys Lake Outflow	0.170	July 31
BPSTR12	Wetland 1 Outflow	7.73	July 31
BPSTR10	Fox Island Creek Outflow	4.24	July 25

3.2 Stream Water Samples

Stream water samples were collected at locations BPSTR06, BPSTR08, BPSTR09, BPSTR10 and BPSTR12 just prior to taking the flow measurements. Stream samples were analyzed for general chemistry and total metals. Results are included in **Appendix A**.

3.3 Mini-piezometers

Mini-piezometers (MPs) were installed in wetlands and streams to assess the vertical gradient of shallow groundwater. In wetlands, the mini-piezometers were installed as nested pairs with one deep and one shallow piezometer. In streams, one mini-piezometer was installed in the stream bed. The locations of the mini-piezometers are identified in **Figure 2**. One wetland pair (MP2) and one stream mini-piezometer (MP6) were instrumented with a data logger to record water levels and temperature at 15 minute intervals over the longer term.

Mini-piezometer sizes were 1.9 cm (¾”) and 2.54 (1”) diameters. Galvanized steel pipe and couplers were used to construct the piezometers. Teflon tape was used on all pipe threads to ensure watertight seals at the joints of the piezometers. The pipe was next hand-tightened into the piezometer tip, and then tightened to finish, using two 18” pipe wrenches. A coupler and pipe were then added to the piezometer using the same method as described above. Measurements were then taken of the length of the screen interval, the length from the bottom of the screen interval to the top of the MP tip, and the length from the top of the tip to the top of the first coupler.

A fence post driver was then used to hammer the piezometer into the ground. In wetland areas, where sphagnum moss and peat layered bedrock were encountered, the piezometers were easily pushed to refusal by hand. In areas where the soil consisted of boulders and packed gravel, it was very difficult to hammer the piezometers into the ground - on occasion several locations were attempted before a suitable location was found. As the piezometer was hammered further into the ground, subsequent couplers and pipes were added, as necessary, with measurements between coupler tops taken each time. Once hammered to refusal, the length of pipe sticking up above the ground was measured.

A differential survey was then completed using a rod and level. Three permanent benchmarks were installed at each site. Benchmarks consisted of either a nail hammered into a tree and marked by spray paint and flagging, or a location on a sturdy boulder marked by spray paint.

Water levels were measured in some of the mini-piezometers following installation, but these measurements are not considered to be representative of equilibrated, static water level conditions and should not be used to estimate the vertical hydraulic gradient. Water level measurements and logger downloads will be completed at all MP’s and existing boreholes on the site at a minimum in the fall of 2014, spring of 2015 and summer of 2015.

Completion details of the MPs are summarized in **Table** 5 and the locations of the MPs are identified on **Figure 2**.

Table 5: Summary of Mini-piezometer Completions

Mini piezometer	UTM		Pipe diameter (cm)	Bottom of perforated interval	Top of perforated interval	DL	Stick up	water level
	Easting	Northing		(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)
P1 shallow	643746	5023335	1.9	2.158	1.807	0.826	0.667	2.205
P1 deep	643746	5023335	1.9	3.334	2.984		0.72	2.98
P2 shallow	644068	5023164	2.54	1.39	0.938	0.487	0.817	nm
P2 deep	644068	5023164	2.54	2.227	1.877		1.815	nm
P3 shallow	644313	5023427	1.9	1.99	1.64	0.789	0.86	1.47
P3 deep	644313	5023427	1.9	3.132	2.779		0.915	1.59
P4 shallow	645531	5023145	1.9	2.058	1.709	0.641	0.771	nm
P4 deep	645531	5023145	1.9	3.042	2.699		1.01	nm
P5 shallow	645412	5022411	1.9	1.812	1.461	1.285	1.005	dry
P5 deep	645412	5022411	1.9	3.447	3.097		0.605	3.51
P6 stream	643981	5023665	n/a	0	n/a	0.985	n/a	-0.088

Mini piezometer	UTM		Pipe diameter (cm)	Bottom of perforated interval	Top of perforated interval	DL	Stick up	water level
P6 deep	643981	5023665	2.54	1.335	0.985		0.897	nm
P7 shallow	644404	5023774	1.9	1.719	1.369	1.07	1.11	nm
P7 deep	644404	5023774	1.9	3.14	2.789		0.904	nm
P8 stream	645305	5022969	n/a	0	n/a	0.44	n/a	-0.075
P8 deep	645305	5022969	1.9	0.79	0.44		0.796	nm
P9 stream	646411	5023019	n/a	0	n/a	1.003	n/a	-0.18
P9 deep	646411	5023019	1.9	1.353	1.003		1.46	nm
nm - not measured								
mbgs – meters below ground surface								

MP 1

MP 1 is located in a wetland west of Fogherty Lake. The wetland was relatively dry at the time of installation. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of ~ 3 m in this area.

MP2

MP 2 is located in a wetland south of Fogherty Lake. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of 2 to 2.5 m in the wetland.. Both the shallow and deep piezometers are instrumented with data loggers.

MP3

MP3 is located east of Fogherty Lake. Thick sphagnum moss and peat is found to a depth > 1.5 m. Bedrock was consistently encountered at a depth of 2 to 3 m in the wetland area.

MP4

MP4 is located in a small wetland area in the eastern portion of the property. Topography indicates the wetland drains to Murphys Lake. The wetland was wetter than those hosting the MPs installed near Fogherty Lake. Outcrops of bedrock are visible within 50.0 m of MP4. Bedrock was encountered at a depth of ~ 3 m.

Photo 1: MP4

MP5

MP5 is located in a large wetland area at the southern end of the property. The wetland feeds a stream discharging to the south (BPSTR012 stream monitoring location). Thick sphagnum moss and peat is found to a depth >1.5 m. Bedrock depth is variable from 1.5 m to 3.5 m.

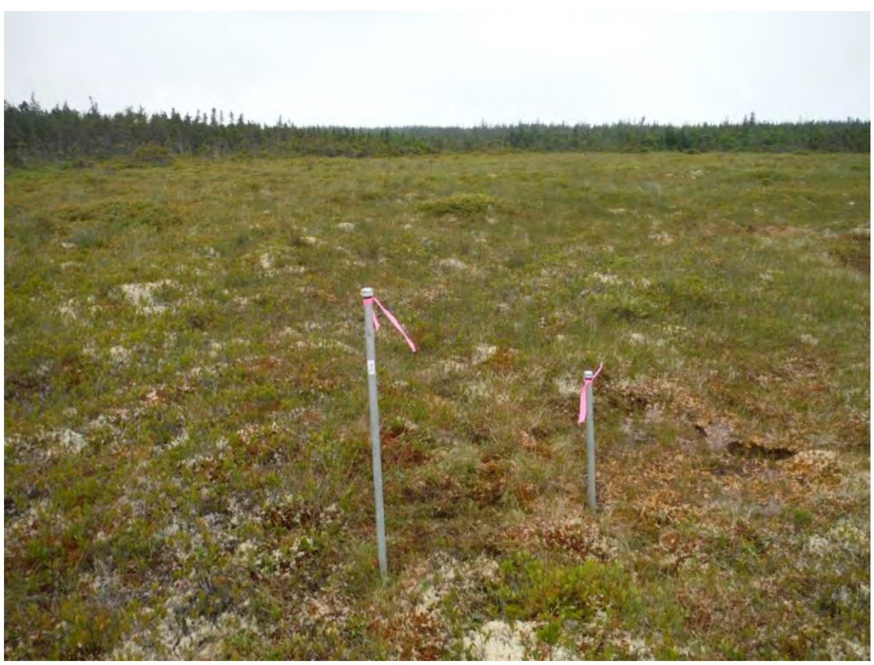


Photo 2: MP5

MP6

MP6 is a single 1 inch piezometer installed in the stream discharging from Fogherty Lake. The stream bed has sand, gravel, cobbles and boulders. Piezometer refusal was common at a depth of 0.5 m. Stream flow measurement, surface water sampling and field parameters measurements were completed at MP6. The piezometer is instrumented with a data logger.

Photo 3: MP6 with Data Logger

MP7

MP7 is located in a northwest trending lineament with ~ 10 m of relief, which is 5 to 10 m wide. No water was running at the location and there is no indication of a stream bed. A nested set of MPs were installed. Moss is found to a depth of 0.5 m, followed by sediment/till. Bedrock/piezometer refusal was not encountered, but piezometer insertion was increasingly difficult past the first pipe length.

Photo 4: MP7

MP8

MP8 is single piezometer located in a small stream in the southeastern portion of the property. The stream bed is composed of sand, gravel, cobbles and boulders. Piezometer refusal was common at a depth of < 0.5 m. Stream flow was negligible and a flow measurement was not completed. A surface water sample was collected.

MP9

MP9 is a single piezometer installed in the stream discharging from Murphys Lake. The stream bed is muddy with sand and cobbles beneath the mud. A stream flow measurement was made, surface water sample collected and field parameters recorded.

4. Summary

Field activities completed in support of the Black Point Quarry environmental assessment provide preliminary information to assess the hydrology and hydrogeology of the Site. Key findings from the field program include:

- There are no residential wells completed in the quarry granite.
- Residences west of the Site utilize dug wells to access potable water.
- Four residences (one south and three east of the Site) utilize drilled wells to obtain potable water.
- The groundwater elevation in the granite is between 53 and 93 masl.
- The granite groundwater exhibits elevated metals including uranium, relative to stream water samples.
- The granite hydraulic conductivity ranges from 10^{-5} m/s to 10^{-8} m/s.

Follow up monitoring should include:

- Mini-piezometer water level measurements in the fall, spring, and summer.
- Downloading of borehole data loggers in the fall, spring, and summer.
- Sampling from the boreholes using a pump to purge the wells prior to sampling.
- A repeat hydraulic conductivity test (k-test) of BP-7.

5. References

Stea R.R., Conley H., Brown Y. 1992. Surficial Geology of the Province of Nova Scotia. Map 92-3. Nova Scotia Department of Natural Resources Mines and Energy Branches.

Table A1: Residential Well Assessment Groundwater Quality Results
Black Point Quarry Hydrogeology Program

	Guideline (CDWQ)	Detection Limit	Units	Dug Wells (Surficial Deposits)											Drilled Wells (Meguma Metasedimentary Bedrock)				
				BPRWA001 16-July-2014	BPRWA002 16-July-2014	BPRWA003 16-July-2014	BPRWA004[1] 17-July-2014	BPRWA005[1] 17-July-2014	BPRWA006 17-July-2014	BPRWA008 17-July-2014	BPRWA012 18-July-2014	BPRWA013 22-July-2014	BPRWA014 25-July-2014	BPRWA015[6] 30-July-2014	BPRWA007 17-July-2014	BPRWA009[2] 17-July-2014	BPRWA010[2] 17-July-2014	BPRWA011 17-July-2014	BPRWA016[6] 31-July-2014
Aluminium (ug/L)[3]	NV	5.0	ug/L	33	17	9.9	16	22	12	94	46	15	83	6.3	11	21	21	16	6.9
Ammonia (total)	NV	0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Antimony	6	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	10	1.0	ug/L	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	**50**	<1.0	<1.0	<1.0	<1.0
Barium	1000	1.0	ug/L	30	52	34	44	<1.0	9.5	31	9	24	7.7	<1.0	<1.0	1.9	<1.0	<1.0	<1.0
Beryllium		1	ug/L	<1.0	<1.0	<1.0	<1.0	44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0	<1.0	<1.0
Bicarbonate	NV	1	mg/L	31	94	30	6.4	<1.0	16	49	10	51	36	99	99	15	<1.0	30	93
Bismuth		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	5000	50	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	60	<50	<50	<50	<50
Cadmium	5	0.010	ug/L	0.048	<0.010	0.034	0.025	0.022	<0.010	0.022	0.075	0.043	0.036	<0.010	<0.010	0.026	0.028	0.044	<0.010
Calcium	NV	100	ug/L	11000	26000	11000	2200	2200	6100	15000	2300	18000	13000	<100	15000	5900	6000	4200	<100
Chloride	NV	1.0	mg/L	37	15	32	12	12	12	16	25	15	9.8	94	14	10	9.9	21	21
Chromium (ug/L)	50	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt		0.04	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Colour	NV	5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper (ug/L)	NV	2.0	ug/L	38	<2.0	160	24	24	180	150	120	5.2	8.4	<2.0	<2.0	260	280	51	2.7
Iron (ug/L)	NV	50	ug/L	160	<50	1200	<50	<50	92	140	2900	<50	130	150	82	<50	<50	<50	<50
Lead (ug/L)	10	0.50	ug/L	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	2.1	<0.50	0.81	<0.50	<0.50	6	7.0	<0.50	<0.50
Magnesium	NV	100	ug/L	4000	6400	2900	1600	1600	1100	2500	2000	4500	1200	<100	4500	1300	1300	3400	<100
Manganese (ug/L)	NV	2.0	ug/L	210	22	330	<2.0	<2.0	2.3	3.3	290	<2.0	320	<2.0	66	16	13	13	4.9
Molybdenum	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	<2.0	<2.0	<2.0	<2.0
Nickel	NV	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)	10	0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	0.059	1.3	<0.050	<0.050	<0.050
Nitrite (as N)	NV	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus	NV	100	ug/L	<100	<100	<100	<100	110	<100	110	<100	<100	110	<100	<100	<100	<100	280	<100
Potassium	NV	100	ug/L	1300	1100	5400	630	680	280	1200	660	930	2300	<100	650	630	630	1200	<100
pH[4]	NV	N/A	pH	6.76	8.1	6.55	6.36	6.37	6.73	7.12	5.95	7.68	6.83	7.41	8.17	6.66	4.65	6.5	7.37
Selenium	10	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (ug/L)	NV	100	ug/L	17000	9500	14000	6800	6700	7000	9900	15000	7700	5800	99000	31000	5800	5900	15000	57000
Strontium		2	ug/L	30	51	52	13	14	25	33	15	46	29	<2.0	98	44	45	24	<2.0
Sulphate	NV	2.0	mg/L	5.6	6.4	6.5	2.7	3	3.1	5.1	7	5.6	3.9	6.2	9.1	3.3	3.4	3.9	12
Thallium	NV	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total dissolved solids (TDS-Calculated)[5]	NV	1.0	mg/L	100	130	95	42	42	46	89	70	99	62	270	150	46	45	89	160
Turbidity	NV	0.10	NTU	0.5	0.34	3.1	0.26		0.28	1.2	13	0.37	0.19	1.2	0.82	<0.10	0.69	<0.10	<0.10
Uranium	20	0.10	ug/L	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.2	<0.10
Vanadium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (ug/L)	NV	5.0	ug/L	11	8	19	8.8	11	52	27	20	20	13	5.7	15	30	28	170	12
Anion Sum		N/A	me/L	1.79	2.47	1.64	0.610	0.610	0.740	1.54	1.07	1.66	1.07	4.78	0.750	1.21	0.660	0.670	2.69
Bicarb. Alkalinity (calc. as CaCO3)		1.0	mg/L	31	94	30	6.4	6.6	16	49	10	51	36	99	18	41	<1.0	<1.0	93
Calculated TDS		1.0	mg/L	100	130	95	42	42	46	89	70	99	62	270	65	100	45	45	160
Carb. Alkalinity (calc. as CaCO3)		1.0	mg/L	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	1.63	2.26	1.55	0.550	0.550	0.710	1.41	1.05	1.63	1.04	4.32	0.950	1.40	0.730	0.710	2.48
Hardness (CaCO3)		1.0	mg/L	44	91	39	12	12	20	47	14	64	38	<1.0	16	16	6.3	6.1	<1.0
Ion Balance (% Difference)		N/A	%	4.68	4.44	2.82	5.17	5.17	2.07	4.41	0.940	0.910	1.42	5.05	11.8	7.28	5.04	2.90	4.06
Langelier Index (@ 20C)			N/A	(2.06)	0.128	(2.28)	(3.79)	(3.76)	(2.57)	(1.36)	(4.02)	-0.696	(1.81)	NC	(3.03)	(2.49)	NC	NC	NC
Langelier Index (@ 4C)			N/A	(2.31)	-0.122	(2.53)	(4.04)	(4.01)	(2.82)	(1.61)	(4.27)	-0.947	(2.06)	NC	(3.28)	(2.74)	NC	NC	NC
Nitrate (N)		0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Saturation pH (@ 20C)			N/A	8.82	7.97	8.83	10.1	10.1	9.30	8.48	9.97	8.37	8.64	NC	9.54	9.19	NC	NC	NC
Saturation pH (@ 4C)			N/A	9.07	8.22	9.08	10.4	10.4	9.55	8.73	10.2	8.62	8.89	NC	9.79	9.44	NC	NC	NC
Total Alkalinity (Total as CaCO3)		5.0	mg/L	31	95	30	6.4	6.6	17	49	10	52	36	100	18	41	<5.0	<5.0	93
Dissolved Chloride (Cl)		1.0	mg/L	37	15	32	12	12	12	16	25	15	9.8	94	11	13	22	22	21
Colour		5.0	TCU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	210	62	350	320	<5.0
Nitrate + Nitrite		0.050	mg/L	0.082	<0.050	<0.050	1.2	1.2	<0.050	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050
Nitrite (N)		0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)		0.050	mg/L	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	0.15	<0.050	<0.050	<0.050
Total Organic Carbon (C)		0.50	mg/L	0.71	0.56	1.4	<0.50	<0.50	<0.50	0.60	1.4	0.64	1.2	0.95	10 (1)	5.2 (1)	17 (1)	14 (1)	0.79
Orthophosphate (P)		0.010	mg/L	<0.010	0.032	<0.010	0.025	0.027	<0.010	<0.010	<0.010	0.012	<0.010	0.040	0.065	0.14	0.011	0.011	0.015
pH		N/A	pH	6.76	8.10	6.55	6.36	6.37	6.73	7.12	5.95	7.68	6.83	7.41	6.51	6.70	4.65	4.66	7.37
Reactive Silica (SiO2)		0.50	mg/L	6.9	9.1	4.6	6.9	6.9	5.7	9.6	8.0	11	5.7	13	18	27	4.5	4.5	19
Dissolved Sulphate (SO4)		2.0	mg/L	5.6	6.4	6.5	2.7	2.6	3.1	5.1	7.0	5.6	3.9	6.2	2.9	<2.0	2.4	2.4	12
Turbidity		0.10	NTU	0.50	0.34	3.1	0.26	<0.10	0.28	1.2	13	0.37	0.19	1.2	19	37	0.69	0.64	<0.10
Conductivity		1.0	uS/cm	190	230	180	67	67	76	140	120	170	100	490	84	120	84	84	260

NOTES:
NV = no value
CDWQ = Canadian Drinking Water Quality Guidelines, Aug 2012
1. Duplicate Sample BPRWA005 2. Duplicate Sample BPRWA010
3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system
BOLD RED: Exceeds guideline

Table A2: Granite Borehole Groundwater Quality Results
Black Point Quarry Hydrogeology Program

	Guideline (CDWQ)	Detection Limit	Units	BPBH5	BPBH07	BPBH08	BPBH09
				22-July-2014	23-July-2014	23-July-2014	23-July-2014
Aluminium (ug/L)[3]	NV	5.0	ug/L	2900	2700	3000	1200
Ammonia (total)	NV	0.050	mg/L	0.072	<0.050	<0.050	0.15
Antimony	6	1.0	ug/L	2.2	<1.0	<1.0	<1.0
Arsenic	10	1.0	ug/L	9.5	**39**	2.1	**31**
Barium	1000	1.0	ug/L	15	10	17	14
Beryllium		1	ug/L	<1.0	1.4	<1.0	<1.0
Bicarbonate	NV	1	mg/L	<1	18	29	41
Bismuth			ug/L	<2.0	2.1	<2.0	<2.0
Boron	5000	50	ug/L	<50	<50	<50	<50
Cadmium	5	0.010	ug/L	0.35	1.8	0.17	0.11
Calcium	NV	100	ug/L	740	3300	5800	3400
Chloride	NV	1.0	mg/L	9.3	11	10	13
Chromium (ug/L)	50	1.0	ug/L	18	4.2	9.4	5
Cobalt		0.4	ug/L	1.7	11	0.65	3.1
Colour	NV	5.0	TCU	110	210	<5.0	62
Copper (ug/L)	NV	2.0	ug/L	15	130	61	22
Iron (ug/L)	NV	50	ug/L	6100	2700	6600	8200
Lead (ug/L)	10	0.50	ug/L	7.3	5.7	**48**	2.6
Magnesium	NV	100	ug/L	660	1900	2300	1900
Manganese (ug/L)	NV	2.0	ug/L	150	400	240	1400
Molybdenum	NV	2.0	ug/L	3.9	13	3.6	7
Nickel	NV	2.0	ug/L	3	11	2.7	4.9
Nitrate (as N)	10	0.050	mg/L	0.11	<0.050	<0.050	<0.050
Nitrite (as N)	NV	0.010	mg/L	<0.010	<0.010	<0.010	<0.010
Phosphorus		100	ug/L	340	270	820	420
Potassium	NV	100	ug/L	1100	2700	2200	4600
pH[4]	NV	N/A	pH	5.05	6.51	6.48	6.7
Selenium	10	1.0	ug/L	<1.0	<1.0	<1.0	<1.0
Silver	NV	0.10	ug/L	73	75	17	4.5
Sodium (ug/L)	NV	100	ug/L	6700	11000	12000	15000
Strontium			ug/L	4.7	22	20	20
Sulphate	NV	2.0	mg/L	<2.0	2.9	2.8	<2.0
Thallium	NV	0.10	ug/L	<0.10	0.13	<0.10	<0.10
Tin			ug/L	<2.0	<2.0	<2.0	<2.0
Titanium			ug/L	35	59	24	22
Total dissolved solids (TDS-	NV	1.0	mg/L	35	65	83	100
Turbidity	NV	0.10	NTU	40	19	39	37
Uranium	20	0.10	ug/L	17	**260**	14	20
Vanadium			ug/L	2.5	<2.0	<2.0	<2.0
Zinc (ug/L)	NV	5.0	ug/L	390	1800	580	1500
Anion Sum		N/A	me/L	0.27	0.75	0.95	1.21
Bicarb. Alkalinity		1	mg/L	<1.0	18	29	41
Calculated TDS		1	mg/L	35	65	83	100
Carb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	0.64	0.95	1.28	1.4
Hardness (CaCO3)		1	mg/L	4.6	16	24	16
Ion Balance (% Difference)		N/A	%	40.7	11.8	14.8	7.28
Langelier Index (@ 20C)			N/A	NC	-3.03	-2.62	-2.49
Langelier Index (@ 4C)			N/A	NC	-3.28	-2.87	-2.74
Nitrate (N)		0.05	mg/L	0.11	<0.050	<0.050	<0.050
Saturation pH (@ 20C)			N/A	NC	9.54	9.1	9.19
Saturation pH (@ 4C)			N/A	NC	9.79	9.35	9.44
Total Alkalinity (Total as CaCO3)		5	mg/L	<5.0	18	29	41
Dissolved Chloride (Cl)		1	mg/L	9.3	11	10	13

Colour		5	TCU	110	210	<5.0	62
Nitrate + Nitrite		0.05	mg/L	0.11	<0.050	<0.050	<0.050
Nitrite (N)		0.01	mg/L	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)		0.05	mg/L	0.072	<0.050	<0.050	0.15
Total Organic Carbon (C)		0.5	mg/L	13 (1)	10 (1)	1.4	5.2 (1)
Orthophosphate (P)		0.01	mg/L	0.013	0.065	0.12	0.14
pH		N/A	pH	5.05	6.51	6.48	6.7
Reactive Silica (SiO2)		0.5	mg/L	9.6	18	23	27
Dissolved Sulphate (SO4)		2	mg/L	<2.0	2.9	2.8	<2.0
Turbidity		0.1	NTU	40	19	39	37
Conductivity		1	uS/cm	46	84	92	120

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)

4. pH Objective (CDWQ): 6.5 - 8.5

5. Calculated result only includes measured parameters. Actual TDS may be higher.

BOLD RED Exceeds guideline

Table A3: Stream Water Quality Results
Black Point Quarry Hydrogeology Program

	(CWQG PAL Freshwater)	Detection Limit	Units	BPSTR09 31-07-2014	BPSTR12 31-07-2014	BPSTR08 24-07-2014	BPSTR06 24-07-2014	BPSTR10[1] 25-July-2014	BPSTR11[1] 25-July-2014
Aluminium (ug/L)[4]	5	5.0	ug/L	**270**	**820**	**680**	**370**	**610**	610
Ammonia (total)[5]	0	0.050	mg/L	**0.084**	<0.050	<0.050	**0.086**	<0.050	<0.050
Antimony	NV	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	5	1.0	ug/L	<1.0	1.5	2	1.7	<1.0	<1.0
Barium	NV	1.0	ug/L	1.4	2.8	2.6	1.6	5.6	5.6
Beryllium		1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bicarbonate Alkalinity	NV	1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth		2	ug/L			<2.0	<2.0	<2.0	<2.0
Boron	NV	50	ug/L	<50	<50	<50	<50	<50	<50
Cadmium	0.017	0.010	ug/L	0.016	**0.019**	0.018	0.021	0.032	0.026
Calcium	NV	100	ug/L	220	410	240	320	1000	920
Chloride[6]	120	1.0	mg/L	12	12	11	12	22	22
Chromium (ug/L)	NV	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt		0.4	ug/L	<0.40	<0.40	<0.40	<0.40	0.7	0.69
Colour	NV	5.0	TCU	91	300	220	300	350	320
Copper		2	ug/L	<2.0	<2.0	390	760	1600	1500
Iron (ug/L)	300	50	ug/L	**320**	**950**	**390**	**760**	**1600**	1500
Lead (ug/L)[10]	1	0.50	ug/L	<0.50	**1.2**	0.86	0.96	**1.2**	1.2
Magnesium	NV	100	ug/L	570	620	450	550	930	920
Manganese (ug/L)	NV	2.0	ug/L	56	46	17	19	200	200
Molybdenum	73	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel[11]	25	2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (as N)[12]	3	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
Nitrite (as N)	0.06	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphorus		100	ug/L	<100	100	<100	110	110	<100
Potassium	NV	100	ug/L	280	290	370	360	750	720
pH[15]	6.5-9	N/A	pH	**4.7**	**4.33**	**4.35**	**4.35**	**4.65**	**4.66**
Selenium	1	1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	0.1	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (ug/L)	NV	100	ug/L	6000	6400	6000	5600	12000	11000
Strontium			ug/L	2.8	4.2	2.8	4.2	7.5	7.4
Sulphate	NV	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	2.4	2.4
Thallium	0.8	0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin		2	ug/L	<0.10	<0.10	<2.0	<2.0	<2.0	<2.0
Titanium			ug/L	<2.0	<2.0	4.9	3.1	10	9.8
Total dissolved solids (TDS-Calculated)[19]	NV	1.0	mg/L	20	26	28	23	45	45
Turbidity	NV	0.10	NTU	0.93	1.6	1.2	1	0.69	0.64
Uranium	NV	0.10	ug/L	<0.10	0.41	0.49	0.14	<0.10	<0.10
Vanadium		2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (ug/L)	30	5.0	ug/L	8.2	10	18	7.5	18	9
Anion Sum		N/A	me/L	0.34	0.33	0.310	0.350	0.660	0.670
Bicarb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS		1	mg/L	20	26	28	23	45	45
Carb. Alkalinity (calc. as CaCO3)		1	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum		N/A	me/L	0.36	0.44	0.380	0.390	0.730	0.710
Hardness (CaCO3)		1	mg/L	2.9	3.6	2.4	3.0	6.3	6.1
Ion Balance (% Difference)		N/A	%	2.86	14.3	10.1	5.41	5.04	2.90
Langelier Index (@ 20C)			N/A	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)			N/A	NC	NC	NC	NC	NC	NC
Saturation pH (@ 20C)			N/A	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)			N/A	NC	NC	NC	NC	NC	NC
Total Alkalinity (Total as CaCO3)		5	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)		1	mg/L	12	12	11	12	22	22
Colour		5	TCU	91	300	220	300	350	320
Nitrate + Nitrite		0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
Nitrogen (Ammonia Nitrogen)		0.05	mg/L	0.084	<0.050	<0.050	0.086	<0.050	<0.050
Total Organic Carbon (C)		0.5	mg/L	7.3	24 (1)	13 (1)	11 (1)	17 (1)	14 (1)
Orthophosphate (P)		0.01	mg/L	<0.010	<0.010	0.019	0.032	0.011	0.011
Reactive Silica (SiO2)		0.5	mg/L	<0.50	5	9.7	2.3	4.5	4.5
Dissolved Sulphate (SO4)		2	mg/L	<2.0	<2.0	<2.0	<2.0	2.4	2.4
Conductivity		1	uS/cm	54	60	57	57	84	84

