Sebright Quarry
Updated Hydrogeological Evaluation
Geographic Township of Dalton,
City of Kawartha Lakes

April 2011

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GENIVAR

Project No. 920365.05

April 18, 2011

Mr. V. Giordano
President
Giofam Investments Inc.
P.O. Box 1359
Uxbridge, Ontario
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Re: Sebright Quarry – Updated Hydrogeological Evaluation
Geographic Township of Dalton, City of Kawartha Lakes

Dear Sirs:

We are pleased to submit the following report for the above-noted undertaking.

A summary of the report findings is presented in the Executive Summary located at the front of the report. Details are provided in the subsequent sections and technical information is appended.

We trust that this report satisfies your current requirements. Please contact us if you have any questions.

Yours truly,
GENIVAR Inc.

Jason T. Balsdon, M.A.Sc., P.Eng.
Director, Environment

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Executive Summary

Giofam Investments Inc. proposes to licence and operate a quarry (Sebright Quarry) on its property located north of Kawartha Lakes Road 45 (formerly Highway 503), which is also known as Monck Road, about 6 kilometres east of Sebright, within the Geographic Township of Dalton Township, City of Kawartha Lakes. Cranberry River flows through the northwest corner of the property, with the Queen Elizabeth II Wilderness Provincial Park (formerly the Dalton Digby Wildlands Provincial Park) located to the north and east. The central portion of the property contains rock knobs that are topographically elevated above the surrounding area.

In 1992 and 2000, Jagger Hims Limited completed a review of the property's potential as an aggregate source. As follow-up, Jagger Hims Limited was retained to complete a hydrogeologic evaluation of a portion of the property for a proposed quarry relative to an application for a licence under the Aggregate Resources Act. Giofam Investments Inc. proposes to obtain a Class A, Category 2 Licence for a quarry with extraction below the water table.

In June 2008, The Habitat Regulations under the Endangered Species Act came into effect. In response, additional field studies were completed with findings that necessitated revisions to the original Site Plan. As a result, this updated hydrogeological evaluation was completed to consider the revised Site Plan and to include additional monitoring data obtained between 2007 and 2010. Throughout this report, the licenced limits of the Sebright Quarry constitute the 'site' within the subject property.

For Phase 1A, which involves the extraction of the one rock knob to an elevation of between 242 and 244 m asl, groundwater elevations around the quarry perimeter are not anticipated to show notable changes relative to baseline conditions. Groundwater use for water wells around the property will not be affected. Shallow groundwater quality will continue to reflect the water quality of precipitation and snowmelt. Implementation of the water management plan will maintain pre-extraction surface water conditions within the watercourses. In addition, surface water quality will not show a detectable change as a result of the Phase 1A quarry operations.

Phases 1B and 2 will involve quarry development below the surrounding water table and watercourses within the low-lying area. No effects of quarry dewatering on groundwater elevations beyond the property boundaries are anticipated, except potentially south of Phase 2 based on 'worse-case conditions'. Dewatering effects between Phase 2 and Kawartha Lakes Road 45 will decrease with distance from the extraction area and should not have a negative effect on local water well supplies.

The groundwater drawdown effects due to extraction will extend below a portion of the watercourses located north and east of Phases 1 and 2. It is predicted that the loss of surface water will be negligible compared to the seasonal flow rates and this water will be returned to the watercourse through the water management program. No detectable effects are predicted for surface water conditions within the Cranberry River.

With the implementation of the water management plan detailed in Section 5, the dewatering of Phase 1/2 and controlled discharge to the tributaries of Cranberry River will not have a detectable effect on pre-extraction total surface water flow rates. It is predicted that the flow rates in the watercourses will be similar or may increase slightly (0.002 to 0.006 m^3/s) during dewatering. No notable change in flow rates with Cranberry River will be detectable.

Groundwater quality beyond the property boundary will not be affected by quarry operations as groundwater will be induced to move toward the excavations. As the groundwater and surface water quality is similar, and environmental management practices will be implemented as part of quarry operations, such as settling ponds and fuelling in controlled areas, no detectable effects on surface water quality are predicted.

Overall, the dewatering program will not have a detectable effect on surface water flow or quality within Cranberry River or on surface water leaving the Cranberry River subwatershed.

A Permit To Take Water will be required for operation of the sump(s) in Phase 1A and during dewatering of Phases 1B and 2, as well as potentially for a temporary production well to supply water for dust control prior to construction of a quarry sump. The required pumping rate for the sumps will increase as the area and depth of the extraction area increases as summarized below.

PHASE	AVERGE PUMPING RATE (m^3/day)	MAXIMUM PUMPING RATE (m^3/day)
Phase 1A	131	1,288
Phase 1B	278	2,741
Phase 1/2	390	3,846

NOTES:
1) 'm^3/day' indicates cubic metres per day.
2) Average pumping rate based on 365 days per year.
3) Maximum pumping rate based on 81% of water being removed over a 30 day period (April).

Approval for discharge of the groundwater and surface water collected within the extraction areas will be required.

Upon completion of Phases 1/2 the rehabilitation will involve the establishment of a lake within the extraction area. Based on the existing topography, the lake level for Phase 1/2 will be about 240 m asl. It is estimated that the lake will require about 30 to 40 years to achieve stable levels, but may be longer if some dewatering is required to supplement surface water flow within the central low-lying area and Watercourse 1. Upon complete rehabilitation of the property, the surface water and groundwater conditions will be similar to baseline conditions, with some reduction of groundwater seeps immediately around the rehabilitation lake. There will be no detectable effects beyond the property boundaries on groundwater and surface water conditions within the Cranberry River subwatershed.

A Performance Monitoring Program was initiated for the site to establish baseline conditions and will be continued, during, and for two years after achieving stable conditions within the rehabilitated lakes. The monitoring program and trigger mechanisms to implement contingency measures are provided in Section 8 of the report.

Contingency measures to ensure protection of groundwater supplies and surface water are provided in Section 9.

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1. Introduction

1.1 Background

The subject property, which includes land proposed to be licenced and other land owned by Giofam Investments Inc., is located north of Kawartha Lakes Road 45 (former Highway 503), which is also known as Monck Road, about 6 kilometres (km) east of Sebright. The property is about 423 hectares (ha) in area and encompasses: Part Lots 18, 19, and 20, Concession 3; Part Lot 17, and Lots 18 to 21, Concession 4; Part Lot 17, Lots 18 to 20, and Part Lots 21 and 22, Concession 5, within the Geographic Township of Dalton Township, City of Kawartha Lakes. A location map is provided in Figure 1.

Cranberry River flows through the northwest corner of the property, with the Queen Elizabeth II Wilderness Provincial Park (formerly the Dalton Digby Wildlands Provincial Park) located to the north and east. Figure 2 provides a regional plan of the property and surrounding area. The central portion of the property contains rock knobs that are topographically elevated above the surrounding area.

From 1992 to 2001 geology and resource testing of the granitic gneiss on the property was completed. Results are presented in the Geology and Resource Assessment report (Jagger Hims Limited, 2008). Rock quality testing indicated that the granitic gneiss is capable of providing high quality asphalt aggregate in accordance with the MTO HL1 specifications. Extraction of select rock knobs to a base elevation of 220 metres above sea level (m asl) would provide about 13 million cubic metres (m^3) of material. A decision was made to proceed toward licensing a portion of the property. Giofam Investments Inc. initiated an application to obtain a Class A, Category 2 Licence for a quarry with extraction below the water table.

In June 2008, The Habitat Regulations under the Endangered Species Act came into effect. In response, additional field studies were completed with findings that necessitated revisions to the original Site Plan. For example the proposed extraction areas were reduced from four to two areas, with a reduced available resource of about 7.2 million m^3. As a result, this updated hydrogeological evaluation was completed to consider the revised Site Plan and to include additional monitoring data obtained between 2007 and 2010. Throughout this report, the licenced limits of the Sebright Quarry constitute the 'site' within the subject property.

1.2 Planning Context - Hydrogeology

The primary purpose of the hydrogeological evaluation of the site is to complete a Level 1 and 2 Hydrogeological Evaluation for a Class A, Category 2 License in accordance with the requirements of the Aggregate Resources Act (R.S.O., 1990). As such, this technical report provides information on and an evaluation of the following:

(a) water wells;
(b) springs;
(c) groundwater aquifers;
(d) surface watercourses and bodies;
(e) discharge to surface water;
(f) proposed water diversion, storage and drainage facilities on property;
(g) methodology;

(h) description of the physical setting including local geology, hydrogeology, and surface water systems;
(i) water budget;
(j) impact assessment;
(k) mitigation measures including trigger mechanisms;
(l) contingency plan;
(m) monitoring plan; and
(n) technical support data in the form of tables, graphs and figures, usually appended to the report.

In addition, this hydrogeological evaluation provides input to the technical requirements of the County of Victoria Official Plan Consolidation (2004), the Provincial Policy Statement (2005), and the City of Kawartha Lakes Official Plan (2010).

1.3 Objectives and Scope

The principal objectives of the hydrogeological evaluation are as follow.

- To establish the groundwater and surface water conditions on the site and adjacent lands.
- To provide input to identify a suitable source of water for quarry operations.
- To provide input to the quarry design, including water management, such as water use, diversion, storage, and drainage.
- To identify potential effects of a quarry on groundwater and surface water resources, and to provide conceptual mitigative options, if required.
- To outline a performance monitoring program, trigger mechanisms, and a contingency plan to evaluate predictions for the continued protection of water resources.

This updated report provides a hydrogeological evaluation of the Sebright Quarry. Also considered in the evaluation is the regional area within about 3 km of the subject property. Studies regarding ecology/biology, traffic, archaeology, and blasting were completed by others and are reported under separate cover.

1.4 Work Program

The work program was completed in several phases to permit a progressive understanding of the site and to develop a work program to obtain the required information in an efficient manner.

1.4.1 Site Reconnaissance Visit

An initial site reconnaissance visit was completed on October 27, 2003, with subsequent site visits completed as part of the monitoring program and with the Ministry of Natural Resources. The visit included the completion of the following tasks.

- A review of the site topography, geology, and surface water features.
- An assessment of the condition of boreholes BH00-1, BH00-2, and BH00-3, which were completed on the property in 2000.
- The measurement of groundwater levels within BH00-1, BH00-2, and BH00-3, and an assessment of the response of the groundwater within the boreholes to groundwater removal.
- Identification and flagging of potential borehole drilling locations.

1.4.2 Borehole Drilling Program

Two borehole drilling programs were completed. The first program was completed between December 8 to 15, 2003, and the second program was completed between September 13 and 16, 2004. Drilling was completed by Lantech Drilling Services using a track-mounted drilling rig. Boreholes were advanced with an HQ (64 mm diameter) diamond drill. Casing was installed into each borehole and seated into the upper portion of the bedrock to maintain an open borehole for testing and monitoring well installations. A borehole summary, which includes the previous boreholes completed on the property, is provided in Table 1 and borehole logs are provided in Appendix A. Borehole locations are presented in the Property Details map of Figure 3.

Boreholes completed in 2003 and 2004 were continuously cored from ground surface to the completion depth. Rock core was placed in core boxes in the field and transported to Jagger Hims Limited for a detailed description by a Professional Geoscientist. Descriptions included stratigraphic descriptions, fracture frequency and general orientation, percent recovery, and rock quality designation.

1.4.3 Hydraulic Testing

Hydraulic testing of rock was completed for each of the boreholes drilled in 2003 and 2004. Testing was not completed within the older boreholes owing to sediment accumulation and possible rock movement at fractures that could puncture or trap the testing equipment.

The hydraulic tests were completed with a pneumatic packer assemblage that was lowered directly into each borehole. Packers were inflated with compressed air and falling head or constant head tests were completed depending on the hydraulic response of the test interval. Supplemental tests were completed for some test intervals for quality assurance. Test results are provided in Table A-1, Appendix A. A summary of the testing completed is provided in Table 2.

1.4.4 Monitoring Well Installations

Monitoring wells were constructed within each of the boreholes drilled in 2003 and 2004. To obtain information to determine vertical hydraulic gradients, two monitoring wells were installed at each borehole location. For the boreholes advanced in 2003, both monitoring wells were installed in a single borehole. The deep monitoring well was constructed near the base of the borehole to intercept deep fractures, where present, and the shallow monitoring well was installed to obtain water table elevations. For the boreholes completed in 2004, the monitoring wells were installed within separate boreholes. The deep monitoring well was installed within bedrock and the shallow monitoring well was installed within the overburden.

Each monitoring well was constructed of 38 mm or 50 mm diameter, environmental grade, polyvinyl chloride (PVC) riser and screens. Clean sand filter packs were emplaced around the screens to reduce the movement of sediment into the monitors. A bentonite seal was emplaced above the sand packs. Well construction details are shown in the borehole logs of Appendix A and are detailed in Table B-1, Appendix B. A summary of the screen interval for the monitoring wells is provided in Table 3. Monitoring well locations are presented in Figure 3.

1.4.5 Residential Water Well Survey

A residential water well survey was completed for residences located within at least 1 km of the property to obtain additional information on local water wells and to permit correlation with the MOE water well records where possible. As summarized in Table A-3, Appendix A, seventeen (17) interviews were completed and nine (9) residents were not available for interviews on May 9 and June 13, 2006.

1.4.6 Groundwater Monitoring

Groundwater levels were measured with an electric contact gauge on the following dates. Levels and elevations for the monitoring wells are presented in Table B-2, Appendix B. Groundwater hydrographs are provided in Figures B-1 to B-7, Appendix B.

October 27, 2003	May 19, 2005	January 24, 2007	January 29, 2009
February 24 to March 17, 2004	June 20, 2005	March 22, 2007	March 26, 2009
April 1, 2004	July 14, 2005	May 24, 2007	May 27, 2009
April 2, 2004	August 31, 2005	July 20, 2007	July 23, 2009
April 27, 2004	September 28, 2005	September 20, 2007	September 24, 2009
May 18, 2004	October 20, 2005	November 15, 2007	November 27, 2009
September 13, 2004	November 30, 2005	January 16, 2008	January 19, 2010
October 18, 2004	January 27, 2006	March 24, 2008	March 22, 2010
November 17, 2004	March 23, 2006	May 22, 2008	May 27, 2010
December 13, 2004	May 8, 2006	July 29, 2008	July 22, 2010
January 24, 2005	July 31, 2006	September 29, 2008	September 30, 2010
February 16, 2005	September 21, 2006	November 13, 2008	November 22, 2010
March 18, 2005	November 28, 2006		

In addition, groundwater levels were obtained from accessible water wells on May 9 or June 13, 2006. Water levels are presented in Table B-3, Appendix B.

Six groundwater sampling events were completed to obtain information on groundwater quality on the property. Monitoring wells were purged and sampled on August 31, 2005, May 9, 2006, May 24, 2007, May 22, 2008, May 27, 2009, and May 27, 2010. Samples were collected into laboratory prepared bottles and submitted to Maxxam Analytics Inc. for analyses of general chemicals. Field and laboratory results are summarized in Table B-4 and laboratory certificates of analyses are provided in Appendix B.

Residential well groundwater quality testing was also completed for accessible wells on May 9 or June 13, 2006. Samples were collected prior to treatment systems and submitted to Maxxam Analytics Inc. for analyses of general chemicals. Chemical results are summarized in Table B-5, Appendix B.

1.4.7 Surface Water Monitoring

Surface water stations were established at the locations listed in Table 4 to obtain input to characterize local surface water resources. Station locations are presented in Figure 3.

Surface water flow rates were measured at stations SW1 through SW4 on the following dates. Results are summarized in Table C-1 and presented in Figure C-1, Appendix C. Flow rates were measured over watercourse profiles with an electromagnetic velocity meter.

September 14, 2004	May 8, 2006	July 29, 2008
October 18, 2004	July 31, 2006	September 29, 2008
November 17, 2004	September 21, 2006	November 13, 2008
December 13, 2004	November 28, 2006	January 29, 2009
January 24, 2005	January 24, 2007	March 26, 2009
February 17, 2005	March 22, 2007	May 27, 2009
March 18, 2005	April 19, 2007	July 23, 2009
April 14, 2005	May 8, 2007	September 24, 2009
May 19, 2005	May 23, 2007	November 27, 2009
June 20, 2005	July 20, 2007	January 19, 2010
July 14, 2005	September 20, 2007	March 22, 2010
August 31, 2005	November 15, 2007	May 27, 2010
September 28, 2005	January 16, 2008	July 22, 2010
October 20, 2005	March 25, 2008	September 30, 2010
November 30, 2005	May 23, 2008	November 22, 2010

Flow rate monitoring at stations SWA and SWB was initiated in May 2006, and at station SW5 in September 2007. Results are also provided in Table C-1, Appendix C. Surface water samples were collected on the following dates and submitted to Maxxam Analytics Inc. for laboratory analyses of general chemical parameters. Analyses for organic parameters were completed on November 28, 2006 and May 24, 2007 and analyses for BTEX and oil and grease were completed on the dates as noted in the table below. A summary of the results is provided in Tables C-2 and C-3, Appendix C. Laboratory certificates of analyses are maintained on file.

SAMPLE DATE	STATION LOCATION
August 31, 2005	SW1, SW2
November 30, 2005	SW1, SW2, SW3, SWA, SWB
May 8, 2006	SW1, SW2, SW3, SW4, SWA, SWB
September 21, 2006	SW1, SW3, SWA, SWB
November 28, 2006	SW1, SW2, SW3, SW4, SWA, SWB
April 19, 2007	SW1, SW2, SW3, SW4, SWA, SWB
May 8, 2007	SW1, SW2, SW3, SW4, SWA, SWB
May 24, 2007	SW1, SW2, SW3, SW4, SWA, SWB
July 20, 2007	SW1, SW2, SW3, SW4, SWA, SWB
November 15, 2007	SW1, SW2, SW3, SW4, SW5, SWA, SWB
May 23, 2008*	SW1, SW2, SW3, SW4, SW5, SWA, SWB
September 29, 2008*	SW1, SW2, SW3, SW4, SW5, SWA, SWB
May 27, 2009*	SW1, SW2, SW3, SW4, SW5, SWA, SWB
September 24, 2009*	SW1, SW2, SW3, SW5, SWA, SWB
May 27, 2010*	SW1, SW2, SW3, SW4, SW5, SWA, SWB
September 30, 2010*	SW1, SW2, SW3, SW4, SW5, SWA, SWB

* BTEX and oil and grease were also analysed.

1.4.8 Data Collation and Interpretation

Information collated as part of the evaluation included the following.

- Previous work completed for the property
- Ministry of the Environment (MOE) Water Well Records – provided in Table A-2, Appendix A
- Public mapping and reports
- Climatic data from the Orillia TS Climatological Station
- Data collected as part of the work program detailed in Section 1.4.

The interpretation, findings, and conclusions are presented in the following report.

2. Baseline Hydrogeologic Conditions

2.1 Physiography

The property and regional study area are located on the boundary between the Carden Plain physiographic region to the south and the Georgian Bay Fringe physiographic region to the north (Chapman and Putnam, 1984). The boundary of the two physiographic regions roughly follows Kawartha Lakes Road 45 within the regional study area. The Carden Plain is comprised of a Paleozoic-age limestone plain with thin overburden. Similarly, the Precambrian age rock of the Georgian Bay Fringe has little soil cover, but also has bare rock knobs and ridges.

2.2 Topography

The topography of the regional study area is shown in the regional plan of Figure 2. Higher topography occurs within the eastern portion of the study area, with highlands that exceed an elevation of 280 metres above sea level (m asl). The elevation generally decreases from east to west towards Head River where elevations less than 230 m asl occur. Occasional rock knobs are evident from the topographic contours, with one rock knob on the property that exceeds an elevation of 260 m asl.

Within the southeastern corner of the regional study area, an area of highland also occurs with elevations higher than 260 m asl. The land in this area slopes towards Head River to the northeast and northwest.

2.3 Surface Drainage

Surface water drainage is influenced by the soil cover and rock type, with the drainage direction influenced by topography. Beaver dams also affect the drainage locally. There are a number of swampy areas and small lakes within the study area.

Estimated watershed boundaries are presented in Figure 2. The main watershed in the study area is the Head River watershed, which also includes the Cranberry River subwatershed and Deverells Creek subwatershed. In addition, Dalrymple Lake and Young Lake discharge to Head River. The Black River watershed is located within the northwestern portion of the study area. Head River eventually joins Black River approximately 7.5 km northwest of Sebright, with discharge into Lake Couchiching.

The property is located on a surface water drainage divide between Head River to the south and Cranberry River to the north. This drainage divide extends over areas of high land and rock knobs within the southern portion of the property. Cranberry River flows through the northwestern portion of the property, while Head River is located south of the property and Kawartha Lakes Road 45.

2.4 Geology

2.4.1 Regional Geologic Setting

The regional bedrock geology based on published maps is shown in Figure 4. Bedrock within the majority of the study area consists of Precambrian rock, including gneisses, migmatites, and felsic intrusives. These rocks are part of the Canadian Shield, which has its southern boundary just south of Kawartha Lakes Road 45 within Dalton Township.

In the southern portion of the subject property, and also south of Head River, overlying Paleozoic rocks include the following, from the oldest (Shadow Lake Formation) that directly overlies the Precambrian rock, to the youngest (Bobcaygeon Formation).

NAME	DESCRIPTION
Shadow Lake Formation	Shale and sandstone
Gull River Formation – Lower Member	Various types of limestone and dolostone
Gull River Formation – Upper Member	Limestone
Bobcaygeon Formation – Lower Member	Limestone
Bobcaygeon Formation – Middle Member	Limestone and shale

The shale and sandstone of the Shadow Lake Formation directly overly the Precambrian rock and occur along the perimeter of the Paleozoic rock. An outlier of the Shadow Lake Formation also occurs within the southern portion of the property. Limestone and dolostone of the Gull River Formation (lower member) are also present overlying the Shadow Lake Formation within the outlier on the property. Paleozoic rock becomes progressively younger to the south of the property.

The Quaternary geology of the study area is presented in Figure 5. It is noted that Figure 5 is based upon two maps referenced in the figure. As a result, some of the geologic boundaries do not match at the contact of the two maps. A majority of the regional study area consists of exposed bedrock and bedrock with thin soil cover. In addition, north of Kawartha Lakes Road 45 a large proportion of the soil cover is bog and swamp deposits of muck and peat with some marl. A variety of soil types that range from clay to sand and gravel also occur as localized deposits in the area. For example, within the western portion of the property, a glaciolacustrine shallow water deposit of sand, with some clay and/or silt is present and is less than 1.5 m thick (OGS, 1992).

Regional cross-sections presented in Figures A-1 and A-2, Appendix A, show the variable topography, soil thickness, and rock type across the study area. The cross-sections are based on water well records presented in Table A-2, Appendix A. Water well locations are shown in Figure 6.

2.4.2 Local Geologic Setting

Borehole locations are presented in Figure 3, with borehole logs provided in Appendix A. Figures A-3 and A-4, Appendix A, provide local cross-sections through the property.

Overburden was present at borehole locations BH03-5, BH03-6, BH04-7, and BH04-8. These boreholes were intentionally advanced at the property boundaries or near Cranberry River within areas that were not located on the bedrock knobs. The soil at these locations was generally identified as brown to grey clayey silt, with variable amounts of clay, sand, and gravel.

The soil thickness at BH03-5 and BH03-6 included 0.3 m of topsoil overlying 3.5 m to 3.7 m of the sandy clayey silt. Adjacent to Cranberry River at BH04-7 and BH04-8, the soil thickness below 0.1 m to 0.2 m of topsoil was between 3.2 and 4.3 m. At these two borehole locations the soil consisted of silty clay to clayey silt.

Paleozoic bedrock was detected at borehole locations BH03-5 and BH03-6. At BH03-5 the rock consisted of 6.2 m of alternating shale and sandstone layers, whereas at BH03-6 the rock consisted of 1.0 m of sandstone. This rock is part of the Shadow Lake Formation. The shale was a dark reddish brown to bluish green, and the coarse-grained sandstone was grey with pink colouration. Moderate weathering was identified within the upper portion of the rock in both boreholes and within some fractures.

Each borehole was terminated within Precambrian bedrock. At BH00-1, BH00-2, BH00-3, BH03-1, and BH03-4 the Precambrian rock was exposed at surface. Only about 0.1 m of topsoil was detected at BH03-4. These findings were expected as the borehole locations were intentionally selected on the bedrock knobs.

The Precambrian bedrock was identified as dominantly granitic or tonalitic gneiss/migmatite. In general, the gneiss/migmatite was hard with black and white, occasionally salmon pink, coarse-grained minerals. Core from the Precambrian bedrock at BH04-7 and BH04-8 is shown in Figures 7 and 8. Granitic dikelets and layers were identified within the gneiss/migmatite, including a 7.3 m thick layer of granite at BH03-5.

The frequency of fractures varied between borehole locations. Some fractures showed discolouration that was indicative of weathering from water movement.

The local cross-sections show the general distribution of rock type across the property. As expected, the exposed rock knobs and areas to the north contain Precambrian rock. East and south of the rock knobs, overburden and Paleozoic sedimentary rock occur, which corresponds with the more subdued topography.

2.4.3 Rock Hydraulic Characteristics

Hydraulic testing was completed for the boreholes drilled in 2000 during the property visit of October 2003. Fracture-controlled flow was identified for both BH00-1 and BH00-3. At BH00-1 water was observed cascading into the borehole during testing at about 4.5 m below ground surface. Audible cascading groundwater was detected in BH00-3, although the water level was stabilized at about 7.9 m below ground surface. It is interpreted that fracture flow at BH00-3 permitted the water within the borehole to flow toward the low-lying area to the west. No fracture flow was detected at BH00-2.

Insitu hydraulic testing was completed for the boreholes that were drilled in 2003 and 2004. Results are listed in Table A-1, Appendix A, and presented on the borehole logs. Specific bulk hydraulic conductivity results could not be determined for some of the test intervals as outlined below.

1. No detectable decrease in water levels within the test interval was interpreted to indicate a low bulk hydraulic conductivity of the rock. Based on the testing equipment and duration, a bulk hydraulic conductivity of less than 1×10^{-10} m/s was inferred.
2. A rapid response to water injection was observed for some test intervals. The oscillatory response of the water levels was indicative of a high bulk hydraulic conductivity, possibly related to the rapid movement of water through a fracture(s). A bulk hydraulic conductivity of greater than 5×10^{-4} m/s was inferred.

In summary, each borehole tested showed zones of high bulk hydraulic conductivity and zones of low bulk hydraulic conductivity. The high bulk hydraulic conductivity zones typically correlated with fractures that showed some discolouration, although some high values were measured within test intervals with no detectable fractures or weathering. Within these areas, features interpreted as drilling breaks may have been joints or fractures. The low bulk hydraulic conductivity zones typically occurred in test areas with no detectable fractures or weathering.

Based on the borehole hydraulic conductivity test results summarized in Table A-1, Appendix A, the geometric mean bulk hydraulic conductivity in metres per second (m/s) for each borehole was calculated as summarized below. For hydraulic conductivities less than 1×10^{-10} m/s the geometric mean calculations assigned a value of 1×10^{-10} m/s. Similarly, a value of 5×10^{-4} m/s was assigned for hydraulic conductivities greater than 5×10^{-4} m/s.

- BH03-1 – 5×10^{-8} m/s
- BH03-4 – 2×10^{-8} m/s
- BH03-5 – 2×10^{-5} m/s
- BH03-6 – 7×10^{-10} m/s
- BH04-7 – 1×10^{-8} m/s
- BH04-8 – 3×10^{-8} m/s

In general, the bulk hydraulic conductivities at the boreholes were low and ranged from about 7×10^{-10} m/s to 5×10^{-8} m/s. One exception was at BH03-5 where a bulk hydraulic conductivity of 2×10^{-5} m/s was determined. The geologic characteristics at this borehole were different as there was a thick (6.2 m) overlying unit of shale/sandstone and a thick (7.3 m) granite intrusion.

2.5 Groundwater

2.5.1 Regional Groundwater Setting

The regional groundwater setting is shown in the cross-sections of Figures A-1 and A-2, Appendix A. It is noted that the static water levels presented in the cross-sections are representative of groundwater conditions at the time of the construction of the individual water wells. Thus, the static levels presented are representative of groundwater conditions at one point in time and may be affected by the hydraulic response of each respective well.

The water well information presented in the cross-sections permits the following interpretations.

- Groundwater pressures within the bedrock are generally greater in the areas of high topography relative to the low-lying areas. Thus, groundwater in the bedrock moves toward the watercourses.

- The various depths of water wells required to achieve a suitable quantity of water for residential use indicates that groundwater movement within the bedrock is controlled by fractures. The depth of fractures with the ability to transmit sufficient water is not consistent between well locations.

- Some watercourses may be recharged from shallow groundwater movement through the fractured rock. Static water levels at some locations suggest that surface water within some watercourses may be perched above the water levels within the surrounding bedrock.

- Overburden thickness at some locations is sufficient to suggest that the water table within the overburden may be locally perched above water levels within the surrounding bedrock.

2.5.2 Local Groundwater Setting

2.5.2.1 Groundwater Elevations

Groundwater levels obtained from open boreholes and monitoring wells on the property are provided in Table B-2, Appendix B. Groundwater hydrographs are shown in Figures B-1 to B-7, Appendix B.

The groundwater elevations typically showed a seasonal trend of lower elevations during the summer months and higher elevations during the spring months. Seasonal water level fluctuations ranged from less than 1 m up to about 5 m. The higher groundwater elevations during the spring are expected as a result of greater infiltration of water from precipitation and snowmelt. The following four anomalous water level patterns are noted.

1. Open borehole BH00-1 showed four anomalously high water levels in 2006, 2007, and 2008 that are likely a result of temporary runoff accumulation in the borehole.

2. The open borehole at BH00-2 showed a gradual increase in groundwater elevations to mid 2008. This increase may be a result of the slow accumulation of water within the open borehole as a result of runoff from the surrounding exposed rock.

3. The open borehole at BH00-3 showed generally constant water elevations at a depth that approximated the hydraulically active fracture discussed in Section 2.4.3. It is interpreted that the fracture permitted drainage of water from the open borehole to the surrounding low-lying area.

4. At BH03-4-I and BH03-6-I, the water elevations dropped notably in after the removal of water as part of the sampling program discussed in Section 1.4.6, and then slowly recovered from the inflow of groundwater from the surrounding rock of low hydraulic conductivity. For example, the greatest bulk hydraulic conductivity adjacent to the intake area of the two monitoring wells was 6×10^{-10} m/s and 9×10^{-9} m/s, respectively. In comparison, the bulk hydraulic conductivity of the rock adjacent to monitoring wells that showed a more rapid recovery of water elevations was

greater than 5 x 10^{-5} m/s. The difference in the rate of water level recovery between BH03-4-I and BH03-6-I is attributed to differences in fracture interconnectivity and transmissivity at greater distances from the boreholes.

Groundwater elevations for shallow monitoring wells indicate higher elevations within areas of higher topography, such as at BH00-1, BH00-2, BH00-3, BH03-1, BH03-5, and BH03-6. Shallow groundwater is inferred to move from these areas of higher topography to the surrounding low-lying areas as represented by groundwater elevations at BH03-4, BH04-7, and BH04-8.

Groundwater elevations for March 22, 2010, are presented in Figure 9 and shown on the cross-sections of Figures A-3 and A-4, Appendix A. As noted above, groundwater elevations are highest in the areas of high topography, such as the rock knobs and the estimated watershed boundary, and decrease toward the surrounding areas of lower elevation, which includes ponds, watercourses, and Cranberry River. It is expected that seasonal groundwater seeps or springs occur at the base of the rock knobs.

Vertical hydraulic gradients were typically downward at BH03-1 and BH03-5, at a magnitude of between less than 0.001 and 0.2. As expected, it is apparent that the downward hydraulic gradients were greatest in areas of higher elevation, such as BH03-5.

Upward hydraulic gradients typically occurred at BH04-7, and BH04-8 at a magnitude of less of between less 0.02 and 0.15. The upward hydraulic gradients are a result of the lower surface topography and the groundwater pressures in the bedrock that are influenced by the surrounding areas of high topography. It is noted that at BH04-7 and BH04-8 flowing artesian conditions occurred within the deep monitoring wells.

The upward hydraulic gradients and deep artesian pressures at BH04-7 and BH04-8 confirm that there is a hydraulic connection between fractures of the high areas of land and surrounding low-lying areas. The degree of fracture interconnection varies across the property as indicated by the water level recovery after sampling from monitoring wells BH03-4-I and BH03-6-I. In addition, hydraulic gradients at the two monitoring well locations indicate that deeper water-bearing fractures are confined by overlying rock with a lower bulk hydraulic conductivity, likely as a result of less fractures.

Upward hydraulic gradients typically occurred at BH03-4 until July 2008 and at BH03-6 until September 2005, at which time a reversal in hydraulic gradients was observed to typically downward.

2.5.2.2 Groundwater Quality

Groundwater quality was tested at the shallow and deep monitoring wells on the property and at some local residential water wells. Chemical results are summarized in Tables B-4 and B-5, Appendix B.

Quality assurance and quality control testing, which involved field analyses, field prepared blind duplicate samples, and laboratory quality assurance testing, indicated that laboratory results are representative of the groundwater tested.

Groundwater temperatures ranged between about 8°C to 19°C from August 2005 to May 2010. Lower water temperatures generally occurred within the deeper monitoring well at each location during the summer (August), but during the spring (May) the lower water temperatures generally occurred within the shallower monitoring wells. This temperature pattern is indicative of a more hydraulically active shallow groundwater system (compared to the deeper system) that is influenced by incident precipitation and snowmelt.

Piper plots of the major ions for the shallow groundwater samples are presented on Figures 10 and 11 and for the deep groundwater samples on Figures 12 and 13. In summary, the shallow groundwater at BH03-5 shows similar proportions of major ions as the local surface water, which is most indicative of precipitation runoff. In contrast, major ions within groundwater for deep monitoring wells in rock of low hydraulic conductivity (BH03-4-I, BH03-6-I, and BH-04-8-I) show a tendency for lower proportions of alkalinity and greater proportions of sulphate. It is interpreted that major ion proportions that plot between those groupings reflect mixing of recent infiltration with older groundwater that is more mineralized.

Based on the Ontario Drinking Water Quality Standards (2006) (ODWQS), groundwater quality is naturally elevated in iron and/or manganese, both of which are parameters that affect the aesthetic quality of the water. Exceptions included BH03-1-I, BH03-5-I, and BH03-5-II. The concentrations of dissolved organic carbon (DOC) and total dissolved solids (TDS) were also elevated at some monitoring wells, and also affect the aesthetics of the water. As noted in the preceeding paragraph, sulphate concentrations at BH03-4-I, BH03-6-I, BH04-7-I and BH04-8-I were elevated and exceeded the ODWQS. Hardness concentrations were elevated at each monitoring well based on the operating guideline if water treatment is to be considered, except for notably low hardness concentrations at BH-03-4-II. Sodium was exceeded at BH03-4-I and BH03-6-I which is a parameter that affects the aesthetic quality of the water. Chloride and nitrate were also exceeded at BH03-6-I in most of the samples and selenium was exceeded in one sample. Chloride affects the aesthetic quality of the water. Nitrate and selenium are health-related parameters. The exceedances in nitrate may be a result of the use of agricultural fertilizers. Selenium occurs naturally in waters at trace levels as a result of geochemical processes such as weathering of rocks.

2.5.3 Groundwater Use

No Wellhead Protection Areas extend into or within 1 km of the property. Water well records and results of the residential well survey provided in Tables A-2 and A-3, Appendix A, were used to determine the groundwater use in the study area. Wells considered are presented in Figure 6.

The records were obtained from the Ministry of the Environment (MOE) database and contained some wells completed as recently as 2001. It should be noted that the records are based on information provided to the MOE from water well drillers. As such, the presence and accuracy of well information in the database is dependent on records provided by the well driller.

Table 5 provides a summary of the water well database based on the MOE well records. In summary, the majority of water wells within the regional area are developed in the Precambrian rock, with the remaining wells developed in either the overburden or the Paleozoic rock. As expected, the range of pumping rates is greatest for the Precambrian rock since well yields are dependent on the development of fractures in the rock. Most wells are used for domestic purposes, with two wells used for stock watering and one well used for both. Water quality is identified as fresh.

Groundwater quality for the residential wells is provided in Table B-5, Appendix B, and plotted in the piper plot of Figure 14. Each residential well that was tested is a drilled well developed within the Precambrian rock, except for 61 Dartmoor Road that is a shallow dug well likely developed within the overburden.

Water quality was naturally hard at each of the residential wells tested. Hardness is an operating guideline of the ODWQS and will result in the build-up of scale on piping and plumbing fixtures. No health-related ODWQS were exceeded except for lead at one deep (32 m) well on Monck Road.

Aesthetic ODWQS that were exceeded at some wells included: total dissolved solids (TDS), manganese, dissolved organic carbon (DOC), and iron. These elevated concentrations may occur naturally or are affected by the age or depth of the well.

Road salt effects on well water quality that exceeded the aesthetic ODWQS were detected at three of the residential wells on Monck Road. Elevated chloride concentrations were detected at the three wells and elevated sodium concentrations were detected at one of the wells. The three wells are located along the same portion of Monck Road and range in depth from about 14 m to 32 m. A deeper well (91 m) in the same area shows notably lower chloride and sodium concentrations.

As shown on the piper plot of Figure 14, the groundwater quality for residential wells developed in the Precambrian rock does not show a common grouping and is generally similar to the variable quality of deep groundwater on and around the Sebright Quarry as a result of variable well depths and potential influences by local land uses, such as road salting, agriculture, and rural development.

2.6 Surface Water

The regional surface water drainage system is discussed in Section 2.3. In summary, a drainage divide extends through the property as shown in Figure 3 with the majority of the property (northern portion) located in the Cranberry River subwatershed, which is a component of the Head River watershed that also encompasses the southern portion of the property.

The Cranberry River flows through the northwestern corner of the property. This river is a perennial river and contains a number of rapids/falls as well as beaver dams upstream and downstream of the property. At the location of the rapids/falls, the river directly overlies the bedrock. In other areas, the base of the river is located within the overburden or within sediment that overlies the bedrock. As shown in Figure 2, the catchment area for the river includes Cranberry Lake and numerous smaller lakes. The property is located near the downstream limits of the Cranberry River subwatershed.

There are two main tributaries of the Cranberry River on the property that are located in the vicinity of Sebright Quarry. See Section 3.0 for the quarry development concept. These tributaries are shown in Figure 9 and are outlined below.

- Within the southwestern portion of the property, surface water runoff accumulates in a low-lying area as a result of beaver activity and an access trail south of the low-lying area. Discharge occurs through a culvert below the trail as shown in Figure 15. This area discharges through a shallow watercourse past the western property boundary (SW4), shown in Figure 16, which eventually discharges into Cranberry River about 400 m downstream of the property. This watercourse is designated as Watercourse 1. The catchment area of Watercourse 1 is about 77.3 ha.
- Within the eastern portion of the property, surface water runoff enters watercourses or accumulates within beaver ponds (SWB) as shown in Figure 17. Surface water ultimately flows in a northwesterly direction along a watercourse (SW2) that discharges into a wetland connected to Cranberry River upstream of Sebright Quarry. The watercourse at station SW2 is shown in Figure 18. This watercourse is designated as Watercourse 2. The approximate catchment area for Watercourse 2 is 126.5 ha.

Minor tributaries of Cranberry River also direct surface water from the northwestern portion of Sebright Quarry to Cranberry River. The catchment area for these watercourses is about 21.32 ha.

The Cranberry River is monitored at one upstream station (SW1) and two downstream stations (SW3 and SW5) relative to Sebright Quarry. Figure 19 presents Cranberry River at station SW3.

2.6.1 Surface Water Flow Rates

Table C-1 and Figure C-1, Appendix C, provide surface water flow rates at six surface water stations located on the property and one station located west of the property. Flow at station SWB typically occurs as leakage through the beaver dam and could not be measured. Flow rates within Cranberry River fluctuate on a seasonal basis, typically with greater flow rates in the spring and fall months, and lesser flow rates in the summer. Flow rates measured from 2004 through 2010 ranged from less than 0.1 m^3/s up to 5.41 m^3/s. As shown in Figure C-1, Appendix C, flow rates were generally greater at upstream station SW1 during the summer and early fall, but during the late fall and spring the flow rates were greater at downstream station SW3. Of note in September and November 2007, July 2008, and May and July 2010 the surface water flow at downstream station SW5 was greater than both upstream stations. This flow rate pattern suggests varying periods when the Cranberry River contributes water to the adjacent low-lying areas, and other periods when there is an increased contribution of surface water runoff from the surrounding land.

In summary, the contribution of water from the property to Cranberry River occurs from: 1) overland flow, 2) surface water from ponds and watercourses, and 3) groundwater baseflow directly into the watercourses or as seeps or springs at the base of rock knobs.

Most overland flow occurs over the exposed bedrock and the low to moderate permeability overburden. This flow will follow the topography and discharge into swamps, watercourses, and ponds. Considering the subwatershed drainage divide, a majority of the overland flow for the property eventually enters Cranberry River. The greatest contribution of overland flow to the Cranberry River occurs during the spring, after snowmelt and prolonged precipitation events, and during the late fall.

Surface water ponds and watercourses located on the property also eventually discharge into the Cranberry River. One pond of interest is located in the western portion of the property where flow from the outlet (SWA) ranged from no detectable flow (dry) to 0.04 m^3/s from 2006 through 2010, and downstream flow (SW4) ranged from no detectable flow to 0.06 m^3/s. A series of beaver ponds (SWB) are oriented in a northwest-southeast direction immediately north of the rock knobs at BH00-1 and BH00-2 and exhibited downstream (SW2) flow rates that ranged from no detectable flow (dry) to 0.18 m^3/s. Other swamps and ponds are located within the northern portion of the property. The ponds are maintained through overland flow, groundwater baseflow, direct precipitation, and beaver dams. The intermittent watercourse outlets from the ponds direct the surface water to Cranberry River during periods of high precipitation and/or snowmelt.

During the summer and early fall, the contribution of overland flow to low-lying areas adjacent to Cranberry River is minor owing to low water levels as a result of low amounts of precipitation and/or high rates of evapotranspiration. During these periods, surface water from Cranberry River contributes to the surface water and shallow groundwater system in the adjacent low-lying areas. As noted above, this loss of surface water results in a decrease in flow rates within Cranberry River during the summer and early fall.

Groundwater baseflow occurs as a result of groundwater movement through the overburden or bedrock fractures from areas of high topography to areas of lower topography. Owing to the variable topography across the property, a component of groundwater baseflow will discharge into the swamps, ponds, and smaller watercourses. A component of baseflow will also move from the elevated areas of bedrock to the low-lying areas along Cranberry River, with eventual discharge into the river. The baseflow within the tributaries of Cranberry River was minimal to nonexistent during portions of the summer and early fall when no detectable flow occurred in the tributaries. Most baseflow would occur during the spring when groundwater levels and pressures are highest. However, the large amount of runoff during this period obscures the baseflow contribution.

2.6.2 Surface Water Quality

Surface water quality was determined within Cranberry River at stations SW1, SW3, and SW5, as well as within two tributaries of Cranberry River at stations SW2, SW4, SWA, and SWB. Station locations are shown in Figure 3.

Quality assurance and quality control testing, which involved laboratory quality assurance testing, indicated that laboratory results are representative of the surface water tested. One exception was for some of the inorganic parameters for the November 30, 2005, sample from station SW3. Parameter concentrations indicated that the sample bottle was contaminated with acid and were not representative of actual water quality. The affected data were screened from the database.

Surface water temperatures show seasonal effects and ranged between about 27°C in the late spring/summer and about 4°C in the early spring and fall. As expected, lower water temperatures typically occurred during the later fall and also likely occur during the winter.

Figures 20 to 24 present piper plots of the major ions for the surface water samples collected from spring and fall of 2006 to 2010. The on-site surface water quality is similar based on major ion proportions and is interpreted to be more representative of precipitation runoff. Surface water quality within Cranberry River is similar at the upstream (SW1) and downstream (SW3) stations. During the spring (May) the proportions of major ions approach the pattern observed for the on-site runoff and are indicative of the contribution of precipitation and runoff to surface water flow with Cranberry River. In contrast, the fall (November) major ion proportions show a lower proportion of alkalinity.

Considering the overall concentrations of the parameters tested, surface water quality within Cranberry River was similar at the upstream and downstream stations, with typically only a slight increase in concentrations in the downstream direction. Therefore, the contribution of overland flow and groundwater baseflow from the property did not result in a notable change in surface water quality within the river for each sampling event. Based on time-concentration graphs for total organic carbon (TOC), iron, phosphorus, and total dissolved solids (TDS) as presented in Figures C-2 to C-4, Appendix C, seasonal water quality patterns evident for Cranberry River include an increase in TOC and iron concentrations during low flow periods (summer).

Within Watercourse 1 the concentrations of the four indicator parameters typically decreased in a downstream direction, whereas in Watercourse 2 the concentrations typically increased in a downstream direction.

Surface water sampling for three spring events over a five week period between April 19 and May 24, 2007, was completed for an assessment of surface water quality changes during the spring freshet. During this period the surface water flow rates fluctuated from a high flow rate in April to a low flow rate in early May, to a mid-range flow rate in late May. Surface water quality also typically fluctuated, although some concentrations increased with time while others decreased.

Based on the Provincial Water Quality Objectives (1999) (PWQO) for the water samples collected from 2005 to 2010, surface water quality is naturally elevated in aluminum and iron. Values for pH, cobalt, copper, lead, silver, total phosphorus and total suspended solids also periodically did not satisfy the PWQO. As presented in Table C-3, Appendix C, no volatile organic compounds were detected within the surface water samples. However, oil and grease was detected at most of the surface water samples on May 27, 2009 and September 30, 2010, however the detection of oil and grease is interpreted to be attributed to natural interferences with the analytical testing method, such as the presence of natural organics from peat within the wetlands.

2.7 Water Budget

The water budget for the area is based upon climatic data from the Orillia TS climatological station. This station is located 25 km west of the property. Results for the 30-year normal and detailed in Table D-1, Appendix D. Evapotranspiration estimates are based on the Thornthwaite and Mather method (1957). A summary of precipitation for 2001 through 2010 at local climatological stations is provided in Table D-2, Appendix D, although the available records for Environment Canada are incomplete for some years.

In summary, the total annual precipitation average based on the 30-year normal is about 1,043 millimetres (mm). From 2001 through to the end of 2010 the total precipitation ranged from about 976 mm/a to 1,164 mm/a. On average, most precipitation occurs in the fall and winter. Thus, the spring precipitation and snowmelt create a spring freshet that results in higher groundwater and surface water elevations, as well as greater flow within Cranberry River. The calculated annual net water surplus for the 30-year normal is about 482 mm, which considers a moisture holding capacity for the silty soil of 150 mm. In areas of exposed bedrock with no notable soil cover, but some moss or lichen and sediment cover, a greater water surplus of about 559 mm/a is estimated as the rock cover material provides a limited water holding capacity.

Table 6 provides a summary of infiltration and runoff coefficients for the property. Based on an interpretation that the property consists of about 50% soil cover and about 50% exposed rock, the estimated infiltration for the property is about 215 mm/a. The estimated runoff for the property is about 280 mm/a. Actual values will vary depending on location on the property and weather conditions, but the values presented provide reasonable estimates.

Table 7 provides a summary of the pre-extraction water balance for the property based on the interpreted subwatershed divide presented in Figure 9. In summary, the approximately 423 ha property contributes about 949,256 m^3/a of runoff to surface water flow within Cranberry River. Considering that most precipitation infiltration to shallow groundwater will contribute baseflow to Cranberry River and its tributaries, the groundwater contribution of 728,893 m^3/a results in an overall contribution of about 1,678,149 m^3/a of water from the property to Cranberry River. As detailed in Section 2.6 surface water flow fluctuates on a seasonal basis.

3. Quarry Development Concept

A quarry development concept is provided to permit an impact assessment of the quarry. Location details are shown in Figure 25 and a Conceptual Quarry Development Plan is provided at the back of the report as Sheet 1. Figures 26 and 27 provide development concept schematics through the property.

3.1 Phase 1

Overburden will be stripped, where present, and stockpiled for use in future progressive rehabilitation. Extraction will commence within the southern portion of Phase 1 and progress in a northerly direction. The initial excavation of Phase 1 (identified as Phase 1A) will be completed to an elevation above 242 m asl, such that the base elevation of the quarry will be above the surrounding ground surface and about 2 m above the water table of the surrounding low-lying area. To maintain this base elevation of 242 m asl, the area of Phase 1A will be slightly less than the Phase 1 area presented in the Conceptual Quarry Development Plan owing to ground surface elevations of between about 240 and 242 m asl within the western portion of Phase 1. Overall, based on the existing topography, the minimum extraction base elevation will be between about 242 m asl within the western portion of Phase 1 and about 244 m asl within the eastern portion. As a result, runoff within the extraction area will initially flow toward the west to the interior of the proposed licensed area.

Within the southern portion of Phase 1, an initial sump(s) will be excavated down to an elevation of about 232 m asl to provide initial water storage for use as part of on-site operations, then for dewatering purposes as the base of the excavation of Phase 1 is deepened. Phase 1B will consist of the progressive deepening of the Phase 1A extraction area to an elevation of about 220 m asl, with a base slope that directs runoff to the sump(s). The sump base elevation for Phase 1B would be about 215 m asl.

The on-site operations will initially include crushing and screening, with material transported off-site for washing. A Settling Pond and an Equalization Pond will be constructed and operated to reduce suspended solids within runoff and for eventual storage/recycling of washwater. Upon accumulation of sufficient water within the on-site sump(s), washing operations may be established. The plant and associated ponds will be located immediately west and south of Phase 2. This area is identified as the Access, Processing and Stockpile Area of the Site Plan (Skelton Brumwell, 2011). Material stockpiles will be placed in the wash plant area or on the quarry floors during operation.

3.2 Phase 2

Phase 2 is located south of Phase 1 and will be started as Phase 1 nears completion. It may be necessary to commence portions of Phase 2 during extraction of Phase 1 to manage rock quality. Extraction of Phase 2 may occur as two phases, above and below the water table, or as one phase. The base of Phase 2 will be about 220 m asl as shown in Figure 27. Extraction within Phase 2 will proceed in a north to south direction.

3.3 Water Use

Water use will occur for dust control, material washing, and to service the scale house and maintenance building.

Dust control will be required on a seasonal basis to supplement incident precipitation. Most of the dust control will occur within the permanent and temporary haul roads, and within the traffic areas of the Processing and Stockpiling Area. Based on a maximum application rate of 2.5 cm (1 inch) per week during dry summer periods over an area of about 5 ha, it is estimated that between 0 and 200 m^3/day (6 days/week) of water will be consumed for dust control. Water required for dust control may initially be obtained from an on-site water well capable and permitted to provide up to 200 m^3/day of water or from the Settling Pond.

Wash operations will reuse water from the Settling Pond to wash material prior to stockpiling for off-site transport. The following summary provides an estimate of water to be used for material washing.

VARIABLE	UNITS	VALUE
Production	Tonnes/year	200,000
Production Period	Days/year (6 months)(26 weeks)	130
Duration of Washing Per Day	Average Hours	12
Water for Washing	Litres/minute/tonne/hour	18
Average Water Use	Cubic metres/12 hour day	1,662

NOTES:
1) Washing will be periodic. Assumes washing 5 days per week on average.

Water consumed by washing will be lost by evaporation from stockpiles and settling ponds, as well as water that adheres to product that is removed from the quarry. Studies suggest that stockpile evaporation and adherence losses can range from about 2% to 4% of aggregate by weight (Golder Associates, 2006), which is equivalent to between 31 m^3/day to 62 m^3/day (130 day period). Water loss by evaporation from the Settling Pond could represent an additional loss of about 3 m^3/day for a 5 m deep pond with three days of storage capacity (4,986 m^3) in each of three compartments, and a difference between existing evapotranspiration and open water evaporation of about 3 mm/a (565 mm/a – 562 mm/a) (MOE, 2009).

In total, the calculated water consumption by quarry operations is between 34 m^3/day and 265 m^3/day. Therefore, for an average water use for quarry operations of 1,662 m^3/day, about 84% to 98% of the water used will be recycled and reused.

Water loss from the Equalization Pond is not considered as this pond will dominantly contain water removed as part of the dewatering process, which will remove water from the quarry extraction area that would have moved to surface water under pre-quarry conditions.

3.4 Servicing

i) Access Road

Construction of the access road will reduce infiltration along the road and will influence the direction of surface water runoff. Owing to the length and width of the access road relative to the surrounding land, the reduction in infiltration will be minor. Mitigation will include the collection of road runoff into adjacent vegetated ditches or swales that will: 1) encourage infiltration within the ditches or swales, 2) prevent water ponding adjacent to the access road during the spring or after prolonged precipitation events, and 3) permit the removal of fines or grit from the road runoff with the vegetation in the ditches or swales.

Use of grassed ditches or swales that discharge into the existing Monck Road drainage ditch will continue to encourage runoff drainage within the existing watershed and will reduce fines or grit within the surface water.

ii) Scale, Scale House, and Maintenance Building

For construction and operation of the scale, scale house, and maintenance building runoff will be directed to adjacent vegetated ditches or swales to: 1) encourage infiltration into the soil and 2) prevent ponding on the adjacent land. It is recommended that a geotechnical assessment be completed to ensure suitable soil bearing capacity or to design suitable engineering measures for the scale, scale house, and maintenance building.

It is understood that waste products from the maintenance building will be disposed in an environmentally acceptable manner. Waste oil, lubricants, and similar material will be contained in an approved storage container with secondary containment. This material will be stored temporarily in the service area for collection and off-site disposal by a licensed contractor. Spill containment material will be available on-site at all times.

iii) Sewage System

Considering the potentially high percolation time for the soil and the potential for elevated water table levels during the spring, a raised tile bed for the sewage system may be required. A detailed sewage system design based on field testing will be required for a sewage system in accordance with the Ontario Building Code. If required prior to sewage system construction a portable toilet should be used and maintained on a regular basis. No water quality or quantity impacts should occur as a result of the operation of the sewage system.

iv) Aboveground Fuel Storage

It is understood that fuel will be stored in aboveground storage tanks with secondary containment and crash barriers. Staff will be trained and familiar with the spill contingency plan. Spill containment material will be available on the site. Through adhering to current industry practice for fuel storage and dispensing, no impacts to groundwater or surface water quality are predicted.

3.5 Settling Pond and Equalization Pond

The Settling Pond and Equalization Pond will be located immediately southwest of Phase 2 as shown in the Conceptual Quarry Development Plan. The purpose of the Settling Pond and the Equalization Pond is to provide sufficient retention time for the water to remove suspended solids, such that water may be reused for on-site processing of aggregate, and for discharge of water into the low-lying area southwest of the Processing and Stockpile Area.

The Settling Pond will be used as the primary settling pond for water that originates from the following sources.

- Runoff from the Stockpile and Processing Area
- Washwater from the washing plant

Water from the Settling Pond will be used for the following.

- Recycled for use as washwater
- Dust control

The Settling Pond has been sized with a depth of 5 m and to provide a minimum of three days storage for average washwater requirements (1,662 m^3/day) within each of three settling compartments. This storage time will provide sufficient time for the settlement of silt-sized suspended solids. At about 70 m in width, a minimum pond length of about 47 m (43 m plus two, 2 m separation barriers) is proposed.

The Equalization Pond will operate as a contingency settling pond as it will collect excess discharge from the Settling Pond after excessive precipitation events and it will permit equalization of water temperature from the dewatering systems for the extraction areas prior to discharge into the low-lying area of Watercourse 1. As shown in the Conceptual Quarry Development Plan, the Equalization Pond is about 300 m long and 70 m wide. One downstream outlet from the Equalization Pond will discharge into the eastern portion of the low-lying area. With a 2 m depth, the Equalization Pond will provide a storage volume of 42,000 m^3, which is sufficient to provide two weeks retention of the predicted water to be removed from Phase 1/2 during dewatering at the time of the spring freshet. A smaller Equalization Pond size may be considered if a decreased retention time is required for discharge into the low-lying area.

3.6 Rehabilitation

Quarry rehabilitation will include the establishment of a lake within the excavation. The final lake level will correspond with the lowest existing outlet elevation, although alternative outlets can be constructed at a similar or lower elevation. Based on the available topographic mapping, two outlets for the rehabilitation lake were established to allow surface water flow from the western edge of the lake into low-lying area of Watercourse 1 (natural low elevation) and the northeastern edge of the lake into Watercourse 2 (will require channel construction). The two outlets of the Phase 1/2 lake would be at an elevation of about 240 m asl. Figure 27 provides conceptual schematics of the lake levels within the excavation. Table 8 provides a comparison of the pre-extraction catchment areas for Phases 1 and 2 compared to the predicted post-extraction catchment areas with two lake outlets, each providing 50% of the lake discharge to the respective watercourse.

4. Impact Assessment

The impact assessment methodology involves the assessment of the interpreted changes in baseline (pre-extraction) conditions with the development of the quarry as conceptualized in Section 3. The following aspects were considered for potential effects on water quantity and quality.

- Groundwater Conditions
- Groundwater Use
- Surface Water Conditions
- End Use Considerations

It is noted that the quarry will be developed in two phases and the extraction for each phase will occur over a period of decades. The approximate volume of material available in Phase 1/2 and the minimum duration of extraction based on an annual extraction rate of 80,000 m^3/a or about 200,000 tonnes/a (assumed density of 2.5 g/cm^3) is 7.2 million m^3 and about 90 years of extraction, respectively.

Extraction faces and locations will vary depending on the rock quality. Therefore, changes in groundwater and surface water conditions will be incremental. The calculations and impact assessment presented in the following sections generally relate to conditions at full extraction of each phase or combined phases as indicated.

Various methods were considered to simulate the effects of the Sebright Quarry on the groundwater and surface water resources. Computer generated numerical simulations are used for certain hydrogeologic settings to simulate groundwater movement and interaction with surface water in soil and fractured rock. For the Sebright Quarry the benefits of numerical modelling are limited owing to:

- the micro-hydrogeological settings for each of the rock knobs,
- the dominance of groundwater movement through discontinuous fractures in the bedrock,
- the variable extent and thickness of soil or sediment cover over the rock and below the watercourses, and
- the presence of beaver dams and their influence on surface water storage in ponds and flow in the watercourses.

Therefore, analytical modelling was used to predict potential effects of the Sebright Quarry on local water resources. This modelling considered various subsurface conditions as determined at borehole and monitoring well locations.

In addition, to assess 'worse-case conditions' the fractured rock was assessed as an equivalent porous medium that would accentuate the effects of groundwater movement within fractures in the low hydraulically conductive bedrock.

4.1 Phase 1A Development

The area for Phase 1A is 17.0 ha. Based on existing topographic contours it is inferred that about 11.6 (68%) of runoff and shallow groundwater movement is toward Watercourse 1 and about 5.4 ha (32 %) moves toward Watercourse 2.

4.1.1 Groundwater Conditions

i) Groundwater Levels

The completion of Phase 1A will involve quarry development below the baseline water table within the rock knobs. At BH00-2 and BH00-3, the base elevation of the quarry (242 to 244 m asl) will be about 5 m to 14 m below the maximum baseline water table elevation considering the 2004 through 2010 groundwater conditions. However, considering the ground surface elevation of 240.5 m asl to the west and about 242.5 m asl to the east, as well as typical high groundwater levels around the rock knobs that are within about 1 m of ground surface, the quarry base for Phase 1A will be about 1.5 m or more above the water table that is present in the surrounding low-lying area.

The quarry sump for Phase 1A will be excavated to about 232 m asl to control runoff to maintain a suitable (dry) working area, and to allow for the collection of water for on-site production facilities. As a result, the base of the sump will be about 7.5 m to 9.5 m below the water table for the surrounding low-lying area. Thus, surface water runoff within the extraction area would drain to the sump, and groundwater around the sump would be induced to move through the rock fractures and toward the sump until the water level in the sump achieves stable conditions. The water level in the sump will fluctuate on a seasonal basis and also depending upon water use requirements for on-site operations, such as material washing.

The analytical calculation considered with respect to the extent of the zone of influence of the drawdown is summarized below. As the size, orientation, and location of the sump(s) may vary depending on operations, groundwater flow to a trench was considered.

Maximum Drawdown Distance

$$Q = \frac{Kx}{2L}(H^2 - h^2) \qquad (1)$$

where:

Q = Rate of flow into sump per unit width. The rate will be similar to the infiltration rate over the drawdown distance (m^3/a)
K = Hydraulic conductivity of the rock (m/a)
x = Unit width (m)
L = Maximum distance of drawdown (m)
H = Stable water level above sump base (m)
h = Seepage face into sump (m)

Drawdown With Distance

$$H^2 - h_o^2 = \frac{L-y}{L}(H^2 - h^2) \qquad (2)$$

where:

h_o = Drawdown at distance of interest is H-h_o (m)
y = Drawdown distance of interest (m)

Table 9 provides a summary of the available water and the predicted drawdown effects of the Phase 1A sump on local groundwater levels.