NV = no value

Canadian Water Quality Guidelines (CWQG) Protection for Aquatic Life (PAL) Freshwater Guidelines Update 7.0: Sep 2007

1. Duplicate sample is BPSTR011

4. Aluminum Guideline (CWQG Aquatic Life - Freshwater): if pH < 6.5 then 0.005 mg/L (5 ug/L), else if pH >= 6.5 then 0.1 mg/L (100 ug/L)

5. Ammonia (CWQG Aquatic Life - Freshwater) - guidelines vary with pH and temperature. See fact sheet for details

6. Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L

7. Copper Guideline (CWQG Aquatic Life - Freshwater): if $CaCO_3$ < 120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.003 mg/L, if CaCO3 > 180 mg/L then 0.004 mg/L

8. Dissolved Oxygen Guideline (CWQG A.L. - Freshwater): Warm-water biota early life stages 6000 ug/L, other life stages 5500 ug/L, Cold-water biota early life stages 9500 ug/L, other life stages 6500 ug/L

9. Dissolved Oxygen Guideline (CWQG Aquatic Life - Marinewater): > 8000 ug/L

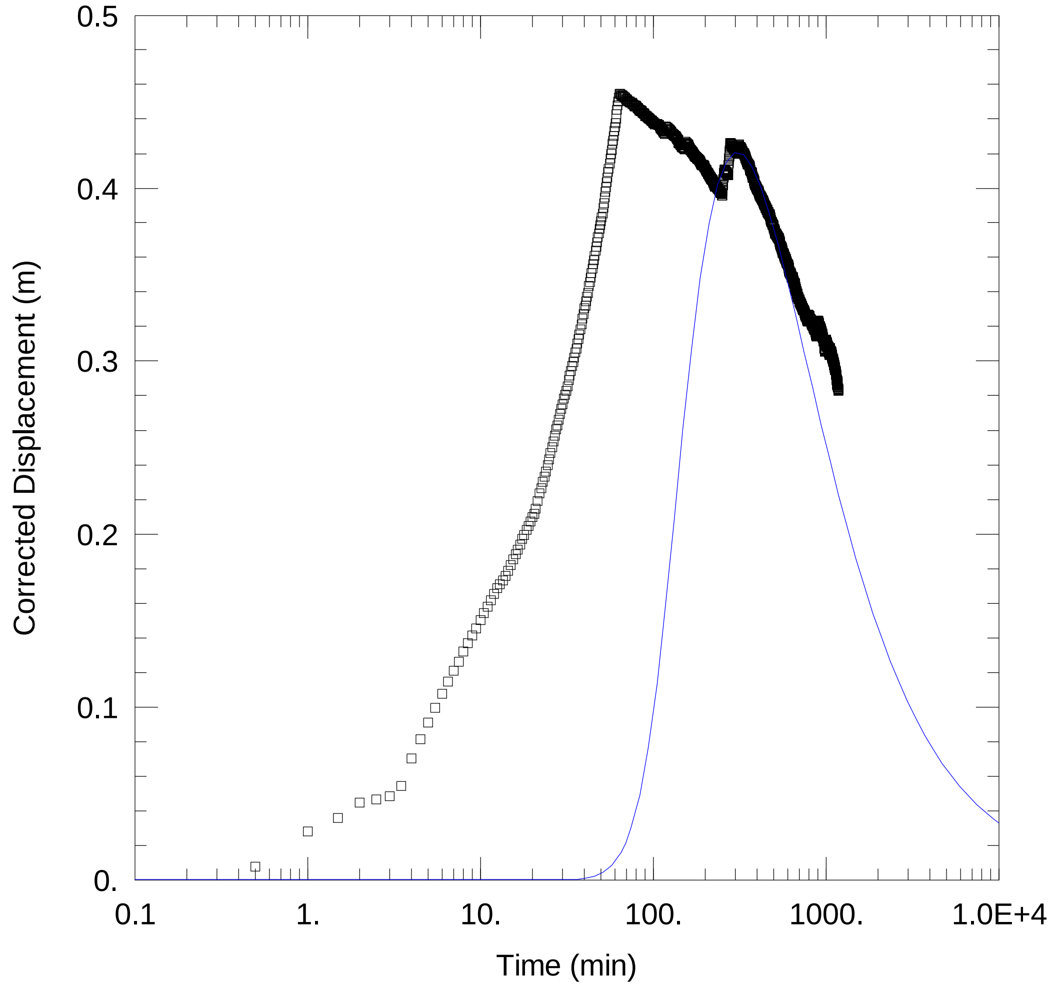
10. Pb Guideline (CWQG A.L.- Freshwater): if $CaCO_3$ < 60 mg/L then 0.001 mg/L, if CaCO3 = 60-120 mg/L then 0.002 mg/L, if CaCO3 = 120-180 mg/L then 0.004 mg/L, if CaCO3 > 180 mg/L then 0.007 mg/L,

11. Ni Guideline (CWQG A.L.-Freshwater): if $CaCO_3$ < 60 mg/L then 0.025 mg/L, if CaCO3 = 60-120 mg/L then 0.065 mg/L, if CaCO3 = 120-180 mg/L then 0.110 mg/L, if CaCO3 > 180 mg/L then 0.150 mg/L

12. Nitrate Canadian Water Quality Guidelines (CWQG) for Aquatic Life represents lower value for "Long Term Exposure". Short Term exposure values are 124 and 339 for Freshwater and Marine respectively

15. pH Guideline (CWQG Aquatic Life): Freshwater 6.5 - 9, Marine 7.0 - 8.7
16. Salinity Guideline (CWQG Aquatic Life - Marinewater): < 10% fluctuation.
17. Taste Aesthetic Objective (CDWQ): "Inoffensive"
18. Temperature Aesthetic Objective (CDWQ): <= 15^{o}C
19. Calculated result only includes measured parameters. Actual TDS may be higher.

BOLD RED	Exceeds guideline



WELL TEST ANALYSIS

Data Set: P:\...\RWA001 yield test.aqt
Date: 08/13/14 Time: 10:37:23

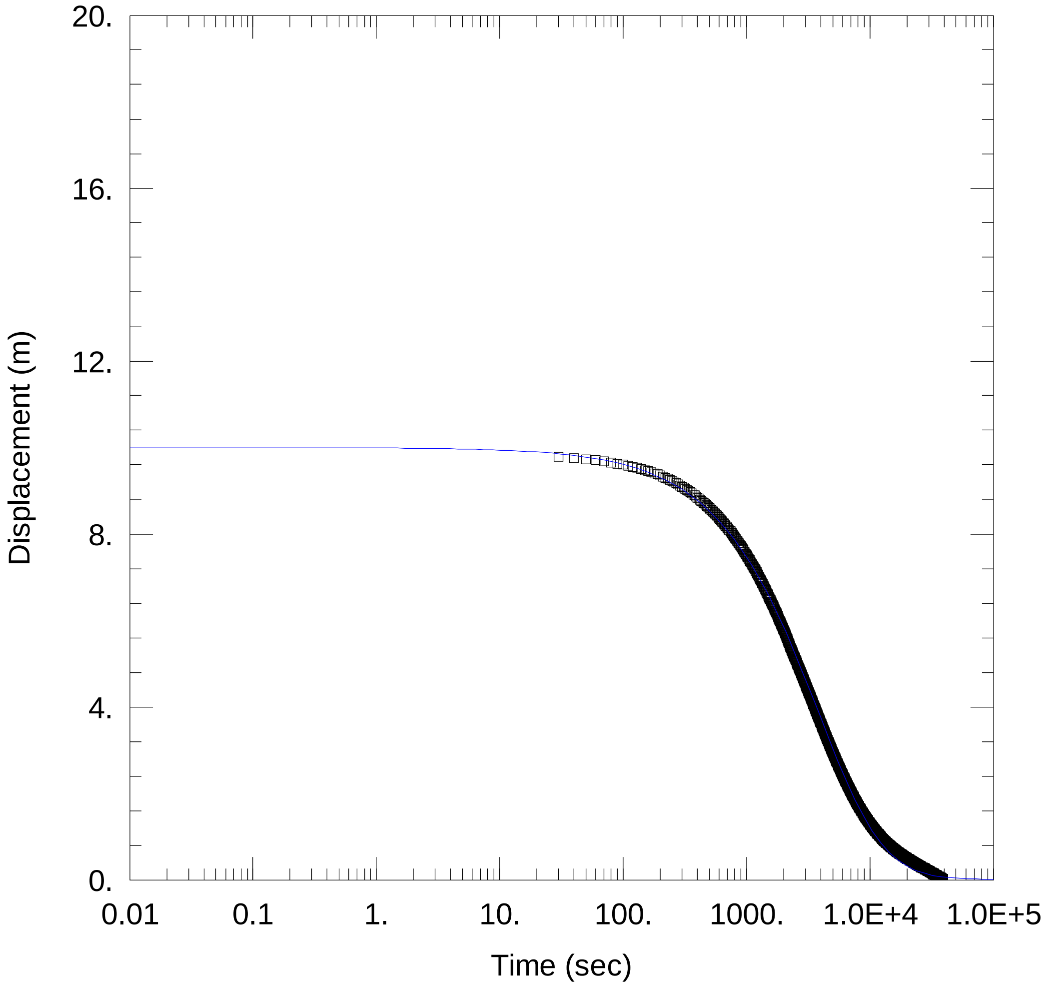
PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA001
Test Date: July 16, 2014

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 2.545E-6 m^2/sec
S = 0.7879
Kz/Kr = 1.0E-5
b = 3. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA007
Test Date: July 17, 2014

AQUIFER DATA

Saturated Thickness: 73. m

WELL DATA (BPRWA007)

Initial Displacement: 10. m
Total Well Penetration Depth: 83. m
Casing Radius: 0.076 m

Static Water Column Height: 73. m
Screen Length: 80. m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 5.807E-8 m/sec
Kz/Kr = 1.

Ss = 1.402E-6 m^{-1}

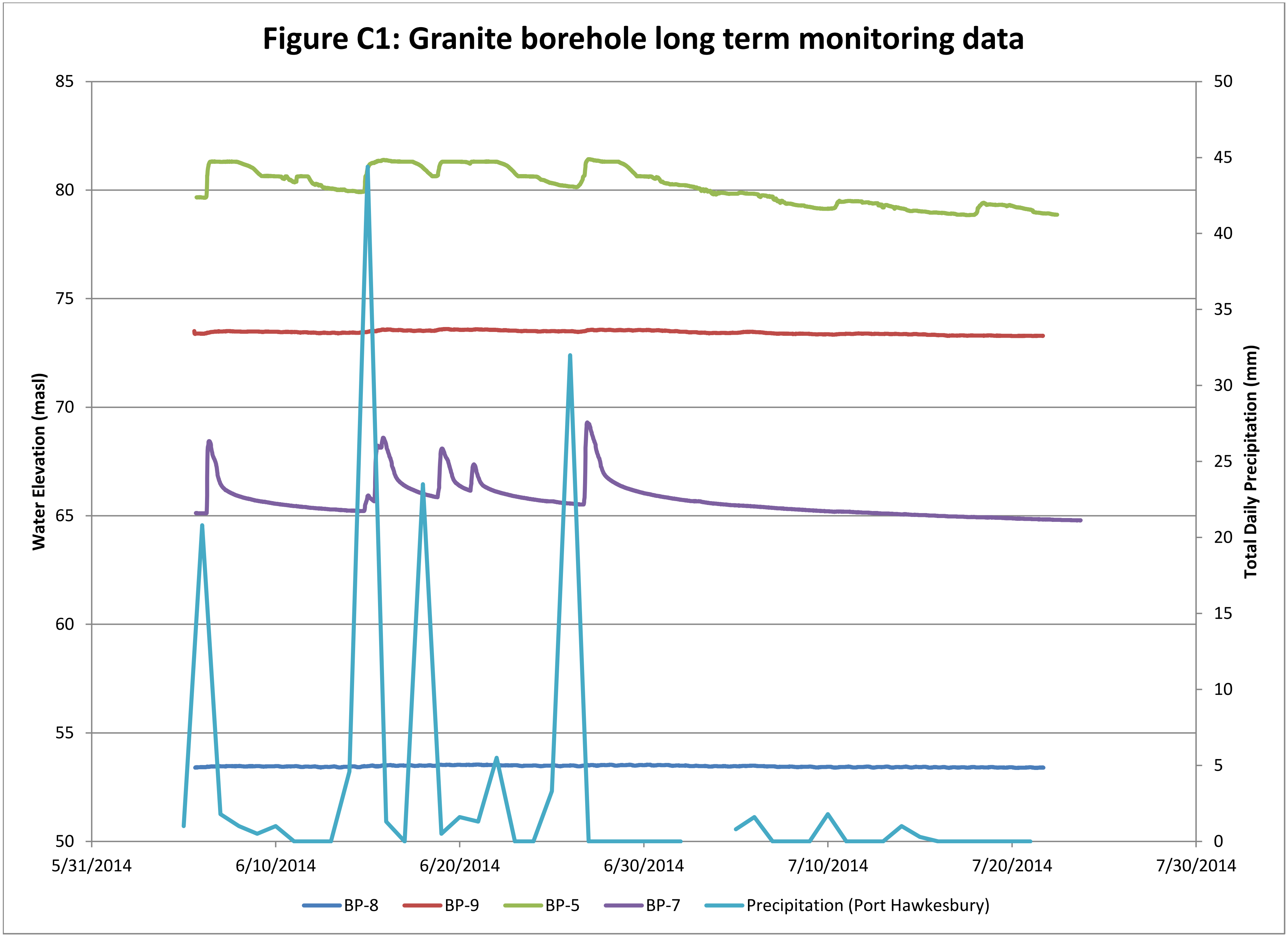


Figure C1: Granite borehole long term monitoring data
Water Elevation (masl)
Total Daily Precipitation (mm)
85
80
75
70
65
60
55
50
50
45
40
35
30
25
20
15
10
5
0
5/31/2014
6/10/2014
6/20/2014
6/30/2014
7/10/2014
7/20/2014
7/30/2014
BP-8
BP-9
BP-5
BP-7
Precipitation (Port Hawkesbury)

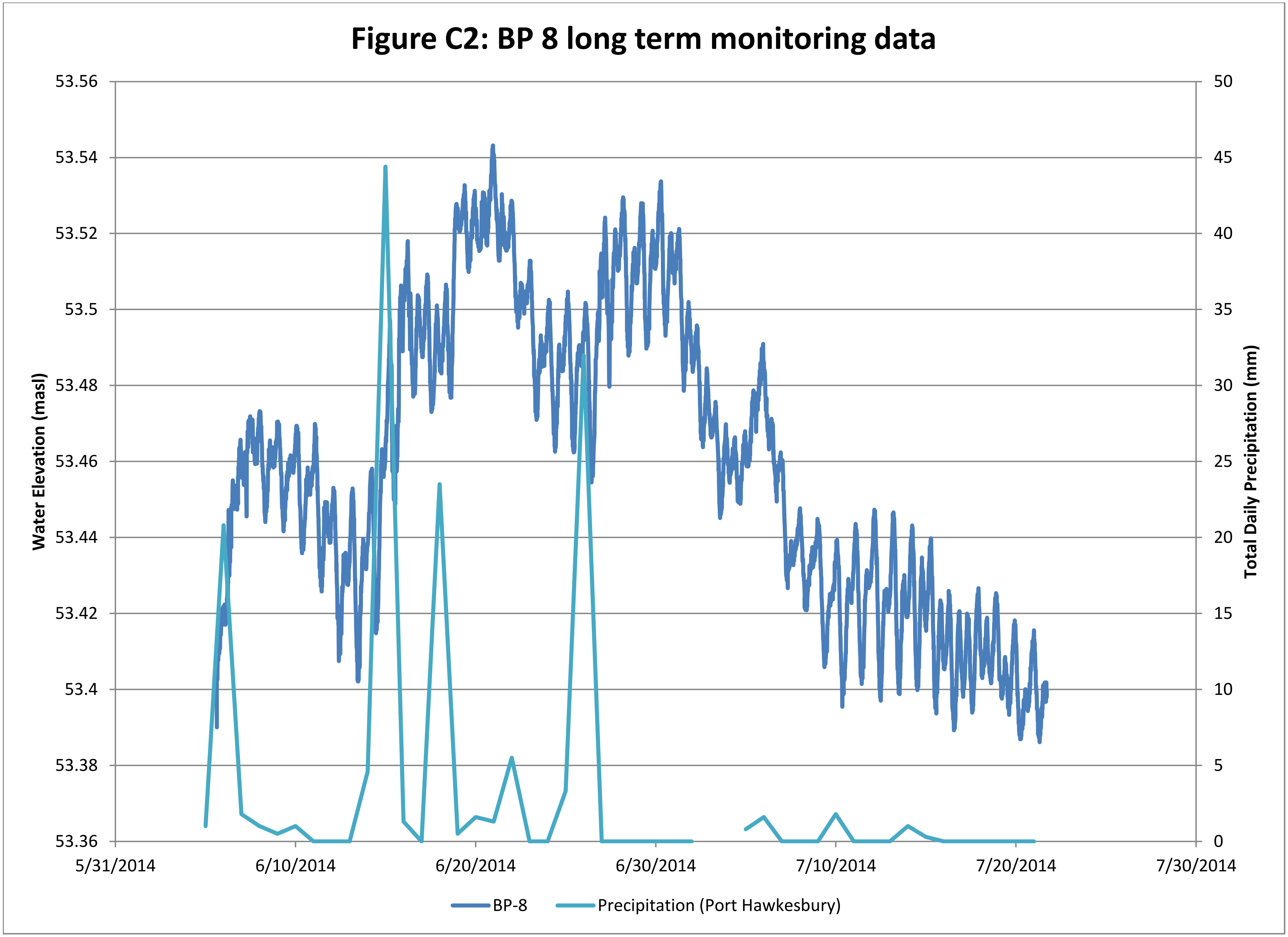


Figure C2: BP 8 long term monitoring data
Water Elevation (masl)
Total Daily Precipitation (mm)
53.56
53.54
53.52
53.5
53.48
53.46
53.44
53.42
53.4
53.38
53.36
50
45
40
35
30
25
20
15
10
5
0
5/31/2014
6/10/2014
6/20/2014
6/30/2014
7/10/2014
7/20/2014
7/30/2014
BP-8
Precipitation (Port Hawkesbury)

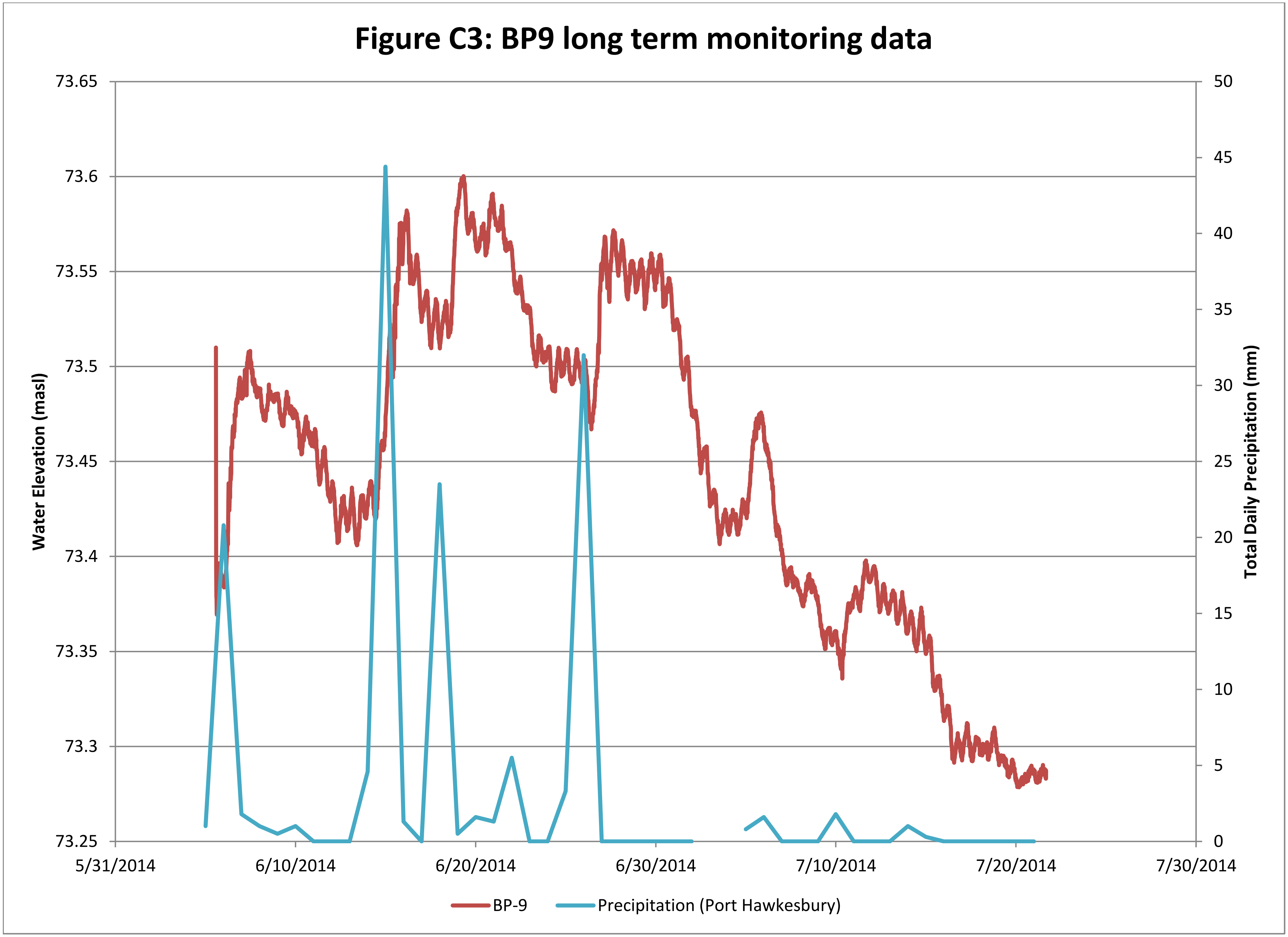
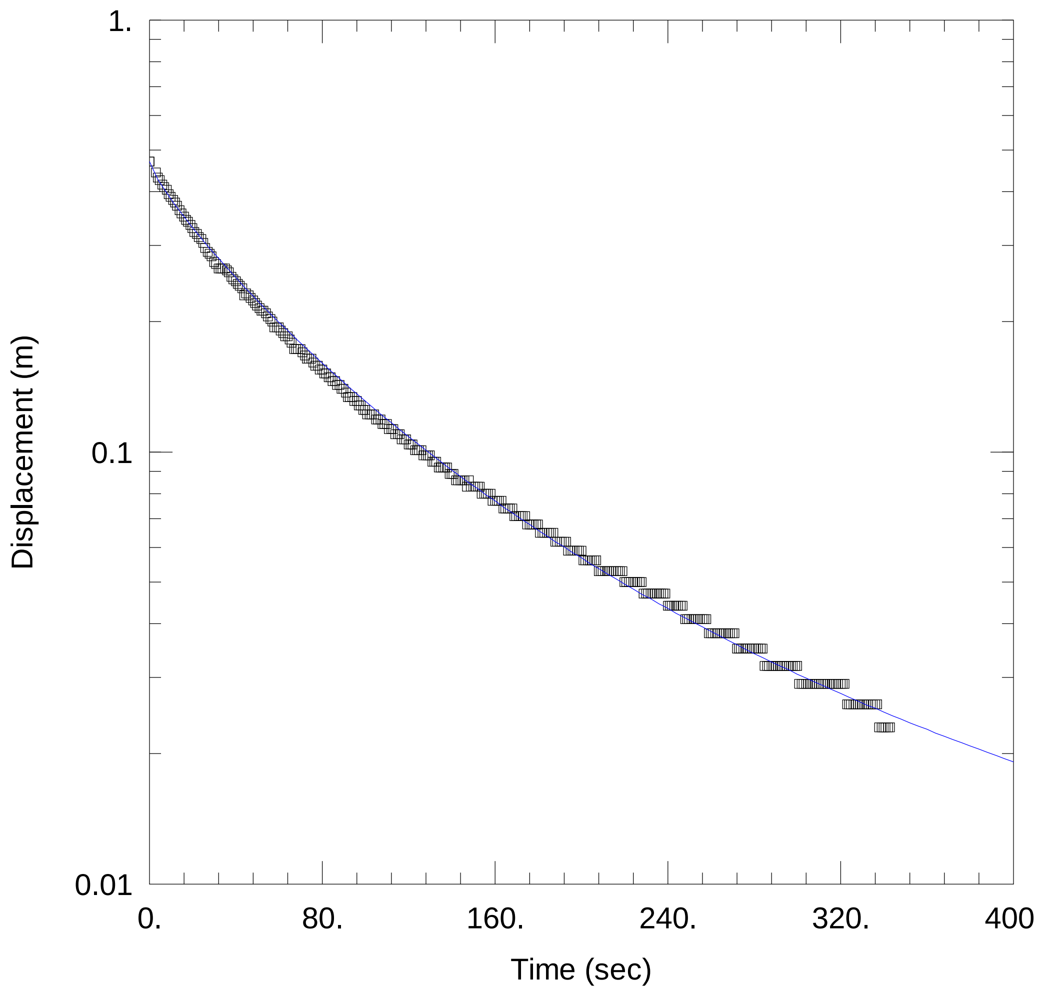