Most water available for the sump will occur as direct precipitation or runoff from the quarry floor with a minor component of shallow groundwater movement below the quarry. This excess water may be directed to flow by gravity to the sump or to an alternate on-site storage pond. The component of groundwater that is not drawn to the sump will continue to move laterally through the rock fractures to the surrounding low-lying area or into the underlying rock fractures. The direction of groundwater movement will depend on the hydraulic gradients. Owing to the removal of the Phase 1A rock knob, localized shifts in the groundwater drainage divide will occur, but on average the areas shifted to the west or the east should be similar. The influence of continual groundwater use from the sump is predicted to have a detectable effect (greater than 1 m drawdown) on seasonal high groundwater levels no further than 10 m from the sump on average. The actual distance of influence will vary based on fracture locations, orientation, and transmissivity.

Potential effects from rock blasting include the propagation and widening of existing fractures or the creation of new fractures. Blasting effects should not extend greater than 5 m from the excavation. The creation of a more hydraulically conductive halo around the excavation will induce greater infiltration into the underlying rock and groundwater movement toward the sump. The predicted detectable drawdown distance beyond the excavation area will not be notably affected.

The component of groundwater diverted by the sump to surface water is marginal (95 m^3/a) and represents less than 1% of pre-extraction infiltration. The localized changes in the location of the groundwater drainage divide should not result in a notable change in the contribution of groundwater to the catchment areas for Watercourse 1 or Watercourse 2. Therefore, groundwater elevations around the perimeter of Phase 1A will continue to show seasonal fluctuations, and shallow groundwater levels will continue to contribute baseflow to local watercourses. Recharge gradients (downward hydraulic gradients) within the rock knobs will be reduced, which will result in the movement of more water in a lateral direction through the shallow bedrock than vertically down into the deeper bedrock. However, upward hydraulic gradients around the knobs will be maintained as the quarry floor will be above the surrounding groundwater levels.

Operation of the sump will reduce the volume of groundwater movement toward the surrounding low-lying area by less than 1 % of pre-extraction conditions and is predicted to result in a decrease in the spring high water table levels of greater than 1 m within about 10 m of the sump. Location of the sump greater than 10 from the excavation limits should prevent groundwater effects in the surrounding low-lying areas during operation of the sump.

In summary, extraction of Phase 1A and the operation of a sump are not anticipated to have negative effects on local groundwater conditions adjacent to the extraction area. See Figure 26 for a conceptual interpretation of hydrogeologic conditions. Predicted conditions are outlined below.

- The water table that will be present below the quarry floor in Phase 1A will continue to be at a higher elevation than groundwater elevations within the surrounding low-lying areas. Therefore, no quarry drawdown effects on the surrounding water table are predicted and groundwater flow directions from the perimeter of the excavation will be similar to baseline conditions. Groundwater seeps or springs around the rock knobs may reduce in duration during the drier summer months.

- Continual operation of the sump will not have a detectable effect on groundwater levels beyond 10 m of the sump. In addition, as quarry operations will be above the surrounding groundwater table, only temporary sump use will be required. Occasional sump use or gravity drainage may also be required to control surface water runoff accumulation within the quarry.

- North, east, and west of Phase 1A, the local topography indicates that the watercourses are lower in elevation than the proposed base elevation of the quarry. As a result, groundwater will continue to move toward the watercourses.

ii) Groundwater Flow

Lateral hydraulic gradients will continue to be from the area of Phase 1A to the surrounding low-lying areas as discussed in Section 2.5.2. The magnitude of the hydraulic gradients will be less than baseline conditions owing to the removal of the high water table elevations within the fractured bedrock of the rock knobs. Considering the predicted groundwater table within about 1 m of the base of the excavation in Phase 1A, a decrease in the hydraulic gradient of about 80% to 90% may occur, which will locally reduce the deep groundwater pressures within the surrounding low-lying area. This reduction will result in localized shifts of the groundwater drainage divide that extends through Phase 1A, but the groundwater contribution to the watercourse catchment areas should be similar as pre-extraction conditions. The resultant groundwater movement toward the two watercourses is summarized in Figure 28.

As discussed above, a fracture halo will be developed within the rock immediately adjacent to the quarry as a result of blasting and quarry operations. This fracture halo will have a greater bulk hydraulic conductivity than the surrounding rock, which will permit a localized greater lateral movement of groundwater relative to baseline conditions. However, as the blasting effects will be limited to about 5 m from the excavation, the surrounding natural rock conditions will continue to control groundwater movement.

iii) Groundwater Quality

Within the rock knobs the groundwater movement is dominantly through rock fractures to the surrounding low-lying areas. Water quality within the fractures will reflect the residence time of the water within the fractures, the surrounding rock type, and material within the fractures. As presented in Section 2.5.2, groundwater quality within the rock fractures is naturally variable on the property, with older water in zones of lower hydraulic conductivity showing more mineralization, lower proportions of alkalinity, and greater proportions of sulphate.

Fracture flow limits the natural processes that are available for polishing groundwater quality. Processes such as filtration, sorption, chemical changes, and biochemical changes will have minor influences on the groundwater quality. Typically, constituent concentrations within the groundwater will be controlled by dilution from infiltrating precipitation.

Groundwater quality within Phase 1A will continue to be representative of the water quality of precipitation and snowmelt that is captured in the excavation area. Possible influences on the water quality within the fractures may occur as a result of the following.

1. Dust and other fines within the working area that may increase the total suspended solids within groundwater.
2. Effects due to other property activities, such as blasting.

Considering the volume of water that will be available for dilution and environmental management processes that can be implemented as part of property operations as discussed in Section 7, no detectable groundwater quality effects beyond the excavation area are anticipated.

4.1.2 Groundwater Use

Groundwater use for water wells around the property will not be affected by the Phase 1A development. As discussed above, the groundwater flow at the property boundaries will be similar to baseline conditions. The area of groundwater recharge near BH03-5 near the southern boundary of Sebright Quarry will continue to locally provide water to the bedrock fractures south of the property.

4.1.3 Surface Water Conditions

A change in the components of the surface water balance for Phase 1A is predicted relative to baseline conditions. Table 10 and Figure 28 provide a summary of the pre and post extraction water balance for Phase 1A. In summary, it is predicted that completion of Phase 1A will result in the diversion of about 95 m^3/a of groundwater to surface water and the collection of about 47,695 m^3/a of runoff into the excavation sump. Therefore, a water management plan is proposed to approximate the pre-extraction water balance and surface water conditions.

The Water Management program includes the following as shown in Figure 28.

- Approximately 68% of the water from the quarry sump from Phase 1A should be directed to the Equalization Pond for discharge into Watercourse 1.

- Approximately 32% of the water from the quarry sump should be discharged to Watercourse 2 near the watercourse headwaters near the southeastern corner of Phase 1. Most discharge will occur during the spring.

The use of percentages for the water management program is proposed since actual discharge rates will vary depending on quarry development, the season, and weather conditions. It is predicted that the maximum pumping rate will occur during the spring freshet as a result of snowmelt and more frequent precipitation. Considering that about 81% of the available water surplus occurs during months with average temperatures less than -1 ºC and during the first month with warmer temperatures, it may be predicted that the maximum cumulative pumping rates during a 30-day spring freshet (April) will not exceed 0.02 m^3/s (1,288 m^3/day). Similarly, the maximum 30-day discharge rate into either Watercourse 1 or 2 will be less than 0.01 m^3/s, which is less than the observed spring freshet flow rates within either watercourse. Sufficient storage capacity below the pump intake will be maintained in the sump to permit the settlement of fine-grained material. The diversion of sump discharge to the vegetated headwaters of Watercourse 2 or into the Equalization Pond for Watercourse 1 will permit equalization of water temperatures for runoff that may accumulate in the sump.

Overall, the water management plan for Phase 1A will have no detectable effect on surface water flow within Cranberry River or the Cranberry River subwatershed. Any water lost from the subwatershed would occur as washwater that adheres to aggregate removed from the property or evaporation from stockpiles, ponds, and dust control. This water loss would be less than 0.003 m^3/s (between 34 m^3/day and 265 m^3/day as noted in Section 3), which will not be detectable based on the overall subwatershed surface water flow rates and volume.

4.2 Phase 1B Development

The extraction area for Phase 1B will incorporate the Phase 1A area as well as the western portion of the Phase 1 area that has a ground surface elevation between about 240 m asl and 242 m asl.

4.2.1 Groundwater Conditions

i) Groundwater Levels

Phase 1B extraction involves deepening the Phase 1 excavation to an elevation of about 220 m asl, with a base slope that directs runoff to the sump(s). The sump base elevation for Phase 1B will be about 215 m asl. Therefore, the excavation base will be below the local water table and surrounding surface water levels. During operations, groundwater and surface water accumulation within the quarry will be removed by pumping. Therefore, it is inferred that the minimum groundwater level within the quarry will be slightly below the quarry base and will average about 219 m asl.

The hydraulic characteristics of the bedrock indicate that there are conductive fracture zones within the low permeability bedrock that will transmit water into the excavation from the surrounding bedrock and overburden. As a result, hydraulic gradients will be toward Phase 1B from the surrounding area. Table 11 provides a summary of analytical calculations for the theoretical distance of influence from the excavation based on recharge from precipitation. To calculate 'worse-case conditions', no recharge boundaries, such as watercourses, are considered and the lateral contribution of groundwater from the surrounding bedrock is not considered.

The calculations provide a range of approximate impact scenarios and the results are considered reasonable for implementation of a performance monitoring program and the conceptualization of mitigation measures if required. Based on the borehole hydraulic conductivity test results, the drawdown around Phase 1B will vary. The geometric mean bulk hydraulic conductivity for each borehole as detailed in Section 2.4.3 is summarized below.

- BH03-1 – 5 x 10^{-8} m/s
- BH03-4 – 2 x 10^{-8} m/s
- BH03-5 – 2 x 10^{-5} m/s
- BH03-6 – 7 x 10^{-10} m/s
- BH04-7 – 1 x 10^{-8} m/s
- BH04-8 – 3 x 10^{-8} m/s

Thus, the greatest potential drawdown effects will occur toward the south in the vicinity of BH03-5. A maximum drawdown distance of about 1,096 m from the extraction area is predicted. In other directions, a maximum drawdown distance of less than about 50 m is predicted. Considering that a drawdown effect of about 1 m is required to be detectable over and above natural seasonal water level fluctuations, the detectable drawdown distances are about 1,017 m and 46 m, respectively. It is noted that the predicted distances reflect ‘worse-case conditions’ as they assume that groundwater movement through the rock will be controlled by the more hydraulically active fractures, whereas most of the rock mass has a low hydraulic conductivity. Therefore, it is anticipated that actual drawdown distances will be less than predicted, but the predicted distances should be considered in determining monitoring distances for the Performance Monitoring Program detailed in Section 8.

Furthermore, the water level drawdown predictions infer that the surrounding water table is flat and that there are no recharge boundaries, such as watercourses, that will contribute additional water to the subsurface. For example, south of Phase 1B the elevated groundwater levels in the existing rock knob of future Phase 2 and the watershed boundary further to the south will reduce the predicted drawdown distance. Thus, drawdown effects beyond the property boundary are not anticipated.

There is a potential for water accumulation within Phase 1B as a result of the influx of groundwater and from direct precipitation. A component of water that accumulates in Phase 1B will continue to be lost through evaporation. Excess water accumulation will require pumping to the Equalization Pond or Watercourse 2 to maintain suitable working conditions within the excavation. The sump for Phase 1B will be excavated to an elevation of about 215 m asl. As a result, the sump base will be about 5 m below the average base of the excavation. For dewatering, it is assumed that the water level in the sump will be maintained at about 1 m below the base of excavation at approximately 219 m asl. Table 12 provides a summary of water that may require dewatering within the excavation.

Upon completion of Phase 1B, it is predicted that about 101,500 m^3/a of water will require removal from the excavation. This volume is equivalent to an average daily pumping rate of about 278 m^3/day. The effect of continual groundwater dewatering is predicted to not have a detectable effect (1 m drawdown) on groundwater levels beyond the southern property boundary as the boundary is greater than 300 m from Phase 1. See Table 11 for a summary of drawdown distances.

Potential effects from rock blasting may result in greater infiltration into the localized rock underlying the excavation and induce groundwater movement toward the sump. It is expected that blasting effects will not extend more than 5 m beyond the excavation. Therefore, the expected detectable drawdown distance beyond the excavation area will not be notably affected by the blasting effects.

As discussed above, groundwater elevations will decrease around the perimeter of Phase 1B. Similarly, deeper groundwater pressures will be reduced as a result of the removal of the pre-excavation groundwater high within the rock knob as well as the dewatering. It is predicted that hydraulic gradients below portions of Watercourse 2 and associated ponds north and east of Phase 1B will become downward. As the central low-lying area is greater than 50 m from Phase 1B, a drawdown influence on the low-lying area is not predicted. In addition, because of the topographic highs and the continuing elevated groundwater elevations associated with the rock knobs to the west, it is predicted that hydraulic gradients will continue to be upward into the Cranberry River.

ii) Groundwater Flow

Groundwater flow will be induced to move inward toward Phase 1B. Therefore, groundwater that moved from the rock knob of Phase 1 toward the surrounding low-lying areas during baseline conditions will no longer provide baseflow to the surrounding surface water system. In addition, the predicted reversal in hydraulic gradients will result in the movement of some surface water into the groundwater system north and east of Phase 1B.

iii) Groundwater Quality

The inward movement of groundwater toward Phase 1B will prevent the outward movement of groundwater into the surrounding environment. As a result, potential water quality effects within the quarry arising from total suspended solids, or other property operations will not affect local groundwater quality. Regardless, environmental management processes will be implemented as part of property operations to prevent unacceptable effects on the water within the excavation as outlined in Section 7.

4.2.2 Groundwater Use

No potential effects are predicted for the Phase 1B development on the quantity or quality of groundwater available for water wells around the property. As discussed above, the predicted zone of influence will not extend beyond the southern property boundary.

4.2.3 Surface Water Conditions

In the vicinity of the Phase 1B extraction area, the induced groundwater movement toward the quarry in response to quarry dewatering will result in some surface water recharge of the groundwater system below Watercourse 2 and associated ponds north and east of the extraction area. As the central low-lying area is greater than 50 m from Phase 1B, a drawdown influence on the low-lying area is not predicted.

Table 13 provides the predicted surface water loss from Watercourse 2 and associated ponds located north and east of Phase 1B as a result of recharge to the groundwater system. Owing to the meandering nature of the watercourse in some areas, a distance of 100 m from the extraction area was considered in the surface water loss assessment. In addition, the predicted hydrogeologic characteristics beneath the watercourse and ponds assumed that surface water directly overlies the rock. Sediment or clayey silt soil that may be present would not increase the hydraulic conductivity of the underlying rock, but could potentially function as a lower hydraulic conductivity barrier to flow. Therefore, the actual surface water loss should be less than predicted.

Considering the baseline flow conditions of Watercourse 2 as determined at station SW2, surface water flow typically ranges from no detectable flow to about 0.18 m^3/s (5.7 million m^3/a). Therefore, the predicted loss of less than 0.001 m^3/s of surface water from Watercourse 2 would not be detectable.

Table 14 and Figure 29 provide a summary of the pre and post extraction water balance. In summary, it is predicted that completion of Phase 1B will result in the collection of about 53,928 m^3/a (36,550 + 17,378) of groundwater and about 47,600 m^3/a (excludes 50 m zone) of surface water through the operation of the sump to maintain suitable working conditions within the excavation. Thus, a total of 101,528 m^3/a of water would require management from the sump.

The purpose of the water management plan is to approximate baseline surface water flow conditions within the two watercourses. This water balance will be attained through controlled discharge of water from the sump(s) of Phase 1B. As presented in Figure 29, the following water management plan would be implemented.

- 68 % of the water from the quarry sump(s) would be discharged to the Equalization Pond for discharge into Watercourse 1.
- 32 % of the water from the quarry sump(s) would be discharged to the headwaters of Watercourse 2 located near the southeastern corner of Phase 1.

It is predicted that the maximum pumping rate will occur during the spring freshet as a result of snowmelt and more frequent precipitation. Considering that about 81% of the available water surplus occurs during months with average temperatures less than -1 ºC and the first month with warmer temperatures occurs in April, it may be predicted that the maximum cumulative pumping rates during a 30-day spring freshet (April) will not exceed 0.03 m^3/s (2,741 m^3/day). The maximum 30-day discharge rate into Watercourse 1 will be about 0.02 m^3/s (68%) and into Watercourse 2 will be about 0.01 m^3/s (32%). Predicted maximum discharge into Watercourse 2 is notably less than observed spring freshet flow rates. Discharge into the Equalization Pond with subsequent discharge into the low-lying area prior to Watercourse 1 will also maintain reasonable flow rates within Watercourse 1.

The diversion of sump discharge to the vegetated headwaters of Watercourse 2 or into the Equalization Pond for Watercourse 1 will permit equalization of water temperatures for runoff that may accumulate in the sump. Based on the similar baseline groundwater and surface water quality as presented in Section 2.6.2, the discharge of groundwater to the surface water system should not have a detrimental effect on surface water quality and temperature. Use of the Equalization Pond will maintain acceptable surface water quality for discharge to Watercourse 1. Similarly, direct discharge into the headwaters of Watercourse 2 will satisfy the Provincial Water Quality Objectives (1999 and updates) or background conditions.

Overall, the diversion of water from the groundwater system to the surface water system will have no detectable effect on surface water flow within the Cranberry River or the Cranberry River subwatershed. Any water lost from the subwatershed would occur as washwater that adheres aggregate removed from the property or evaporation from stockpiles, ponds, and dust control. As noted in Section 3, this water loss would be less than 0.003 m^3/s (between 34 m^3/day and 265 m^3/day), which will not be detectable based on the overall subwatershed surface water flow rates and volume.

4.3 Phase 2 Development

The area of Phase 2 is provided in Table 15 and summarized below for the catchment areas for Watercourses 1 and 2 based on existing topography.

PHASE	TOTAL AREA (ha)	AREA TO WATERCOURSE 1 (ha)	AREA TO WATERCOURSE 2 (ha)
2	6.2	4.0	2.2
1/2	23.2	15.6	7.6

4.3.1 Groundwater Conditions

i) Groundwater Levels

The completion of Phase 2 will involve extending Phase 1B toward the south. Dewatering will continue to occur from the sump(s) in Phase 1. The base excavation will continue to be to an elevation of about 220 m asl, with a base slope that directs runoff to the sump(s). The sump base elevation will be about 215 m asl.

The excavation base of Phase 2 will be below the local water table and surrounding surface water levels. During operations, groundwater and surface water accumulation within the excavation will be removed by pumping. Therefore, it is assumed that the minimum groundwater level within the excavation will be slightly below the quarry base and will average about 219 m asl.

As noted in Section 4.2, the hydraulic characteristics of the bedrock indicate that there are conductive fracture zones within the low hydraulically conductive bedrock that will transmit water into the excavation from the surrounding bedrock and overburden. As a result, hydraulic gradients will be inward toward Phase 2 from the surrounding area. Based on the borehole hydraulic conductivity test results, the drawdown around Phase 2 will vary. At most locations the detectable drawdown will not extend greater than 50 m from the excavations. One possible exception is in the vicinity of BH03-5 where a detectable drawdown (1 m of drawdown) distance of about 1 km is predicted. It is noted that these drawdown distances reflect ‘worse-case conditions’ as they assume that groundwater movement through the rock will be controlled by the more hydraulically active fractures, whereas most of the rock mass has a low hydraulic conductivity. Therefore, it is anticipated that actual drawdown distances will be less than predicted, but the predicted distances were considered in determining monitoring distances for the Performance Monitoring Program detailed in Section 8.

South of Phase 2 the elevated groundwater levels at the inferred watershed boundary will reduce the predicted drawdown distance. Thus, maximum drawdown effects should not extend beyond Kawartha Lakes Road 45. The predicted detectable drawdown distances will not extend below Cranberry River.

Water accumulation will occur within Phase 2 as a result of the influx of groundwater and from direct precipitation. Excessive water accumulation will require pumping to the Equalization Pond or to the headwaters of Watercourse 2 just east of Phase 2 to maintain acceptable working conditions within the excavation. The sumps will be excavated to about 215 m asl, which is about 5 m below the average base of the excavation. For dewatering, it is assumed that the water level in the sumps will be maintained at about 1 m below the base of excavation at elevation 219 m asl. Table 15 provides a summary of available water within Phase 2 for dewatering and Figure 30 summarizes the water management amounts for the combined extraction area of Phase 1 and 2 (Phase 1/2).

Upon completion of Phase 2, it is predicted that about 142,456 m^3/a to 362,318 m^3/a of water will require removal from the Phase 1/2 excavation as presented in Figure 30. The lower rate is expected based on the hydrogeologic characteristics of the bedrock elsewhere on the site. The water management plan will maintain surface water flow within Watercourse 2 by the discharge of 33% of the water collected or an annual maximum of about 47,010 m^3 to 119,565 m^3 to the headwater area of Watercourse 2. Any additional water will be discharged into the Equalization Pond, which discharges into the low-lying area and Watercourse 1. It is noted that both Watercourses 1 and 2 discharge into Cranberry River which flows into the Head River watershed. Therefore, no net water loss to the Head River watershed would occur.

The noted dewatering rates for Phase 1/2 are equivalent to a daily pumping rate (365 days/year) of between 390 m^3/day and 993 m^3/day (0.005 m^3/s to 0.01 m^3/s). Assuming a 30-day pumping period during the spring freshet in April when about 81% of the snowpack could melt, the maximum pumping rate is calculated to not exceed about 3,846 m^3/day to 9,783 m^3/day (0.04 m^3/s to 0.11 m^3/s). Based on the local geology and drainage divide to the south, the maximum pumping rate should not exceed 3,846 m^3/day (0.04 m^3/s) during this 30 day period.

Potential effects from rock blasting may result in greater infiltration into the rock underlying the excavations and induce groundwater movement toward the sumps. The potential detectable drawdown distance beyond the excavation areas will not be notably affected.

As discussed above, groundwater elevations around the perimeter of Phase 2 will decrease. Similarly, deeper groundwater pressures will be reduced as a result of the removal of the pre-excavation groundwater high within the rock knobs, as well as the dewatering. Hydraulic gradients will continue to be upward into Cranberry River owing to the rock hydraulic conductivity and areas of high land west of Phase 1/2 and west of Cranberry River.

ii) Groundwater Flow

Groundwater flow will be inward toward Phase 2 during dewatering. Therefore, groundwater that moved toward the surrounding low-lying areas during baseline conditions will no longer recharge the surrounding surface water systems. In addition, the localized downward hydraulic gradients within about 50 m of the extraction area for Phase 1/2 will result in the seasonal movement of some surface water from the watercourses into the groundwater system north and east of the extraction area.

iii) Groundwater Quality

The inward movement of groundwater toward the dewatered excavations will prevent the outward movement of groundwater into the surrounding environment. As noted previously, potential water quality effects within the quarry from total suspended solids or other property operations will not affect local groundwater quality. Regardless, environmental management processes outlined in Section 7 will be implemented as part of property operations to prevent unacceptable effects on the water within the excavation.

4.3.2 Groundwater Use

Based on the predicted groundwater drawdown effects for Phase 1/2, potential detectable off-property impacts on groundwater users for 'worse-case conditions' are predicted only south of Phase 2 for a distance of about 1 km from Phase 2. However, as discussed in Section 4.3.1, the elevated groundwater levels at the inferred watershed boundary south of Phase 2 will reduce the predicted drawdown distance and maximum drawdown effects should not extend beyond Kawartha Lakes Road 45. For assessment purposes the 1 km distance of influence was considered and incorporates Kawartha Lakes Road 45 as well as Lots 18, 19, 20, and possibly 21, Concession 3. The following water wells are located within this area of influence.

ADDRESS AND/OR MOE WELL NUMBER	WELL TYPE	DEPTH (metres)	COMMENT
North of Kawartha Lakes Road 45			
6415883	Drilled	26	Location based on well record is questionable
6400525		5	Vacant – Giofam Investments Inc. property
633			Vacant – Giofam Investments Inc. property
655	Drilled	Not Confirmed	
South Of Kawartha Lakes Road 45			
594/6407438	Drilled	61	

The drilled wells at 594 and 655 Kawartha Lakes Road 45, as well as MOE 6415883 are of sufficient depth that a negative impact to groundwater use is not predicted. The two water wells reportedly on property owned by Giofam Investments Inc. should be decommissioned upon quarry approval.

As noted in Section 4.2.1, the predicted drawdown distances reflect 'worse-case conditions' as they assume that groundwater movement through the rock will be controlled by the more hydraulically active fractures, whereas most of the rock mass has a low hydraulic conductivity. Therefore, although it is anticipated that actual drawdown distances will be less than predicted, the noted water wells should be included in the performance monitoring program where access permission is granted.

As groundwater around the quarry will be induced to move toward the dewatered excavations, no groundwater quality effects are predicted for local groundwater users.

4.3.3 Surface Water Conditions

The induced groundwater movement toward the quarry as a result of quarry dewatering will result in some localized surface water recharge of the groundwater system from Watercourses 1 and 2 when the watercourses typically contain water.

Table 17 provides the predicted surface water loss from Watercourse 2 as a result of recharge to the groundwater system near Phase 1/2. Owing to the meandering nature of the watercourse in some areas, a distance of 100 m from the extraction area was considered in the surface water loss assessment. In addition, the predicted hydrogeologic characteristics beneath the watercourse and ponds assumed that surface water directly overlies the rock. Sediment or clayey silt soil that may be present would not increase the hydraulic conductivity of the underlying rock, but could potentially function as a lower hydraulic conductivity barrier to flow. Therefore, the actual surface water loss should be less than predicted.

Considering the baseline flow conditions of the watercourse as determined at station SW2, surface water flow typically ranges from no detectable flow to about 0.18 m^3/s (5.7 million m^3/a). Therefore, the potential loss of surface water from the watercourses would not be detectable.

Table 16 and Section 4.3.1 provide a summary of the pre and post-extraction water balances for combined Phase 1/2. Dewatering to maintain suitable working conditions will result in the diversion of about 78,153 m^3/a (49,880 + 28,273 m^3/a) of water from the groundwater system in the Cranberry River subwatershed to the surface water system. As the Cranberry River subwatershed is within the Head River watershed, there will be no detectable change in surface water flow rates or volumes in the Head River watershed.

A water management plan is provided in Section 5 to control discharge into Cranberry River through Watercourses 1 and 2 to approximate baseline surface water flow conditions within the two watercourses. This water balance will be attained through controlled discharge of water from the sump(s). As presented in Figure 30, the following water management plan would be implemented.

- 67 % of the water from the extraction area would be discharged to the Equalization Pond for discharge into Watercourse 1.
- 33 % of the water from the extraction area would be discharged to the headwaters of Watercourse 2 located near the southeastern corner of Phase 2.

On average the discharge into the two watercourses would result in surface water flow rates of 0.001 m^3/s in Watercourse 2 to 0.003 m^3/s in Watercourse 1, which is an increase of less than 0.002 m^3/s from existing conditions per Figure 30. These predictions indicate no detectable change in the average flow rate within the two watercourses. If more groundwater than predicted is dewatered as a result of high rock hydraulic conductivity, the average flow rates would not increase by a factor of more than 2 to 3, with flow rates continuing to be less than 0.01 m^3/s.

It is predicted that the maximum pumping rate will occur during the spring freshet as a result of snowmelt and more frequent precipitation. Considering that about 81% of the available water surplus occurs during months with average temperatures less than -1 ºC and the first month with warmer temperatures occurs in April, it may be predicted that the maximum cumulative pumping rates during a 30-day spring freshet (April) will not exceed 0.04 m^3/s (3,846 m^3/day). The maximum 30-day discharge rate into Watercourse 1 will be about 0.03 m^3/s (67%), which is less than the observed peak spring freshet flow rate at SW4, and into Watercourse 2 will be about 0.01 m^3/s (33%), which is also less than the observed peak flow rates. The predicted 30-day maximum discharge rate was not determined for the potential effects of the higher bulk hydraulic conductivity at BH03-5 as a rapid spring melt would enhance runoff in a downslope direction toward the Head River with no notable seasonal change in groundwater movement toward the quarry.

The diversion of sump discharge to the vegetated headwaters of Watercourse 2 or into the Equalization Pond for Watercourse 1 will permit equalization of water temperatures for runoff that may accumulate in the sump. Based on the similar baseline groundwater and surface water quality as presented in Section 2.6.2, the discharge of groundwater to the surface water system should not have a detrimental effect on surface water quality and temperature. Use of the Equalization Pond will maintain acceptable surface water quality for discharge to Watercourse 1. Similarly, direct discharge into the headwaters of

Watercourse 2 will satisfy the Provincial Water Quality Objectives (1999 and updates) or background conditions.

Overall, the diversion of water from the groundwater system to the surface water system will have no detectable effect on surface water flow within the Cranberry River or the Cranberry River subwatershed. Any water lost from the subwatershed would occur as washwater that adheres aggregate removed from the property or evaporation from stockpiles, ponds, and dust control. As noted in Section 3, this water loss would be less than 0.003 m^3/s (between 34 m^3/day and 265 m^3/day), which will not be detectable based on the overall subwatershed surface water flow rates and volume.

4.4 End Use Considerations

Upon completion of excavation activities, the quarry area may be closed for a passive end use. Closure of the quarry is predicted to result in the following as shown in Figure 27.

- Precipitation and groundwater will continue to accumulate within the quarry area. The surface water level within the excavations will increase to the elevation of the lowest discharge point. Considering the hydraulic characteristics of the bedrock, seasonal variations of surface water levels will occur.

- The predicted lake level for Phase 1/2 is about 240 m asl. The outlet elevations may be modified to control the points of discharge for the lake.

- Considering the predicted lake level, an excavation base elevation of 220 m asl, maintenance of pre-extraction surface water flow rates in Watercourse 2, and the influx rates presented in Section 4.3.1, it is predicted that Phase 1/2 will require about 30 to 40 years to achieve stable levels. A longer period to fill the lakes would occur if some water is also required to supplement surface water flow within the central low-lying area and Watercourse 1.

- Groundwater movement will depend on the elevation of surface water levels within the lake. The location of the quarry near the drainage divide will result in the movement of groundwater from the lake toward Cranberry River and its tributaries. Thus, water movement to Cranberry River will be similar to baseline conditions.

- Once the water level within the lake achieves equilibrium, the outlets will be established such that local surface water conditions will be similar to baseline conditions. Discharge from the lake into each watercourse would be about 50% of the water surplus, compared to the existing condition of 67% toward Watercourse 1 and 32% toward Watercourse 2. Surface water flow will be greatest during the spring freshet and after prolonged precipitation events. The upper reaches of Watercourse 2 above elevation 240 m asl may show slightly less flow during the drier summer months as a result of some water recharge and movement toward the lake. Water quality will be similar to water quality common to the regional setting.

- Overall, upon rehabilitation of the property, the quantity and quality of surface water resources within the Cranberry River subwatershed should be similar to baseline conditions.

5. Water Management Plan

The Sebright Quarry is located within the Cranberry River subwatershed, as shown in Figure 2. Cranberry River and its subwatershed contribute to the Head River watershed.

Surface water flow rates in the Cranberry River fluctuate on a seasonal basis. Based on data from three surface water monitoring stations, flow rates ranged from 0.1 m^3/s to 5.41 m^3/s from 2004 through 2010. The flow rate pattern indicates that there are natural periods when the Cranberry River is a losing stream and contributes water to the adjacent low-lying areas and flow rates decrease in a downstream direction, and there are periods when flow rates increase in a downstream direction dominantly as a result of the contribution of surface water runoff from the surrounding land.

The contribution of water from the Sebright Quarry to Cranberry River occurs from: 1) overland flow, 2) surface water from ponds and watercourses; and 3) groundwater. Two main tributaries of Cranberry River on the property and in the vicinity of the Sebright Quarry include Watercourse 1 and Watercourse 2. Other minor tributaries are located on the property and within the floodplain west of the Sebright Quarry.

Watercourse 1 is located within the southwestern portion of the property. The headwaters of Watercourse 1 include a central low-lying area that contains water on a continual basis as a result of beaver activity and an access trail. Flow within Watercourse 1 is intermittent, with most flow occurring during the late winter and spring. Flow rates range from no detectable flow (dry) to 0.06 m^3/s.

East and north of the Sebright Quarry is Watercourse 2 that directs water from low-lying areas and beaver ponds to Cranberry River. Although Watercourse 2 is also intermittent, the no flow (dry) period is shorter than for Watercourse 1 and flow rates range up to 0.18 m^3/s.

To maintain the surface water conditions within Cranberry River to pre-extraction conditions and to retain the ecological function of the central low-lying area and watercourses in the vicinity of Sebright Quarry, this water management plan is provided for implementation. Hydrogeological input for the plan is provided in Sections 2 to 4 of this report. Natural environment input was obtained from the Natural Environment Level 1 and Level 2 Assessments Report (RiverStone Environmental Solutions, 2011).

5.1 Runoff Management

Beyond the Sebright Quarry the overland flow (runoff) will be similar for pre and post-extraction conditions. No quarry operations or alterations to surface conditions or drainage will occur, except for the construction of the access road from Kawartha Lakes Road 45 to the quarry. It is understood that runoff from the access road will be controlled with road ditches and will be retained within the Head River watershed.

Runoff within the extraction area (Phases 1 and 2) will be managed through quarry dewatering as presented in Section 5.3. Thus, stormwater that collects within the extraction area will be monitored and controlled through the dewatering system. Runoff from the Processing and Stockpile Area will be contained by shallow ditches and directed to a Settling Pond. Conceptual details for the Settling Pond are provided in Section 7. This runoff will continue to contribute to Watercourse 1, similar to pre-extraction conditions, and acceptable quality will be maintained through the use of the Settling Pond and the Equalization Pond.

A Performance Monitoring Program (Section 8) and Contingency Measures (Section 9) are provided to permit the evaluation of the predictions of no unacceptable effects and for input to mitigation, if required.

5.2 Groundwater Management

Infiltration will continue to contribute to the groundwater system beyond the extraction areas. Within about 50 m of the extraction areas the groundwater will be induced to move toward the quarry and will be managed through dewatering as outlined in Section 5.3. South of Phase 2 there is the potential for an influence on groundwater conditions that may extend to Kawartha Lakes Road 45; however, this potential is low as the prediction is based on findings from one borehole (out of eight).

Beyond the extraction areas and predicted 50 m zone of influence, groundwater will continue to move toward surface waterbodies and watercourses. There will be no detectable change in the groundwater contribution to baseflow or groundwater availability to water wells.

Similar to runoff management, a Performance Monitoring Program and Contingency Measures are detailed in Sections 8 and 9 of the report.

5.3 Dewatering Water Management

Dewatering of the extraction areas will be required to maintain suitable (dry) working conditions within the quarry. The amount of dewatering required will depend on the extraction area and depth, season, weather conditions, and operational requirements.

A Permit to Take Water (PTTW) will be required for the operation of the sump(s) within Phase 1A as well as for dewatering of Phases 1B and 2. An average pumping rate for a completed Phase 1/2 is 390 m^3/day. A greater pumping rate may be required if the higher bulk hydraulic characteristics as BH03-5 are more pervasive than anticipated, but an amended PTTW could be obtained at that time based on monitoring results gathered. To account for spring snowmelt and precipitation, a maximum pumping rate of about 3,850 m^3/day may be required for a 30 day period based on cumulative pumping from Phase 1/2. However, lower pumping rates will be required for different phases as summarized below.

PHASE	AVERGE PUMPING RATE (m^3/day)	MAXIMUM PUMPING RATE (m^3/day)
Phase 1A	131	1,288
Phase 1B	278	2,741
Phase 1/2	390	3,846

NOTES:
1) ‘m^3/day’ indicates cubic metres per day.
2) Average pumping rate based on 365 days per year.
3) Maximum pumping rate based on 81% of water being removed over a 30 day period (April).

Pumping rates will also vary on a seasonal basis.

Table 18 and Figures 28 to 30 provide the water management plan for discharge to Watercourses 1 and 2. In addition, to provide an overall assessment of low conditions within the two watercourses, Table 18 provides the total surface water flow based on discharge from the sump to surface water plus the contribution of groundwater baseflow. During dewatering of Phase 1 or Phase 1/2 the total surface water flow in Watercourse 1 will be similar or increase slightly (0.004 to 0.006 m^3/s) during high flow conditions at the time of the spring freshet. The increase in flow should not be detectable as measured spring flow conditions range up to 0.06 m^3/s at station SW4. Once Phase 1/2 has been extracted, pumping may need to be continued at a lesser rate to maintain seasonal surface water within the central low-lying area and Watercourse 1, and to allow for water accumulation within the excavation.

The total surface water flow within Watercourse 2 will be similar or increase slightly (0.002 to 0.003 m^3/s) during the spring freshet, which reflects the observed pre-extraction conditions.

Water quality within Watercourse 1 and Watercourse 2 will be maintained by the discharge of water through the Equalization Pond and to the headwaters of Watercourse 2 near the southeastern portion of Phase 2, respectively. Upon rehabilitation of Phase 1/2, lake water will discharge directly the low-lying area that drains to Watercourse 1 through a western outlet and to Watercourse 2 through a second outlet near the northeastern corner of the lake. Table 8 provides a summary of the rehabilitation lake catchment areas.

The Performance Monitoring Program (Section 8) will be completed to allow for an evaluation of dewatering or lake effects on the watercourses. If an unacceptable impact is detected, Contingency Measures (Section 9) would be implemented.

5.4 Operational Water Management

Water will be required for operational processes, such as dust control and aggregate washing (washwater). This water will be removed from the Settling Pond. Excess washwater will be returned to the Settling Pond in a closed-loop system, which permits recycling and conservation of water resources. As detailed in Section 3.3, of the 1,662 m^3/a required to wash 200,000 tonnes of aggregate per year, approximately 34 m^3/a to 265 m^3/a (2% to 16%) would be consumed by quarry operations with the remaining 84% to 98% recycled and reused.
Near quarry completion when the maximum water taking will occur, it is estimated that approximately 2% to 13% of the water managed by dewatering ((34 to 265)/(1,662 + 390) m^3/day) will be consumed over the 130 day operational period. The remaining 87% to 98% will be returned to the natural environment.

6. Impact Management - Mitigation

6.1 Phase 1A

No detrimental quantity or quality impacts on the groundwater or surface water resources are predicted based on the Phase 1A quarry development. A water management plan is proposed to control water accumulation from direct precipitation within the quarry and for controlled dewatering and discharge to Watercourses 1 and 2 to maintain pre-extraction surface water conditions. The water table in Phase 1A will continue to be at a higher elevation than elevations within the surrounding low-lying areas. Therefore, water table elevations and groundwater flow directions will be similar to baseline conditions. Seeps that may occur around the perimeter of Phase 1 will continue to occur, but may occur for a shorter duration during the drier summer months.

Occasional sump use and/or gravity drainage will be required to control surface water runoff accumulation or to supplement surface water storage for property operations. Based on the local hydrogeologic characteristics of the rock, detectable effects from sump use will not extend greater than 10 m from the sump.

Groundwater quality within Phase 1A will continue to be representative of the water quality of precipitation and snowmelt that is captured in the excavation area. Environmental management systems, such as the Settling and Equalization Pond, and contained fuelling, will maintain acceptable water quality beyond the excavation area.

It is predicted that about 47,695 m^3/a of water will be collected within the excavation through the use of runoff control measures and operation of the sump. A water management is provided in Table 18 and Figure 28. In summary, approximately 68% of the discharge will be directed to Watercourse 1 and 32% of the discharge will be directed to Watercourse 2. As a result there should not be detectable change in surface water conditions within the watercourses or Cranberry River. If discharge occurs dominantly during a 30-day spring freshet, the surface water flow rates would change by less than 0.001 m^3/s, which would have no negative effect on the surface water flow system. The controlled discharge would occur through the use of the Equalization Pond for Watercourse 1 and through discharge to the vegetated headwaters of Watercourse 2 near the southeastern portion of Phase 1.

Based on the similar baseline groundwater and surface water quality, the diversion of groundwater to surface water should not have a detrimental effect on surface water quality.

Overall, as the water diversion will continue to be toward tributaries of Cranberry River, there will be no detectable water quality or quantity change within Cranberry River or for water leaving the Cranberry River subwatershed.

To confirm acceptable water resources, the Performance Monitoring Program detailed in Section 8 should be completed. If trigger levels that are defined in the Performance Monitoring Program are exceeded, the Contingency Measures outlined in Section 9 would be implemented.

6.2 Phases 1B and 2

Excavation below the water table for the surrounding low-lying area and operation of dewatering sumps will not have a detrimental effect on water resources. One possible exception under ‘worse case conditions’, as discussed below, may occur for groundwater users at 594 and 655, and MOE Well 6415883 located along Kawartha Lakes Road 45.

Detectable groundwater level effects will be limited to a distance of about 50 m from the excavations, except south of Phase 2. The 50 m distance from the excavations will be contained within the property limits. South of Phase 2, considering ‘worse-case conditions’ the hydrogeologic characteristics may result in a detectable decrease in the water table level within about 1 km m of Phase 2, which encompasses water wells located at 594 and 655, and MOE Well 6415883 on Kawartha Lakes Road 45. At 594 Kawartha Lakes Road 45 and MOE Well 6415883 the wells are recorded as being deep into bedrock, and at 655 Kawartha Lakes Road 45 a deep water well was recently installed. Owing to the distance of the three wells from Phase 2 and the well depths, the available well capacity should not be negatively impacted by the quarry. No mitigation is expected to be necessary.

There are no active pits or quarries, as well as proposed quarries, within at least 5 km of the proposed extraction areas the area. Thus, considering the ‘worse-case conditions’ assessment of the Sebright Quarry, the minimum 5 km distance to other quarries, and the minor consumption of water for the Sebright Quarry, there will be no cumulative impact on water resources as a result of the Sebright Quarry

A decrease in groundwater levels near the excavations will result in the movement of surface water from adjacent watercourses into the groundwater system. Based on the predicted distance of influence for drawdown effects, the predicted loss in surface water flow is less than 0.001 m^3/s. This reduction in surface water flow would not be detectable based on natural seasonal fluctuations observed during baseline conditions. In addition, this amount of groundwater drawn to the quarry would be returned to the watercourse as part of the water management program.

The local drawdown of groundwater levels adjacent to Phase 1 and Phase 1/2 will reduce the occurrence of groundwater seeps in this area. Groundwater levels and the presence of seeps around the rock knobs further to the west will be unaffected by the quarry dewatering.

The inward movement of groundwater toward the excavations will prevent the outward movement of groundwater into the surrounding environment. This inward groundwater movement and environmental management processes will prevent unacceptable effects on local water quality.

A water balance assessment of the property during pre and post-extraction was completed for each phase. Phases 1 and 2 were combined (Phase 1/2) as the two phases will be completed sequentially.

A water management plan is provided in Section 5 to maintain pre-extraction surface water conditions in Watercourses 1 and 2. In summary, during dewatering and extraction of Phase 1/2, about 67% of the discharge will be directed to the Equalization Pond and subsequently to Watercourse 1, and about 33% of the discharge will be directed to the headwaters of Watercourse 2. Changes in the total surface water flow rates within the two watercourses are predicted to be not detectable, ranging from no calculated difference during average flow conditions to an increase of 0.002 to 0.006 m^3/s during the spring freshet. Water management details are provided in Table 18.

Upon rehabilitation of the quarry phases, the lake will have two outlets that will continue to provide water to the two watercourses. For Watercourse 2 the catchment area will increase by about 17% (50%-33%) of pre-extraction conditions, while the catchment area for Watercourse 1 will decrease by about 18% (68%-50%). Both changes will not have a detectable effect on surface water flow. Peak flow conditions during the spring will continue with the surface water eventually flowing to Cranberry River which is the ultimate discharge point for the two watercourses.

Based on the similar groundwater and surface water quality, the diversion of water should not have a detrimental effect on the surface water quality.

On a subwatershed basis, water diversion will continue to provide water to the Cranberry River, with no net change in surface water quantity or quality within the subwatershed.

7. Site Development Considerations

Considering the hydrogeologic assessment findings, the following site development concepts should be considered.

i) Settling Pond and Equalization Pond

One Settling Pond and one Equalization Pond will be constructed within the Processing and Stockpile Area as shown in the Quarry Conceptual Development Plan. The Settling Pond will collect drainage from the Processing and Stockpile Area and washwater to provide primary settling. The inlet elevation of the Settling Pond will be about 240.7 m asl.

The settling pond has been sized with a depth of 5 m and to provide a minimum of three days storage for average washwater requirements (1,662 m^3/day) within each of three settling compartments. This storage time will provide sufficient time for the settlement of silt-sized suspended solids. At about 70 m in width, a minimum pond length of about 47 m (43 m plus two, 2 m separation barriers) is proposed. Inlets and outlets for each compartment will allow from water movement across the 70 m width of the pond to provide the longest flow path for sediment removal.

Water within the Settling Pond will be used as washwater or will provide water for quarry operations such as dust control. In the event of an excessive storm event, the Settling Pond will gravity drain to the Equalization Pond as a contingency measure. The Equalization Pond will also collect dewatering discharge from the sump in the active extraction area. The conceptual design of the Equalization Pond provides one inlet at 240.1 m asl and one outlet near the southwest corner at 239.9 m asl. The capacity of the 2 m deep Equalization Pond is about 42,000 m^3, which is sufficient to provide two weeks retention of the predicted water to be removed from Phase 1/2 during dewatering at the time of the spring freshet. A smaller Equalization Pond size may be considered if a decreased retention time is required for discharge into the low-lying area.

Watercourse 1 improvements downstream of the Equalization Pond may include the replacement of the culvert below the access trail near the road allowance.

ii) Fuelling

Fuelling will occur within a controlled area with secondary containment to minimize the potential for problems to arise in the event of fuel spillage. Emergency spill containment material will also be available on the property. Fuel will be provided by means of a mobile system or on-site storage facility.

iii) Blasting

An environmental management system was developed for the blasting program to prevent unacceptable quality effects to shallow on-site groundwater. Details are provided under separate cover (Explotech Engineering Limited, 2008).

iv) Permit To Take Water

A Permit To Take Water (PTTW) will be required in accordance with Section 34 of the Ontario Water Resources Act (OWRA) to operate the quarry dewatering system in excess of 50 m^3/day. A summary of the calculated average and maximum dewatering rates is provided below. As noted in Section 5.4, most (87% to 98%) of the water that will be handled will be returned to the natural environment as surface water. At the maximum extent of quarry operations, only about 2% to 13% of the water handled will be consumed through site operations.

PHASE	AVERGE PUMPING RATE (m^3/day)	MAXIMUM PUMPING RATE (m^3/day)
Phase 1A	131	1,288
Phase 1B	278	2,741
Phase 1/2	390	3,846

NOTES:
1) 'm^3/day' indicates cubic metres per day.
2) Average pumping rate based on 365 days per year.
3) Maximum pumping rate based on 81% of water being removed over a 30 day period (April).

A temporary production well may be required to provide sufficient water for dust control prior to construction of a sump. Proposed pumping rates at that time may require a PTTW.

v) Discharge

A Certificate of Approval for Sewage Works (Discharge) will be required in accordance with Section 53 of the Ontario Water Resources Act (OWRA) to discharge the water from the dewatering system to the watercourses north and south of Sebright Quarry. It is recommended that no direct discharge occur into Cranberry River.

8. Performance Monitoring Program

It is predicted that the quarry development will not have a detrimental effect on groundwater or surface water resources beyond the property boundaries. Current groundwater use at 594, 655 and MOE Well 6415883 on Kawartha Lakes Road should not be negatively impacted by the quarry. The monitoring program detailed in Table 19 is recommended to obtain factual data to evaluate the impact predictions and to obtain information in the event that contingency measures are required.

An annual report should be prepared to provide the following.

- Historic data and data collected for the current year
- An assessment of changes in data trends or patterns, and an evaluation of potential quarry effects
- A comparison of the data with the trigger mechanisms
- A comparison of quarry dewatering rates to permitted rates in accordance with the Permit To Take Water
- A summary of mitigative or contingency measures that were implemented and associated results
- A summary of complaints and the response/action to resolve the complaints
- Changes to the quarry operations
- Recommended changes to the Performance Monitoring Program

The Performance Monitoring Program has been initiated to provide input to establishing baseline conditions and will continue during quarry operations, and for two years upon achieving stable levels within the rehabilitated lake (excluding discharge monitoring). After two years, if no trigger mechanisms are exceeded, the monitoring program may be stopped.

The trigger mechanisms presented in Table 20 will be used to determine if mitigation measures are required as outlined in Section 9. In instances where background concentrations naturally exceeded the ODWQS or PWQO, a trigger value of 75% of the background concentration is used.

Water wells on the property that are not required should be decommissioned in accordance with the applicable regulatory requirements.

9. Contingency Measures

The following contingency measures are provided for consideration in the event that the trigger mechanisms presented in Section 8 are exceeded.

For off-site groundwater effects, the construction of enhanced infiltration features along the south-central property boundary and associated drainage divide is suggested to reduce off-site impacts to the south.

- Construction of a groundwater recharge zone will maintain acceptable groundwater levels to the south. This recharge zone could be developed with an infiltration trench(s) or ponds that are supplemented with water removed from the quarry during dewatering.

- Construction of a low permeable barrier with grout-filled trenches or boreholes will prevent groundwater movement through rock fractures. As a result, groundwater drawdown would not extend beyond the property boundary and baseline groundwater conditions would be maintained to the south.

- A temporary potable water supply could be provided. The water supply wells impacted by the quarry would then be deepened or replaced with suitable groundwater supplies as a long-term contingency measure.

Surface water quality or quantity effects could be mitigated with the following.

- Quality could be improved with the discharge of water into a constructed wetland. Controlled flow through the wetland would reduce total suspended solids and provide additional water quality polishing and temperature equalization prior to discharge into a watercourse(s).

- The design of the Settling Pond could be improved to reduce the discharge rate, provide a longer residence time for enhanced settling, or provide additional storage capacity. In addition, supplemental inline settling ponds could be constructed owing to the large size of the Equalization Pond.

- Discharge may be directed to one or more discharge points to compensate for loss of surface water flow or to supplement surface water flow. As the tributaries of the Cranberry River are ephemeral, they provide the opportunity for flow modifications in response to changing property operations or weather conditions. The overall flow into the Cranberry River would remain the same.

10. Conclusions

Based on the conceptual quarry development and impact assessment findings presented in this report, the following conclusions are provided.

- For Phase 1A, which involves the extraction of the one rock knob to an elevation of between 242 and 244 m asl, groundwater elevations around the quarry perimeter are not anticipated to show notable changes relative to baseline conditions. Groundwater use for water wells around the property will not be affected. Shallow groundwater quality will continue to reflect of the water quality of precipitation and snowmelt. Implementation of the water management plan will maintain pre-extraction surface water conditions within the watercourses. In addition, surface water quality will not show a detectable change as a result of the Phase 1A quarry operations.

- Phases 1B and 2 will involve quarry development below the surrounding water table and watercourses within the low-lying area. No effects of quarry dewatering on groundwater elevations beyond the property boundaries are anticipated, except potentially south of Phase 2 based on 'worse-case conditions'. Dewatering effects between Phase 2 and Kawartha Lakes Road 45 will decrease with distance from the extraction area and should not have a negative effect on local water well supplies.

- The groundwater drawdown effects due to extraction will extend below a portion of the watercourses located north and east of Phases 1 and 2. It is predicted that the loss of surface water will be negligible compared to the seasonal flow rates and this water will be returned to the watercourse through the water management program. No detectable effects are predicted for surface water conditions within the Cranberry River.

- With the implementation of the water management plan detailed in Section 5, the dewatering of Phase 1/2 and controlled discharge to the tributaries of Cranberry River will not have a detectable effect on pre-extraction total surface water flow rates. It is predicted that the flow rates in the watercourses will be similar or may increase slightly (0.002 to 0.006 m^3/s) during dewatering. No notable change in flow rates with Cranberry River will be detectable.

- Groundwater quality beyond the property boundary will not be affected by quarry operations as groundwater will be induced to move toward the excavations. As the groundwater and surface water quality is similar, and environmental management practices will be implemented as part of quarry operations, such as settling ponds and fuelling in controlled areas, no detectable effects on surface water quality are predicted.

- Overall, the dewatering program will not have a detectable effect on surface water flow or quality within Cranberry River or on surface water leaving the Cranberry River subwatershed.

- A Permit To Take Water will be required for operation of the sump(s) in Phase 1A and during dewatering of Phases 1B and 2, as well as potentially for a temporary production well to supply water for dust control prior to construction of a quarry sump. The required pumping rate for the sumps will increase as the area and depth of the extraction area increases as summarized below.

PHASE	AVERGE PUMPING RATE (m^3/day)	MAXIMUM PUMPING RATE (m^3/day)
Phase 1A	131	1,288
Phase 1B	278	2,741
Phase 1/2	390	3,846

NOTES:

4) 'm^3/day' indicates cubic metres per day.
5) Average pumping rate based on 365 days per year.
6) Maximum pumping rate based on 81% of water being removed over a 30 day period (April).

- Approval for discharge of the groundwater and surface water collected within the extraction areas will be required.

- Upon completion of Phases 1/2 the rehabilitation will involve the establishment of a lake within the extraction area. Based on the existing topography, the lake level for Phase 1/2 will be about 240 m asl. It is estimated that the lake will require about 30 to 40 years to achieve stable levels, but may be longer if some dewatering is required to supplement surface water flow within the central low-lying area and Watercourse 1. Upon complete rehabilitation of the property, the surface water and groundwater conditions will be similar to baseline conditions, with some reduction of groundwater seeps immediately around the rehabilitation lake. There will be no detectable effects beyond the property boundaries on groundwater and surface water conditions within the Cranberry River subwatershed.

- A Performance Monitoring Program was initiated for the site to establish baseline conditions and will be continued, during, and for two years after achieving stable conditions within the rehabilitated lakes. The monitoring program and trigger mechanisms to implement contingency measures are provided in Section 8 of the report.

- Contingency measures to ensure protection of groundwater supplies and surface water are provided in Section 9.

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Tables

TABLE 1
BOREHOLE COMPLETION SUMMARY
SEBRIGHT QUARRY

BOREHOLE DESIGNATION	DATE COMPLETED	BOREHOLE DEPTH (m)
BH00-1	November 2, 2003	10.6
BH03-1	December 15, 2003	19.8
BH00-2	November 2, 2000	10.8
BH00-3	November 2, 2000	14.8
BH03-4	December 11 to 12, 2003	20.0
BH03-5	December 9 to 10, 2003	24.4
BH03-6	December 8, 2003	24.5
BH04-7-I	September 15 to 16, 2004	18.5
BH04-7-II	September 15 to 16, 2004	4.2
BH04-8-I	September 13 to 14, 2005	17.3
BH04-8-II	September 13 to 14, 2005	3.3

NOTE:
1) ‘m’ indicates metres.

TABLE 2
HYDRAULIC TESTING SUMMARY
SEBRIGHT QUARRY

BOREHOLE DESIGNATION	DATE TEST COMPLETED	TESTING INTERVAL (m BGS)
BH03-1	March 3 to 16, 2004	5.0 to 19.8
BH03-4	February 27 to March 1, 2004	2.2 to 19.6
BH03-5	February 24 to 27, 2004	8.1 to 24.3
BH03-6	March 17 to 18, 2004	5.2 to 24.5
BH04-7	October 28 to 29, 2004	4.5 to 18.5
BH04-8	October 25 to 28, 2004	3.2 to 17.3

NOTE:
1) ‘m BGS’ indicates metres below ground surface.

TABLE 3
MONITORING WELL INSTALLATION SUMMARY
SEBRIGHT QUARRY

BOREHOLE DESIGNATION	MONITOR DESIGNATION	DATE INSTALLED	SCREEN INTERVAL (m ASL)
BH03-1	II	April 2, 2004	236.7 to 238.9
BH03-1	I	April 2, 2004	224.9 to 226.3
BH03-4	II	April 2, 2004	230.5 to 233.5
BH03-4	I	April 2, 2004	216.9 to 218.4
BH03-5	II	April 1, 2004	238.6 to 241.6
BH03-5	I	April 1, 2004	224.4 to 225.9
BH03-6	II	April 1, 2004	237.2 to 240.2
BH03-6	I	April 1, 2004	220.8 to 222.3
BH04-7	II	September 15, 2004	225.1 to 226.5
BH04-7	I	November 29, 2004	211.2 to 212.6
BH04-8	II	September 13, 004	228.3 to 230.0
BH04-8	I	November 29, 2004	215.2 to 216.7

NOTE:
1) ‘m ASL’ indicates metres above sea level.

TABLE 4
SURFACE WATER MONITORING STATION SUMMARY
SEBRIGHT QUARRY

STATION DESIGNATION	STATION LOCATION
SW1	Within Cranberry River, upstream of the confluence of Cranberry River and a tributary that extends north of Sebright Quarry.
SW2	Within a tributary that extends north of Sebright Quarry (Watercourse 2).
SW3	Within Cranberry River, at the downstream property boundary.
SW4	At the western property boundary within a tributary of Cranberry River. The tributary extends from a low-lying area within the southwestern portion of the property (Watercourse 1).
SW5	Within Cranberry River downstream of the property and downstream of the discharge point for Watercourse 1.
SWA	Near the outlet of the low-lying area within the southwestern portion of the property (Watercourse 1).
SWB	Between two ponds located north of Sebright Quarry (Watercourse 2). The ponds provide surface water to the tributary that discharges into the Cranberry River.

TABLE 5
WATER WELL DATABASE SUMMARY
SEBRIGHT QUARRY

PARAMETER	NUMBERS	PUMPING RATE (range, average) (gpm)
Total Number of Wells:	88	
Overburden Wells:	3	6-50, 21
Paleozoic Wells:	5	3-4, 3*
Precambrian Wells:	78	<1-70, 11*
Unknown	2	

NOTES:
1) Unknown indicates information not provided.
2) ‘*’ indicates not all well records provided the noted information.
3) ‘gpm’ indicates gallons per minute.

TABLE 6
WATER BALANCE INPUT PARAMETER SUMMARY
SEBRIGHT QUARRY

PARAMETER	SILTY SOIL	ROCK KNOBS
Water Surplus (mm/a)	482	559
Infiltration Variables:		
Topography	Rolling	Hilly
	0.2	0.1
Soil	Silty	Rock (tight clay)
	0.2	0.1
Vegetation Cover	Woodland	Sediment/Moss
	0.2	0.05
Infiltration Coefficient	0.6	0.25
Runoff Coefficient	0.4	0.75
Infiltration (mm/a)	289	140
Runoff (mm/a)	193	419

NOTE:
1) Source of coefficient variables is MOE (1996).

TABLE 7
PRE-EXTRACTION WATER BALANCE SUMMARY
SEBRIGHT QUARRY

	APPROXIMATE AREA (m^2)	WATER SURPLUS CONTRIBUTION RATE (mm/a)	TOTAL CONTRIBUTION (m^3/a)
Surface Water Contribution from Property			
Cranberry River Subwatershed			
-North of Cranberry River	502,000	280	140,560
-South of Cranberry River	2,888,200	280	808,696
Head River Subwatershed	839,500	280	235,060
Groundwater Contribution from Property			
Cranberry River Subwatershed			
-North of Cranberry River	502,000	215	107,930
-South of Cranberry River	2,888,200	215	620,963
Head River Subwatershed	839,500	215	180,493
Total Property Contribution			
Cranberry River Subwatershed			1,678,149
Head River Subwatershed			415,553

NOTES:

1) 'm^2' indicates square metres.
2) 'mm/a' indicates millimetres per annum.
3) 'm^3/a' indicates cubic metres per annum.

TABLE 8
REHABILITATION LAKE CATCHMENT AREAS
SEBRIGHT QUARRY

PRE-EXTRACTION			
PHASE	**PHASE AREA (ha)**	**CATCHMENT AREAS (ha)**	
		WATERCOURSE 1	**WATERCOURSE 2**
1	17.0	11.6	5.4
2	6.2	4.0	2.2
	SUBTOTAL	15.6	7.6

POST-EXTRACTION			
REHABILITATION LAKE PHASE	**LAKE AREA (ha)**	**CATCHMENT AREAS (ha)**	
		WATERCOURSE 1	**WATERCOURSE 2**
1 / 2	23.2	11.6	11.6
	SUBTOTAL	11.6	11.6

NOTES:

1) ‘ha’ indicates hectares.
2) Two lake discharge points will result in approximately 50% discharge to each watercourse.

TABLE 9
PHASE 1A SUMP WATER AVAILABILITY AND DRAWDOWN EFFECTS SUMMARY
SEBRIGHT QUARRY

PARAMETER	VALUE
Area of Phase 1	17.0 ha
Property Water Surplus:	Runoff - 0.28 m/a Infiltration - 0.215 m/a
Rock Bulk Hydraulic Conductivity	3×10^{-8} m/s
Infiltration	0.215 m/a
Drawdown in Sump Below Surrounding Water Table	5 m
Predicted Maximum Groundwater Drawdown Distance from Sump	Less than 15 m
Predicted 1 m Groundwater Drawdown Distance from Sump	Less than 10 m
Predicted Groundwater Drawn to Sump	2.4 m^3/a/m of wall
Predicted Extraction Area Runoff plus Shallow Groundwater Collected by Sump	47,695 m^3/a

NOTES:
1) Predicted extraction area runoff of 280 mm/a assumes that evaporation in the excavation is similar to the current evapotranspiration and soil holding capacity rates. Excavation base will be sloped toward the sump.
2) Rock bulk hydraulic conductivity based on the geometric mean of field determined values at BH03-1 between elevations 240 and 230 m asl, which represents the hydrogeologic characteristics of the rock knobs.
3) Predicted available groundwater for the sump assumes that the drawdown in the sump remains constant.
4) Sump assumed to be 10 m x 10 m. Base at 232 m asl.
5) Water table inferred to be at 240 m asl.