Figure C3: BP9 long term monitoring data
Water Elevation (masl)
Total Daily Precipitation (mm)
73.65
73.6
73.55
73.5
73.45
73.4
73.35
73.3
73.25
50
45
40
35
30
25
20
15
10
5
0
5/31/2014
6/10/2014
6/20/2014
6/30/2014
7/10/2014
7/20/2014
7/30/2014
BP-9
Precipitation (Port Hawkesbury)



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP5
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 86.67 m

WELL DATA (BP5)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 89. m
Casing Radius: 0.03785 m

Static Water Column Height: 86.67 m
Screen Length: 89. m
Well Radius: 0.03785 m

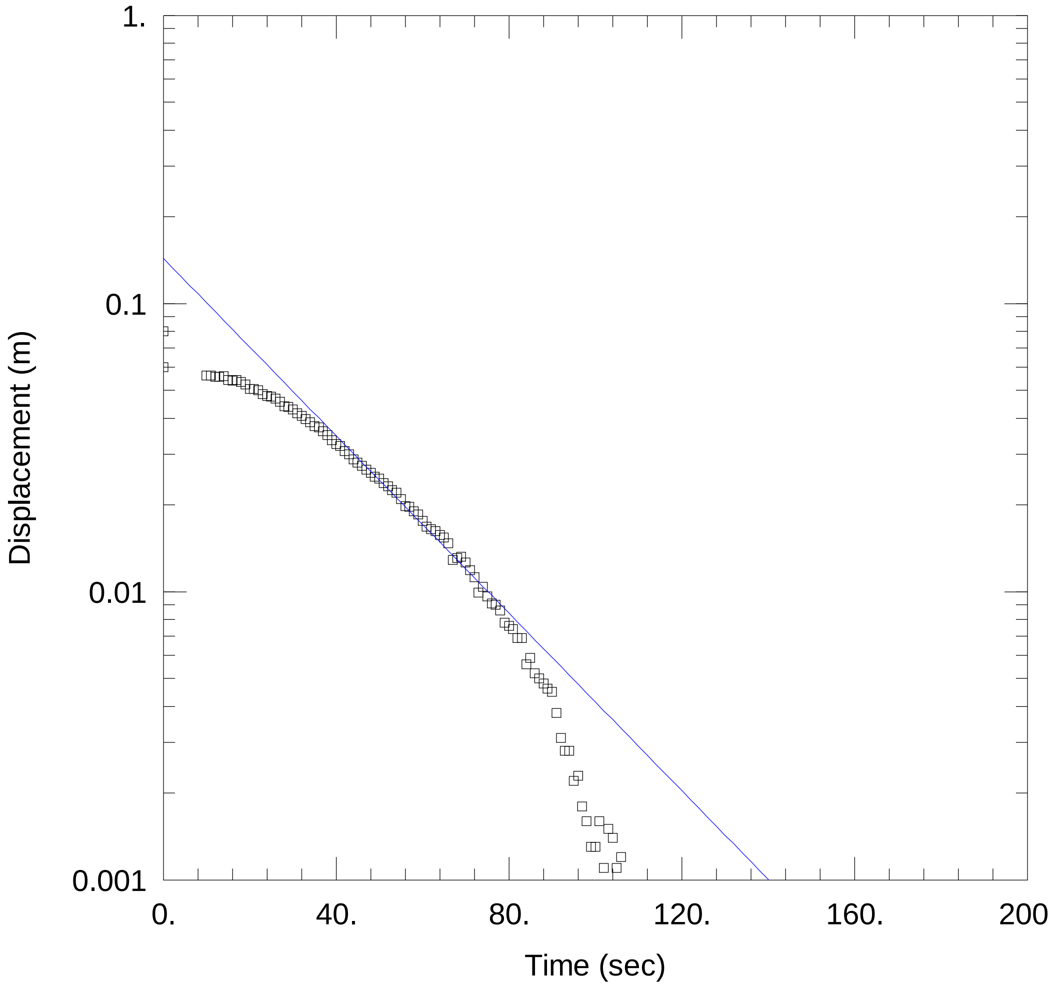
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 4.464E-7 m/sec
Kz/Kr = 1.

Ss = 1.791E-5 m^{-1}



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP7
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 70.69 m
Anisotropy Ratio (Kz/Kr): 1.

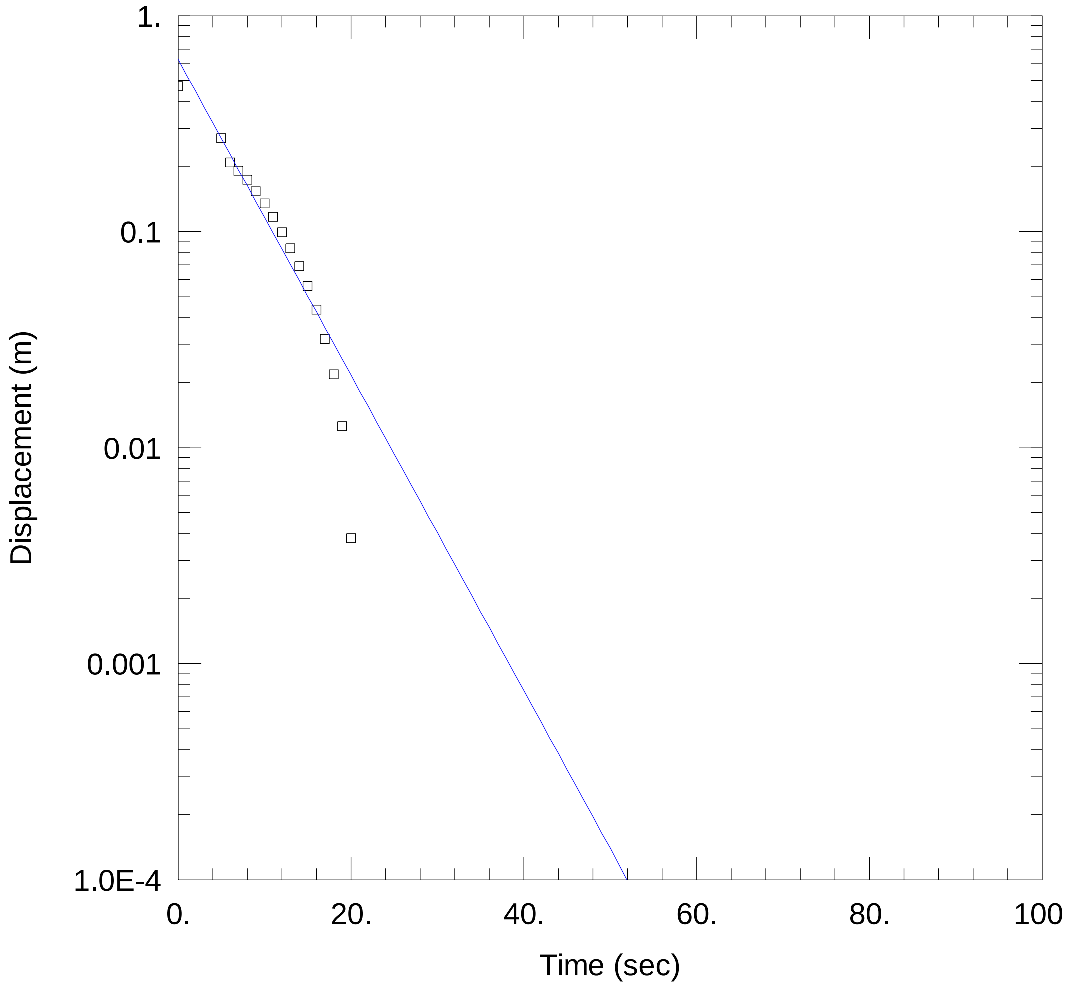
WELL DATA (BP7)

Initial Displacement: 0.08 m
Total Well Penetration Depth: 70.69 m
Casing Radius: 0.0378 m
Static Water Column Height: 70.69 m
Screen Length: 70.69 m
Well Radius: 0.0378 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.343E-6 m/sec
y0 = 0.1435 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP8
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 53. m
Anisotropy Ratio (Kz/Kr): 0.6607

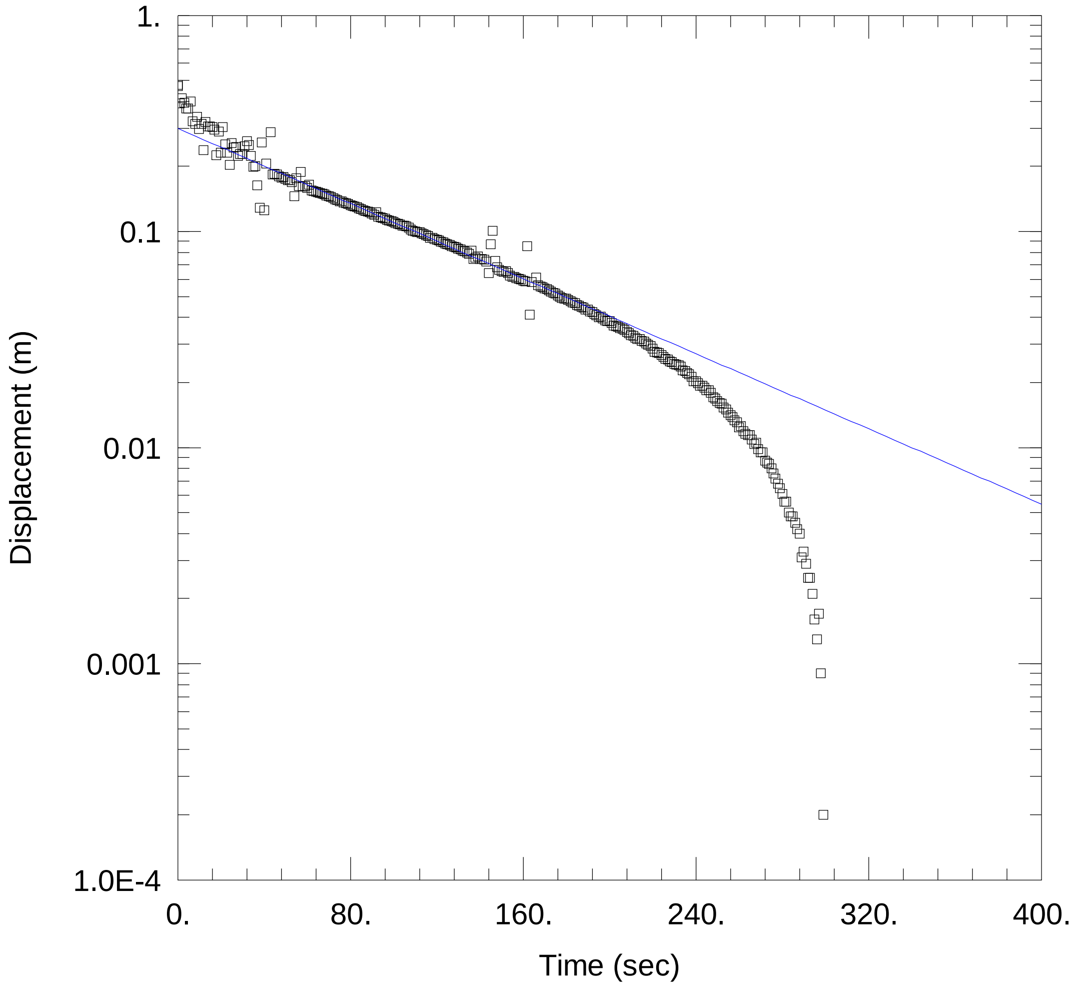
WELL DATA (BP8)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 53. m
Casing Radius: 0.03785 m
Static Water Column Height: 53. m
Screen Length: 53. m
Well Radius: 0.03785 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.412E-5 m/sec
y0 = 0.6262 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: BP9
Test Date: July 22, 2014

AQUIFER DATA

Saturated Thickness: 73. m
Anisotropy Ratio (Kz/Kr): 0.6607

WELL DATA (BP9)

Initial Displacement: 0.47 m
Total Well Penetration Depth: 73. m
Casing Radius: 0.03785 m
Static Water Column Height: 73. m
Screen Length: 73. m
Well Radius: 0.03785 m

SOLUTION

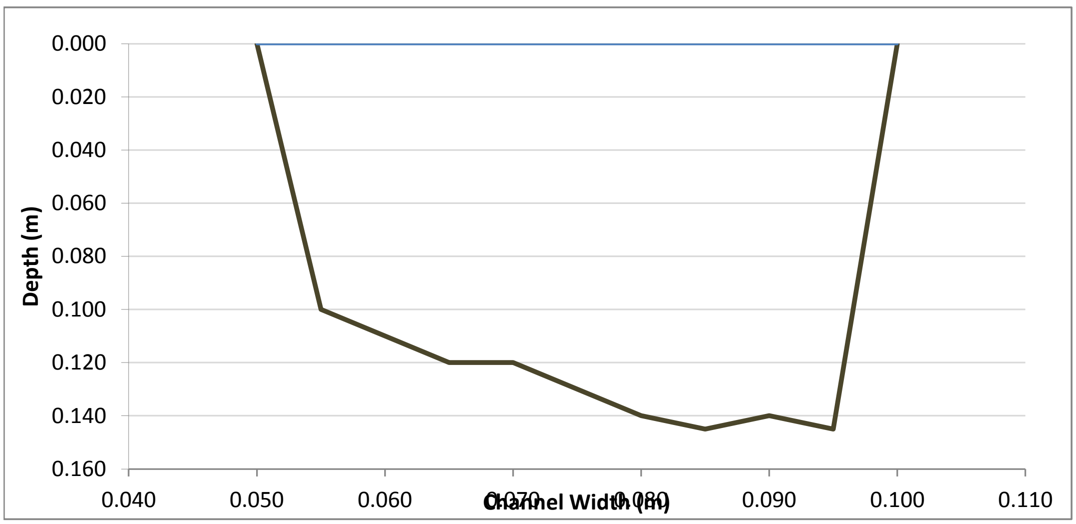
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 6.453E-7 m/sec
y0 = 0.2997 m

Location: BPSTR0P6
Date/Time: July 30, 2014 @ 9:00 am
Coordinates:
Description: Width = 50 cm. Well-defined channel by rock banks and gravel bed.
Metered By: Craig Hatt Recorded By: Tim Bachiu

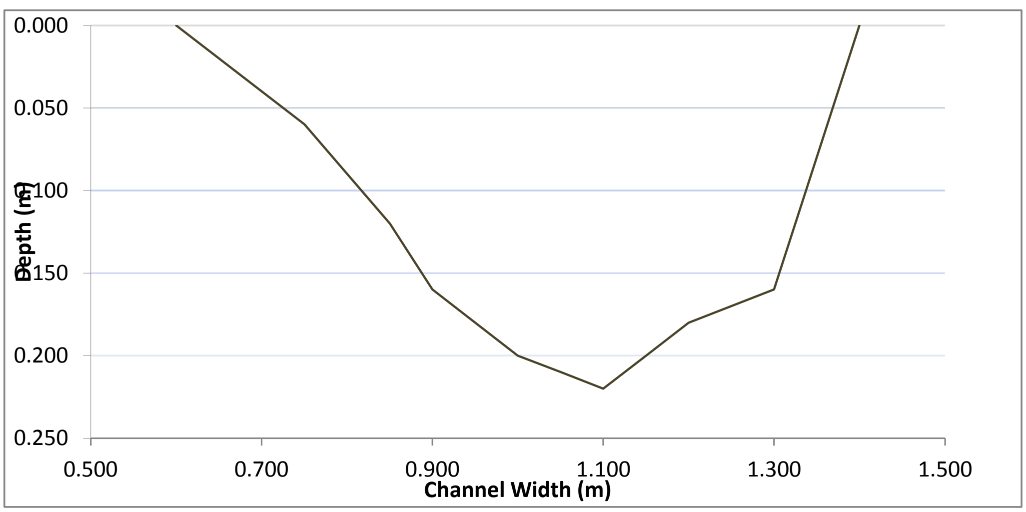
Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
0.050	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
0.055	0.100	0.0005000	-0.01	-0.00000500	
0.060	0.110	0.0005500	0.00	0.00000000	
0.065	0.120	0.0006000	0.00	0.00000000	
0.070	0.120	0.0006000	0.00	0.00000000	
0.075	0.130	0.0006500	0.00	0.00000000	
0.080	0.140	0.0007000	0.01	0.00000700	
0.085	0.145	0.0007250	0.01	0.00000725	
0.090	0.140	0.0007000	0.01	0.00000700	
0.095	0.145	0.0007250	0.02	0.00001450	
0.100	0.000	0.0000000	0.00	0.00000000	RB (Looking Upstream)

Total	0.000031	m^3/s
	0.031	L/s



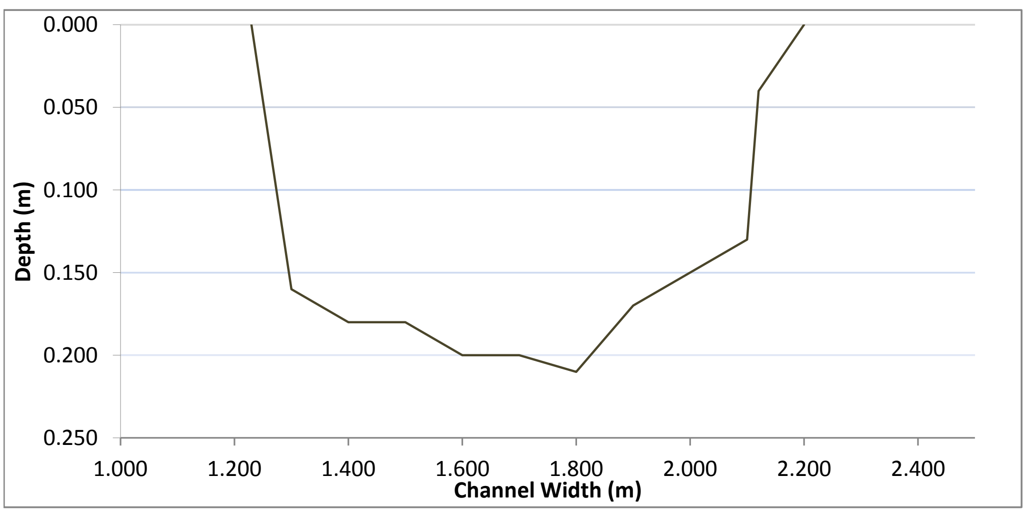
Location: BPSTR09
Date/Time: July 31, 2014 @ 10:40 am
Coordinates:
Description:
Metered By: Craig Hatt Recorded By: Tim Bachiu

Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
0.600	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
0.750	0.060	0.0075000	-0.02	-0.00015000	
0.850	0.120	0.0090000	0.00	0.00000000	
0.900	0.160	0.0080000	0.01	0.00008000	
0.950	0.180	0.0090000	0.01	0.00009000	
1.000	0.200	0.0100000	0.01	0.00010000	
1.050	0.210	0.0105000	0.00	0.00000000	
1.100	0.220	0.0110000	0.01	0.00011000	
1.150	0.200	0.0100000	0.01	0.00010000	
1.200	0.180	0.0135000	0.00	0.00000000	
1.300	0.160	0.0160000	-0.01	-0.00016000	RB (Looking Upstream)
1.400	0.000	0.0000000	0.00	0.00000000	
			Total	0.000170	m^3/s
				0.170	L/s



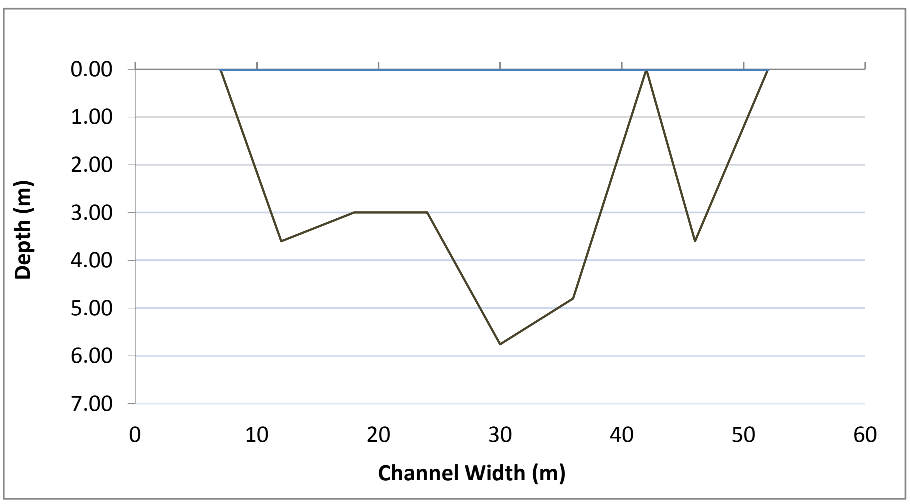
Location: BPSTR12
Date/Time: July 31, 2014 @ 11:45 am
Coordinates: UTM: 645,841m, 5,022,319m
Description: Width = 50 cm. Well-defined channel by rock banks and gravel bed.
Metered By: Craig Hatt Recorded By: Tim Bachiu

Station (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Q (m^3/s)	Notes
1.230	0.000	0.0000000	0.00	0.00000000	LB (Looking Upstream)
1.300	0.160	0.0136000	0.05	0.00068000	
1.400	0.180	0.0180000	0.05	0.00090000	
1.500	0.180	0.0180000	0.05	0.00090000	
1.600	0.200	0.0200000	0.06	0.00120000	
1.700	0.200	0.0200000	0.06	0.00120000	
1.800	0.210	0.0210000	0.05	0.00105000	
1.900	0.170	0.0170000	0.05	0.00085000	
2.000	0.150	0.0150000	0.04	0.00060000	
2.100	0.130	0.0078000	0.04	0.00031200	
2.120	0.040	0.0020000	0.02	0.00004000	
2.200	0.000	0.0000000	0.00	0.00000000	RB (Looking Upstream)
			Total	0.00773	m^3/s
				7.73	L/s



Location: BPSTR10
Date/Time: July 25, 2014 @ 10 am
Coordinates:
Description:
Metered By: Mike McKenzie (SLR) Recorded By: Craig Hatt (AECOM)

Distance (in)	Depth (in)	Area (in^2)	Velocity (in/s)	Q (in^3/s)	Notes
7	0.00	0.00	0.00	0.0	LB (Looking Upstream)
12	3.60	19.80	0.12	2.4	
18	3.00	18.00	0.60	10.8	
24	3.00	18.00	6.48	116.6	
30	5.76	34.56	3.24	112.0	
36	4.80	28.80	0.96	27.6	
42	0.00	0.00	0.00	0.0	
46	3.60	18.00	-0.60	-10.8	
52	0.00	0.00	0.00	0.0	RB (Looking Upstream)
			Total	259	in^3/s
				0.00424	m^3/s
				4.24	L/s



ATTACHMENT F
AECOM Technical Memo – August 2014 Fieldwork

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

AECOM
1701 Hollis Street
SH400 (PO Box 576 CRO)
Halifax, NS, Canada B3J 3M8
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902 428 2021 tel
902 428 2031 fax

Memorandum

To	Russell Dmytriw	Page	1
CC	Robert Till, Steve Usher		
Subject	Technical Memorandum: Black Point Hydrogeology August, 2014 Field Program		
From	Timothy Bachiu		
Date	September 23, 2014	Project Number	60323234

Field work in support of the hydrological and hydrogeological assessments of the proposed Black Point Quarry site was completed by AECOM and SLR Consulting (Canada) staff from August 25-29, 2014. This memo documents field activities and presents data compiled from field tests and measurements completed during the late August field event.

1. Mini-Piezometers

Mini-piezometers were installed at nine (9) locations as documented in the AECOM Technical Memorandum dated August 15, 2014. Water levels in each mini-piezometer (MP) were subsequently measured on August 26 and 27 (**Table 1**). The difference in water levels (DH) at each piezometer location is calculated by subtracting the water level (meters below ground surface – mbgs) in the deep MP from the water level in the shallow MP. Negative values indicate the water level in the deeper MP is lower than the shallow MP. The difference in the depth of the screened intervals (DL) is calculated as the difference between the deepest part of the screen in the shallow MP and depth of the upper limit of the screen in the deep MP. The vertical gradient is calculated by dividing the difference in the water levels by the DL (DH/DL). Negative values indicate a downward vertical gradient and positive values indicate an upward vertical gradient.