TABLE 10
PRE AND POST EXTRACTION WATER BALANCE SUMMARY – PHASE 1A
SEBRIGHT QUARRY

	APPROXIMATE AREA (m^2)	PRE-EXTRACTION CONTRIBUTION (m^3/a)		POST-EXTRACTION CONTRIBUTION (m^3/a)		
		Groundwater	Surface Water	Groundwater	Surface Water	Sump
CRANBERRY RIVER SUBWATERSHED						
North of Cranberry River	502,000	107,930	140,560	107,930	140,560	0
South of Cranberry River	170,000	36,550	47,600	36,455	0	47,695
Phase 1A: Remainder of Area South of Cranberry River	2,718,200	584,413	761,096	584,413	761,096	0
Total	3,390,200	728,893	949,256	728,798	901,656	47,695
		1,678,149		1,678,149		

NOTES:
1) Infiltration is 215 mm/a. Runoff is 280 mm/a.
2) 'm^2' indicates square metres.
3) 'm^3/a' indicates cubic metres per annum.

TABLE 11
PHASE 1B DRAWDOWN EFFECTS SUMMARY
SEBRIGHT QUARRY

BULK HYDRAULIC CONDUCTIVITY OF BEDROCK (m/s)	DISTANCE FOR NO DRAWDOWN (m)	DISTANCE FOR DETECTABLE (1 m) DRAWDOWN (m)	ESTIMATED DEPTH OF DRAWDOWN AT 15 m FROM EXTRACTION AREA (m)	ESTIMATED DEPTH OF DRAWDOWN AT 200 m FROM EXTRACTION AREA (m)
$1 X 10^{-4}$	2,451	2,274	20.7	17.8
$1 X 10^{-5}$	775	719	20.2	13.1
$1 X 10^{-6}$	245	227	18.6	3.6
$1 X 10^{-7}$	78	71	14.7	0
$1 X 10^{-8}$	25	23	6.1	0
$1 X 10^{-9}$	8	7	0	0
$1 X 10^{-10}$	2.5	2	0	0

NOTES:
1) Calculations assume that the elevation of a no-flow boundary below the excavation base is 210 m asl.
2) See Section 2.7 for rationale for the precipitation infiltration rate of 215 mm/a.
3) 'm/s' indicates metres per second.

TABLE 12
PHASE 1B EXCAVATION WATER AVAILABILITY
SEBRIGHT QUARRY

PARAMETER	VALUE
Area of Phase 1	17.0 ha
Property Water Surplus:	Runoff – 0.28 m/a Infiltration – 0.215 m/a Total Surplus – 0.495 m/a
Predicted Available Surplus Within the Excavation	84,150 m^3/a
Rock Bulk Hydraulic Conductivity	4 x 10^{-8} m/s
Infiltration Beyond Excavation	0.215 m/a
Drawdown in Excavation	21 m
Predicted Groundwater Drawdown Distance from Excavation	50 m
Predicted Available Off-Site Groundwater for Excavation	10.5 m^3/a/m of wall
Predicted Groundwater Surplus Within the Excavation (1,655 m perimeter)	17,378 m^3/a
Total Phase 1B Excavation Water Availability	101,528 m^3/a

NOTES:

1) Water surplus assumes that evaporation in the excavation is similar to the current evapotranspiration and soil holding capacity rates. Excavation base will be sloped toward the sump.
2) Rock bulk hydraulic conductivity based on geometric mean values at the six boreholes tested on the property.
3) Predicted available off-site groundwater for the excavation assumes that the drawdown in the excavation remains constant.
4) ‘ha’ indicates hectares, ‘m/a’ indicates metres per year, ‘m/s’ indicates metres per second, ‘m^3/a’ indicates cubic metres per year.

TABLE 13
PHASE 1B – PREDICATED SURFACE WATER LOSS
SEBRIGHT QUARRY

PARAMETER	VALUE
Hydraulic Conductivity of Base of Watercourse/Pond	4 x 10^{-8} m/s
Vertical Hydraulic Gradient (Downward)	1
Width of Watercourse Base Per Station SW2	1 m
Length of Watercourse 2 (Within 100 m of Phase 1)	700 m
Predicted Surface Water Loss Over Length of Watercourse	883 m^3/a
Predicted Surface Water Loss Over Length of Watercourse	<0.001 m^3/s

NOTES:

1) Rock bulk hydraulic conductivity based on geometric mean values at the six boreholes tested on the property.
2) Vertical hydraulic gradient assumes watercourse/pond is underdrained.
3) Length of watercourse considers drawdown zone of 100 m during dewatering to account for potential watercourse meanders. The predicted dewatering effects will not extend beyond 50 m from the extraction area.
4) ‘m/s’ indicates per second, ‘m’ indicates metres, ‘m^3/s’ indicates cubic metres per second.

TABLE 14
PRE AND POST EXTRACTION WATER BALANCE SUMMARY – PHASE 1B
SEBRIGHT QUARRY

	APPROXIMATE AREA (m^2)	PRE-EXTRACTION CONTRIBUTION (m^3/a)		POST-EXTRACTION CONTRIBUTION (m^3/a)		
		Groundwater	**Surface Water**	**Groundwater**	**Surface Water**	**Sump**
CRANBERRY RIVER SUBWATERSHED						
North of Cranberry River	502,000	107,930	140,560	107,930	140,560	0
South of Cranberry River	170,000	36,550	47,600	0	0	84,150
Phase 1B: 55 m Zone Around	82,750	17,791	23,170	0	23,583	17,378
Phase 1B: Remainder of Area South of Cranberry River:	2,635,450	566,622	737,926	566,622	737,926	0
Total	3,390,200	728,893	949,256	674,552	902,069	101,528
		1,678,149		1,678,149		

NOTES:

1) Infiltration is 215 mm/a. Runoff is 280 mm/a.
2) ‘m^2’ indicates square metres.
3) ‘m^3/a’ indicates cubic metres per year.

TABLE 15
PHASE 2 EXCAVATION WATER AVAILABILITY
SEBRIGHT QUARRY

PARAMETER	PHASE 2
Area of Phase	6.2 ha
Property Water Surplus:	0.495 m/a
Predicted Available Surplus Within the Excavation	30,690 m^3/a
Rock Bulk Hydraulic Conductivity	4 x 10^{-8} m/s to 2 x 10^{-5} m/s*
Infiltration Beyond Excavation	0.215 m/a
Drawdown in Excavation	21 m
Groundwater Drawdown Distance from Excavation	50 m to 1,096 m*
Predicted Available Off-Site Groundwater for Excavation	10.5 m^3/a/m to 236 m^3/a/m* of wall
Approximate Perimeter of Excavation	975 m
Predicted Groundwater Surplus Within the Excavation	10,238 m^3/a to 230,100 m^3/a*
Total Phase Excavation Water Availability	40,928 m^3/a to 260,790 m^3/a *

NOTES:

1) Water surplus assumes that evaporation in the excavation is similar to the current evapotranspiration and soil holding capacity rates. Excavation base will be sloped toward the sump.
2) Rock bulk hydraulic conductivity based on geometric mean values at the six boreholes tested on the property.
3) Predicted available off-site groundwater for the excavation assumes that the drawdown in the excavation remains constant.
4) 'ha' indicates hectares, 'm/a' indicates metres per year, 'm/s' indicates metres per second, 'm^3/a' indicates metres per year.
5) '*' indicates value based on geometric mean for one borehole (BH03-5).
6) Phase 2 perimeter excludes portion abutting Phase 1.

TABLE 16
PRE AND POST EXTRACTION WATER BALANCE SUMMARY – PHASE 1 AND 2
SEBRIGHT QUARRY

	APPROXIMATE AREA (m^2)	PRE-EXTRACTION CONTRIBUTION (m^3/a)		POST-EXTRACTION CONTRIBUTION (m^3/a)		
		Groundwater	Surface Water	Groundwater	Surface Water	Sump
CRANBERRY RIVER SUBWATERSHED						
North of Cranberry River	502,000	107,930	140,560	107,930	140,560	0
South of Cranberry River Phase 1 and 2:	232,000	49,880	64,960	0	0	114,840
50 m Zone Around Phase 1and 2:	131,500	28,273	36,820	0	37,477	27,616
Remainder of Area South of Cranberry River:	2,524,700	542,810	706,916	542,810	706,916	0
Total	3,390,200	728,893	949,256	650,740	884,953	142,456
		1,678,149		1,678,149		

NOTES:

1) Infiltration is 215 mm/a. Runoff is 280 mm/a.
2) 'm^2' indicates square metres.
3) 'm^3/a' indicates cubic metres per year.

TABLE 17
PHASES 1 AND 2 – PREDICATED SURFACE WATER LOSS
SEBRIGHT QUARRY

PARAMETER	NORTH OF PHASE 3
Hydraulic Conductivity of Base of Watercourse/Pond	4 x 10^{-8} m/s
Vertical Hydraulic Gradient (Downward)	1
Width of Watercourse Base	1 m (per SW2)
Length of Watercourse (Within about 100 m of Phase 1/2)	850 m
Predicted Surface Water Loss Over Length of Watercourse	1,072 m^3/a
Predicted Surface Water Loss Over Length of Watercourse	<0.001 m^3/s

NOTES:

1) Rock bulk hydraulic conductivity based on geometric mean values at the six boreholes tested on the property.
2) Vertical hydraulic gradient assumes watercourse/pond is underdrained.
3) Length of watercourse considers drawdown zone of 100 m during dewatering to account for potential watercourse meanders. The predicted dewatering effects will not extend beyond 50 m from the extraction area.

TABLE 18
WATER MANAGEMENT PLAN
SEABRIGHT QUARRY

PHASE	COMMENTS	DEWATERING DISCHARGE RATE TO WATERCOURSE 1				DEWATERING DISCHARGE RATE TO WATERCOURSE 2			
		Percent of Discharge	m^3/day (Average)	m^3/day (30-day freshet)	m^3/a	Percent of Discharge	m^3/day (Average)	m^3/day (30-day freshet)	m^3/a
Phase 1A	Active Quarry	68	89	876	32,433	32	42	412	15,262
Phase 1B	Active Quarry	68	189	1,864	69,039	32	89	877	32,489
Phase 1 / 2	Active Quarry	67	261	2,577	95,446	33	129	1,269	47,010

PHASE	COMMENTS	TOTAL SURFACE WATER FLOW RATE IN WATERCOURSE 1			TOTAL SURFACE WATER FLOW RATE IN WATERCOURSE 2		
		Average (m^3/s)	Peak (m^3/s)	Annual (m^3/a)	Average (m^3/s)	Peak (m^3/s)	Annual (m^3/a)
Phase 1A	Pre-Quarry	0.002	0.018	57,222	0.001	0.008	26,696
	Post Quarry	0.002	0.018	57,222	0.001	0.008	26,696
Phase 1B	Pre-Quarry	0.002	0.018	57,222	0.001	0.008	26,696
	Post Quarry	0.002	0.022	69,039	0.001	0.010	32,489
Phase 1 and 2	Pre-Quarry	0.002	0.024	76,943	0.001	0.012	37,897
	Post Quarry	0.003	0.030	95,446	0.001	0.015	47,010

NOTES:
1) ‘m^3/a’ indicates cubic metres per year.
2) ‘m^3/day’ indicates cubic metres per day.
3) ‘m^3/s’ indicates cubic metres per second.
4) 30-day freshet based on 81% of annual flow over a 30 day period for the first month with average temperature greater than -1ºC (April).
5) Total Surface Water Flow Rate considers that groundwater infiltration contributes baseflow to Watercourse 1 and 2.

TABLE 19
PERFORMANCE MONITORING PROGRAM
SEBRIGHT QUARRY

PARAMETER	FREQUENCY	LOCATIONS	PARAMETERS
Groundwater Levels	Bimonthly Prior to Extraction, Then Monthly	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Water Levels
	Annually (May)	Residential Wells Within 1 km of Property	Water Levels
Groundwater Quality	Annually (May)	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Field: pH, conductivity, temperature Lab: Major ions, metals, TSS, nutrients
Surface Water Flow Rates	Bimonthly, Monthly During Dewatering	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Flow Rate
Surface Water Quality	Semi-Annually (May and September)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen Lab: Major ions, metals, TSS, nutrients, oil and grease, and BTEX
	Bimonthly During Dewatering (After Precipitation Events when Possible)	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen
Quarry Discharge	Daily	Discharge Point(s) For Dewatering Pump(s)	Flow Rates
	Monthly	Discharge Point(s) For Dewatering Pump(s) and Equalization Pond	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen
	Annually Prior to Dewatering of Each Phase and Bimonthly During Dewatering	Discharge Point(s) For Dewatering Pump(s)	Field: pH, conductivity, temperature, turbidity, dissolved oxygen, visible sheen. Lab: Major ions, metals, TSS, nutrients

NOTES:
1) Major ions include: chloride, sulphate, alkalinity, sodium, potassium, calcium, magnesium.
2) Metals include: Al, Sb, As, Be, Bo, Cd, Cr, Co, Cu, Fe, Pb, Mo, Ni, Se, Ag, Ti, V, Zn.
3) Nutrients include: total ammonia, nitrate, nitrite, and total phosphorus.
4) TSS indicates total suspended solids.
5) BTEX indicates benzene, toluene, ethylbenzene, and xylenes.
6) Bimonthly indicates once every two months. Semi-annually indicates twice per year.

TABLE 20
TRIGGER MECHANISMS
SEBRIGHT QUARRY

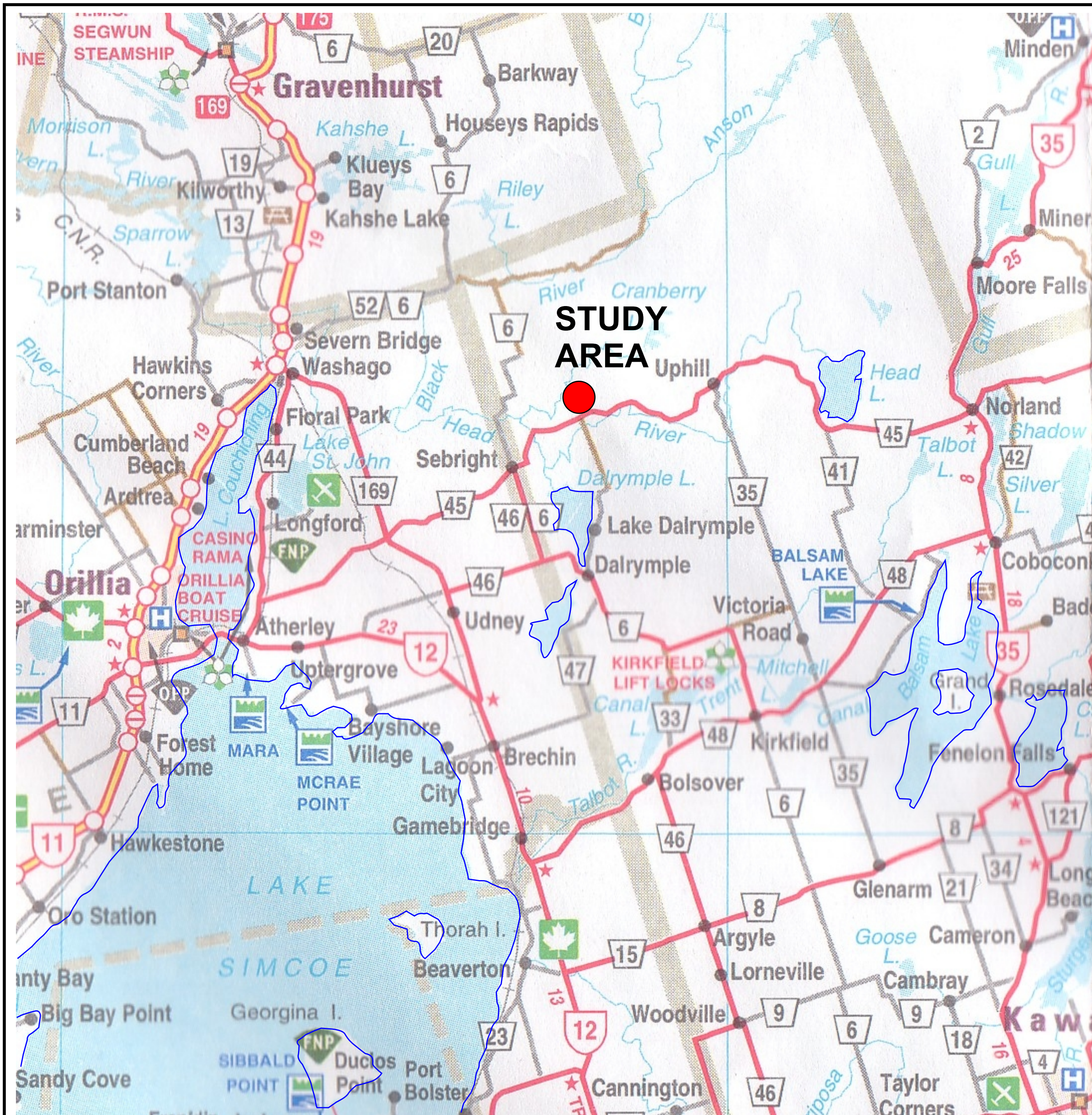
PARAMETER	TRIGGER MECHANISM	LOCATIONS	ACTION
Groundwater Levels	At BH03-1, BH03-4, BH03-6, BH04-7, and BH04-8: Groundwater level decrease by more than 1 m below baseline condition. At BH03-5: Groundwater level decrease of 5 m below baseline conditions.	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related at BH03-1, BH03-4, BH03-6, BH04-7, and BH04-8 implement the applicable contingency measure. If the impact is at BH03-5, evaluate off-site residential well effects then: 1) implement contingency measures if required, or 2) revise Trigger Mechanism.
	Water level below pump intake or insufficient storage capacity in well to meet residential requirements.	Residential Water Wells	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Groundwater Quality	Degradation of water quality in excess of baseline conditions and ODWQS. Ammonia (Total): 50 mg/L Nitrate: 10.0 mg/L Phosphorus: 0.2 mg/L	BH03-1, BH03-4, BH03-5, BH03-6, BH04-7, BH04-8	Determine if the water level decrease is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Surface Water Flow Rates	Decrease or increase in flow rate more than 50% of baseline flow rate.	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the flow rate change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure.
Surface Water Quality	Degradation of water quality in excess of baseline conditions (*) and PWQO. TSS: 25 mg/L Ammonia (unionized): 0.02 mg/L Total Phosphorus: 0.2 mg/L* Oil & Grease: 1.0 mg/L Antimony: 0.020 mg/L Arsenic: 0.005 mg/L Boron: 0.200 mg/L Cadmium: 0.0001 mg/L Chromium: 0.0089 mg/L Cobalt: 0.001 mg/L* Copper: 0.002 mg/L* Iron: 2.2 mg/L* Lead: 0.001 mg/L Molybdenum: 0.040 mg/L Nickel: 0.025 mg/L Silver: 0.0002 mg/L* Vanadium: 0.006 mg/L Benzene: 0.100 mg/L Toluene: 0.0008 mg/L Ethylbenzene: 0.008 mg/L Xylenes: 0.002 mg/L	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge.

TABLE 20
TRIGGER MECHANISMS
SEBRIGHT QUARRY

PARAMETER	TRIGGER MECHANISM	LOCATIONS	ACTION
	Turbidity: 100 NTU	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.
	Visible Sheen	SW1, SW2, SW3, SW4, SW5, SWA, SWB	Determine if the water quality change is a result of quarry activities. If the impact is quarry related, implement the applicable contingency measure for quarry discharge.
Quarry Discharge	Exceeds permitted flow rate	Discharge Point(s) for Dewatering Pumps	Reduce discharge rate in accordance with Permit.
	Turbidity: 100 NTU	Discharge Point(s) for Dewatering Pumps, Equalization Pond	Test for TSS. If TSS is >25 mg/L and the change is quarry related, implement the applicable contingency measure.
	TSS: 25 mg/L Ammonia (unionized): 0.02 mg/L Total Phosphorus: 0.03 mg/L Oil & Grease (Mineral/Synthetic) : 1.0 mg/L	Discharge Point(s) for Dewatering Pumps	Implement the applicable contingency measure.

NOTE:
1) ‘*’ denotes concentration naturally exceeds PWQO.

Figures



LEGEND

APPROXIMATE LOCATION OF STUDY AREA

MAP SOURCE:
2003 OFFICIAL ONTARIO ROAD MAP, MINISTRY OF TRANSPORTATION, 1:700000 SCALE.

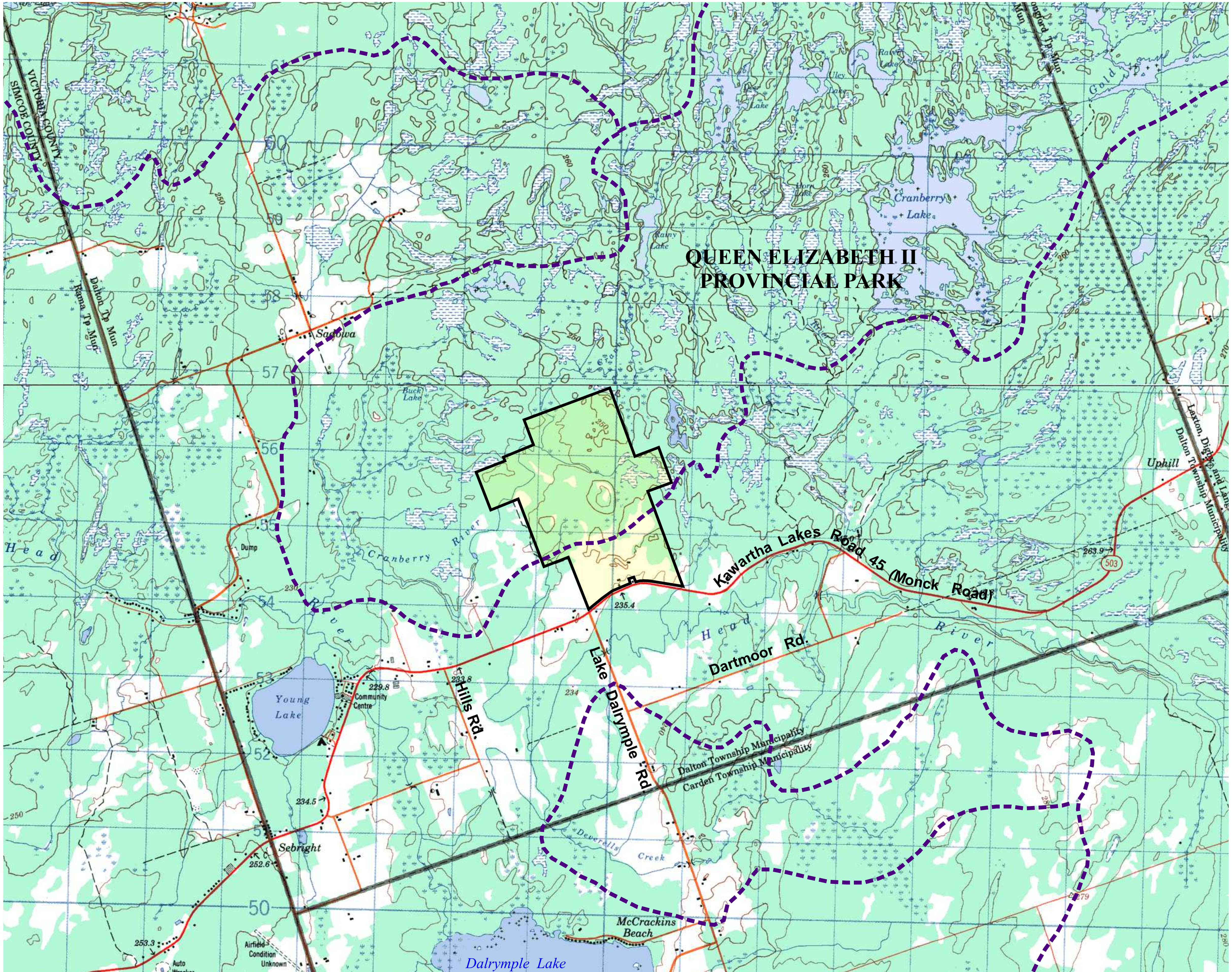
LOCATION MAP

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:350000
PROJECT: 0-920365.05	REF. NO.: 0-92036505F1-LM

GENIVAR

FIGURE 1



LEGEND

PROPERTY BOUNDARY

ESTIMATED WATERSHED BOUNDARY PER 1:50,000 NTS MAP

500 0 1000 m

NOTE:
NTS 1:50,000 MAP SOURCE: GRAVENHURST 31D/14 AND ORILLIA 31D/11.

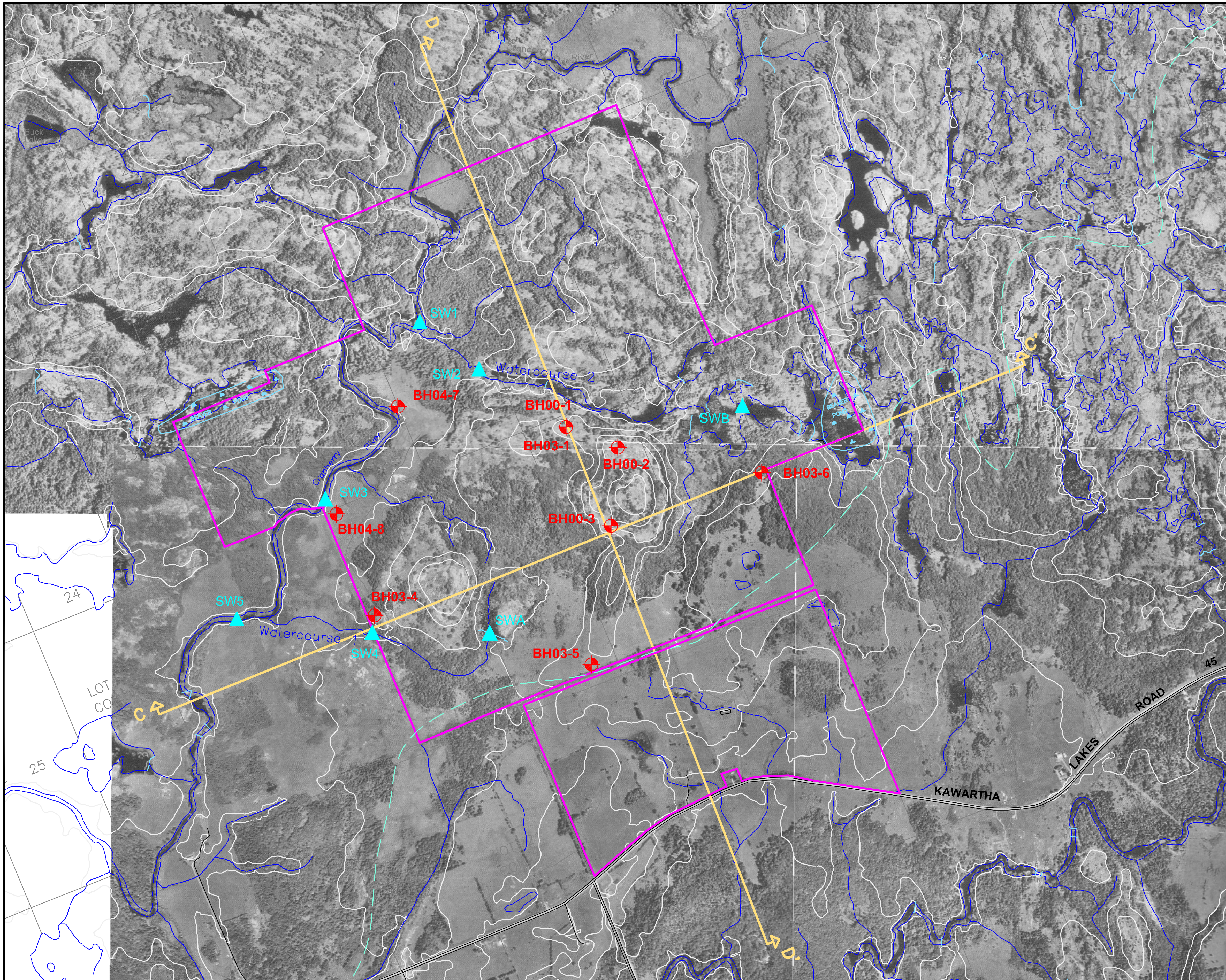
REGIONAL PLAN

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:50000
PROJECT NO.: 0-920365.05	REFERENCE NO.: 0-92036505F2-LM

GENIVAR

FIGURE 2



LEGEND

PROPERTY BOUNDARY

ESTIMATED WATERSHED BOUNDARY

BH03-5 BOREHOLE AND/OR MONITORING WELL LOCATION AND DESIGNATION

C CROSS-SECTION LOCATION AND DESIGNATION

SW2 SURFACE WATER MONITORING STATION AND DESIGNATION

150 0 300 metres

NOTES:
1. AIR PHOTOGRAPHY SOURCE: a)87-443-, 09-142 TO 144, b) 87-4431, 07-122 TO 128.
2. BASE MAPPING FROM OBM 1:10000 SHEETS 101764504950, 101764504955, 101765004950 AND 101765004955, NAD 27 DATUM.
3. CONTOUR INTERVAL IS 5 m.

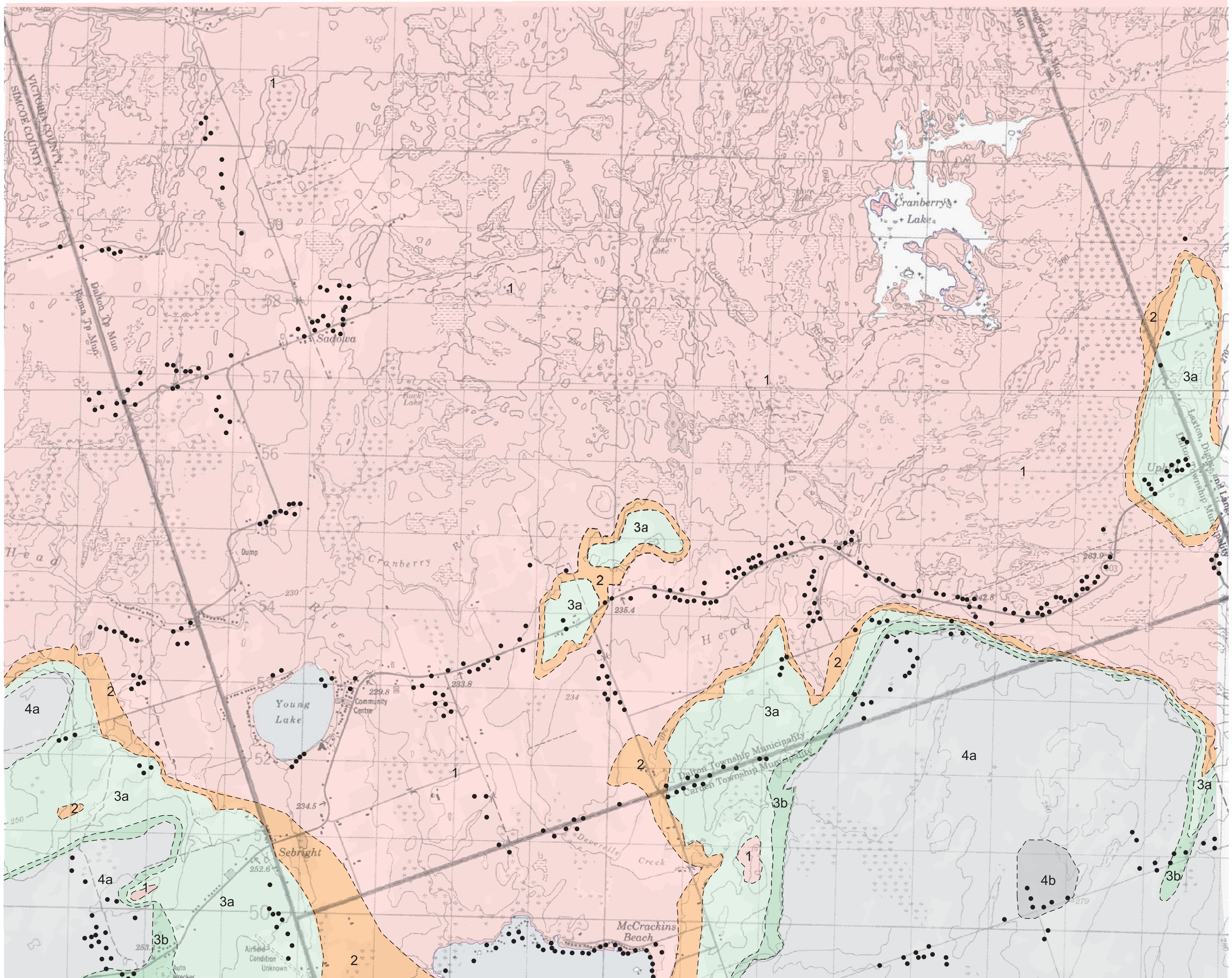
PROPERTY DETAILS

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:15000
PROJECT: 0-920365.05	FILE NO.: 0-92036505F3-SP

GENIVAR

FIGURE 3



Legend

PROPERTY BOUNDARY

PALEOZOIC
BOBCAYGEON FORMATION

4b — Middle Member: Limestone and Shale: light to medium brown, tabular to slightly irregular bedded, fine to coarse-grained, moderately fossiliferous limestone, interbedded with grey-green, calcareous shale.

4a — Lower Member: Limestone: dark to light grey-brown, speudo-nodular to wavey parted, medium to thick-bedded, very fine to coarse-grained, moderately fossiliferous limestones.

GULL RIVER FORMATION

3b — Upper Member: Limestone: light grey to light grey-brown, thin to medium bedded, tabular bedded, micritic to very fine-grained, sparsely fossiliferous limestone.

3a — Lower Member:Limestone and Dolostone: various types including
1) argillaceous, green-grey and grey brown tan weathering fine-grained dolomitic limestones and dolostones;
2) tan calcisiltite-burrow-mottled grey brown very fine-grained fossiliferous limestone;
3) grey brown medium to coarse-grained peloidal cross stratified bioclastic intraclastic limestones;
4) light grey to grey-brown, micritic to very fine-grained sparsley to very fossiliferous limestones.

SHADOW LAKE FORMATION

2 — Shale and sandstone; red and green siliciclastic shales with minor green, medium to coarse-grained shaly sandstones.

PRECAMBRIAN
GRENVILLE PROVINCE

1 — Central gneiss belt; gneisses, migmatites and felsic intrusives.

Geological boundary

outcrop

N

500 0 1000 m

MAP SOURCE:
Armstrong, D.K. And Anastas, A.S., 1993. Paleozoic Geology of the Orillia Area, Southern Ontario: Ontario Geological Survey, Open File Map 222, Scale 1:50,000.

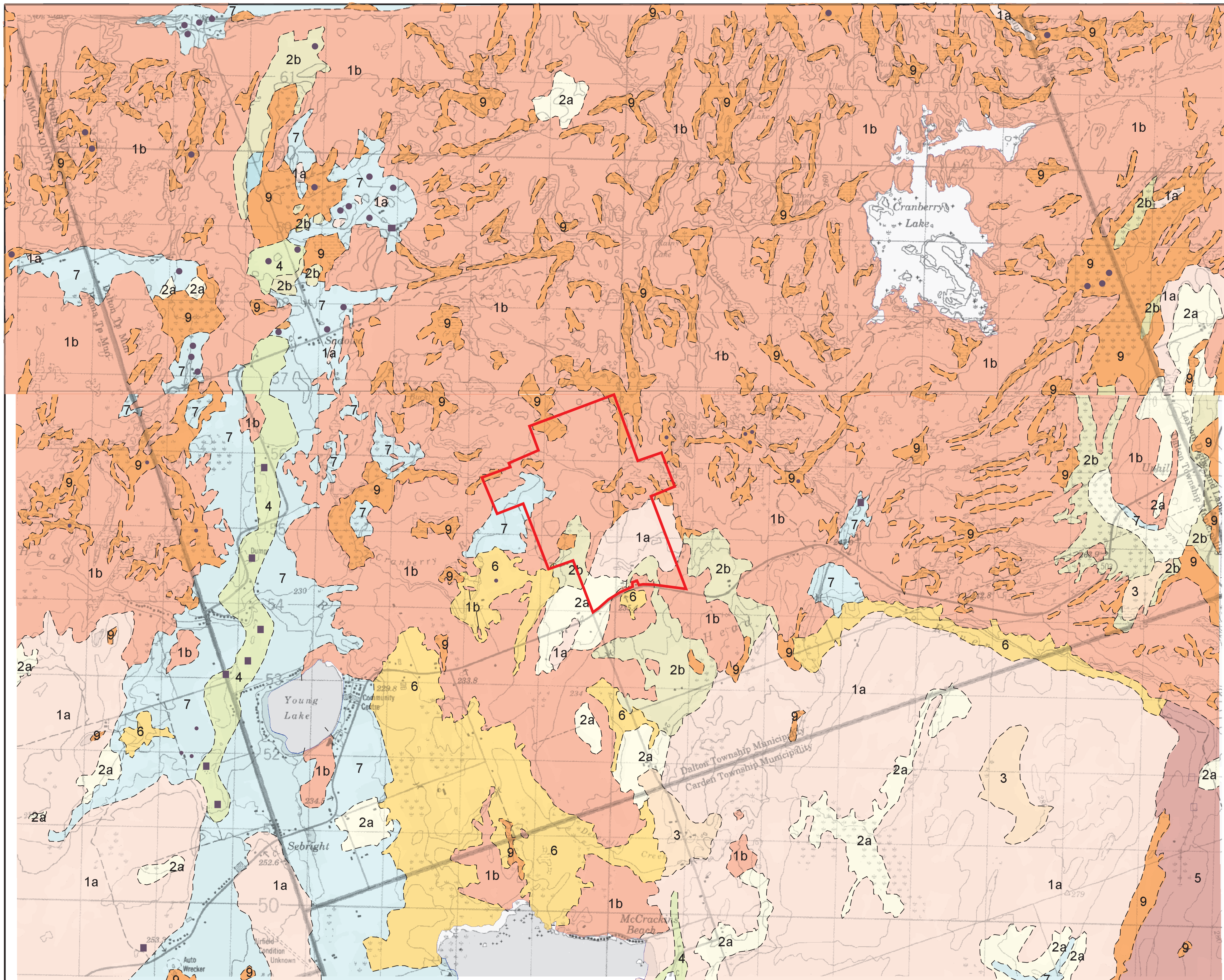
BEDROCK GEOLOGY

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:50000
PROJECT NO.: 0-920365.05	REFERENCE NO.: 0-92036505F4-GE

GENIVAR

FIGURE 4



Legend

- PROPERTY BOUNDARY
- SMALL BEDROCK OUTCROP
- SAND AND GRAVEL PIT
- GEOLOGIC BOUNDARY

PHANEROZOIC, CENOZOIC, QUATERNARY, RECENT

- 11 FILL VARIABLE COMPOSITION, USUALLY OVERLIES BOG AND SWAMP DEPOSITS
- 10 ALLUVIUM UNSUBDIVIDED- SAND, SILT, GRAVEL, CLAY
- 9 BOG AND SWAMP DEPOSITS: MUCK AND PEAT SOME MARL
- 8 EOLIAN DEPOSITS: FINE TO VERY FINE GRAINED SAND
- 7 GLACIOLACUSTRINE SHALLOW WATER DEPOSITS - SAND AND GRAVEL
- 6 GLACIOLACUSTRINE DEEPER WATER DEPOSITS - SILT, CLAY AND SAND
- 5 GLACIOFLUVIAL OUTWASH AND DELTAIC DEPOSITS
- 4 ICE CONTACT STRATIFIED DRIFT: POORLY SORTED SAND AND GRAVEL TO GRAVELLY SAND, SILTY IN PLACES, OCCURS IN ESKERS, KAMES AND MORAINES.
- 3 TILL - SANDY SILT TO SILTY SAND
- 2 BEDROCK DRIFT COMPLEX: DISCONTINUOUS DRIFT, IN PLACES SUFFICIENTLY THICK TO SUBDUE BEDROCK TOPOGRAPHY
  - 2a UNDERLAIN BY PALEOZOIC BEDROCK
  - 2b UNDERLAIN BY PRECAMBRIAN BEDROCK

PALEOZOIC AND PRECAMBRIAN

- 1 BEDROCK: EXPOSED OR WITH VERY THIN DRIFT COVER
  - 1a PALEOZOIC BEDROCK
  - 1b PRECAMBRIAN BEDROCK

N

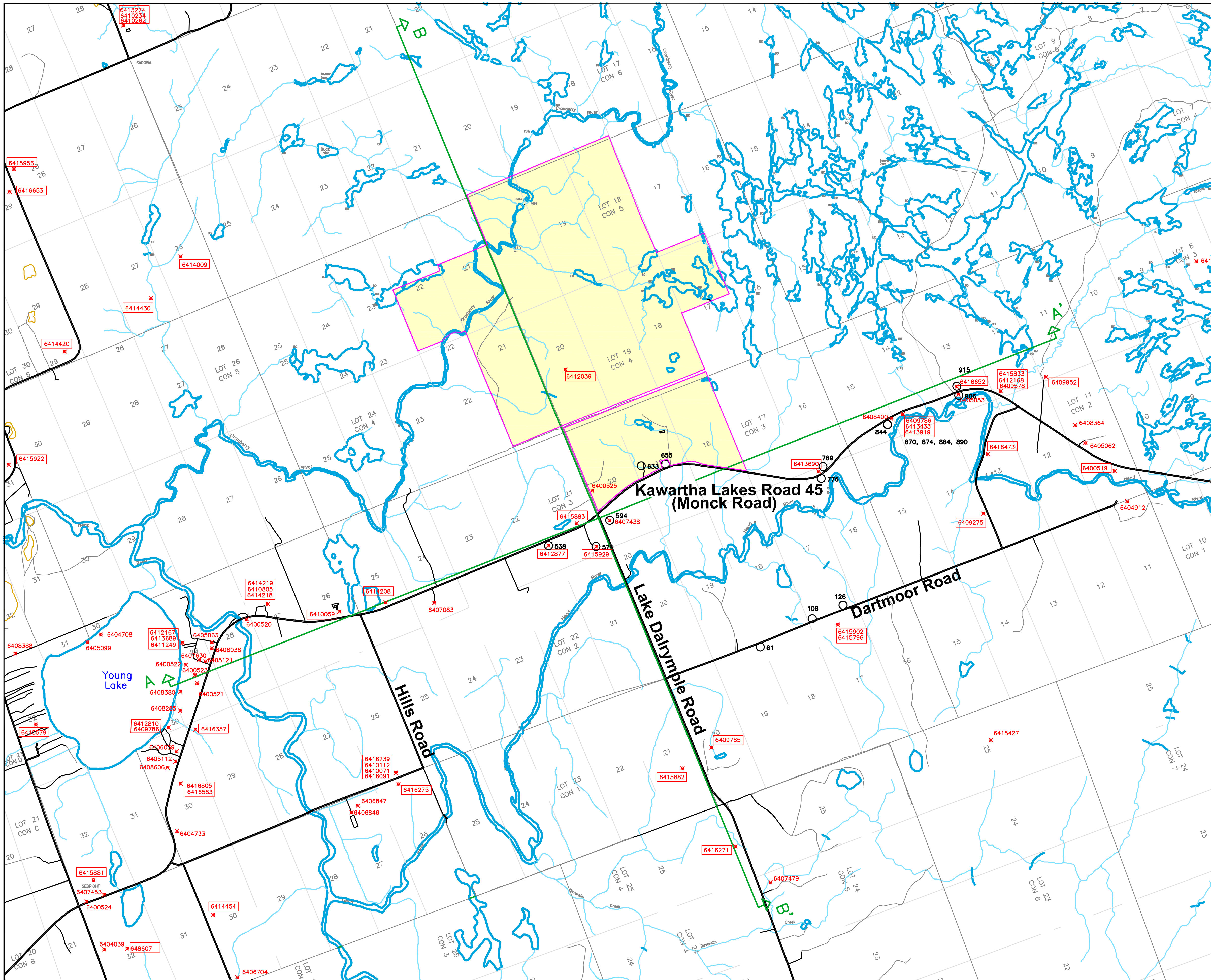
500 0 1000 m

MAP SOURCES:
1) Finamore, P.F. and Bajc, A. F. 1984.Quaternary Geology of the Orillia Area, Southern Ontario. Ontario Geological Survey, Map P. 2697. Geological Series Preliminary Map, Scale 1:50,000, Geology 1981, 1982.
2) Department of Energy, Mines and Resources, 1980. Gravenhurst, Ontario, Scale 1:50,000 (Quaternary Geology).

QUATERNARY GEOLOGY

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:50000
PROJECT NO.: 0-920365.05	REFERENCE NO.: 0-92036505F5-GE
GENIVAR	FIGURE 5



LEGEND

PROPERTY BOUNDARY

6412039 MOE WATER WELL LOCATION AND DESIGNATION BASED ON UTM COORDINATES

6412039 MOE WATER WELL LOCATION AND DESIGNATIONS - APPROXIMATED BASED ON LOT AND CONCESSION NUMBERS AND AIR PHOTOGRAPHS.

574 APPROXIMATE LOCATION AND MUNICIPAL ADDRESS OF RESIDENTS INTERVIEWED

B CROSS-SECTION LOCATION AND DESIGNATION

300 0 600 metres

NOTES:
1. APPROXIMATE MOE WATER WELL LOCATIONS ARE BASED ON INFORMATION PROVIDED IN PUBLIC DATABASE. EXACT LOCATIONS WERE NOT FIELD VERIFIED.
2. BASE MAPPING FROM OBM 1:10000 SHEETS 101764504950, 101764504955, 101765004950 AND 101765004955, NAD 27 DATUM.

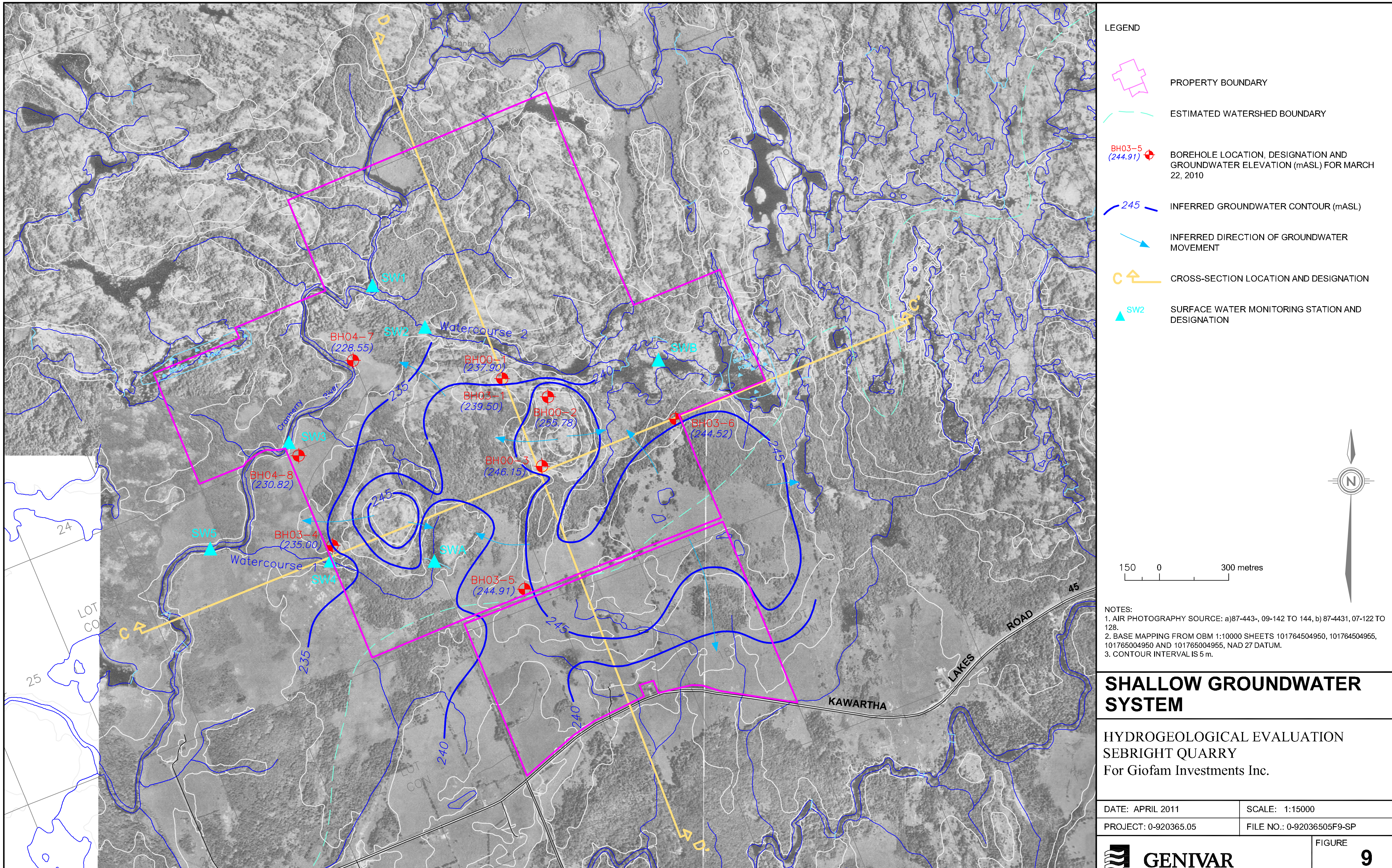
WATER WELL LOCATION MAP

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:30000
PROJECT: 0-920365.05	FILE NO.: 0-92036505F6-WW
GENIVAR	FIGURE 6

SCALE: NOT TO SCALE	**PRECAMBRIAN BEDROCK CORE: BH04-7**
REF. NO.: 0-92036505F7-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	
GENIVAR	FIGURE **7**

SCALE: NOT TO SCALE	**PRECAMBRIAN BEDROCK CORE: BH04-8**
REF. NO.: 0-92036505F8-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	FIGURE **8**
GENIVAR	



NOTES:
1. AIR PHOTOGRAPHY SOURCE: a)87-443-, 09-142 TO 144, b) 87-4431, 07-122 TO 128.
2. BASE MAPPING FROM OBM 1:10000 SHEETS 101764504950, 101764504955, 101765004950 AND 101765004955, NAD 27 DATUM.
3. CONTOUR INTERVAL IS 5 m.

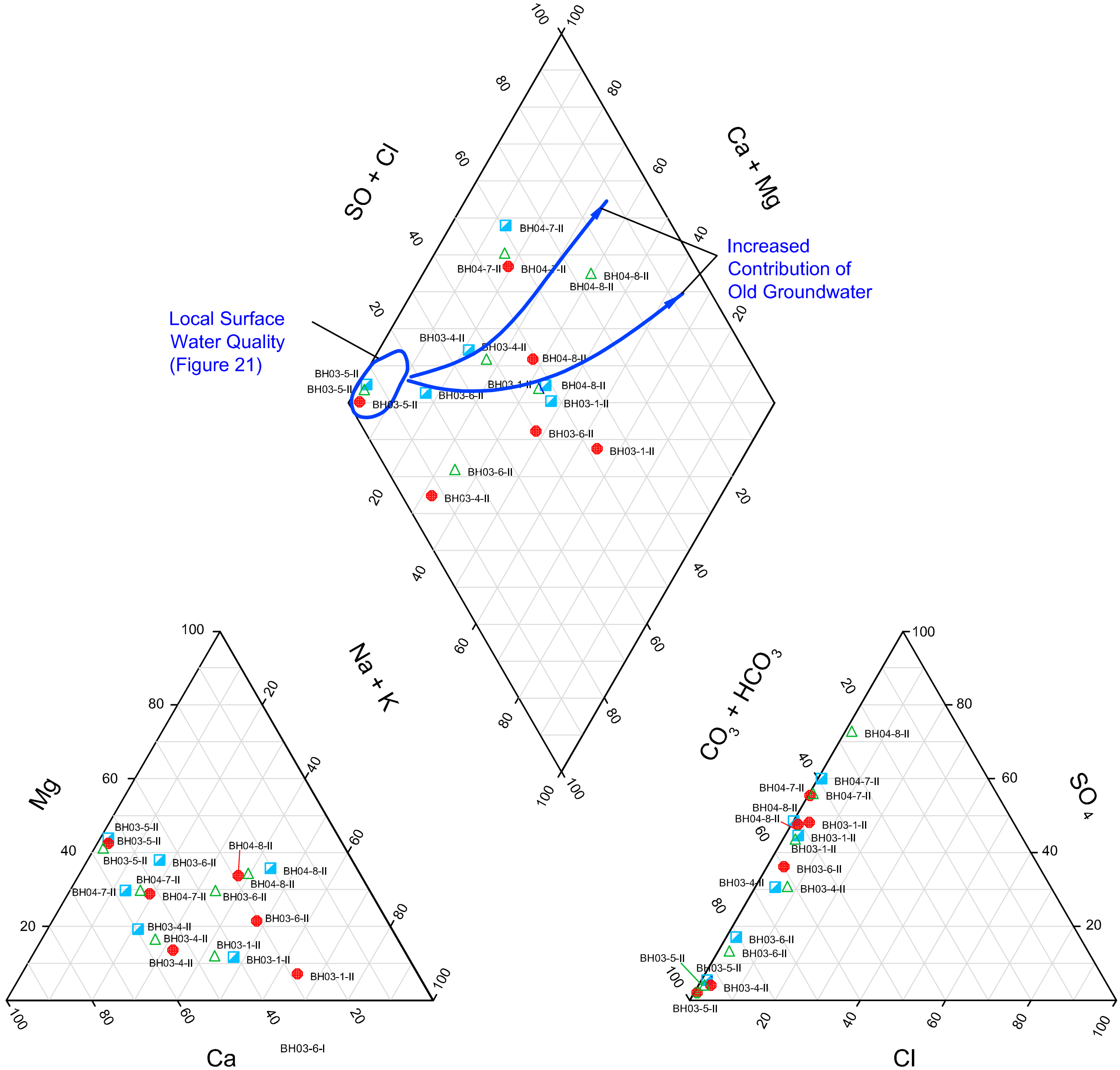
SHALLOW GROUNDWATER SYSTEM

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:15000
PROJECT: 0-920365.05	FILE NO.: 0-92036505F9-SP

GENIVAR

FIGURE 9



Legend

- SHALLOW MONITORING WELL (AUGUST 2005)
- SHALLOW MONITORING WELL (MAY 2006)
- SHALLOW MONITORING WELL (MAY 2007)

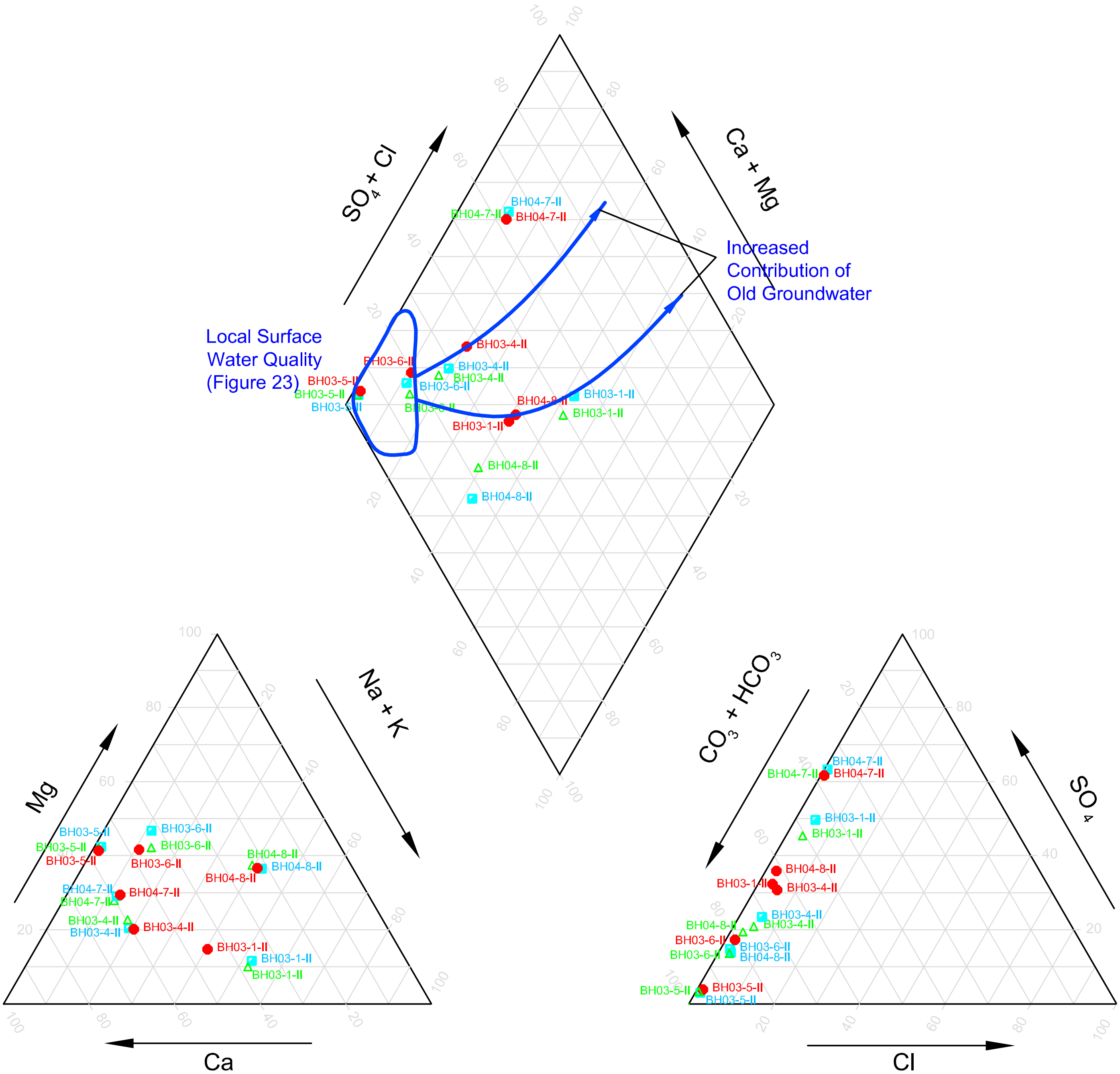
SHALLOW GROUNDWATER QUALITY PIPER PLOT (2005 - 2007)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 920365.05	REF. NO.: 0–92036505F10–TD

GENIVAR

Figure 10



LEGEND

- SHALLOW MONITORING WELL (2008)
- SHALLOW MONITORING WELL (2009)
- SHALLOW MONITORING WELL (2010)

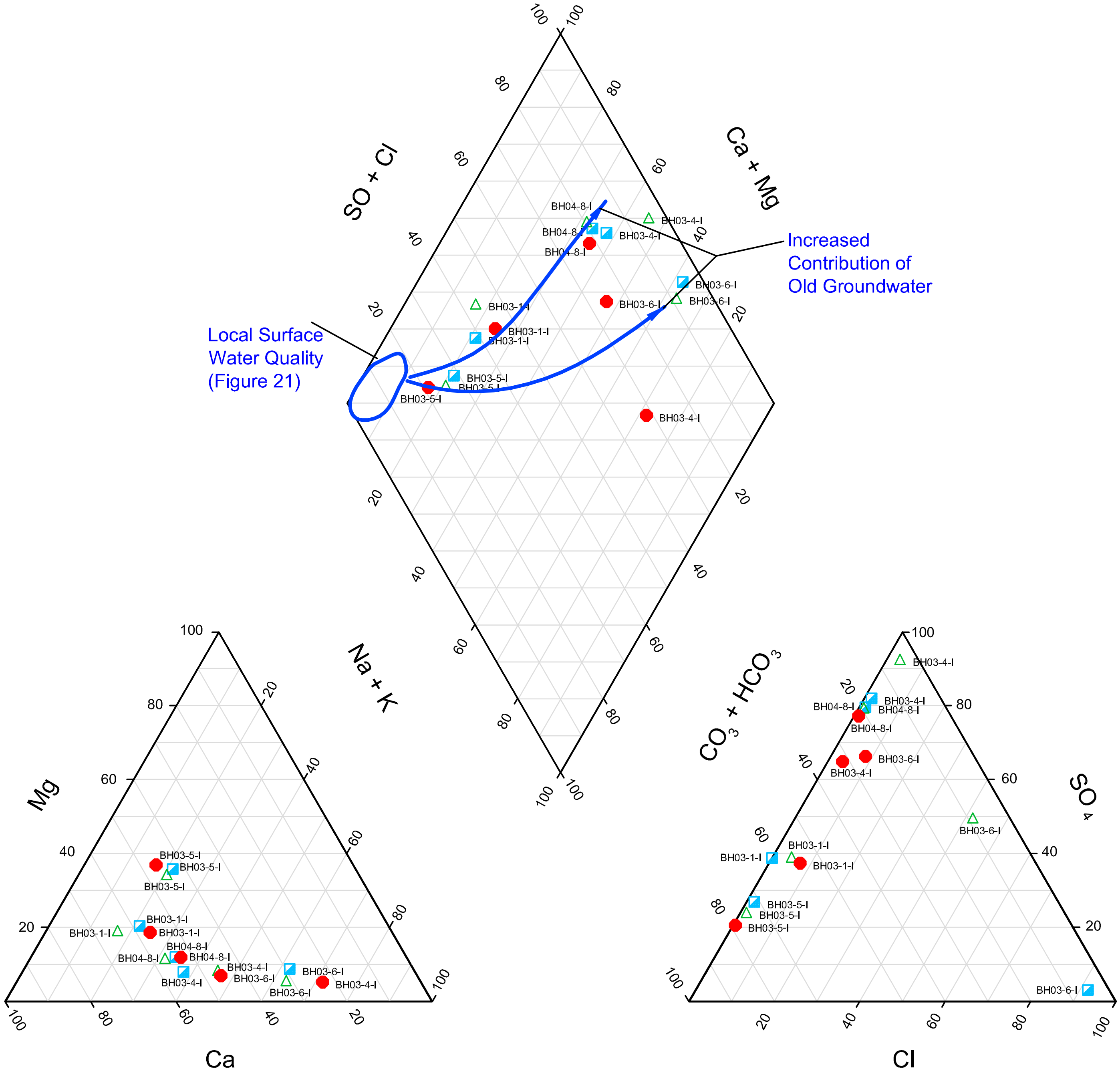
SHALLOW GROUNDWATER QUALITY PIPER PLOT (2008 - 2010)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F11 - TD shallow