Table 1: Water Levels

Mini piezometer ID	Bottom of perforated interval	Top of perforated interval	Vertical separation of screened intervals (DL)	Stick up	Water Level			Vertical gradient
	(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)	(mbgs)	Difference (shallow - deep)	
MP1 shallow	2.158	1.807	0.826	0.667	0.755	0.088	-0.111	-0.13
MP1 deep	3.334	2.984		0.72	0.919	0.199		
MP2 shallow	1.39	0.938	0.487	0.817	1.147	0.33	-0.257	-0.53
MP2 deep	2.227	1.877		1.815	2.402	0.587		
MP3 shallow	1.99	1.64	0.789	0.86	1.273	0.413	0.09	0.11
MP3 deep	3.132	2.779		0.915	1.238	0.323		
MP4 shallow	2.058	1.709	0.641	0.771	0.761	-0.01	0.043	0.07
MP4 deep	3.042	2.699		1.01	0.957	-0.053		
MP5 shallow	1.812	1.461	1.285	1.005	1.2	0.195	-0.17	-0.13
MP5 deep	3.447	3.097		0.605	0.97	0.365		
MP6 stream	0	n/a	0.985	0.897	0.764	-0.133	-0.6	-0.61
MP6 deep	1.335	0.985		0.897	1.364	0.467		
MP7 shallow	1.719	1.369	1.07	1.11	1.186	0.076	0.016	0.01
MP7 deep	3.14	2.789		0.904	0.964	0.06		
MP8 stream	0	n/a	0.44	0.796	0.736	-0.06	-0.146	-0.33
MP8 deep	0.79	0.44		0.796	0.882	0.086		
MP9 stream	0	n/a	1.003	1.46	1.335	-0.125	0.03	0.03
MP9 deep	1.353	1.003		1.46	1.305	-0.155		

Mini-piezometers at MP 2 (deep and shallow) and MP6 (deep and stream) contained data loggers installed during a previous site visit. Recorded data from these MPs are provided in the spreadsheet **Appendix A**.

2. Granite Boreholes

A water level survey of all granite boreholes was completed between August 25 and 28. Water level measurements collected in June, July and August 2014 are provided in Table 2. Data loggers were retrieved, downloaded and replaced. Barometrically compensated data and charts from each data logger are provided in the spreadsheet **Appendix B** in the files accompanying this memorandum.

Table 2: Water Levels

BH ID	Elevation (masl)[1]	Total depth (m)[1]	Stick up (m)[2]	WL (mTOC)	WL (mbgs)	WL elevation (masl)	WL (mTOC)	WL (mbgs)	WL elevation (masl)	WL (mTOC)	WL (mbgs)	WL elevation (masl)
				5-Jun-14			21-Jul-14			21-25 Aug 14		
BP-1A	73	100	-	-	-	-	-	-	-	-	-	-
BP-6A	73	56	n/a	n/a	3.73	**69.27**	n/a	4.01	**68.99**	n/a	4.64	**68.36**
BP-6B	69	70	n/a	-	-	**-**	-	-	**-**	-	-	**-**
BP-1B	74	80	-	-	-	**-**	-	-	**-**	-	-	**-**
BP-2	82	86	n/a	n/a	2.51	**79.49**	n/a	2.64	**79.36**	n/a	2.7	**79.30**
BP-3	74	60	n/a	n/a	3.12	**70.88**	n/a	3.27	**70.73**	n/a	3.39	**70.61**
BP-4	100	120	n/a	n/a	2.46	**97.54**	n/a	3.37	**96.63**	n/a	4.32	**95.68**
BP-5	82	89	n/a	n/a	2.33	**79.67**	n/a	2.33	**79.67**	n/a	3.54	**78.46**
BP-7	70	120	0.68	5.56	4.88	**65.12**	5.93	5.25	**64.75**	6.37	5.69	**64.31**
BP-8	58	108	0.7	5.31	4.61	**53.39**	5.36	4.66	**53.34**	5.51	4.81	**53.19**
BP-9	79	130	0.68	6.17	5.49	**73.51**	6.3	5.62	**73.38**	6.57	5.89	**73.11**
1 - Data from borehole logs												
n/a - not applicable												
'-' no information available												
TOC - Top of Casing												
WL – Water Level												
mbgs - meters below ground surface												
masl - meters above sea level												

Short term pumping tests were completed and water quality samples were collected from granite boreholes BH5, BH7, BH8 and BH9. Prior to pump installation, a data logger with 30 m depth range was installed in the well at depth or approximately 2 m below the anticipated pump intake depth. The pump was installed and water was pumped from each borehole using a 12 Volt submersible pump powered by a 12 Volt marine battery.

The pumping test at BH5 was completed on August 28, 2014. Water was pumped from the borehole for approximately 135 minutes at a rate of 6.2 L/minute. Maximum drawdown approximately 3 m. After the pumping was completed, recovery was monitored until 85% of the drawdown had recovered.

The pumping test at BH7 was completed on August 28, 2014. Water was pumped from the borehole at two intervals of 15 minutes at a rate of 5.7 L/minute. The maximum drawdown observed was 1.4 m. Recovery was monitored for 25 minutes, during which 59% of displacement recovery was observed. During the second portion of the pumping, the pump was malfunctioning and did not operate consistently.

The pumping test at BH8 was completed on August 28, 2014. Water was pumped from the borehole for 135 minutes at a rate of 3.2 L/minute. The maximum drawdown observed was 1.05 m. Recovery was monitored for 12 minutes, during which 41 % of recovery was observed.

The pumping test at BH9 was completed on August 28, 2014. Water was pumped from the borehole for 99 minutes at a rate of 2.6 L/minute. The maximum drawdown observed was 1.63 m. Recovery was monitored for 44 minutes, during which 75% of recovery was observed.

Field parameters were measured at fifteen minute intervals during the pumping tests. The final field parameter measurements prior to sampling are in Table 3. Also included in Table 3 for comparison are the field parameters measured from residential wells and streams.

Table 3: Field Measured Parameters

Sample Location	Temperature	Electrical Conductivity	pH
	(˚C)	(µS/cm)	
Granite Boreholes			
BP-5	9.2	38.7	5.56
BP-7	11.4	83.8	6.86
BP-8	9.5	80	6.4
BP-9	9.6	118.5	6.9
Residential Wells			
BPRWA001	12.8	140	6.57
BPRWA002	15.1	272	7.52
BPRWA003	15.7	398	6.15
BPRWA004	12.1	108	6.33
BPRWA006	17.3	251	6.67
BPRWA007	12.6	354	7.53
BPRWA008	19.7	n/a	6.79
BPRWA009	12.6	n/a	6.56
BPRWA011	14.3	104	6.28
BPRWA012	18.9	260	5.99
BPRWA013	16.4	240	6.72
BPRWA014	17	165	6.62
BPRWA015	n/a	n/a	n/a
BPRWA016	10.7	249	7.46
BPRWA017	14	197	7.68

Sample Location	Temperature	Electrical Conductivity	pH
Streams			
BPSTR06	18.3	56	4.05
BPSTR09	21.9	48	3.96
BPSTR10	21.8	53	3.36

Data logger recorded observations are provided and graphed in the excel spreadsheet **Appendix C** accompanying this memo.

3. Stream Flow Measurements

Stream flow observations and measurements were completed on August 26 and 27 (**Table 3**). The area-velocity method was used to determine stream discharge at BPSTR10. Discharge (Q) is calculated as the product of the mean stream velocity (V) and the cross-sectional area (A) of the channel; or Q=VA. Velocity measurements were taken at selected intervals across the channel cross-section. Stream velocity was measured using a Marsh McBirney Flo-Mate current meter. At each interval, the current meter operator measured water depth and mean velocity. Mean velocity measurements were taken at 0.6 of the depth and were observed for 40 seconds. The flow at BPSTR12 was minimal. A single flow measurement was made using the flow meter at a 5 cm by 5 cm notch where flow was observed. Observations and flow measurements are recorded in the excel spreadsheet **Appendix D** accompanying this memo.

Table 3: Flow

Stream ID	Discharge (L/s)	Date and Time	Stream Conditions
BPSTR06	N/A	Aug 27, 10:00	No measurable flow
BPSTR08	N/A	Aug 26, 16:00	No measurable flow
BPSTR09	N/A	Aug 27, 17:00	No measurable flow
BPSTR10 (Fox Island Main)	0.394	Aug 27, 11:30	Very low flow
BPSTR12	0.325	Aug 27, 15:20	Very low flow

4. Residential Wells

Work completed to assess residential wells included:

- Yield test and a second sampling event at 79 Fox Island Main Road.
- Collection of two water samples at 3421 Highway 16.
- Collection of one water sample at 2927 Highway 16.

The yield test at 79 Fox Island Main Road was completed on August 29, 2014. Two drilled wells, located side by side, are present at this location. A data logger was installed into the drilled well with the pump and water was discharged from the exterior tap for approximately 1 hour. Drawdown is observed to occur in steps which are interpreted to be a result of the pump switch on and off as governed by the in-house pressure tank. Total maximum drawdown was 1.7 m. Recovery was monitored for a period of 120 minutes and recharge of 0.19 m was observed before the data logger was retrieved (**Figure 1**). Complete data of the yield test can be found in excel file **Appendix E** accompanying this memo.

One water quality sample (BPRWA016) was collected at the end of the yield test and submitted to Maxxam for analysis. Results are presented in **Appendix D**.

Two water quality samples (BPRWA007_A, BPRWA007_B) were collected from 3421 Highway 16 on August 28. Sample analyses were completed on one of the samples as unfiltered (BPRWA007_A), and one sampled after in-laboratory filtering (BPRWA007_B) and results are presented in **Appendix D**.

One water quality sample (BPRWA017) was collected from 2927 Highway 16. are presented in **Appendix D**

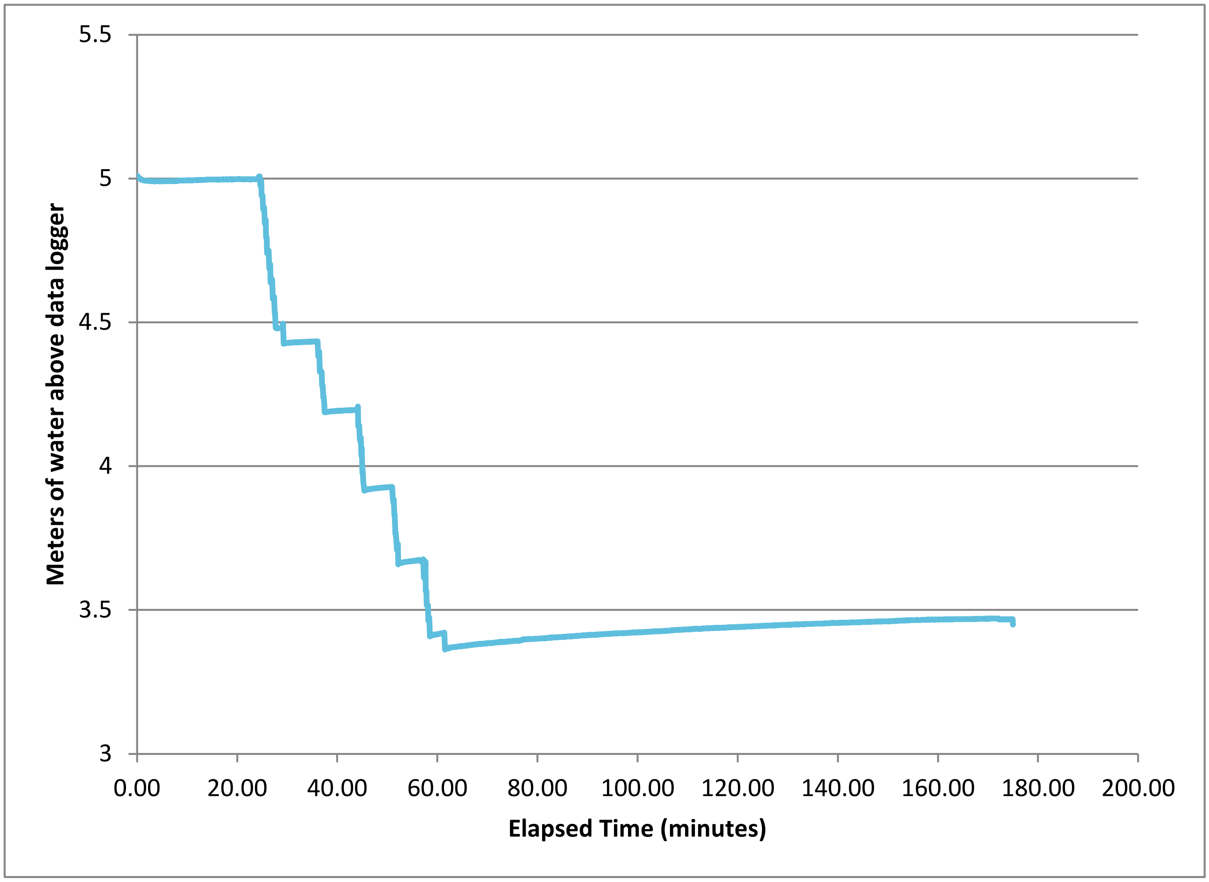


Figure 1: Water Level above the Datalogger during the Yield Test at 79 Fox Island Main Road

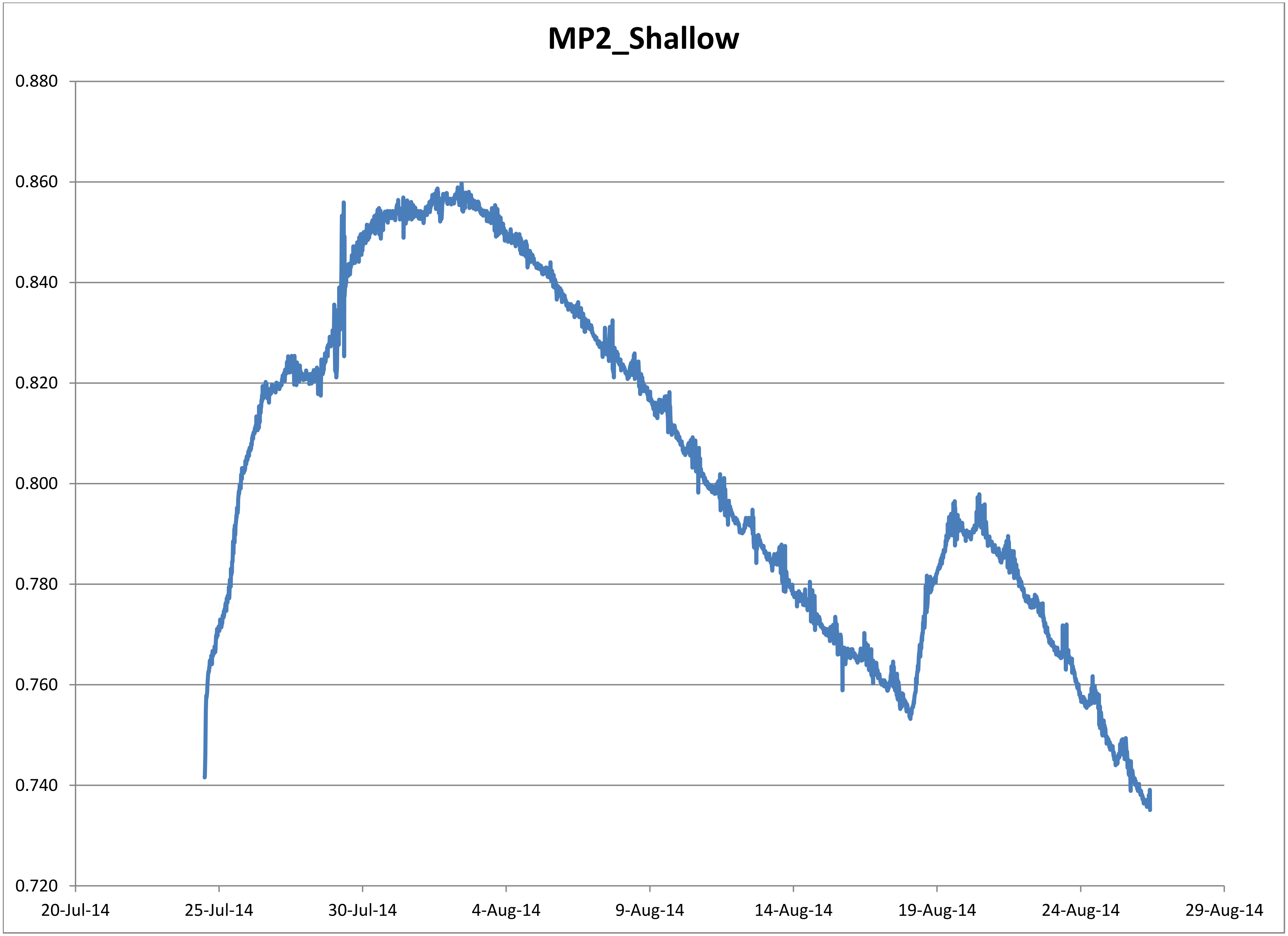
UTM coordinates of residential wells collected in August are summarized in Table 4.

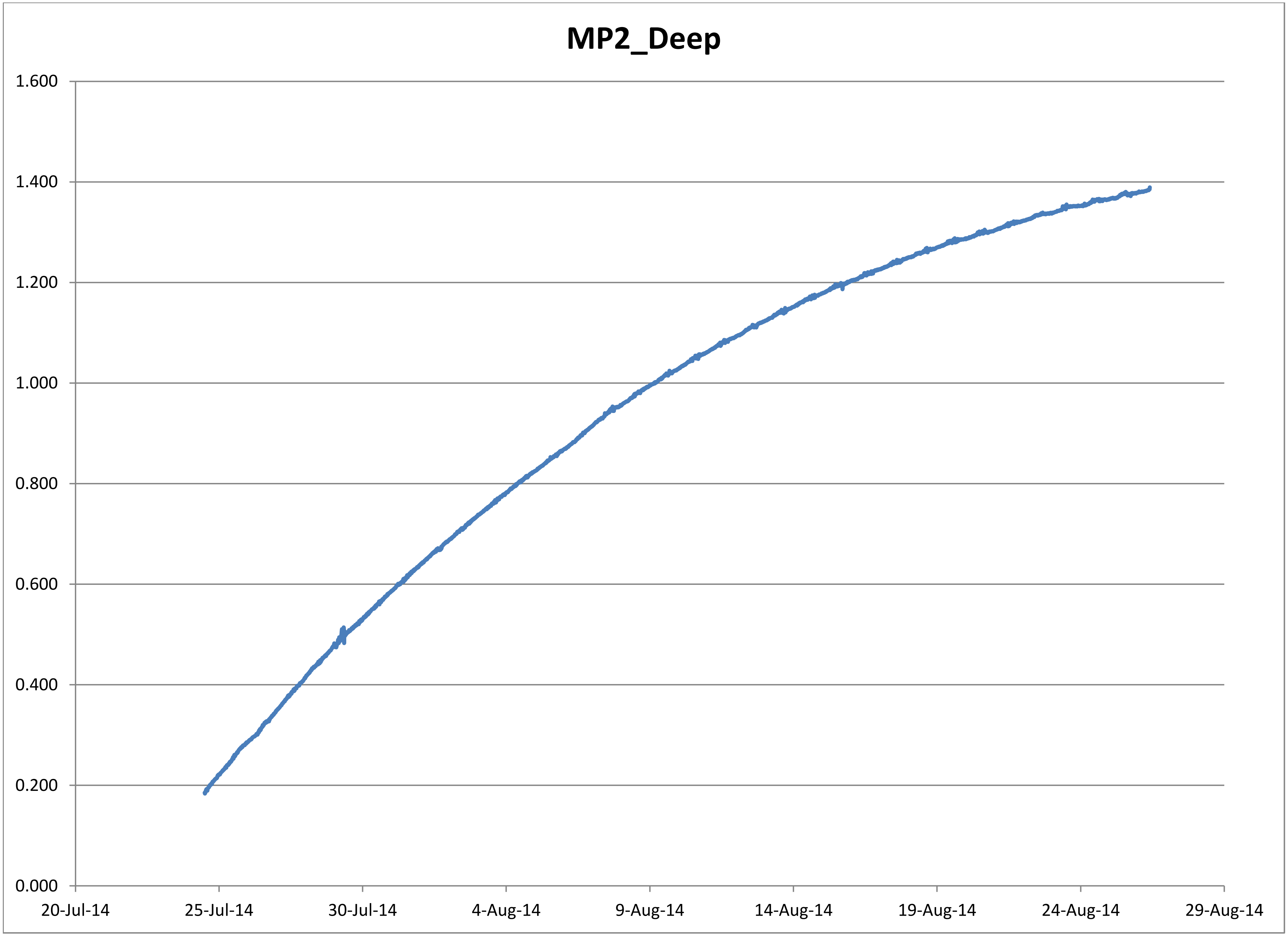
Table 4: Residential Well Coordinates

Address	Easting (m)	Northing (m)
212 Half Island Cove Rd	642025	5023336
215 Half Island Cove Rd	642030	5023399
246 Half Island Cove Rd	642106	5023396
48 Fox Island Main Rd	648704	5022390
75 Fox Island Main Rd	648724	5022566
130 Fox Island Main Rd	648782	5022762
149 Fox Island Main Rd	648776	5022879
169 Fox Island Main Rd	648805	5022958
2927 Hwy 16	646643	5021585
3581 Hwy 16	643696	5021694
2823 Upper Fox Island	647285	5021794

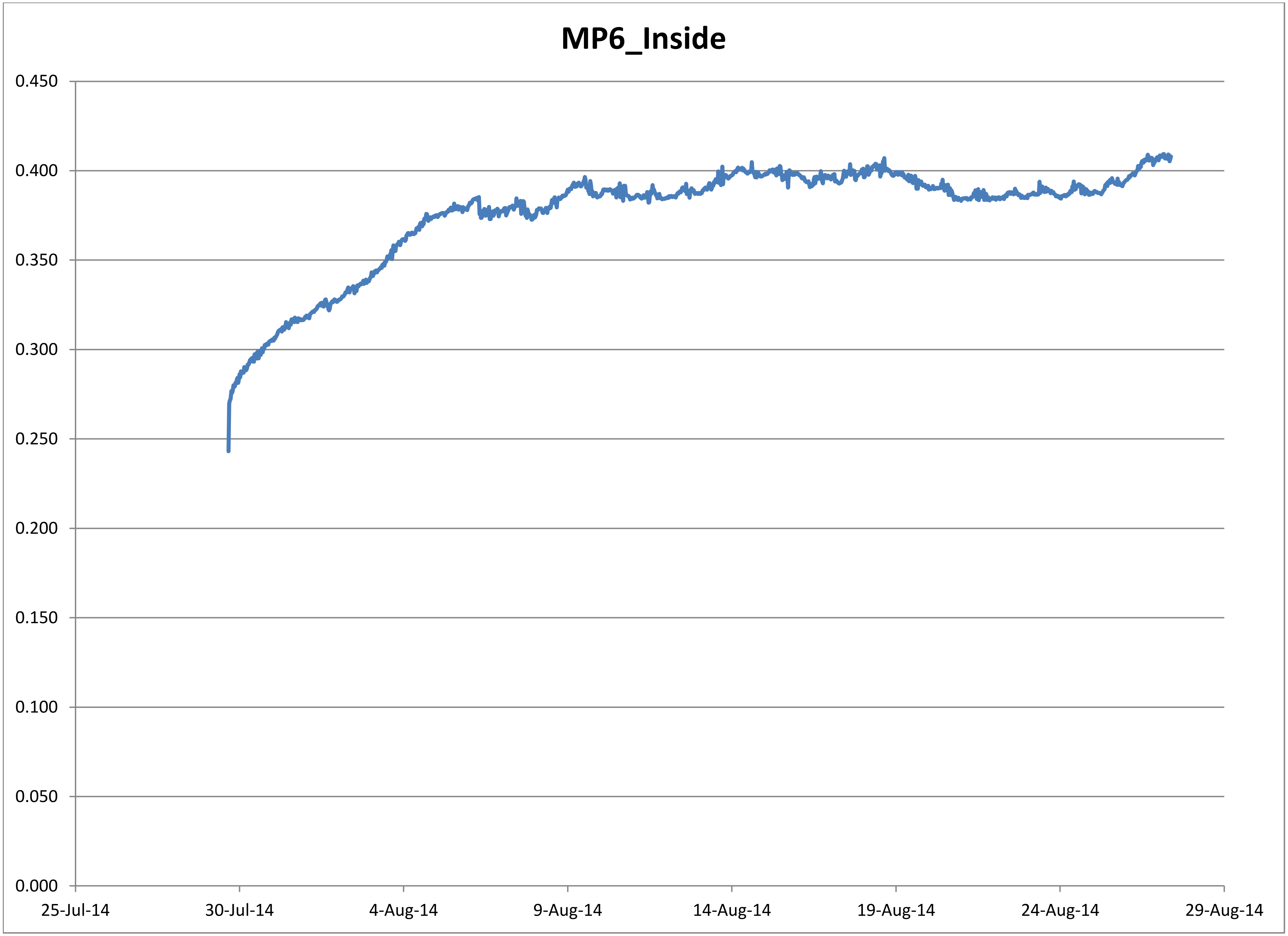
Supporting Excel Documents:

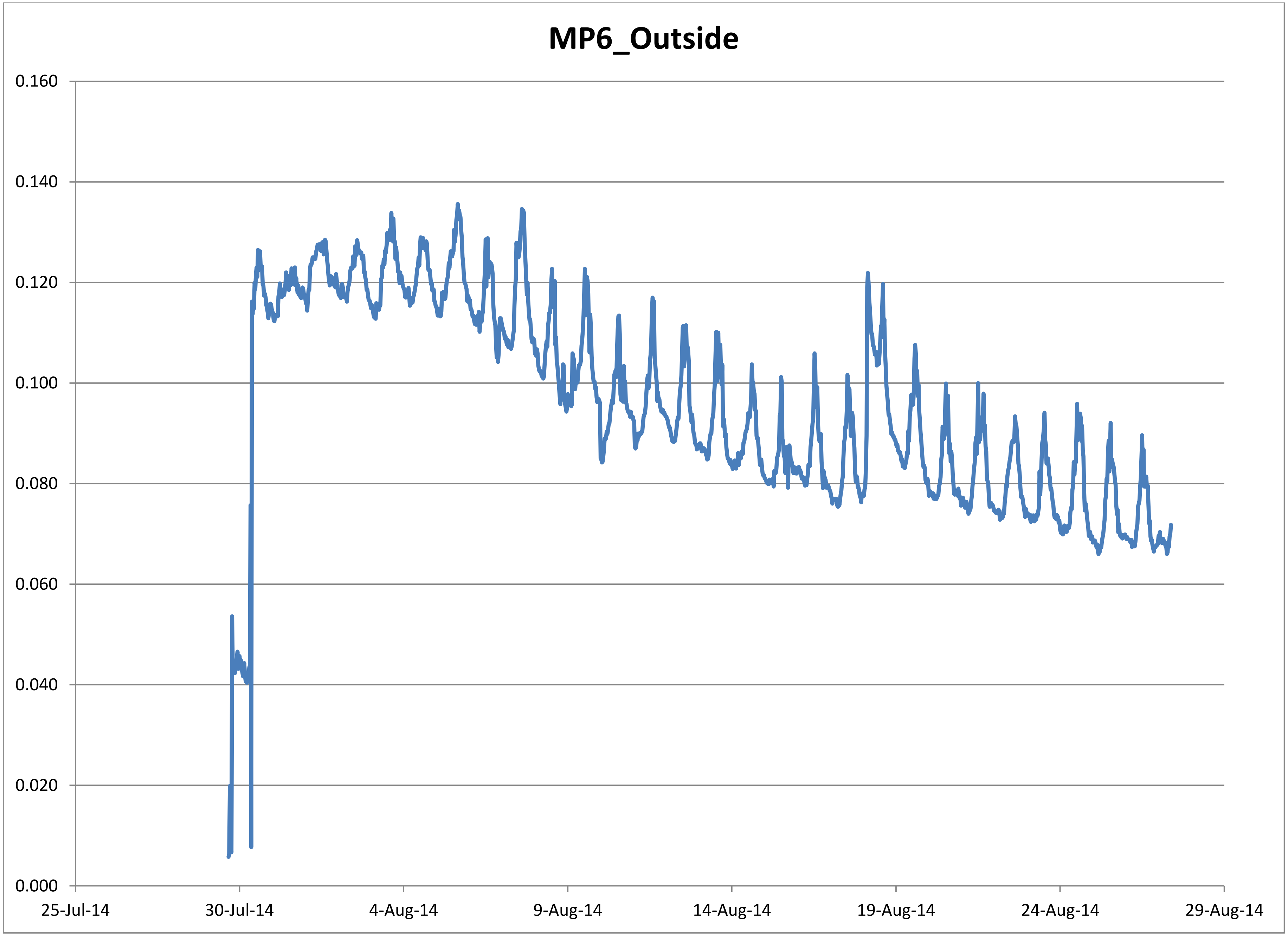
- **Appendix D** Black Point Flow and RWA: Summary of field measurements from stream flow measurements and samples collected from residential well assessments.
- **Appendix C** Master Borehole Drawdown Test Data: barometrically compensated data and charts showing drawdown and recovery data.
- **Appendix A** Master Piezometer Data: Barometrically compensated data from mini-piezometer data loggers and charts showing depth of water above data logger over time.
- **Appendix E** 79 Fox Island Main Road yield test: logger data and charts showing drawdown and recovery.
- **Appendix B** Master Borehole Data: barometrically compensated data from boreholes and charts.

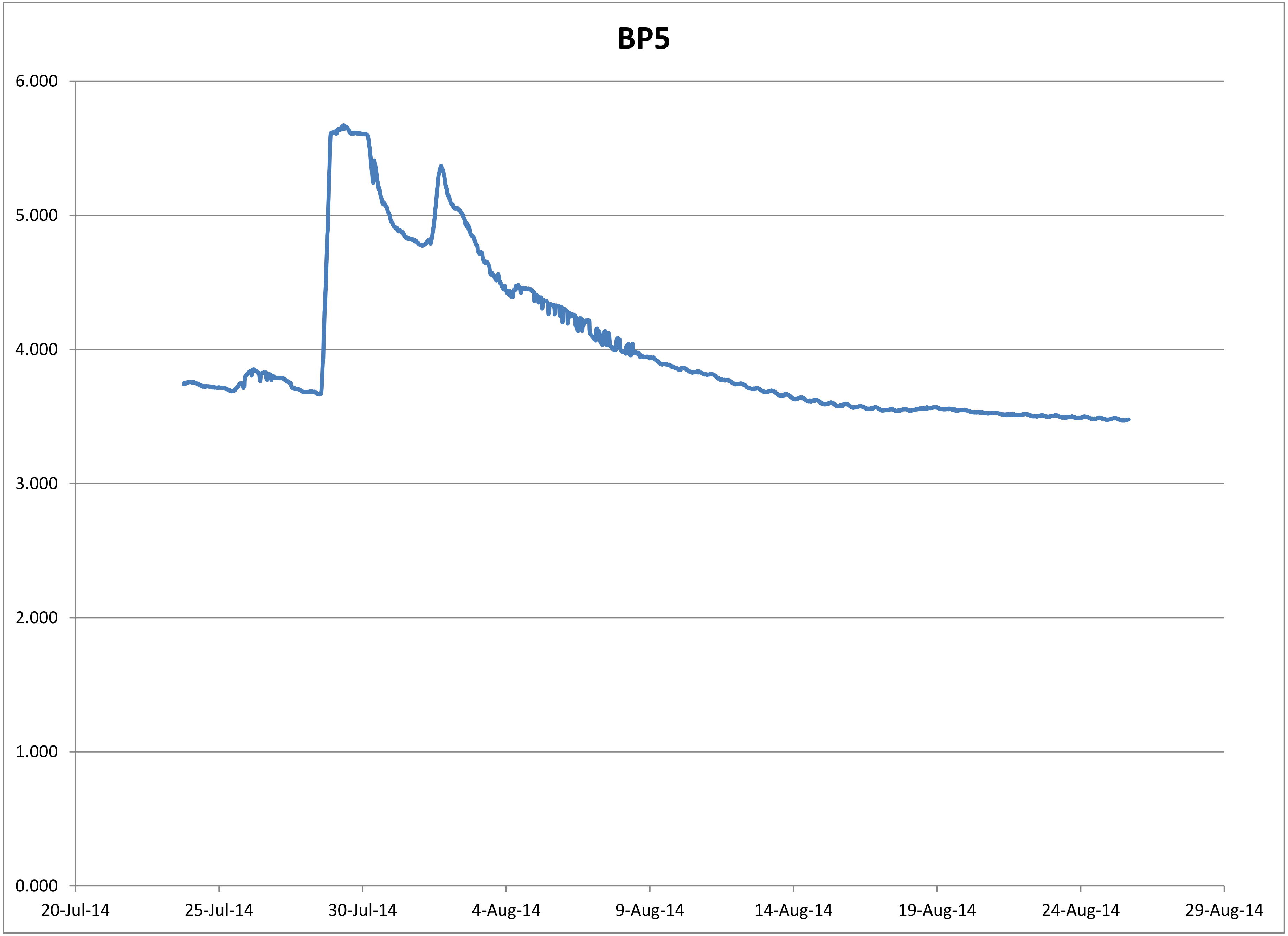

MP2_Shallow
0.880
0.860
0.840
0.820
0.800
0.780
0.760
0.740
0.720
20-Jul-14
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14



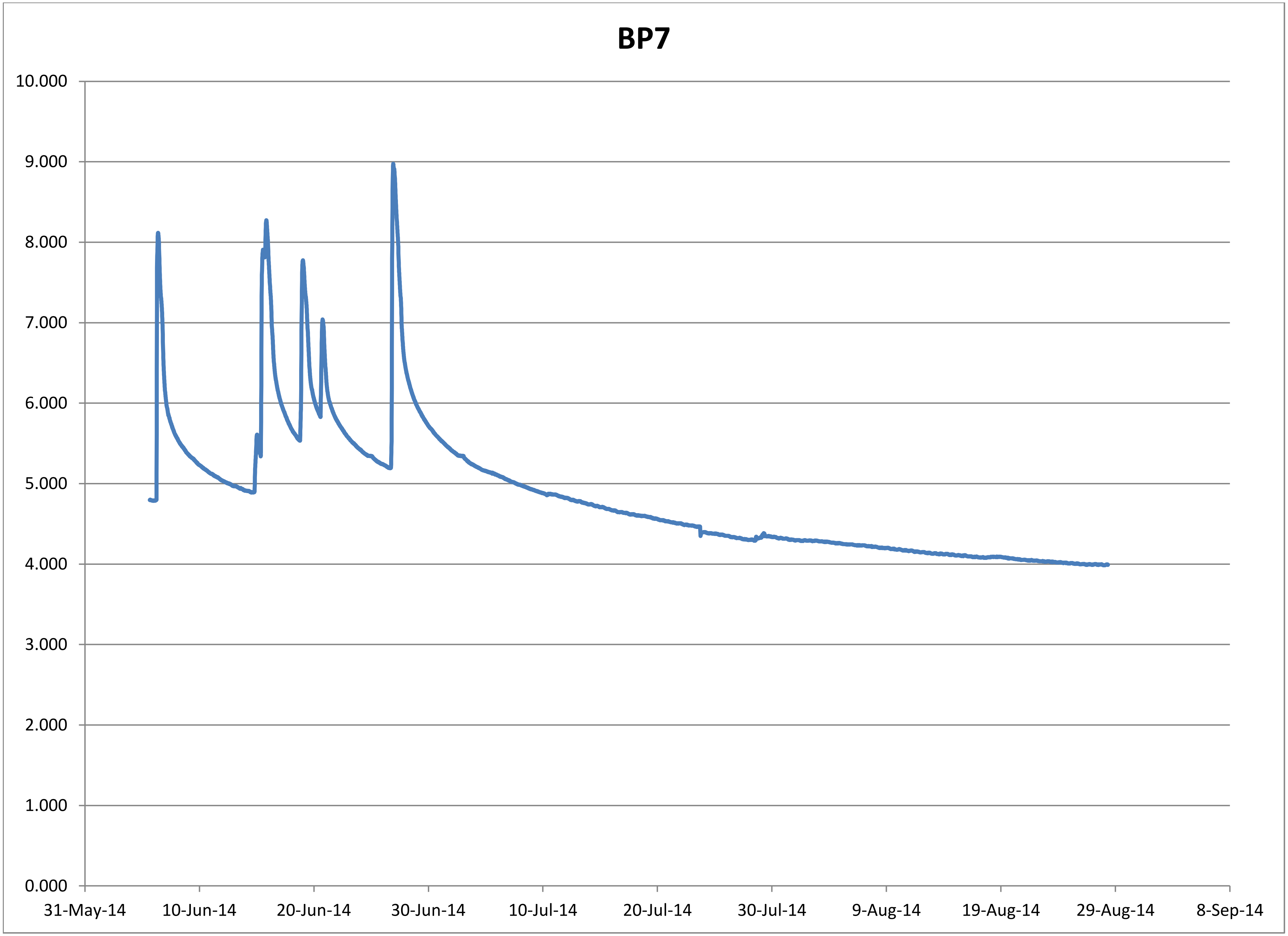
MP2_Deep
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
20-Jul-14
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14

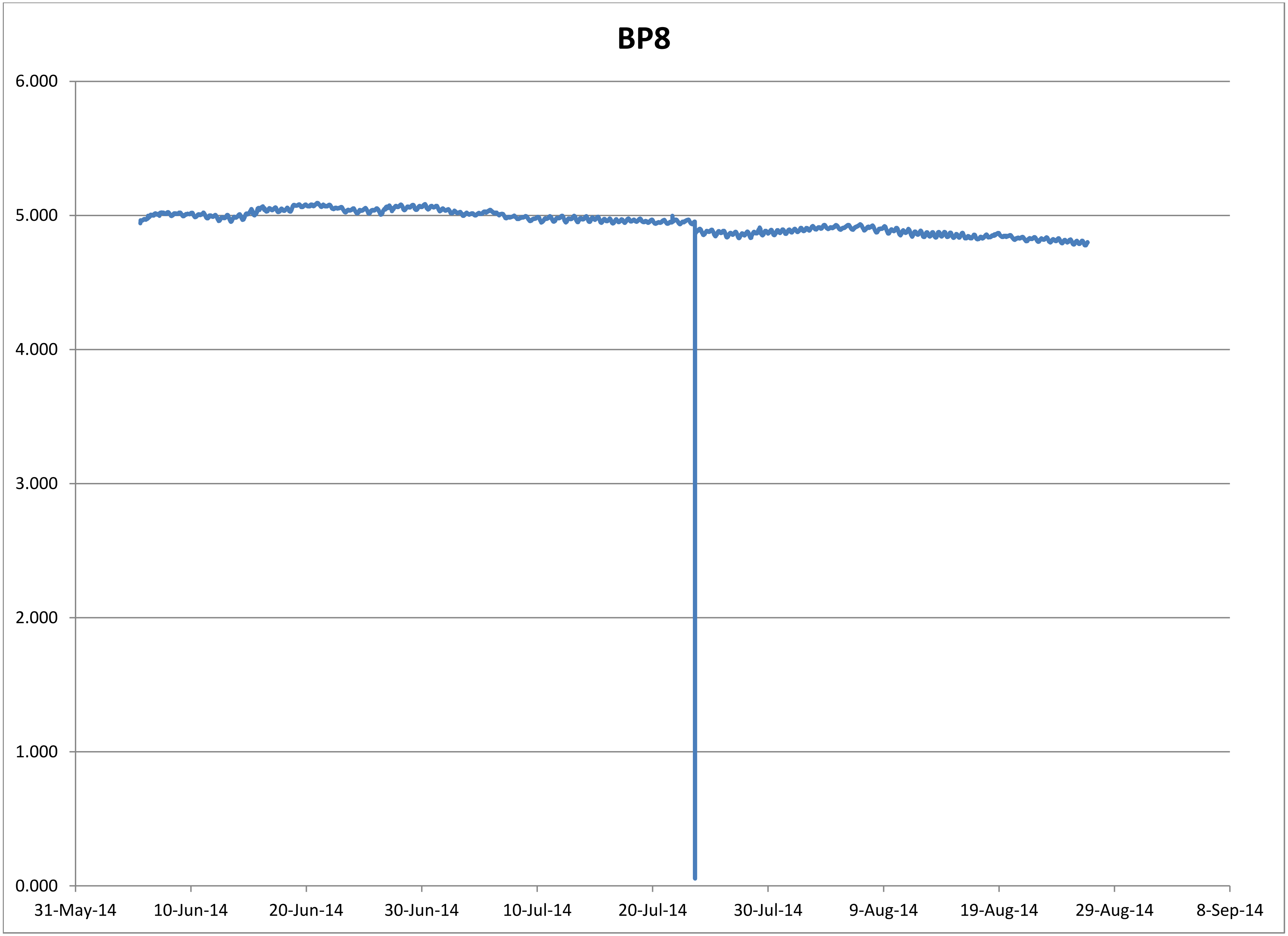

MP6_Inside
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14


MP6_Outside
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14

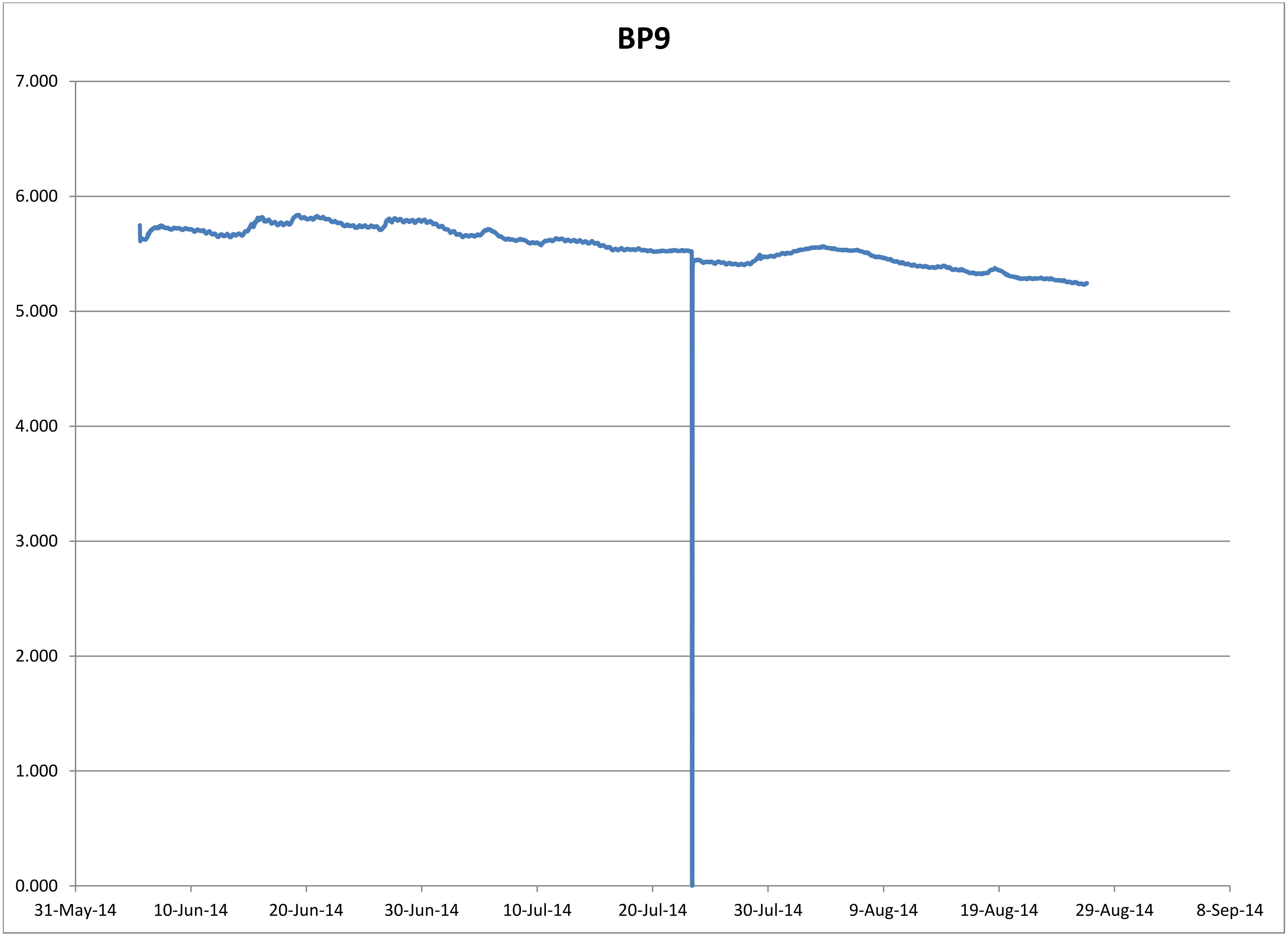


BP5
6.000
5.000
4.000
3.000
2.000
1.000
0.000
20-Jul-14
25-Jul-14
30-Jul-14
4-Aug-14
9-Aug-14
14-Aug-14
19-Aug-14
24-Aug-14
29-Aug-14

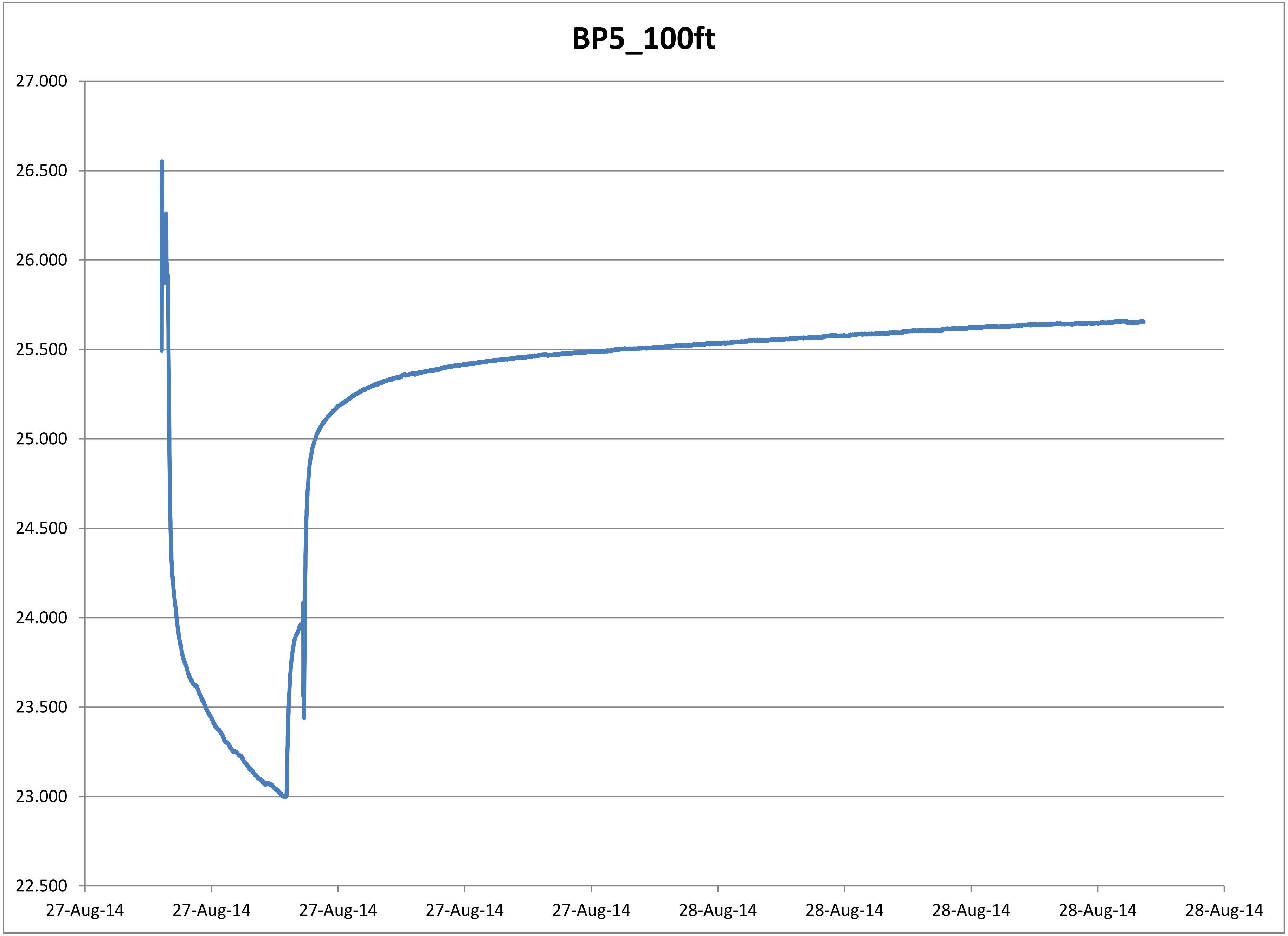

BP7
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
31-May-14
10-Jun-14
20-Jun-14
30-Jun-14
10-Jul-14
20-Jul-14
30-Jul-14
9-Aug-14
19-Aug-14
29-Aug-14
8-Sep-14



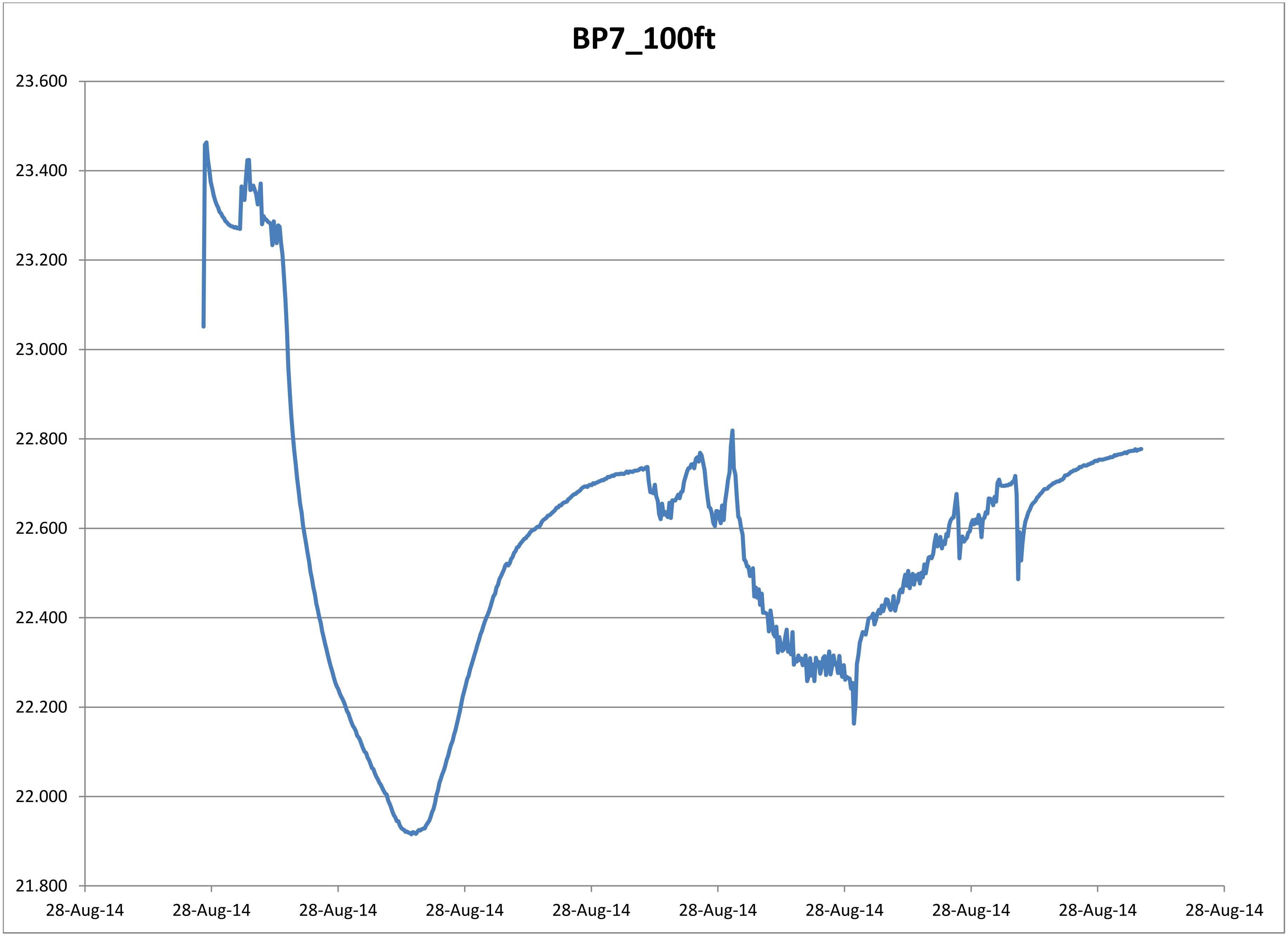
BP8
6.000
5.000
4.000
3.000
2.000
1.000
0.000
31-May-14
10-Jun-14
20-Jun-14
30-Jun-14
10-Jul-14
20-Jul-14
30-Jul-14
9-Aug-14
19-Aug-14
29-Aug-14
8-Sep-14