GENIVAR

FIGURE 11



Legend

- DEEP MONITORING WELL (AUGUST 2005)
- DEEP MONITORING WELL (MAY 2006)
- DEEP MONITORING WELL (MAY 2007)

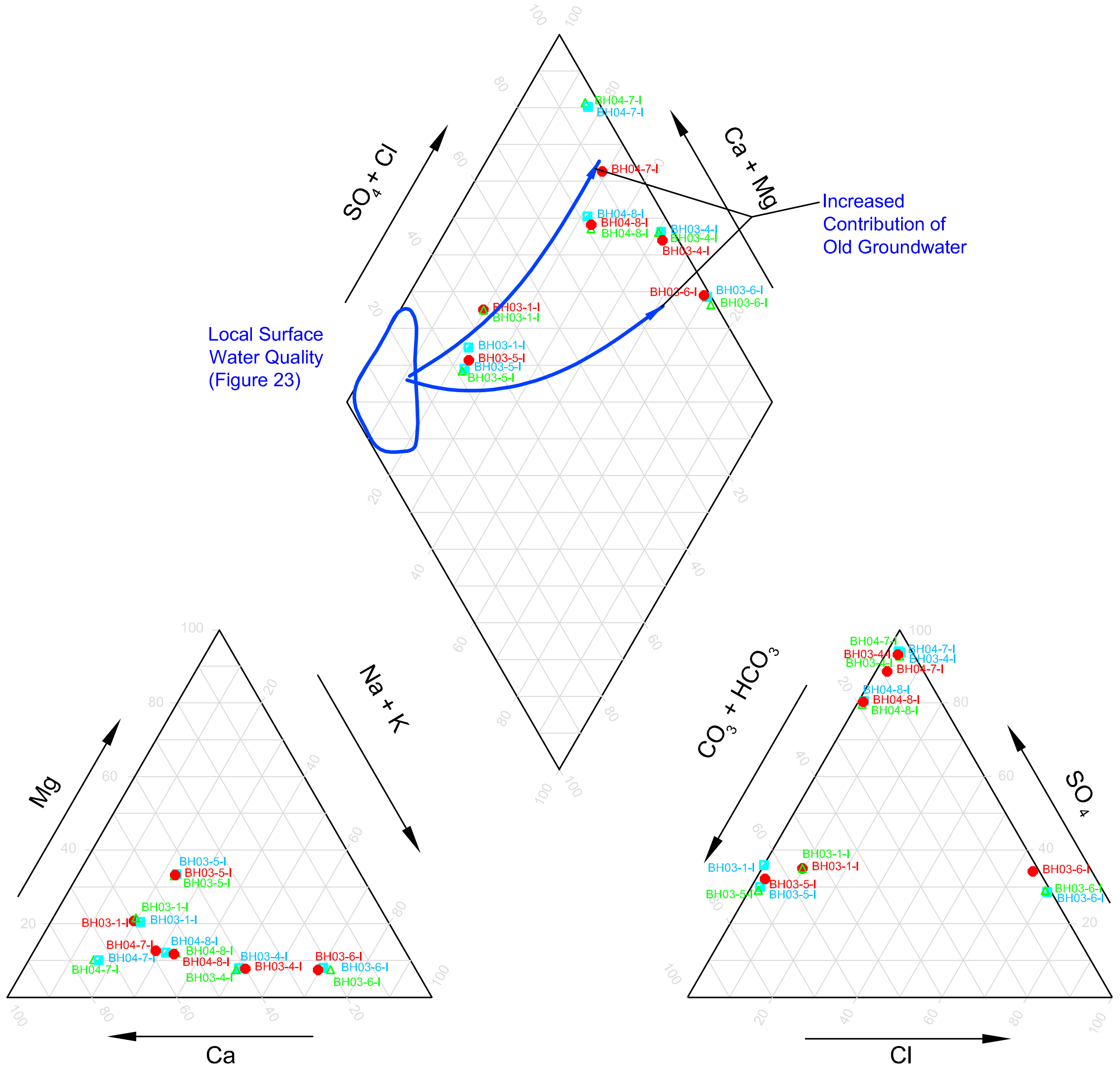
DEEP GROUNDWATER QUALITY PIPER PLOT (2005 - 2007)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 920365.05	REF. NO.: 0–92036505F12–TD

GENIVAR

Figure 12



LEGEND

- DEEP MONITORING WELL (2008)
- DEEP MONITORING WELL (2009)
- DEEP MONITORING WELL (2010)

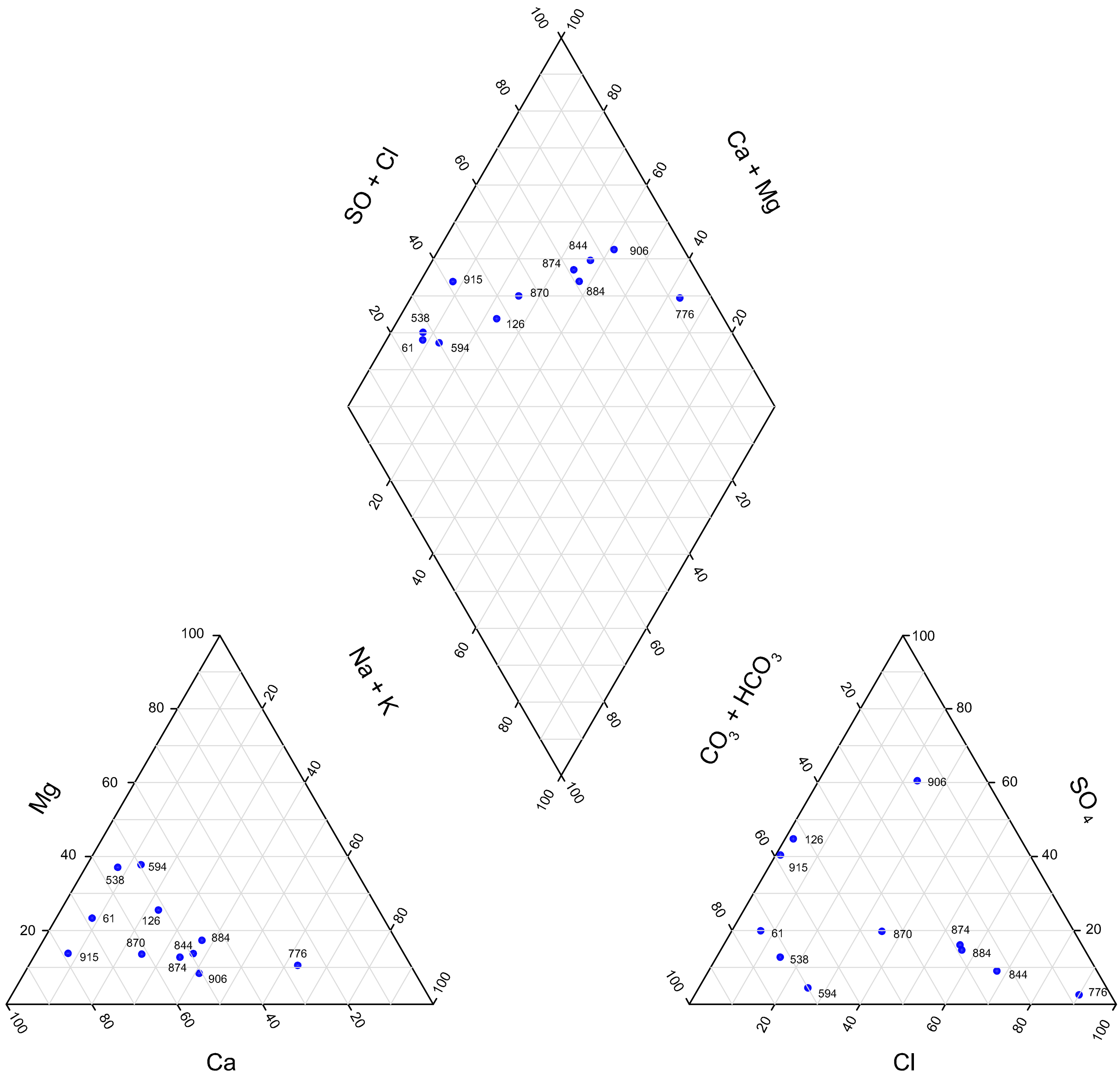
DEEP GROUNDWATER QUALITY PIPER PLOT (2008 - 2010)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F13 - TD shallow

GENIVAR

FIGURE 13



Legend

• RESIDENTAIL WELL AND MUNICIPAL ADDRESS

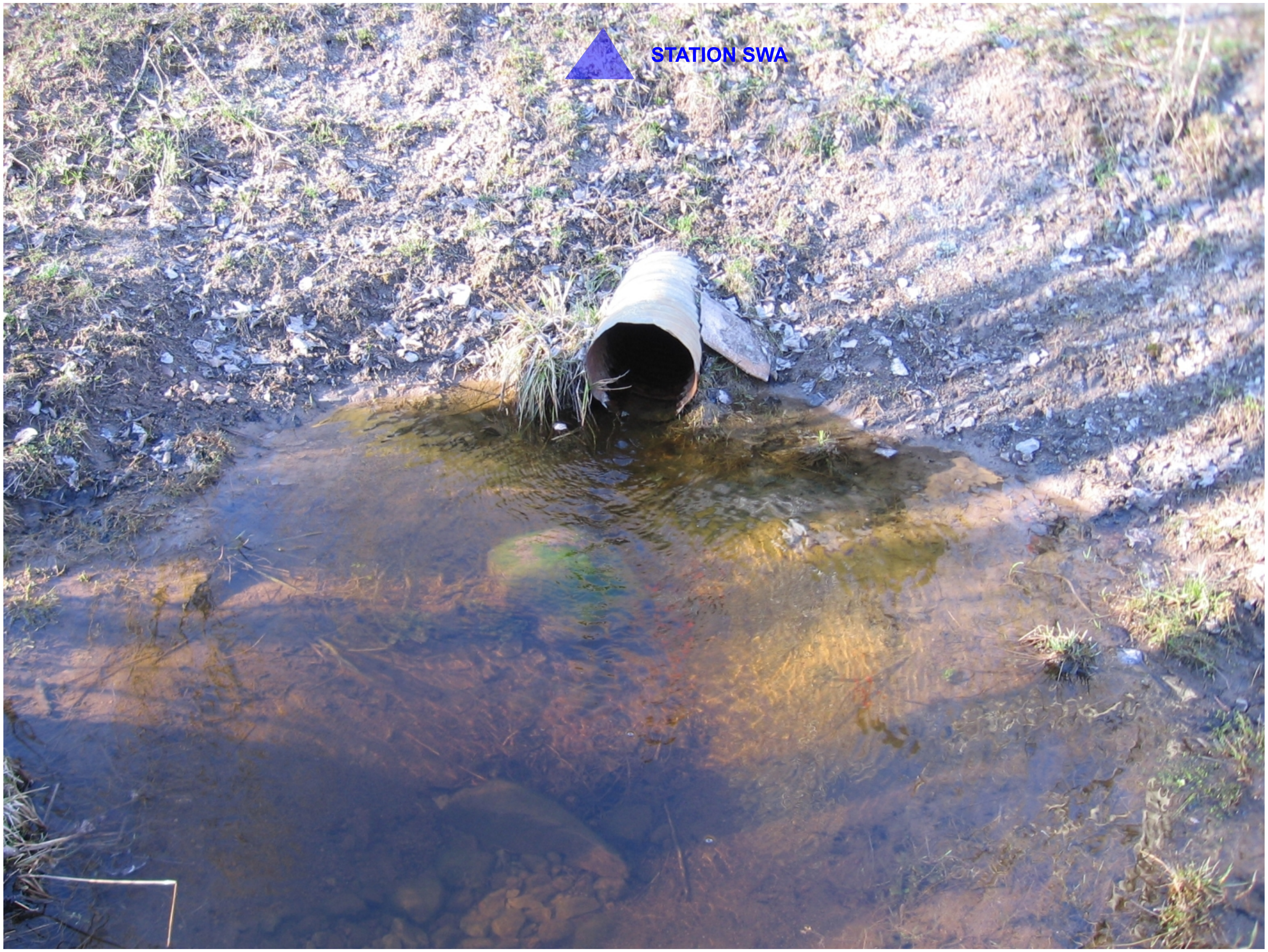
RESIDENTIAL WELL WATER QUALITY PIPER PLOT (2006)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 920365.05	REF. NO.: 0–92036505F14–TD

GENIVAR

Figure
14



NOTE: PHOTO DATE IS APRIL 19, 2007

SCALE: NOT TO SCALE	**STATION SWA**
REF. NO.: 0-92036505F15-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	FIGURE 15
GENIVAR	

SCALE: NOT TO SCALE	**STATION SW4**
REF. NO.: 0-92036505F16-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	
GENIVAR	FIGURE 16

NOTE: PHOTO DATE IS APRIL 19, 2007

SCALE: NOT TO SCALE	**STATION SWB**
REF. NO.: 0-92036505F17-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	
GENIVAR	FIGURE 17

NOTE: PHOTO DATE IS APRIL 19, 2007

STATION SW2

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:350000
PROJECT: 0-920365.05	REF. NO.: 0-92036505F18-PH

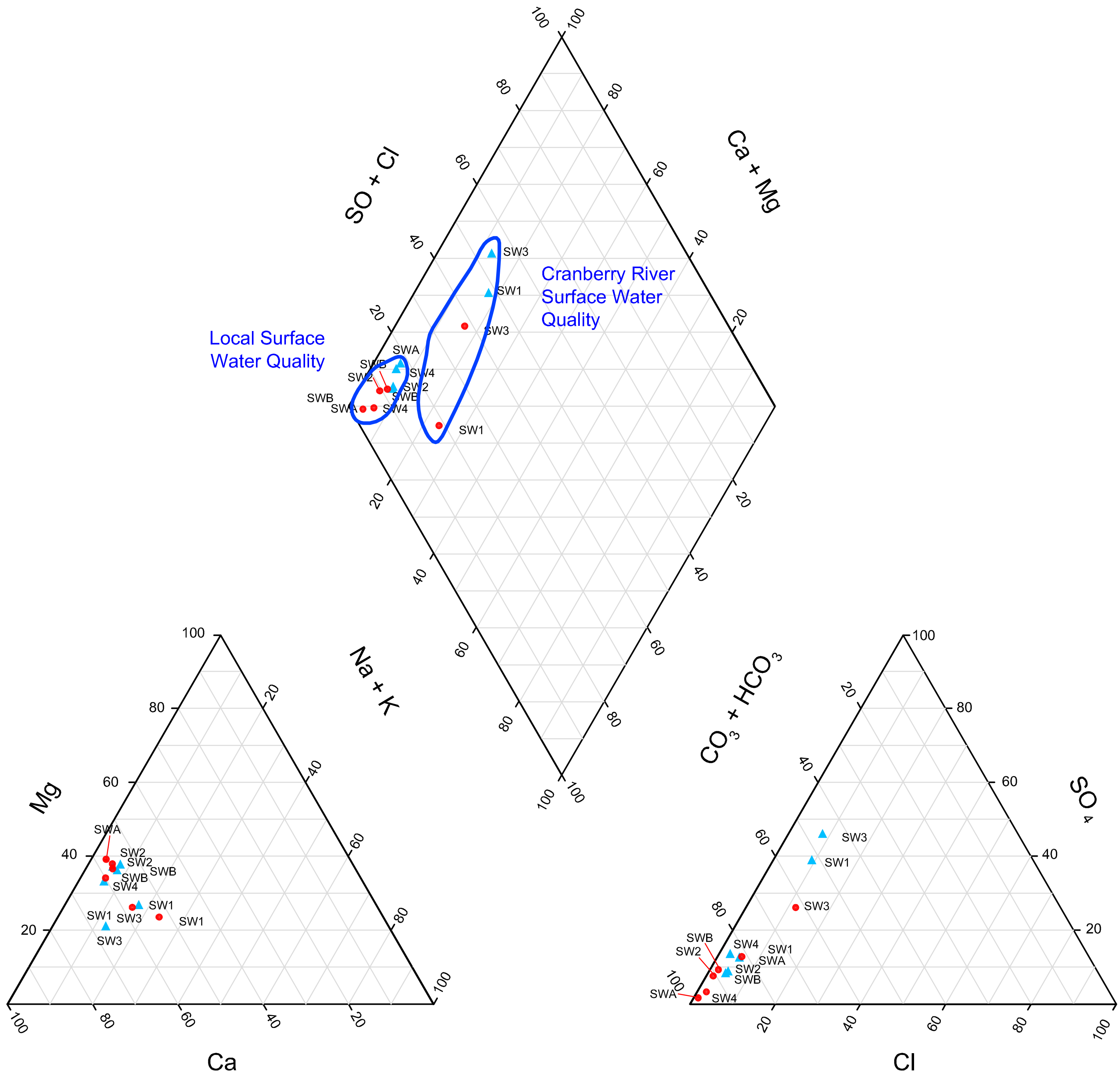
GENIVAR

FIGURE
18

NOTE: PHOTO DATE IS APRIL 19, 2007

NOTE: PHOTO DATE IS APRIL 19, 2007

SCALE: NOT TO SCALE	**STATION SW3**
REF. NO.: 0-92036505F19-PH	
DATE: APRIL 2011	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
PROJECT: 0-920365.05	FIGURE 19
GENIVAR	



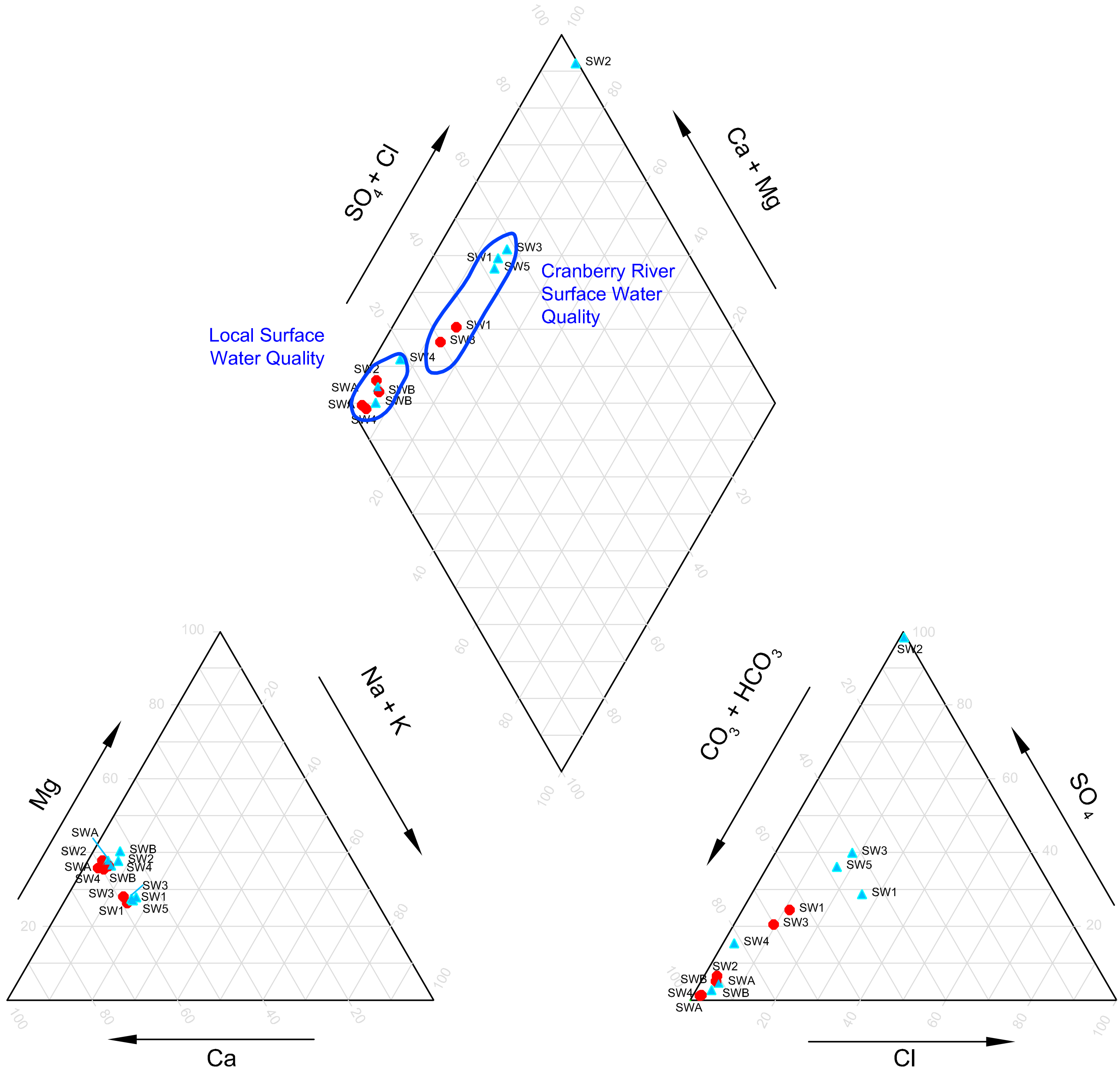
Legend

- SURFACE WATER STATION (MAY 2006)
- SURFACE WATER STATION (NOVEMBER 2006)

SURFACE WATER QUALITY PIPER PLOT (2006)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 920365.05	REF. NO.: 0-92036505F20-TD
GENIVAR	Figure 20



LEGEND

- SURFACE WATER STATION (MAY 2007)
- SURFACE WATER STATION (NOVEMBER 2007)

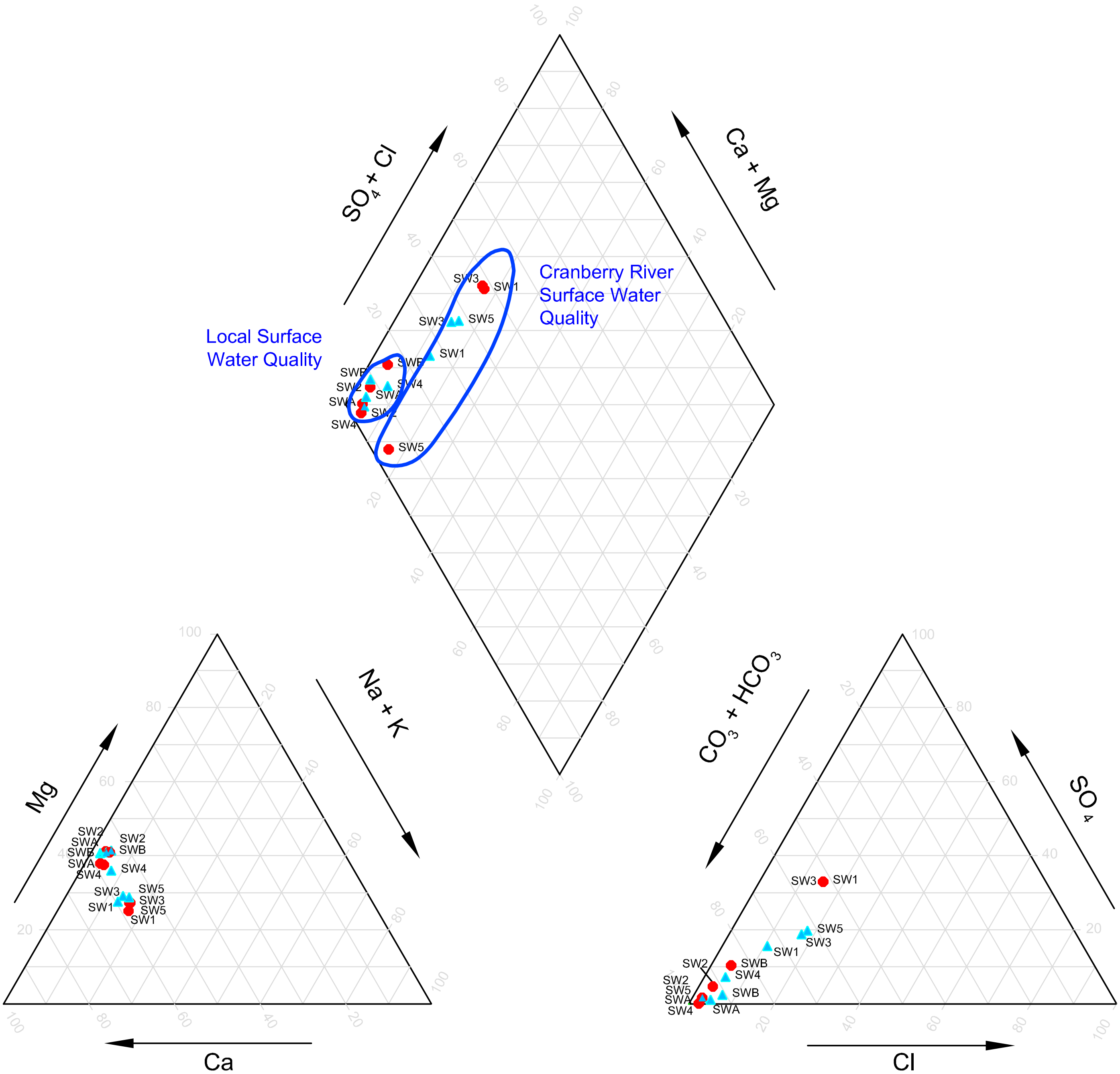
SURFACE WATER QUALITY PIPER PLOT (2007)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F21-TD- SW

GENIVAR

FIGURE 21



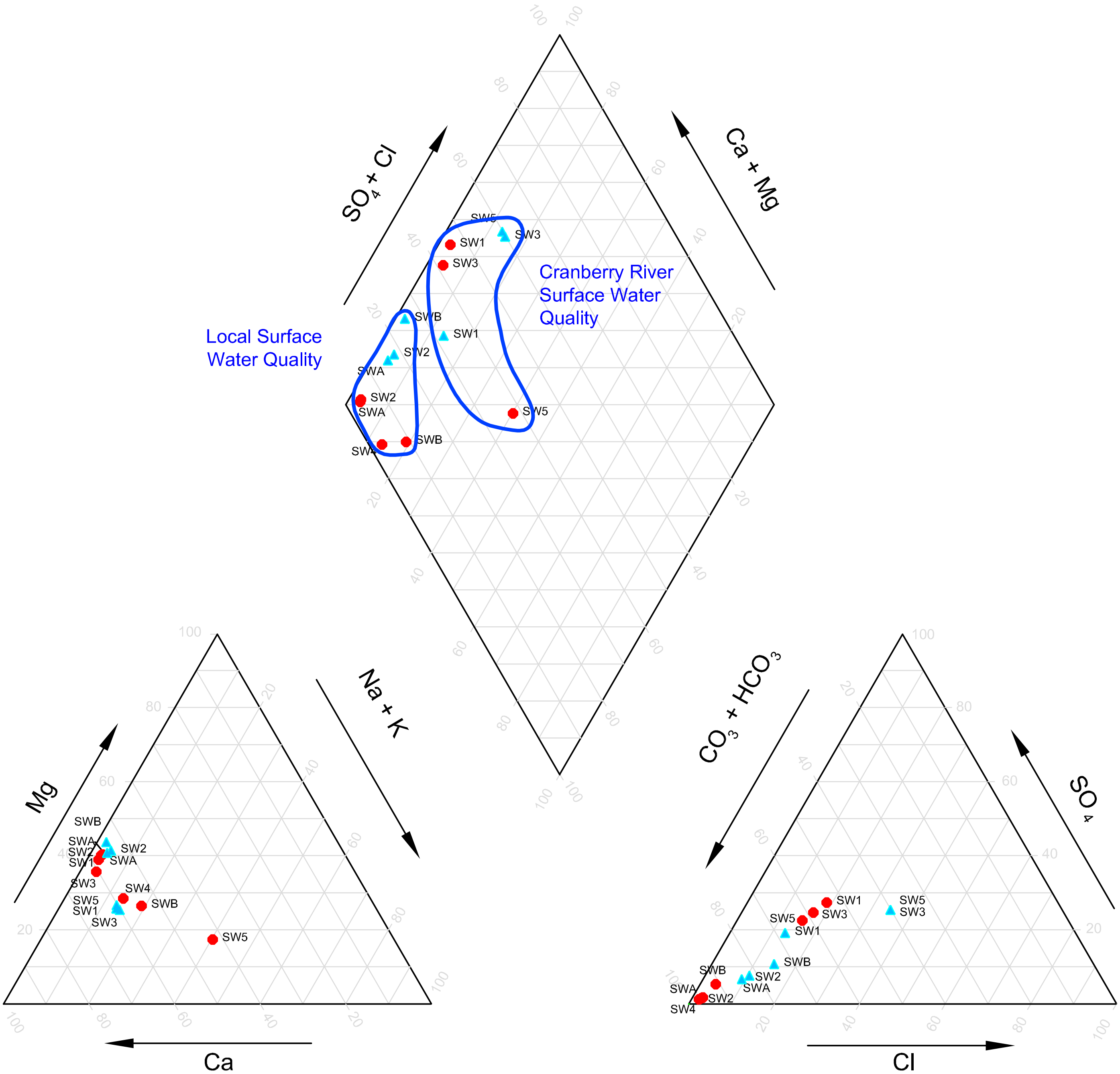
LEGEND

- SURFACE WATER STATION (MAY 2008)
- SURFACE WATER STATION (SEPTEMBER 2008)