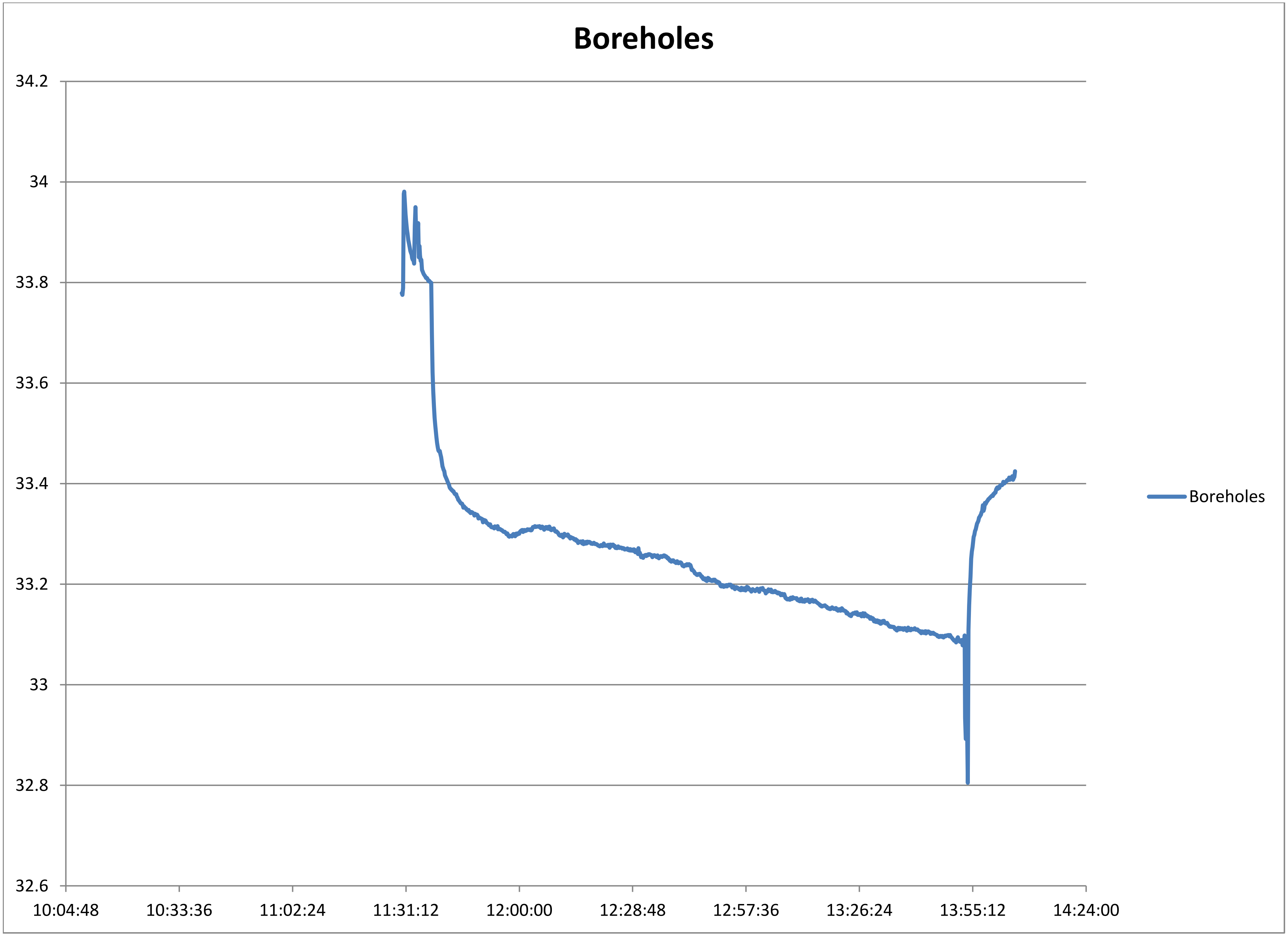
BP9
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
31-May-14
10-Jun-14
20-Jun-14
30-Jun-14
10-Jul-14
20-Jul-14
30-Jul-14
9-Aug-14
19-Aug-14
29-Aug-14
8-Sep-14



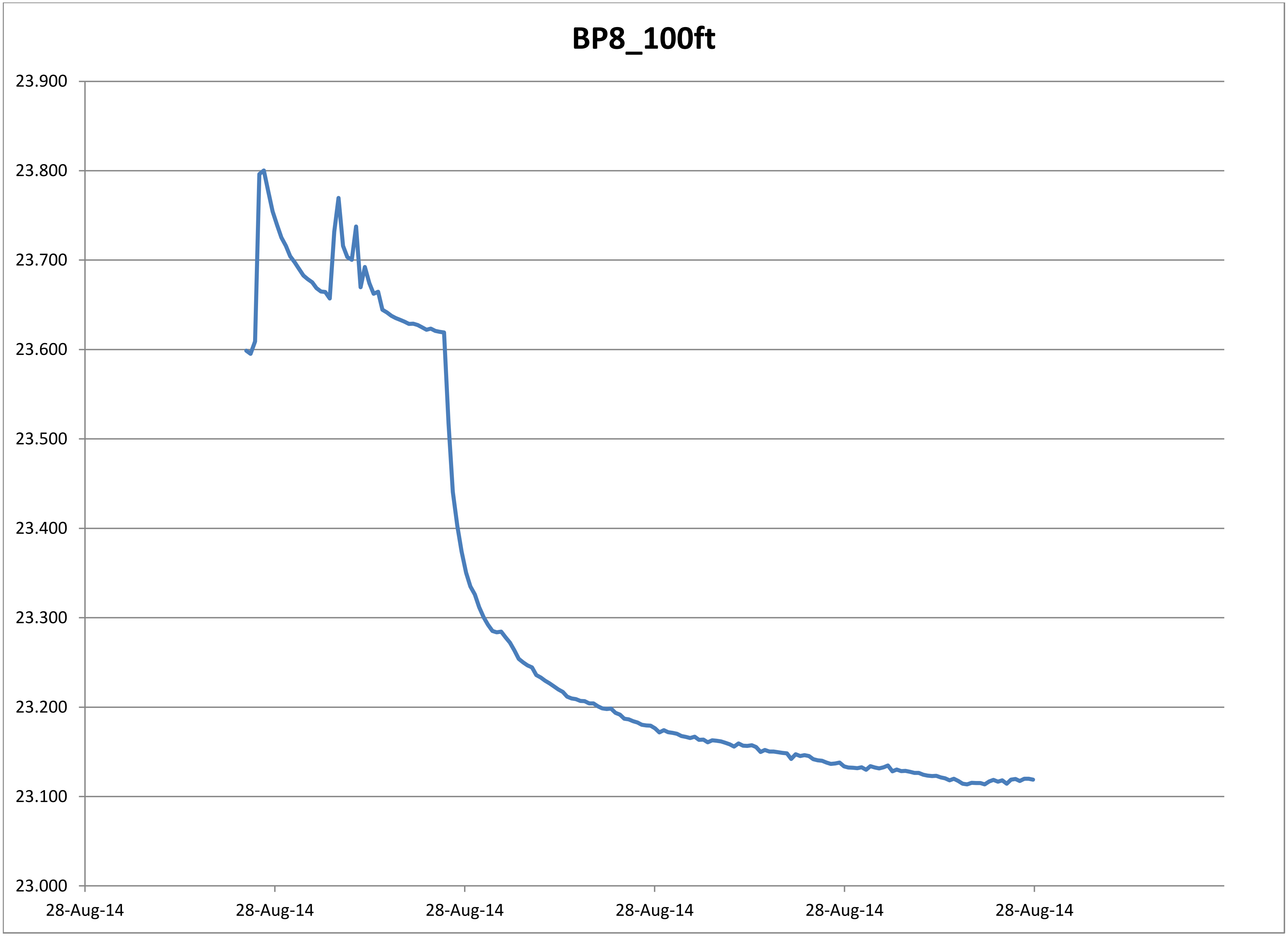
BP5_100ft
27.000
26.500
26.000
25.500
25.000
24.500
24.000
23.500
23.000
22.500
27-Aug-14
27-Aug-14
27-Aug-14
27-Aug-14
27-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14

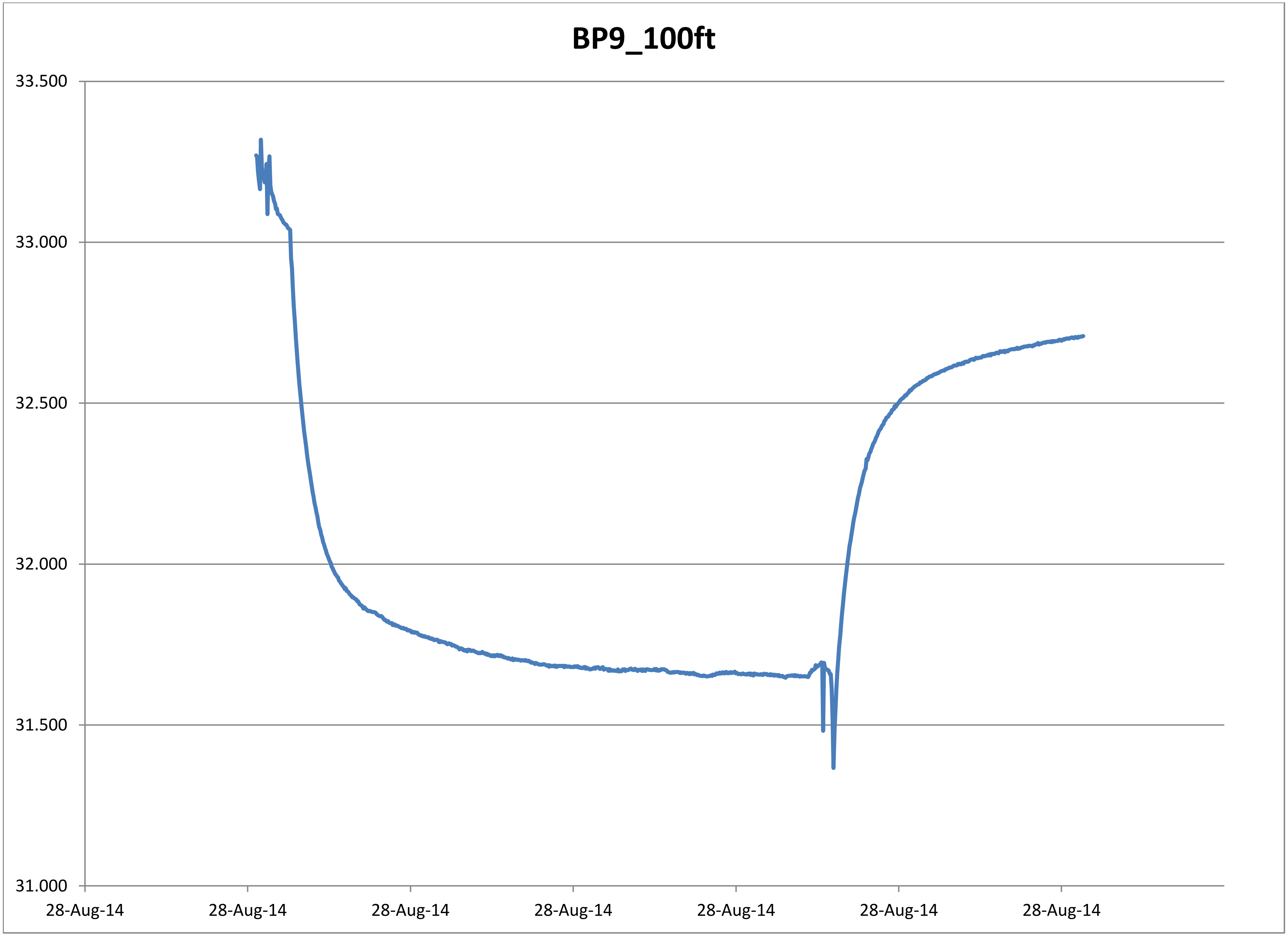


BP7_100ft
23.600
23.400
23.200
23.000
22.800
22.600
22.400
22.200
22.000
21.800
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14



Boreholes
34.2
34
33.8
33.6
33.4
33.2
33
32.8
32.6
10:04:48
10:33:36
11:02:24
11:31:12
12:00:00
12:28:48
12:57:36
13:26:24
13:55:12
14:24:00
Boreholes


BP8_100ft
23.900
23.800
23.700
23.600
23.500
23.400
23.300
23.200
23.100
23.000
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14



BP9_100ft
33.500
33.000
32.500
32.000
31.500
31.000
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14
28-Aug-14

Stream ID	BPSTR10			
Location	Bridge crossing Starks Rd (off Fox Island Main Rd)			
Stream Conditions	Very low flow			
Distance (m)	Depth (m)	Velocity (m/s)	Flow (m^3/s)	Note
0.45	0.00	0.00	0.000000	Left Bank (looking upstream)
0.53	0.08	0.02	0.000104	
0.58	0.08	0.01	0.000040	
0.63	0.08	0.05	0.000200	
0.68	0.02	0.05	0.000050	
0.73	0.00	0.00	0.000000	Right Bank (looking upstream)
		Total Flow	0.000394	m^3/s
			0.394	L/s

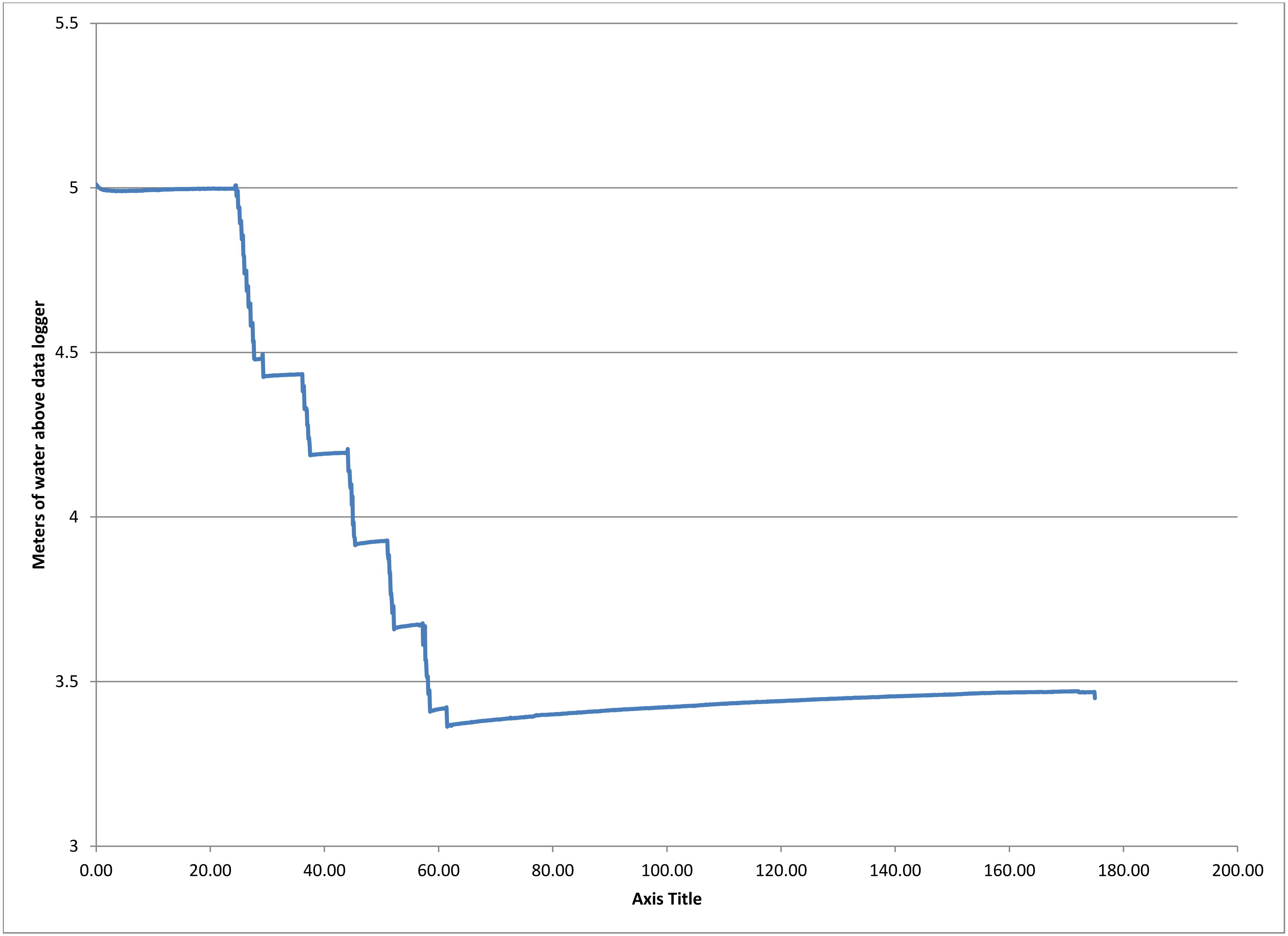
Stream ID	BPSTR12			
Location	Stream Crossing at transmission lines			
Stream Conditions	Very low flow			
Distance (m)	Depth (m)	Velocity (m/s)	T. Flow (m^3/s)	Note
0.05	0.05	0.13	0.000325	Measurement Location: 5cm x 5cm knotch (opening) in a rock that captured all flow at that cross-section of the stream
			0.325	L/s

Well ID	BPRWA016
Date	Aug-29
Address	79 Fox Island Main Rd
Resident's Family Name	Feltmate
Well Inside Diameter (m)	0.157
Stickup (m)	0.499
Flow Rate (L/s)	0.156
Initial Water Level (m)	3.597 _@ 9:27
Pump Start Time	9:35
Final Water Level (m)	5.184 _@11:13
Max Drawdown (m)	1.587

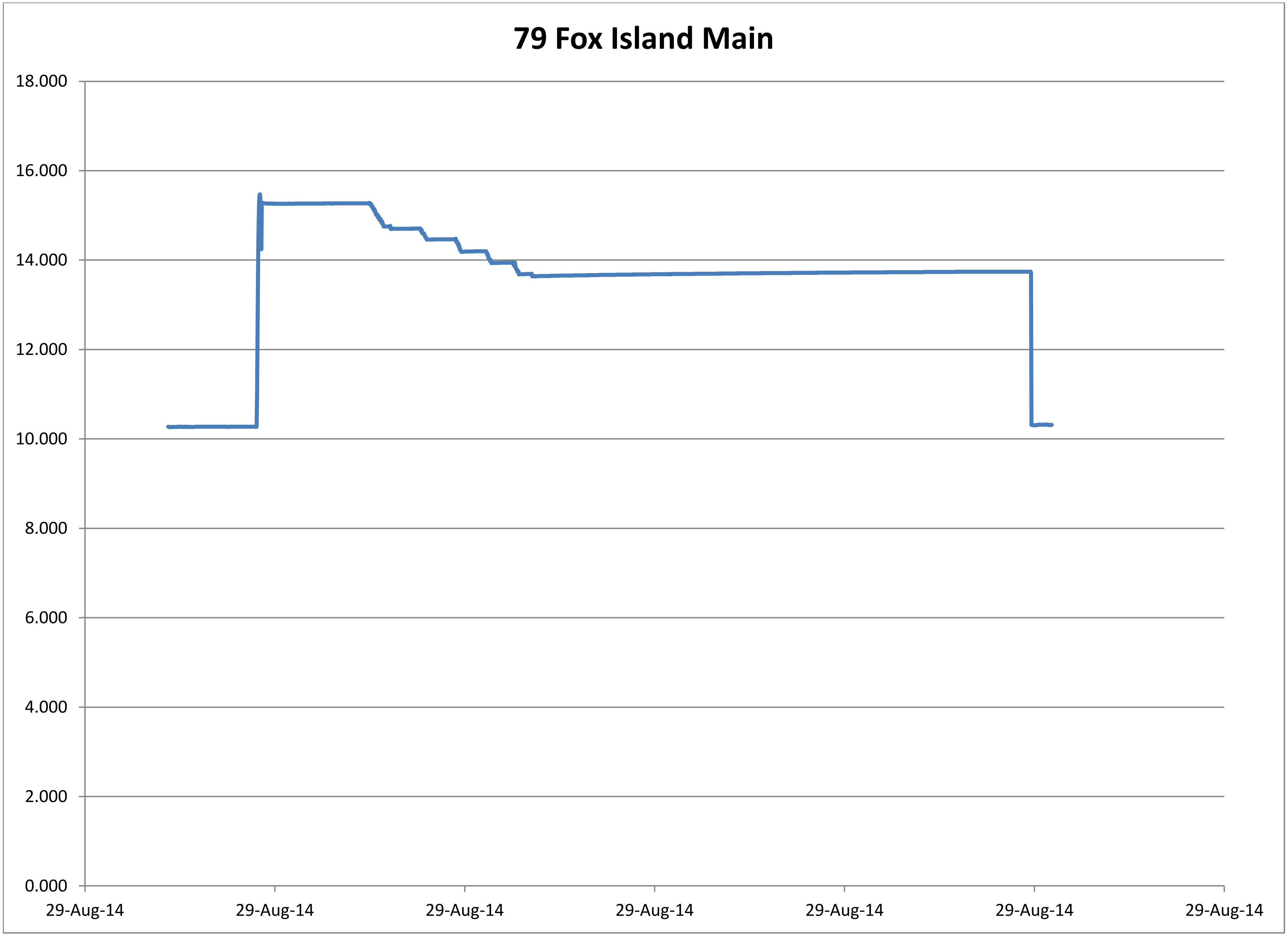
Water Level (m)	Time	EC (µS/cm)	Temp (˚C)	pH
3.595	9:45			
3.585	10:01			
4.107	10:18	243	11.2	7.18
4.154	10:30	257	11.3	7.12
4.395	10:44	253	10.7	7.54
4.669	10:55	248	10.6	7.48
4.925	11:05	249	10.7	7.46

Well ID	BPRWA017
Date	Aug-29

Water Level (m)	Time	EC (µS/cm)	Temp (˚C)	pH
2.69	12:57			
	13:48	196.9	14.0	7.68



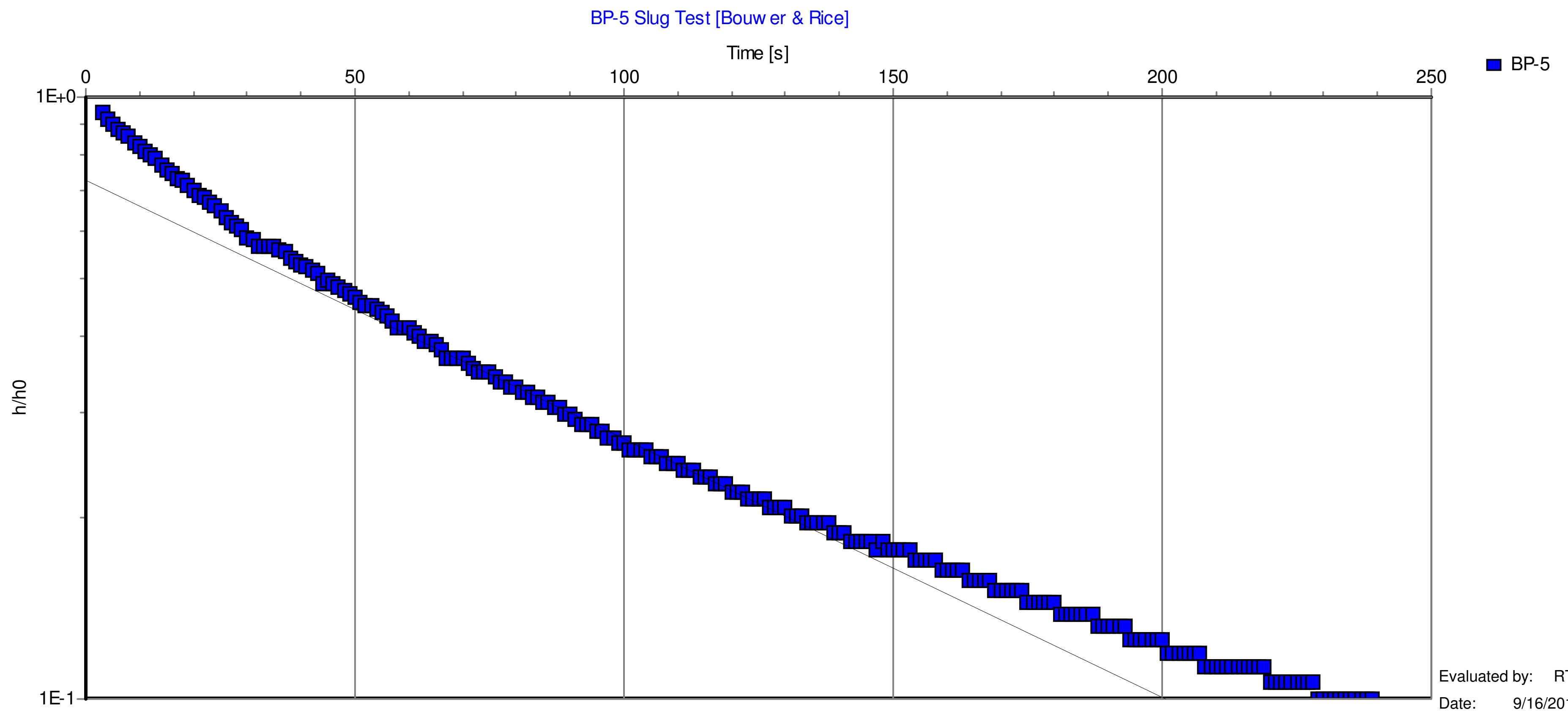
Meters of water above data logger
5.5
5
4.5
4
3.5
3
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
Axis Title


79 Fox Island Main
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14
29-Aug-14

ATTACHMENT G
Hydraulic Conductivity Test Analysis

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

	Analysis Report	Slug Test: BP-5 Slug Test
SLR	Project: Black Point Quarry	**Analysis Method:** **Bouwer & Rice**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 86.7 [m] Max. Head Change = 0.47 [m] R (eff) not used in analysis



Evaluated by: RT

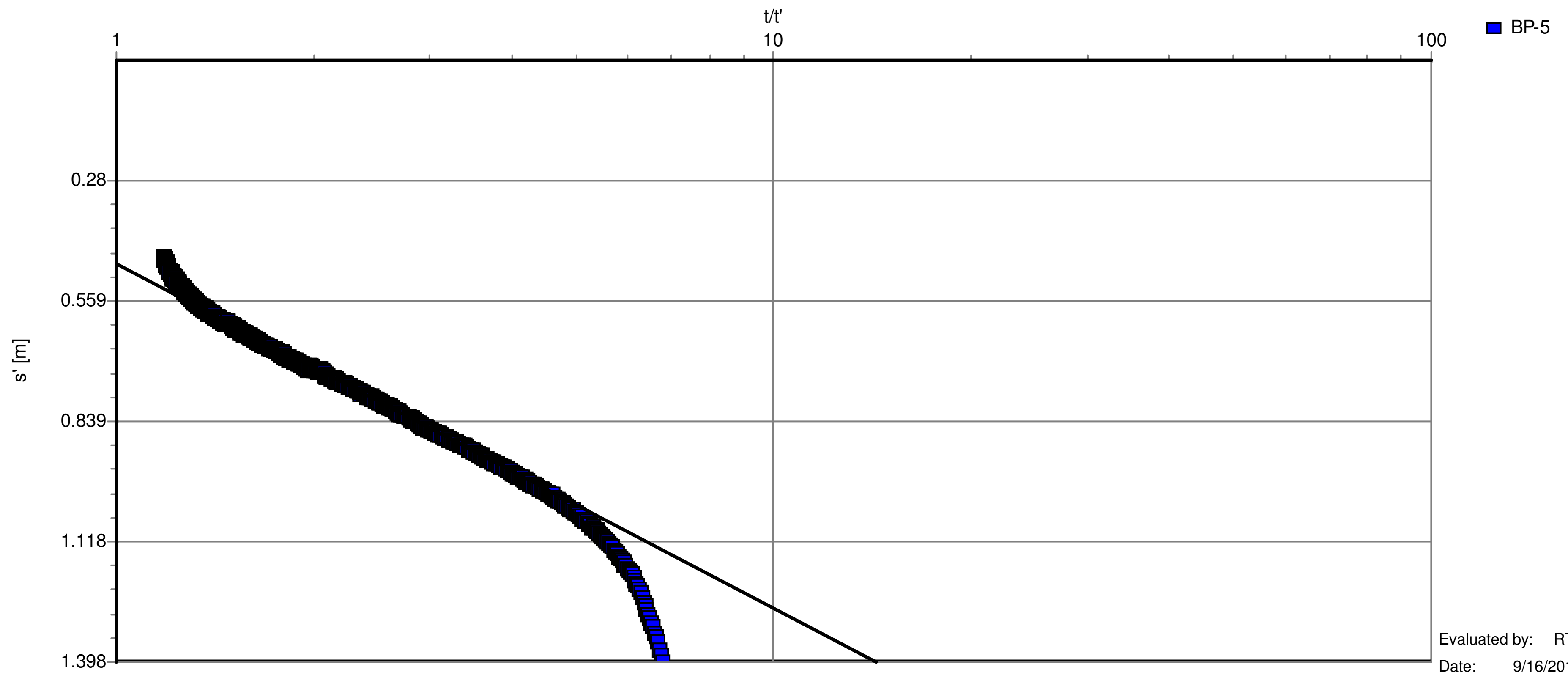
Date: 9/16/2014

Analysis results: Conductivity: 6.06E-7 [m/s]

Test parameters:			
Test Well:	BP-5	r(eff):	0.038 [m]
Screen radius:	0.03785 [m]	Aquifer thickness:	86.67 [m]
Screen length:	89 [m]	Boring radius:	0.03785 [m]

SLR	**Analysis Report**	**Pumping Test:** **BP-5 Recovery Test**
	Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 85.5 [m] Max. Head Change = 3.08 [m] R (eff) not used in analysis

BP-5 Recovery Test [Theis Recovery]



Evaluated by: RT

Date: 9/16/2014

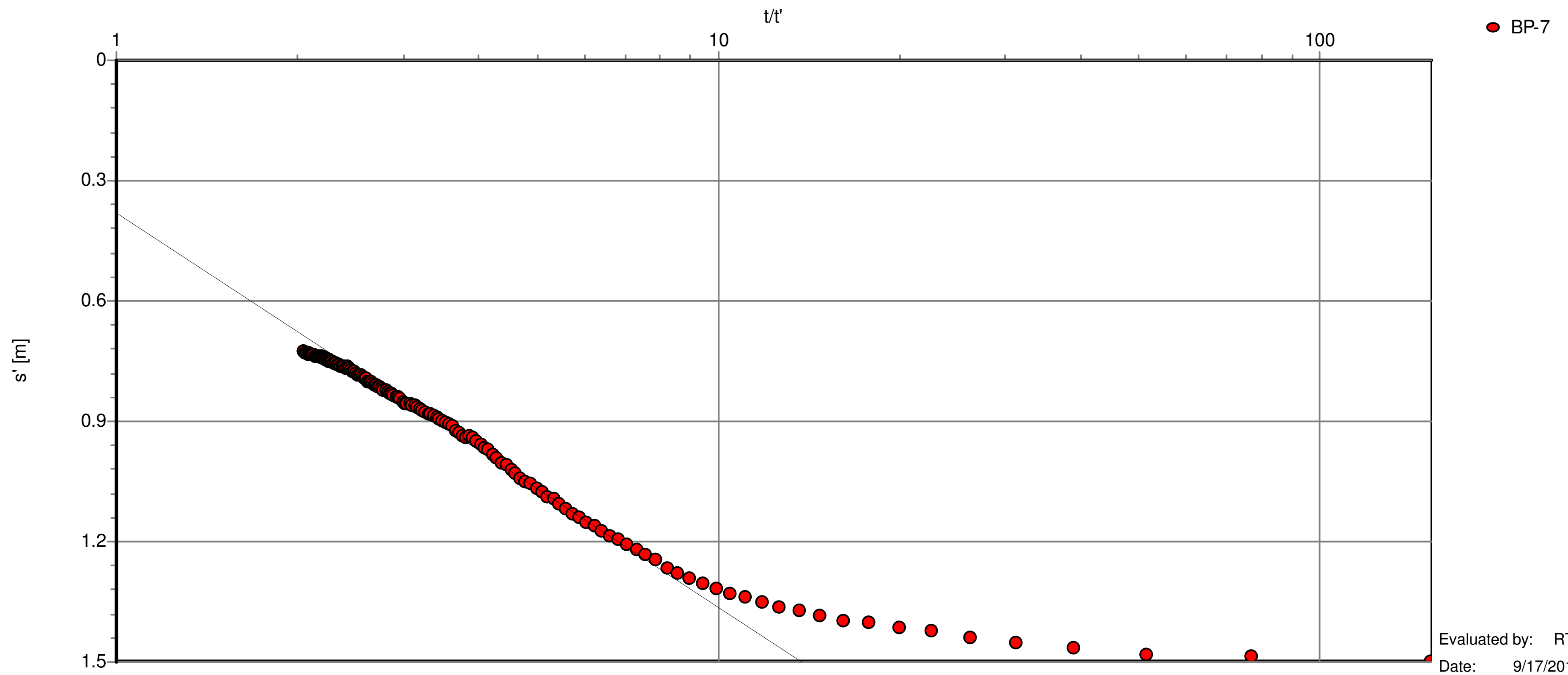
Analysis results:	Transmissivity:	2.29E-5 [m²/s]	Conductivity:	2.68E-7 [m/s]

Test parameters:	Pumping Well:	BP-5	Pumping Time	8440 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	85.46 [m]
	Screen length:	89 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	0.0001 [m³/s]

SLR

Analysis Report	**Pumping Test:** **BP-7 Recovery Test**
Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
Number: 210.05913.00000	Comments:
Client: Morien Resources Corp.	Saturated screen length = 114.3 [m] Max. Head Change = 1.51 [m] R (eff) not used in analysis

BP-7 Recovery Test [Theis Recovery]



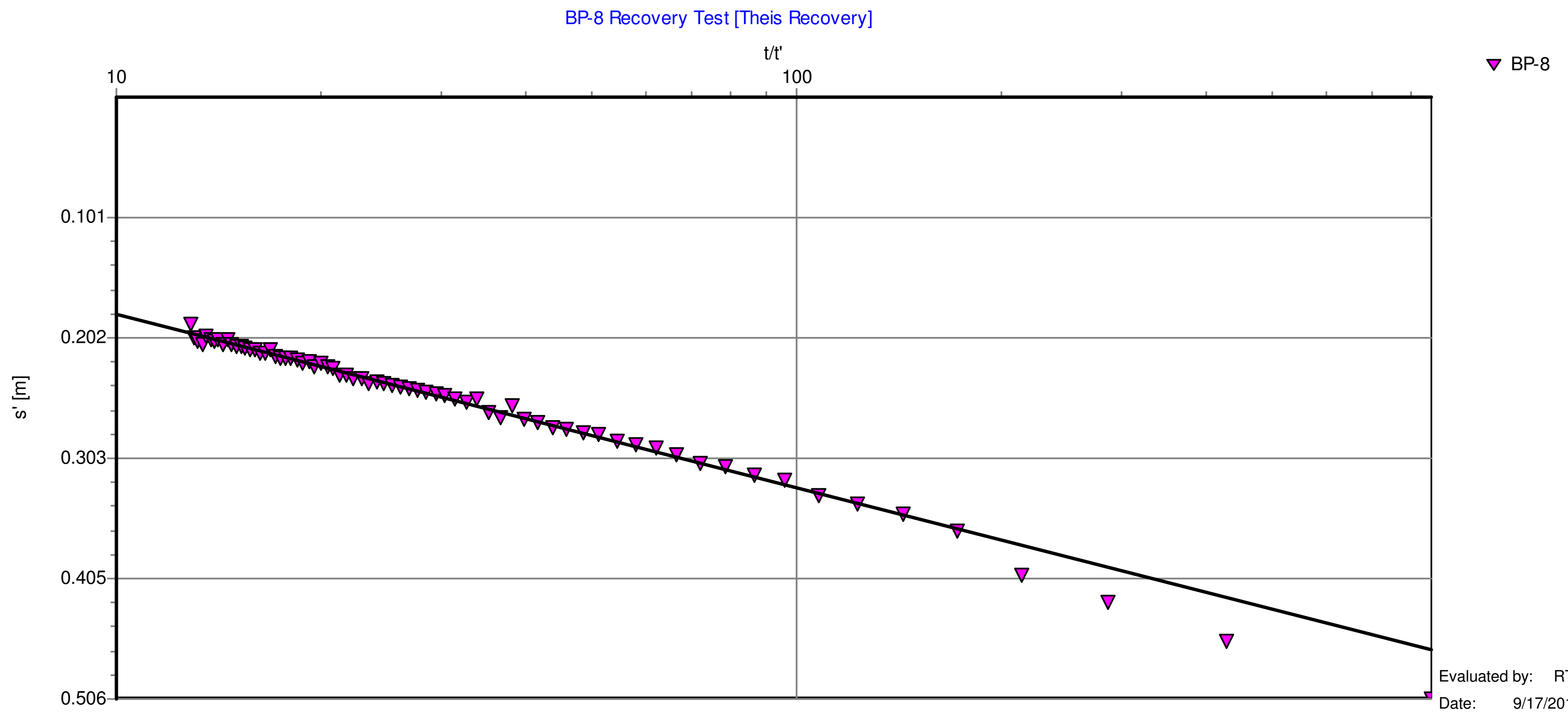
Evaluated by: RT

Date: 9/17/2014

<u>Analysis results:</u> Transmissivity: 1.77E-5 [m²/s] Conductivity: 1.55E-7 [m/s]

<u>Test parameters:</u>			
Pumping Well:	BP-7	Pumping Time	1520 [s]
Screen radius:	0.03785 [m]	Aquifer thickness:	114.31
Screen length:	120 [m]	Boring radius:	0.03785 [m]
		Discharge Rate:	9.5E-5 [m³/s]

	Analysis Report	Pumping Test: BP-8 Recovery Test
SLR	Project: Black Point Quarry	Analysis Method: Theis Recovery
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 103.2 [m] Max. Head Change = 0.81 [m] R (eff) not used in analysis



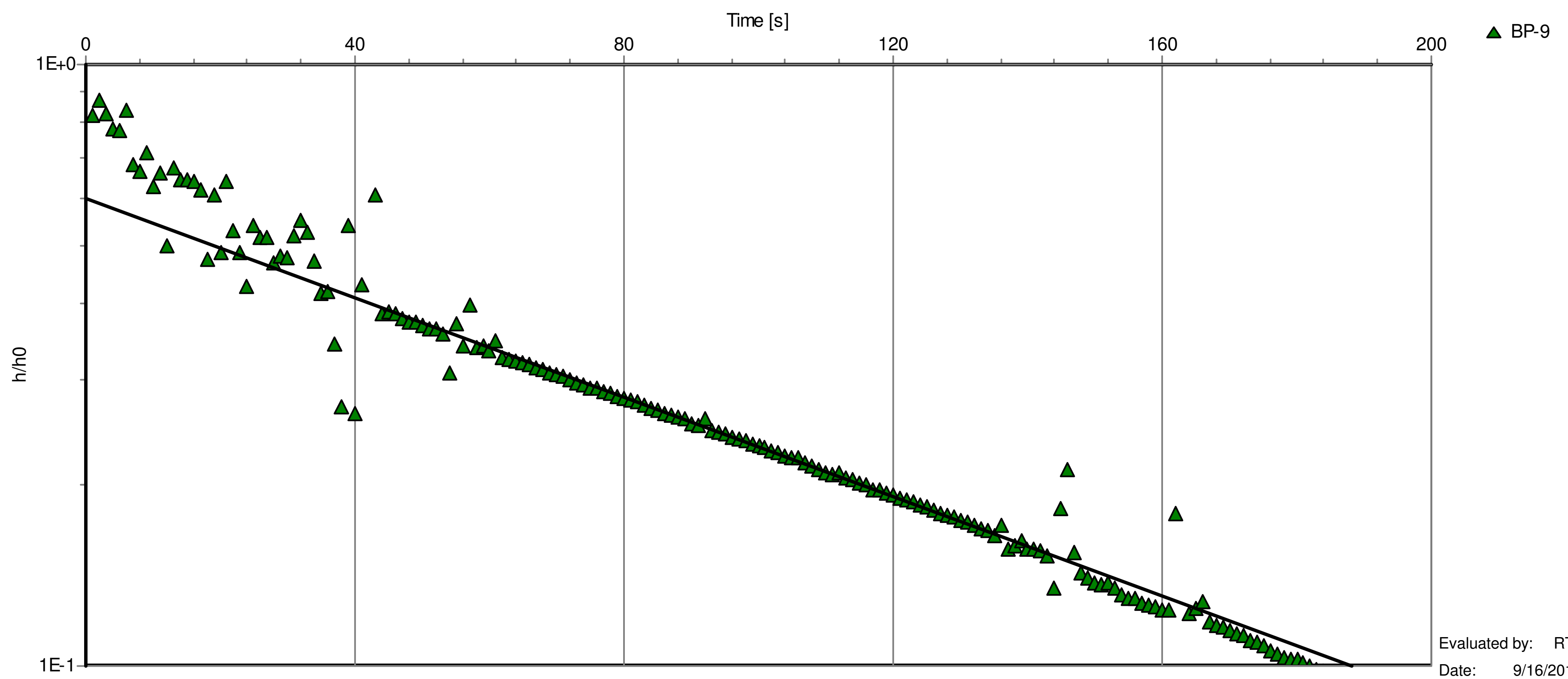
Evaluated by: RT
Date: 9/17/2014

Analysis results:	Transmissivity:	6.67E-5 [m²/s]	Conductivity:	6.47E-7 [m/s]

Test parameters:	Pumping Well:	BP-8	Pumping Time	8540 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	103.19
	Screen length:	108 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	5.333E-5 [m³/s]

Analysis Report		Slug Test:	BP-9 Slug Test
Project:	Black Point Quarry	Analysis Method:	Bouwer & Rice
Number:	210.05913.00000	Comments:	
Client:	Morien Resources Corp.	Saturated screen length = 124.4 [m] Max. Head Change = 0.48 [m] R (eff) not used in analysis	

BP-9 Slug Test [Bouwer & Rice]



Evaluated by: RT

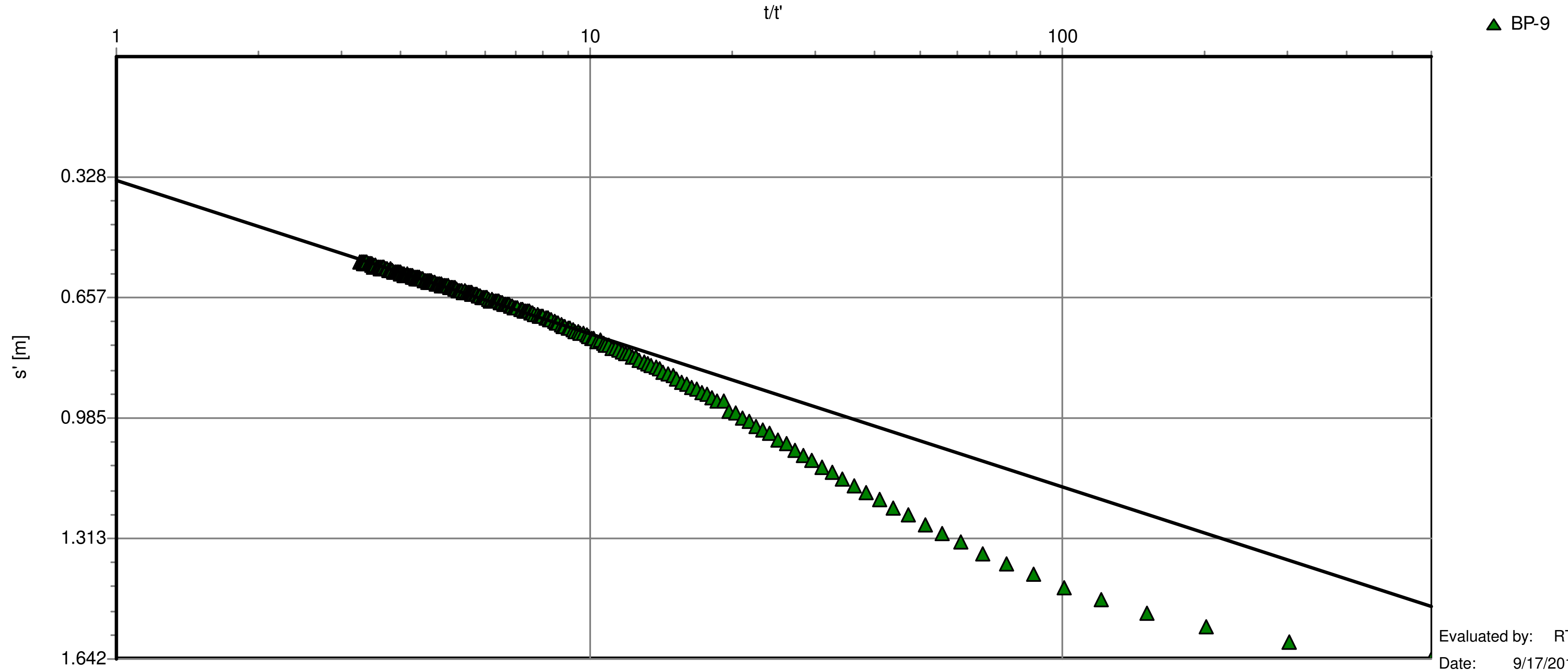
Date: 9/16/2014

Analysis results: Conductivity: 2.23E-6 [m/s]

Test parameters:			
Test Well:	BP-9	r(eff):	0.038 [m]
Screen radius:	0.03785 [m]	Aquifer thickness:	124.38
Screen length:	130 [m]	Boring radius:	0.03785 [m]

Analysis Report	Pumping Test: BP-9 Recovery Test
Project: Black Point Quarry	**Analysis Method: Theis Recovery**
Number: 210.05913.00000	Comments:
Client: Morien Resources Corp.	Saturated screen length = 124.1 [m] Max. Head Change = 1.72 [m] R (eff) not used in analysis

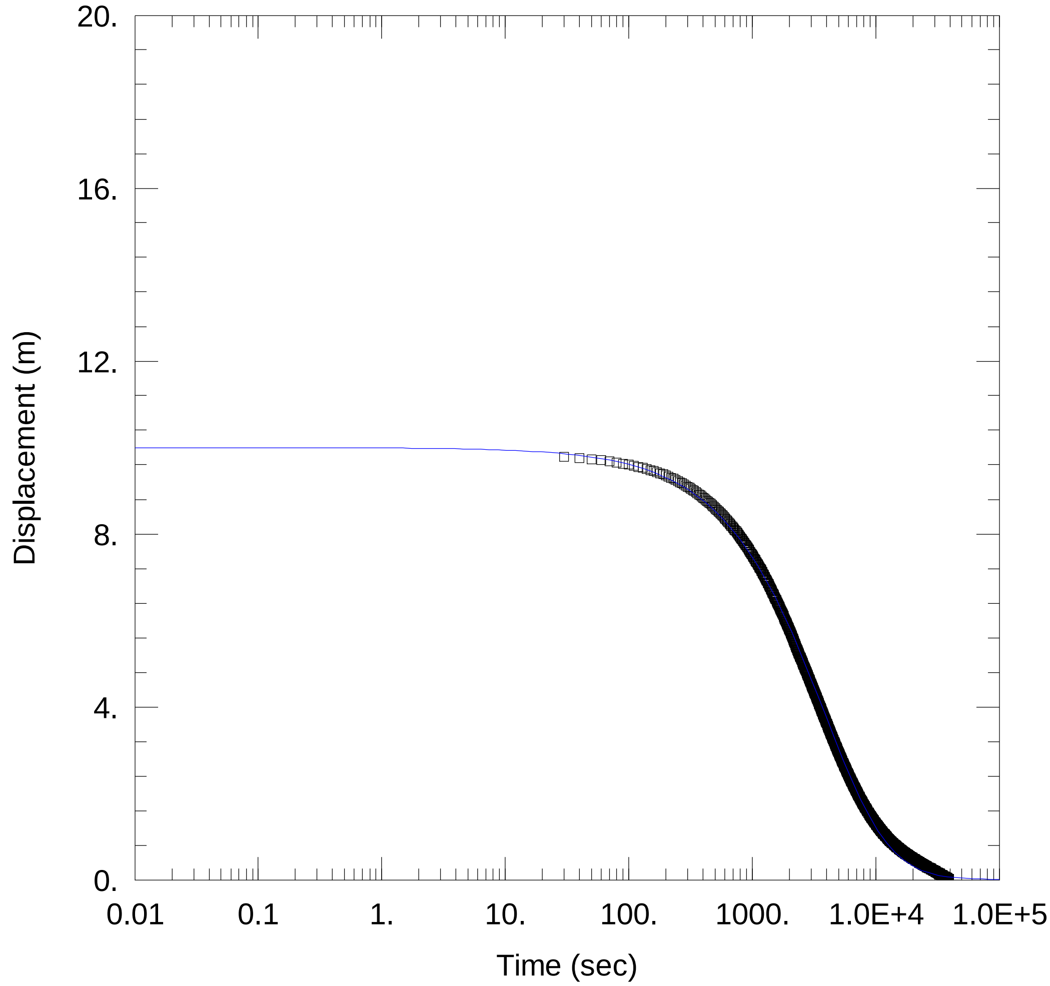
BP-9 Recovery Test [Theis Recovery]



Evaluated by: RT
Date: 9/17/2014

Analysis results:	Transmissivity:	1.90E-5 [m²/s]	Conductivity:	1.53E-7 [m/s]

Test parameters:	Pumping Well:	BP-9	Pumping Time	6010 [s]
	Screen radius:	0.03785 [m]	Aquifer thickness:	124.11
	Screen length:	130 [m]	Boring radius:	0.03785 [m]
			Discharge Rate:	4.333E-5 [m³/s]



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AECOM
Client: Vulcan
Project: 60323234
Location: Black Point
Test Well: RWA007
Test Date: July 17, 2014

AQUIFER DATA

Saturated Thickness: 73. m

WELL DATA (BPRWA007)

Initial Displacement: 10. m
Total Well Penetration Depth: 83. m
Casing Radius: 0.076 m

Static Water Column Height: 73. m
Screen Length: 80. m
Well Radius: 0.076 m

SOLUTION

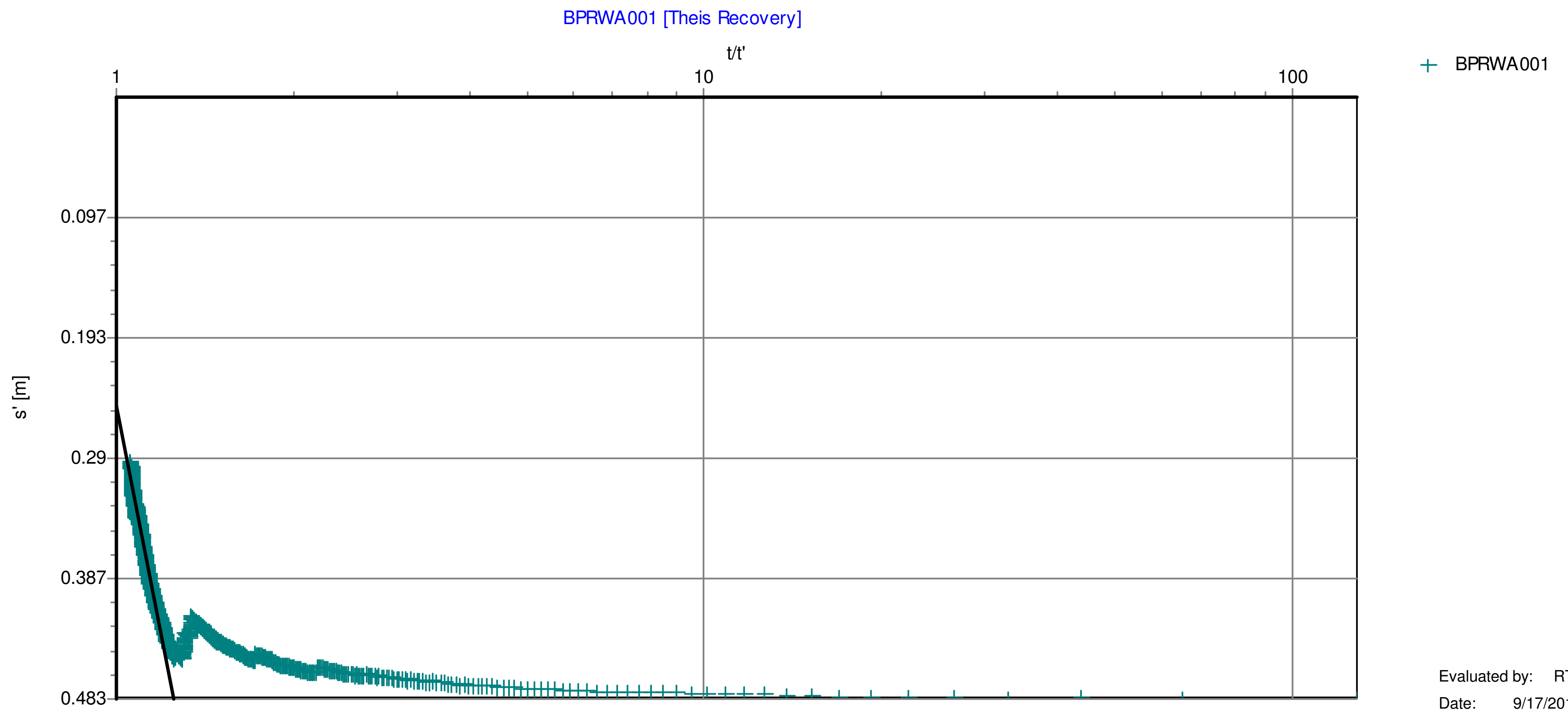
Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 5.807E-8 m/sec
Kz/Kr = 1.

Ss = 1.402E-6 m^{-1}

SLR	**Analysis Report**	**Pumping Test:** **BPRWA001**
	Project: Black Point Quarry	**Analysis Method:** **Theis Recovery**
	Number: 210.05913.00000	Comments:
	Client: Morien Resources Corp.	Saturated screen length = 3.00 [m] Max. Head Change = 0.50 [m] R (eff) not used in analysis



Evaluated by: RT

Date: 9/17/2014

Analysis results:	Transmissivity:	2.15E-5 [m²/s]	Conductivity:	2.15E-6 [m/s]

Test parameters:				
	Pumping Well:	BPRWA001	Pumping Time	3840 [s]
	Screen radius:	0.451 [m]	Aquifer thickness:	10 [m]
	Screen length:	5.3 [m]	Boring radius:	0.451 [m]
			Discharge Rate:	0.00028 [m³/s]

ATTACHMENT H
Groundwater Elevation Summary Tables and Hydrographs

Black Point Quarry Project
Guysborough County, NS
SLR Project No.: 210.05913.00000

Groundwater Level Tables

Project Site Granite Core Holes

Well	BP-1A	BP-2	BP-3	BP-4	BP-5	BP-6A	BP-7	BP-8	BP-9
Ground Elevation (mASL)	73	82	74	100	82	73	70	58	79
September 14, 2011	70.21	79.4	70.85	96.38	79.11	68.35			
June 15, 2014		79.49	70.88	97.54	79.67	69.27	65.12	53.39	73.51
August 26, 2014		79.3	70.61	95.68	78.46	68.36	64.31	53.19	73.11

Residential Water Wells

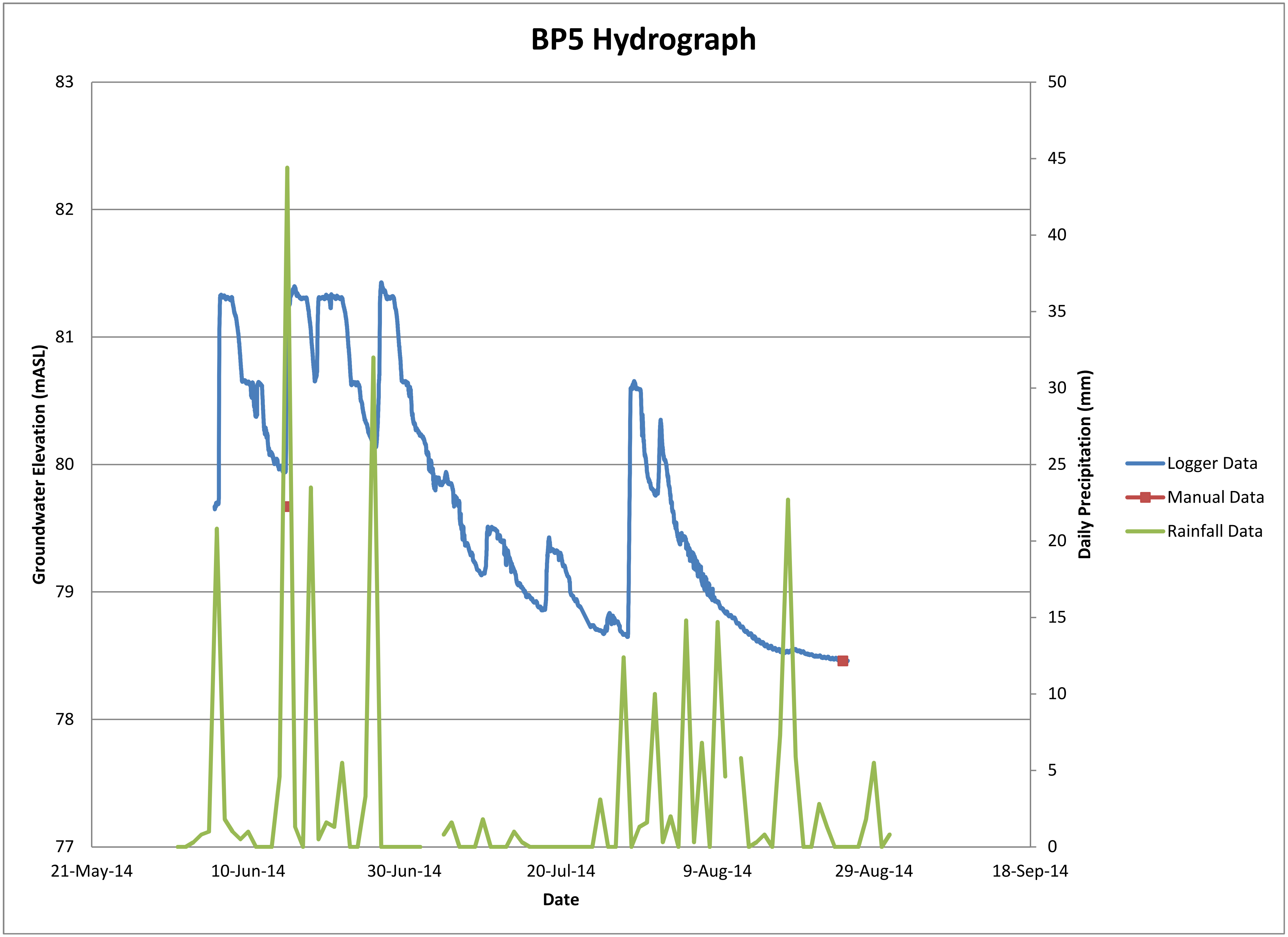
Well	BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA006	BPRWA007	BPRWA008	BPRWA012	BPRWA013	BPRWA014	BPRWA016
Ground Elevation (mASL)	21	21	12	35	32	42	48	5	50	41	17
July 16, 2014	18.71	19.54	10.88								
July 17, 2014				34.75	29.94	30.17	46.61				
July 18, 2014								2.73			
July 21, 2014											
July 22, 2014									46.9		
July 25, 2014										39.81	
August 29, 2014											13.403

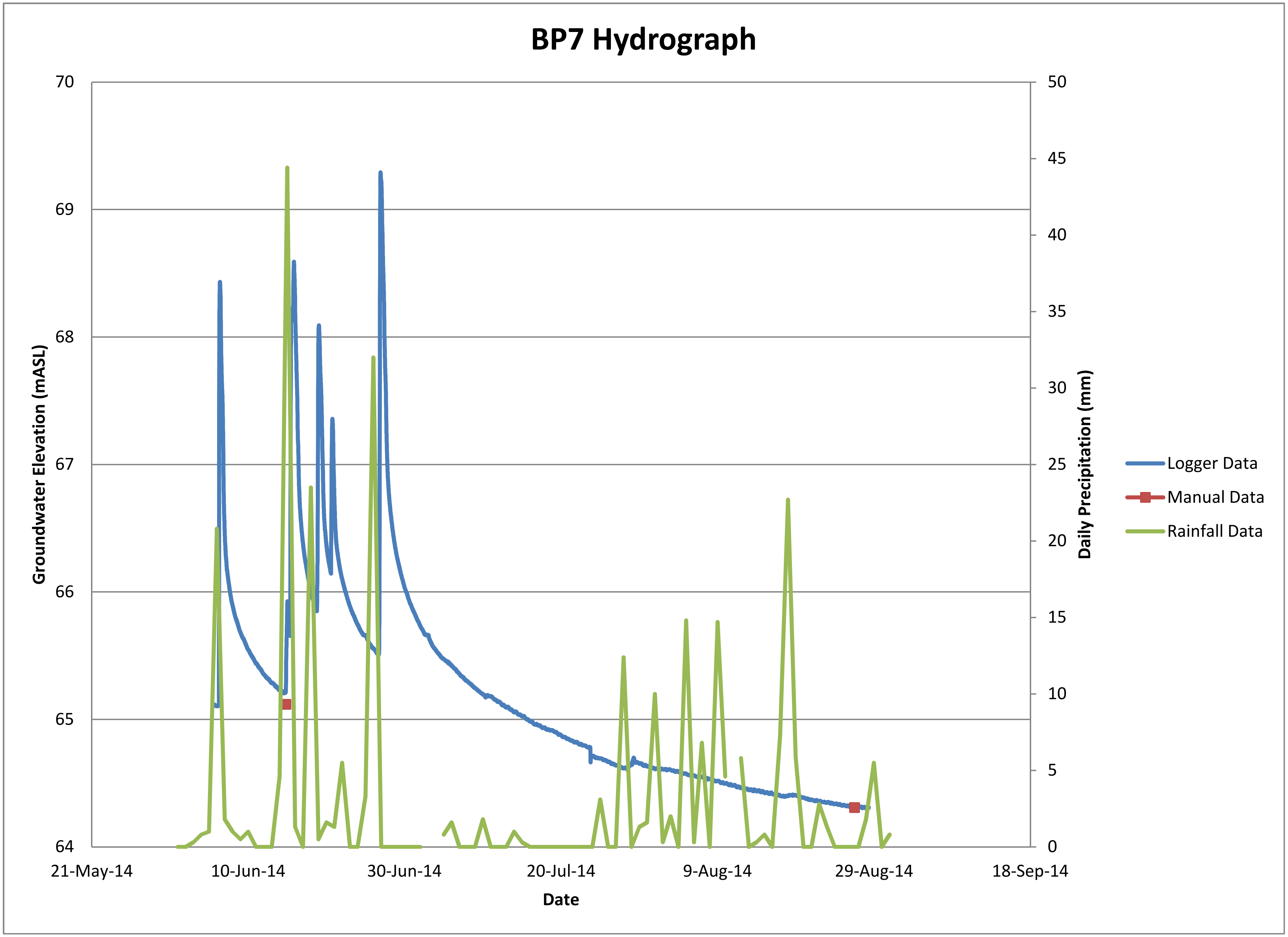
Drive Point Piezometers

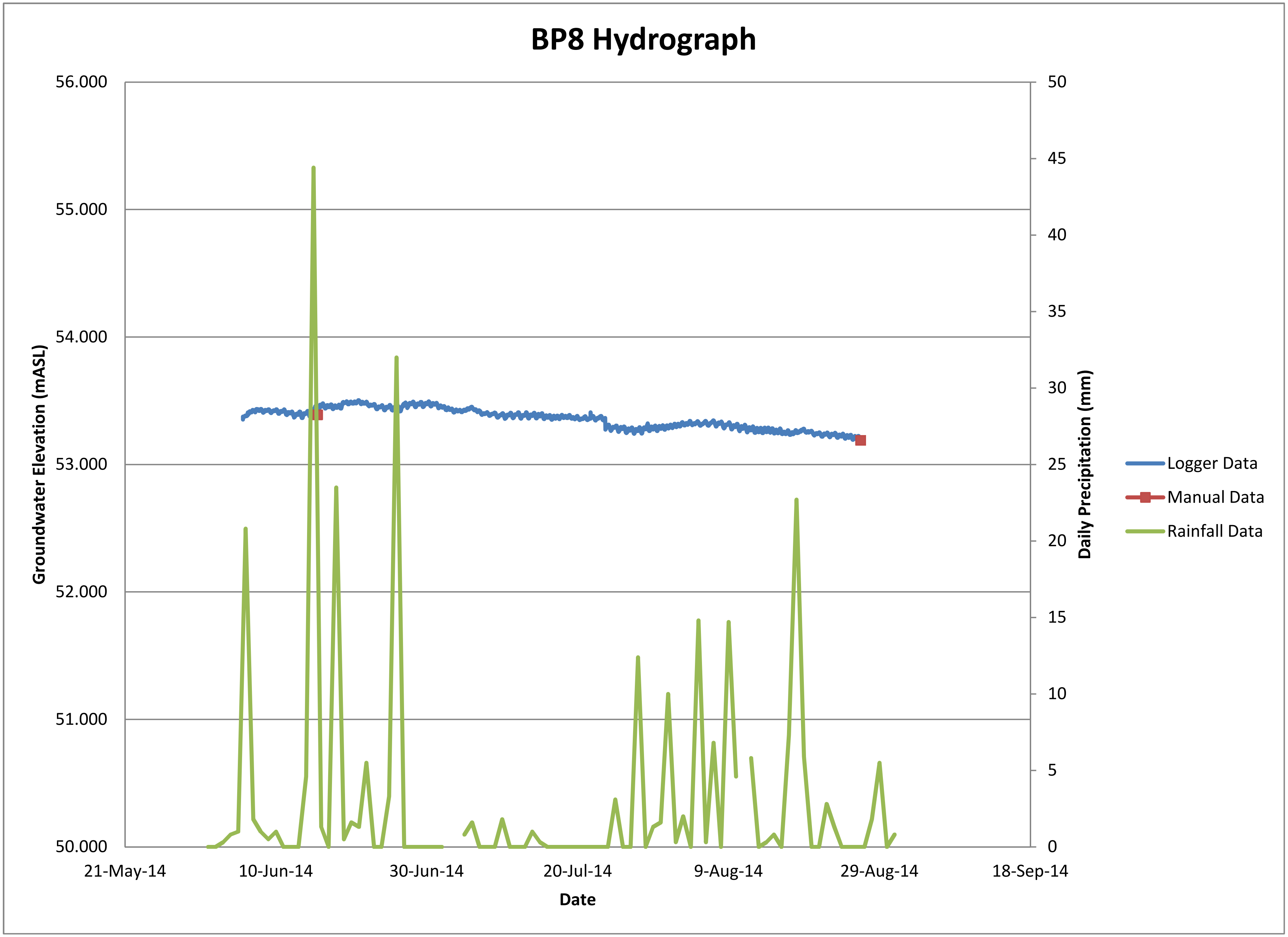
Mini piezometer ID	Ground Elevation	Bottom of perforated interval	Top of perforated interval	Vertical separation of screened intervals (DL)	Stick up	Water Level (26 August 2014)			
	(mASL)	(mbgs)	(mbgs)	(m)	(m)	(m below top of pipe)	(mbgs)	Difference (shallow - deep)	Vertical gradient
MP1 shallow	76	2.158	1.807	0.826	0.667	0.755	0.088	-0.111	-0.13
MP1 deep		3.334	2.984		0.72	0.919	0.199		
MP2 shallow	75	1.39	0.938	0.487	0.817	1.147	0.33	-0.257	-0.53
MP2 deep		2.227	1.877		1.815	2.402	0.587		
MP3 shallow	75	1.99	1.64	0.789	0.86	1.273	0.413	0.09	0.11
MP3 deep		3.132	2.779		0.915	1.238	0.323		
MP4 shallow	53	2.058	1.709	0.641	0.771	0.761	-0.01	0.043	0.07
MP4 deep		3.042	2.699		1.01	0.957	-0.053		
MP5 shallow	47	1.812	1.461	1.285	1.005	1.2	0.195	-0.17	-0.13
MP5 deep		3.447	3.097		0.605	0.97	0.365		
MP6 stream	74	0	n/a	0.985	0.897	0.764	-0.133	-0.6	-0.61
MP6 deep		1.335	0.985		0.897	1.364	0.467		
MP7 shallow	72	1.719	1.369	1.07	1.11	1.186	0.076	0.016	0.01
MP7 deep		3.14	2.789		0.904	0.964	0.06		
MP8 stream	49	0	n/a	0.44	0.796	0.736	-0.06	-0.146	-0.33
MP8 deep		0.79	0.44		0.796	0.882	0.086		
MP9 stream	45	0	n/a	1.003	1.46	1.335	-0.125	0.03	0.03
MP9 deep		1.353	1.003		1.46	1.305	-0.155		

Positive value indicates upward gradient i.e. Groundwater discharge zone

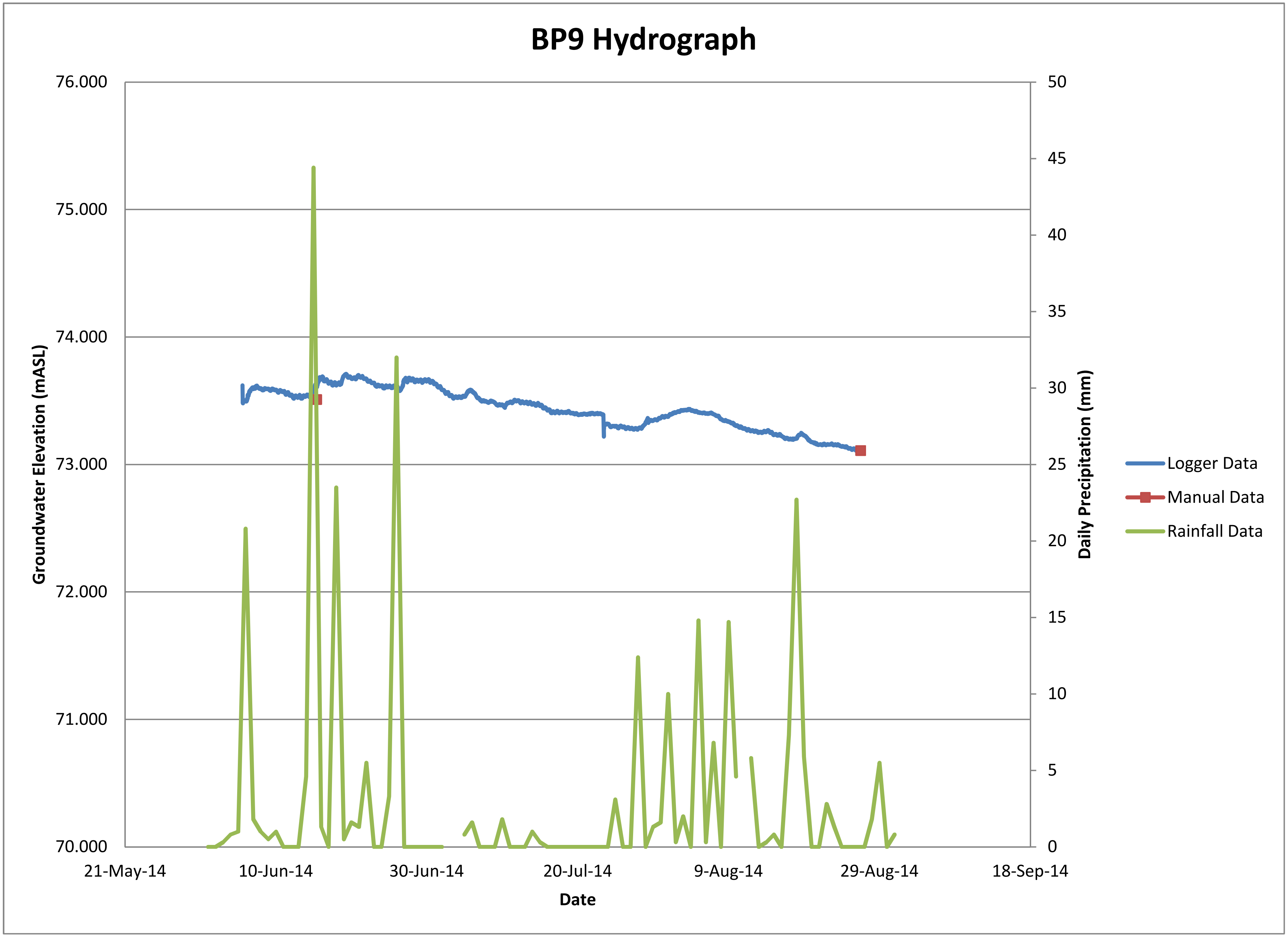
Negative Value indicates downward gradient i.e. Groundwater recharge zone

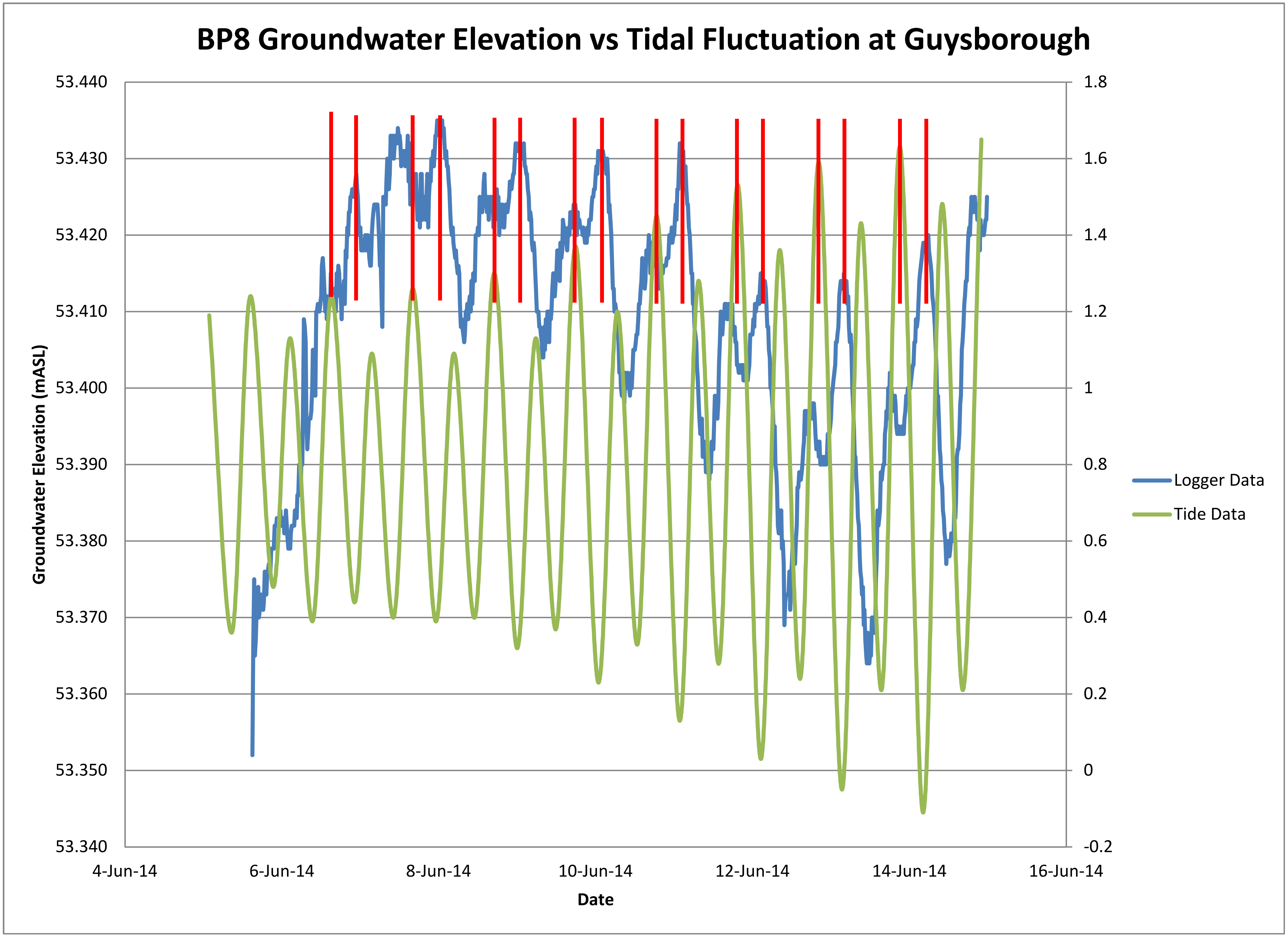

BP5 Hydrograph
Groundwater Elevation (mASL)
Daily Precipitation (mm)
83
82
81
80
79
78
77
50
45
40
35
30
25
20
15
10
5
0
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data


BP7 Hydrograph
Groundwater Elevation (mASL)
Daily Precipitation (mm)
Date
70
69
68
67
66
65
64
50
45
40
35
30
25
20
15
10
5
0
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Logger Data
Manual Data
Rainfall Data



BP8 Hydrograph
56.000
55.000
54.000
53.000
52.000
51.000
50.000
Groundwater Elevation (mASL)
50
45
40
35
30
25
20
15
10
5
0
Daily Precipitation (mm)
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data


BP9 Hydrograph
Groundwater Elevation (mASL)
76.000
75.000
74.000
73.000
72.000
71.000
70.000
Daily Precipitation (mm)
50
45
40
35
30
25
20
15
10
5
0
21-May-14
10-Jun-14
30-Jun-14
20-Jul-14
9-Aug-14
29-Aug-14
18-Sep-14
Date
Logger Data
Manual Data
Rainfall Data



BP8 Groundwater Elevation vs Tidal Fluctuation at Guysborough
Groundwater Elevation (mASL)
53.440
53.430
53.420
53.410
53.400
53.390
53.380
53.370
53.360
53.350
53.340
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
4-Jun-14
6-Jun-14
8-Jun-14
10-Jun-14
12-Jun-14
14-Jun-14
16-Jun-14
Date
Logger Data
Tide Data

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