SURFACE WATER QUALITY PIPER PLOT (2008)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F22- TD SW
GENIVAR	FIGURE 22



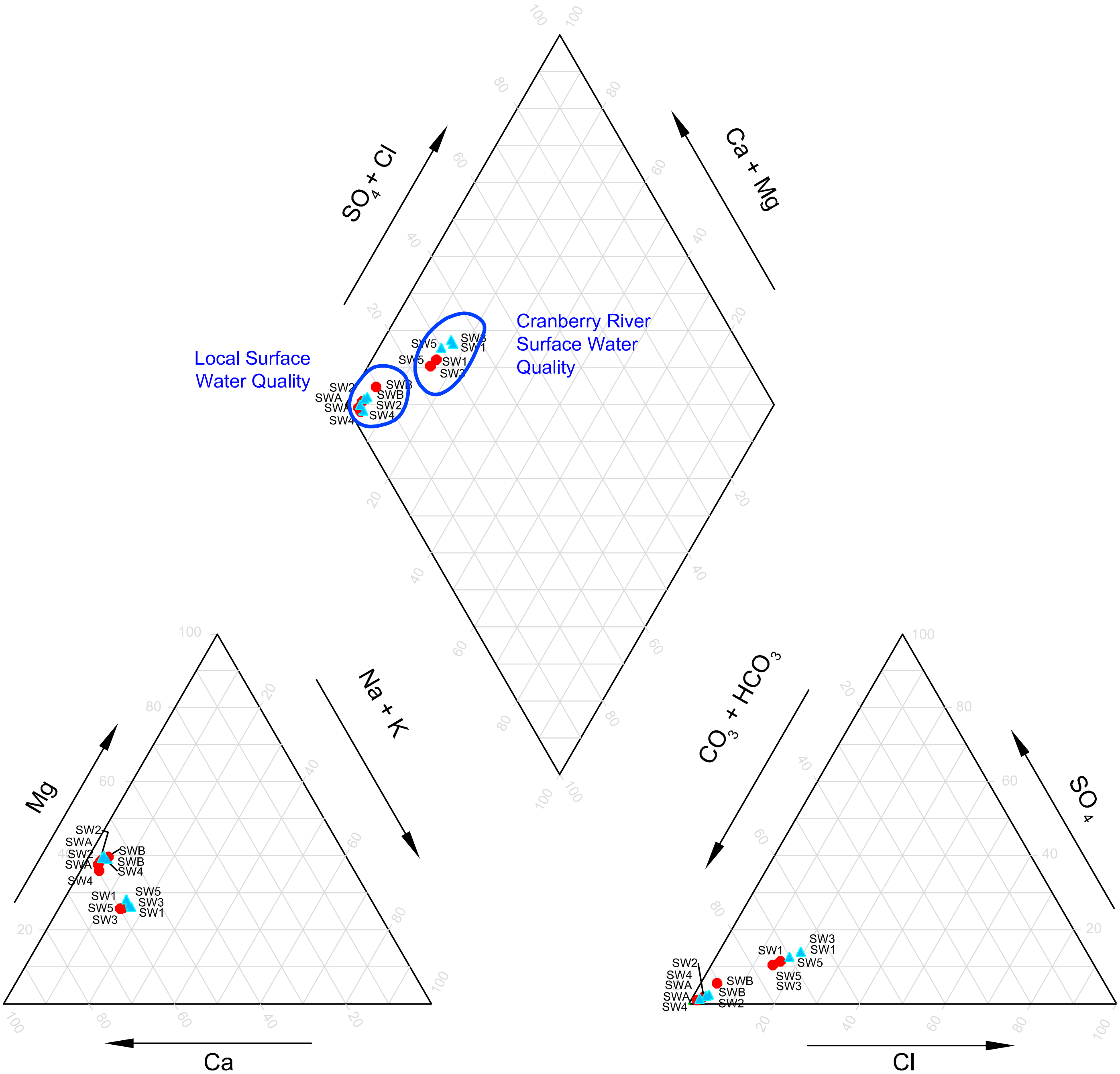
LEGEND

- SURFACE WATER STATION (MAY 2009)
- SURFACE WATER STATION (SEPTEMBER 2009)

SURFACE WATER QUALITY PIPER PLOT (2009)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F23- TD SW
GENIVAR	FIGURE 23



LEGEND

- SURFACE WATER STATION (MAY 2010)
- SURFACE WATER STATION (SEPTEMBER 2010)

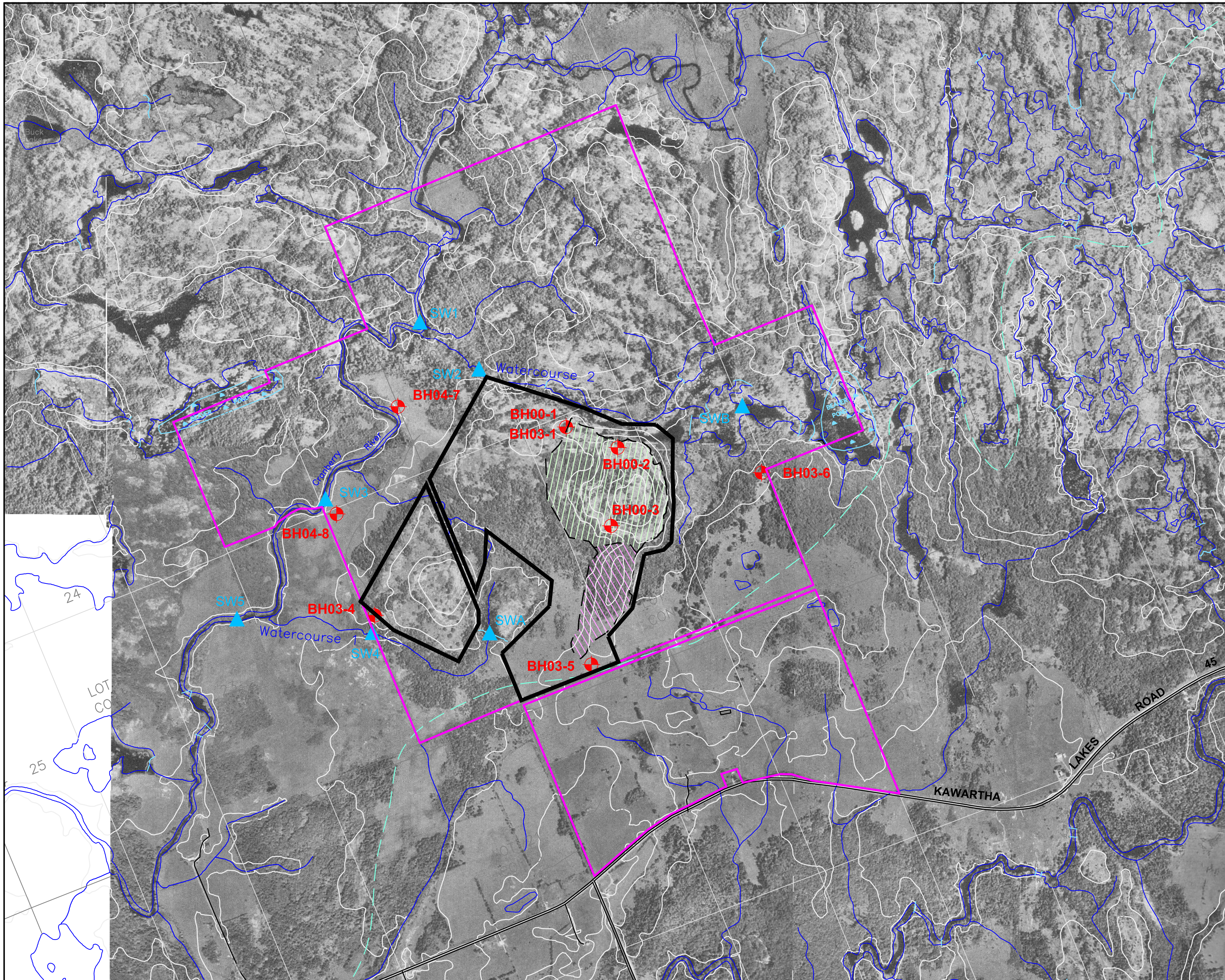
SURFACE WATER QUALITY PIPER PLOT (2010)

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: AS SHOWN
PROJECT: 0-920365.05	REF. NO.: 0-92036505F24- TD SW

GENIVAR

FIGURE 24



LEGEND

- PROPERTY BOUNDARY
- ESTIMATED WATERSHED BOUNDARY
- BH03-5 — BOREHOLE AND/OR MONITORING WELL LOCATION AND DESIGNATION
- SW2 — SURFACE WATER MONITORING STATION AND DESIGNATION
- BOUNDARY OF AREA TO BE LICENSED
  - PHASE 1
  - PHASE 2

150 0 300 metres

NOTES:
1. AIR PHOTOGRAPHY SOURCE: a)87-443-, 09-142 TO 144, b) 87-4431, 07-122 TO 128.
2. BASE MAPPING FROM OBM 1:10000 SHEETS 101764504950, 101764504955, 101765004950 AND 101765004955, NAD 27 DATUM.
3. CONTOUR INTERVAL IS 5 m.

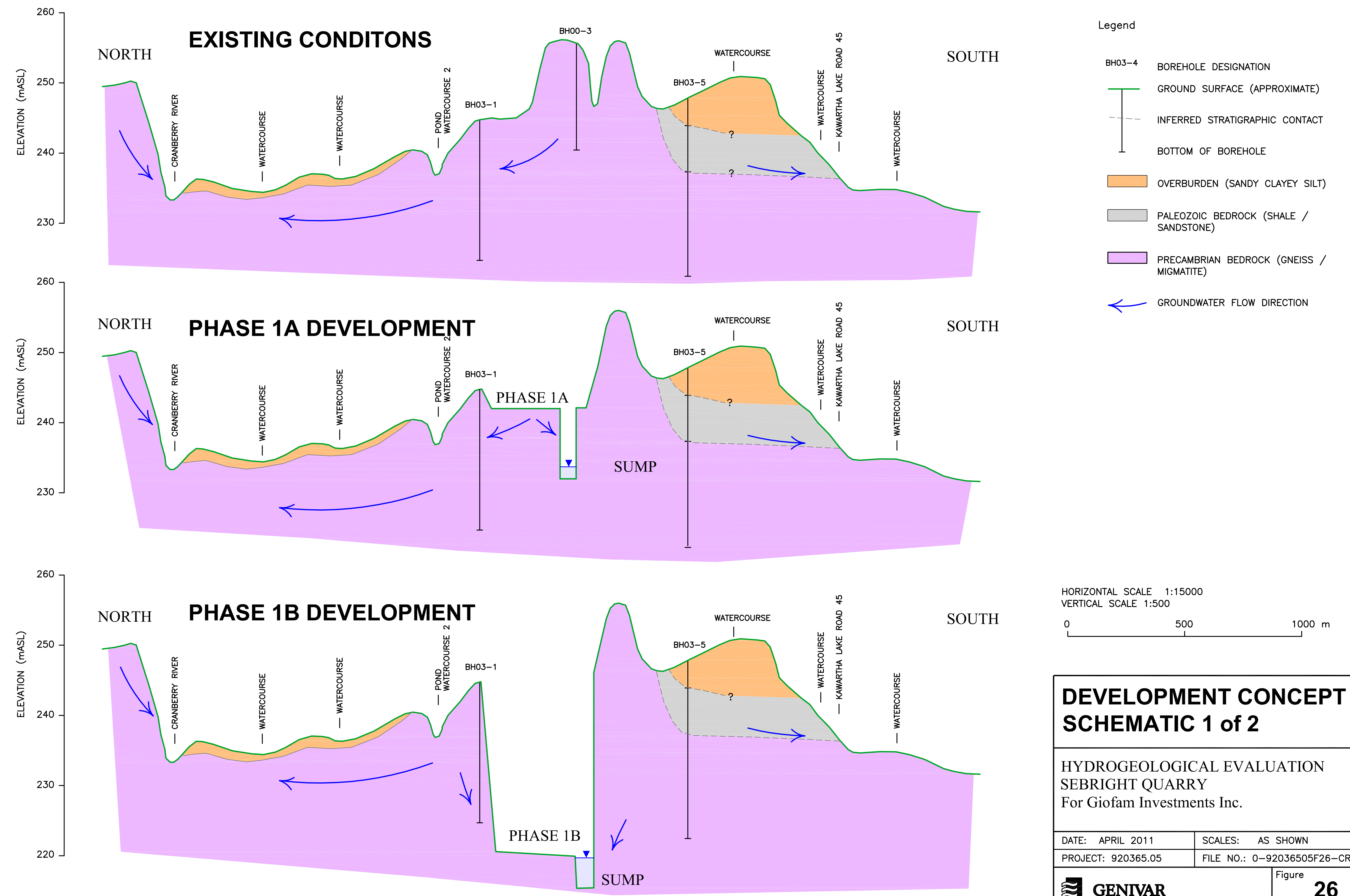
PROPERTY DEVELOPMENT CONCEPT

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:15000
PROJECT: 0-920365.05	FILE NO.: 0-92036505F25-SP

GENIVAR

FIGURE 25



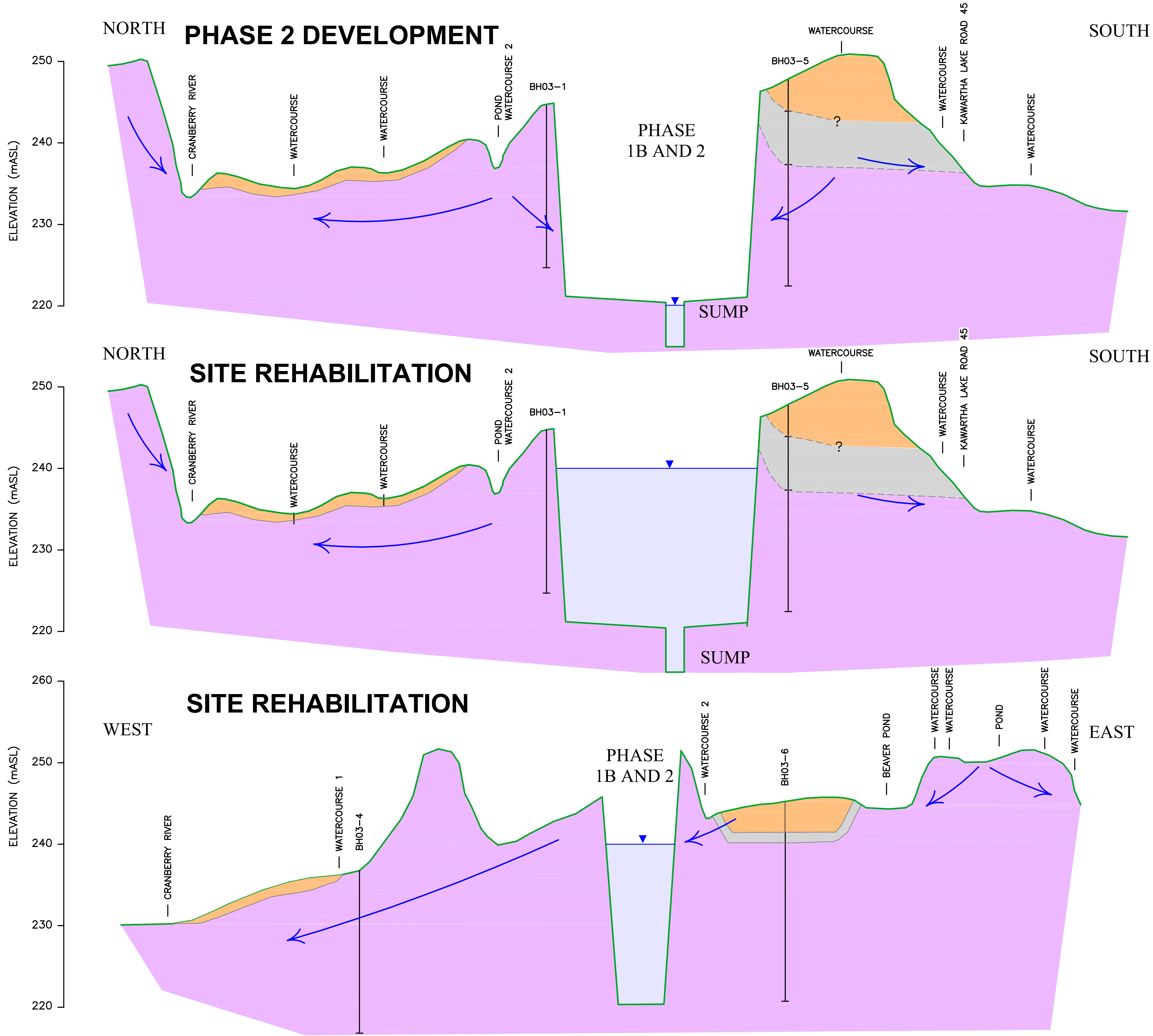
DEVELOPMENT CONCEPT SCHEMATIC 1 of 2

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505F26-CR

GENIVAR

Figure 26



Legend

BH03-4 BOREHOLE DESIGNATION

GROUND SURFACE (APPROXIMATE)

INFERRED STRATIGRAPHIC CONTACT

BOTTOM OF BOREHOLE

OVERBURDEN (SANDY CLAYEY SILT)

PALEOZOIC BEDROCK (SHALE / SANDSTONE)

PRECAMBRIAN BEDROCK (GNEISS / MIGMATITE)

GROUNDWATER FLOW DIRECTION

NOTE:
PHASE 4 DEVELOPMENT NOT APPARENT IN NORTH-SOUTH CROSS-SECTION. SEE FIGURE 22.

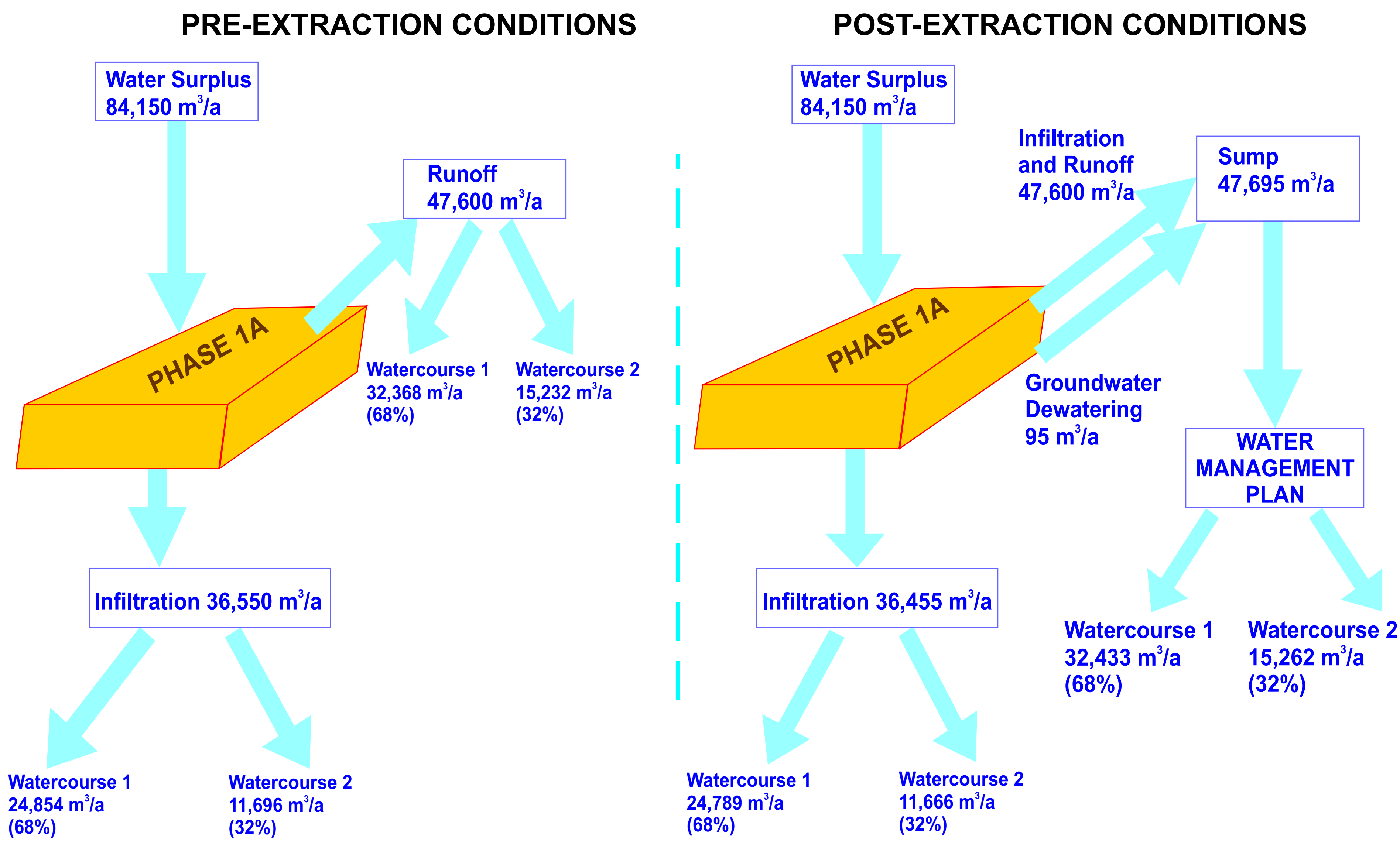
HORIZONTAL SCALE 1:15000
VERTICAL SCALE 1:500

0 500 1000 m

DEVELOPMENT CONCEPT SCHEMATIC 2 of 2

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505F27-CR
GENIVAR	Figure 27



NOTE: ASSUMES INFILTRATION TO INFREQUENT DEEP BEDROCK FRACTURES IS NEGLIGIBLE.

SCALE: NO TO SCALE

REF. NO.: 0-92036505F28-SCH

DATE: APRIL 2011

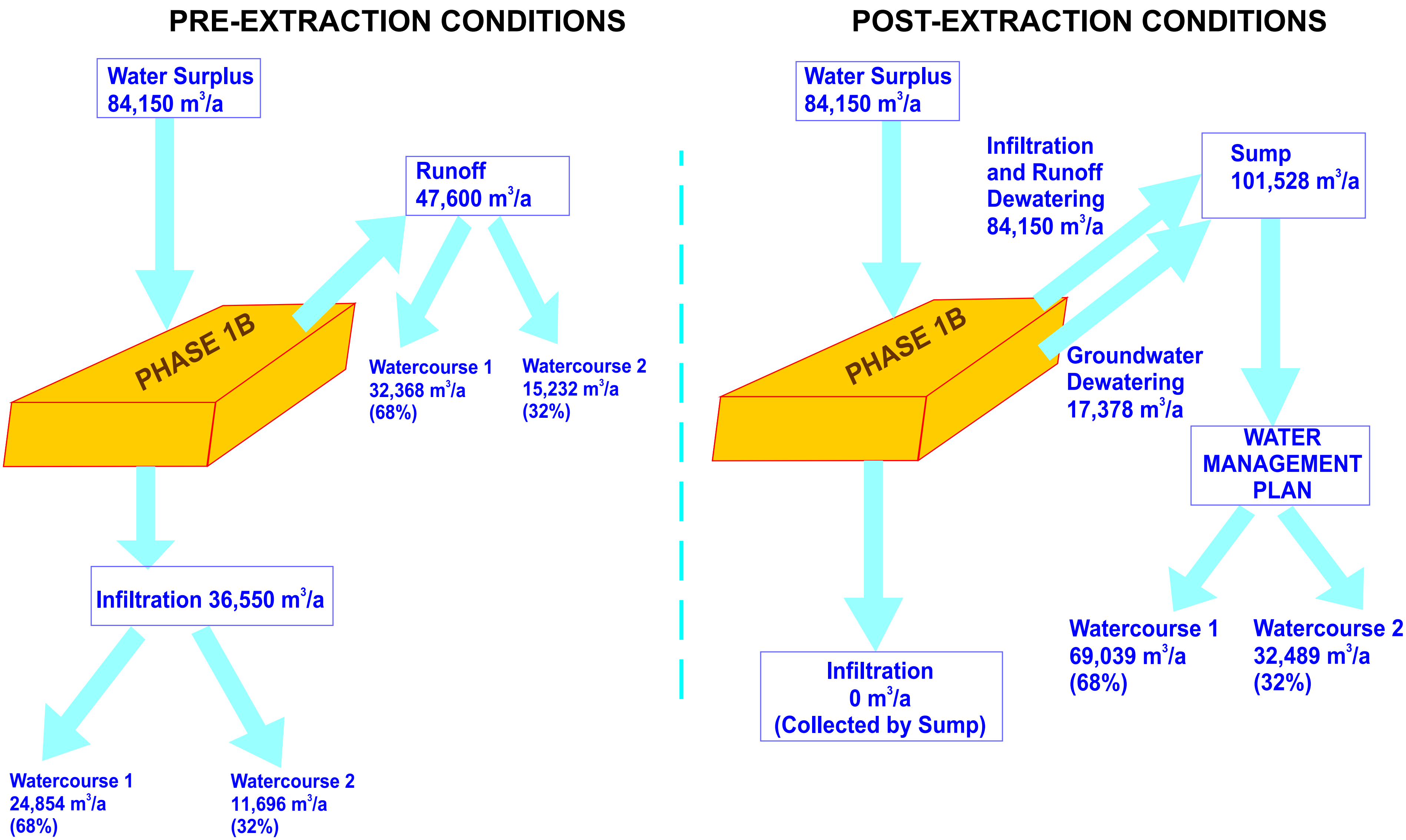
PROJECT: 920365.05

GENIVAR

PHASE 1A WATER BALANCE

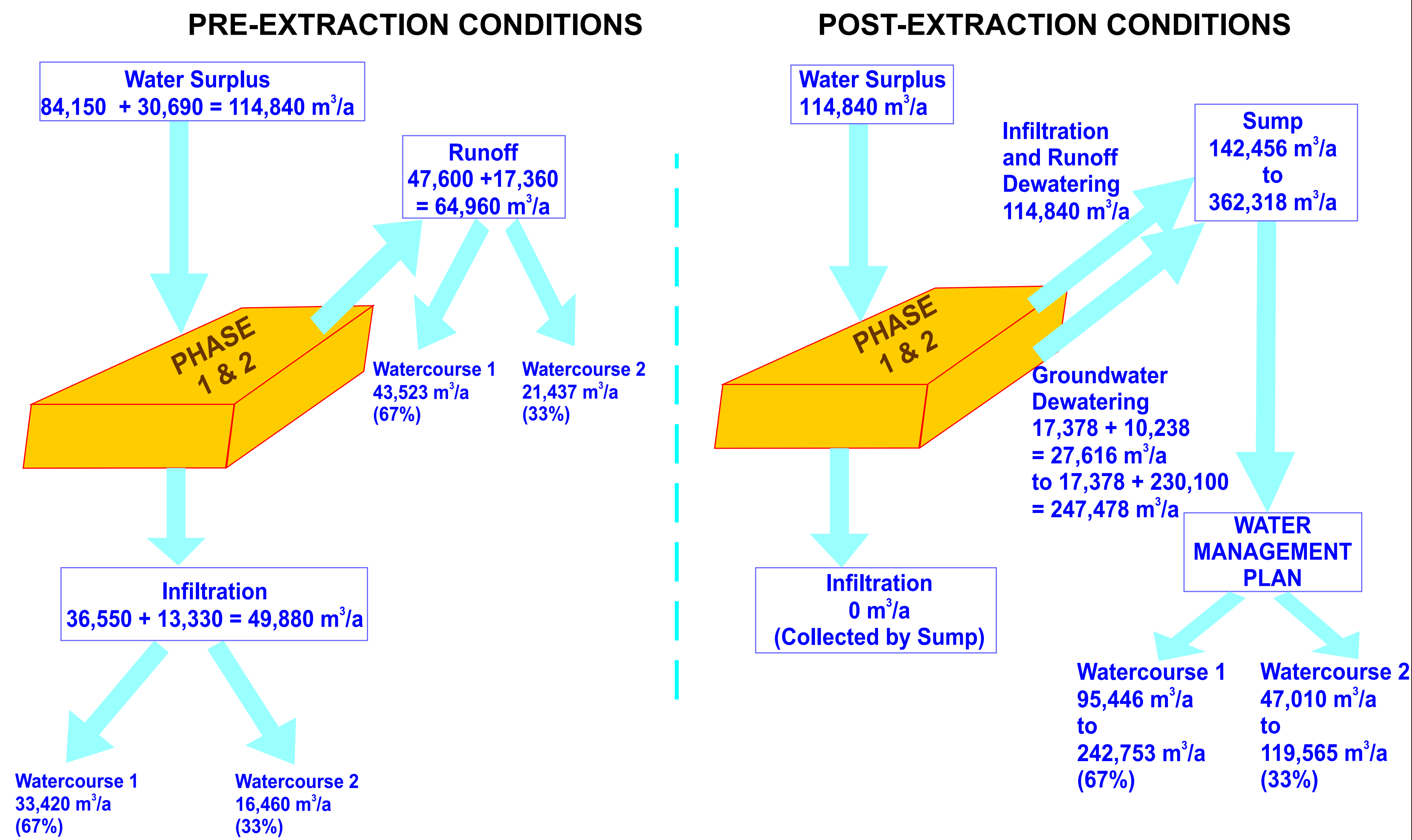
HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

FIGURE 28



NOTE: ASSUMES INFILTRATION TO INFREQUENT DEEP BEDROCK FRACTURES IS NEGLIGIBLE.

SCALE: NO TO SCALE	**PHASE 1B WATER BALANCE**
REF. NO.: 0-92036505F29-SCH	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
DATE: APRIL 2011	FIGURE 29
PROJECT: 920365.05	
GENIVAR	



NOTE: ASSUMES INFILTRATION TO INFREQUENT DEEP BEDROCK FRACTURES IS NEGLIGIBLE.

SCALE: NO TO SCALE	**PHASE 1 AND 2 WATER BALANCE**
REF. NO.: 0-92036505F30-SCH	HYDROGEOLOGICAL EVALUATION SEBRIGHT QUARRY For Giofam Investments Inc.
DATE: APRIL 2011	FIGURE **30**
PROJECT: 920365.05	
GENIVAR	

Appendices

Appendix A

Geologic Details

- Borehole Log Explanation Form
- Borehole Logs
- Regional Cross-Sections – Figures A-1 to A-2
- Local Cross-Sections – Figures A-3 to A-4
- Pressure Packer Testing Summary – Table A-1
- MOE Water Well Records – Table A-2
- Residential Well Survey Summary – Table A-3

BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

Soil Classification*		Terminology	Proportion
Clay	<0.002 mm		
Silt	0.002 to 0.06 mm	"trace" (e.g. trace sand)	<10%
Sand	0.06 to 2 mm	"some" (e.g. some sand)	10% - 20%
Gravel	2 to 60 mm	adjective (e.g. sandy)	20% - 35%
Cobbles	60 to 200 mm	"and" (e.g. and sand)	35% - 50%
Boulders	>200 mm	noun (e.g. sand)	>50%

* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

COHESIONLESS SOIL		COHESIVE SOIL	
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m
Very Loose	0 to 4	Very Soft	0 to 2
Loose	4 to 10	Soft	2 to 4
Compact	10 to 30	Firm	4 to 8
Dense	30 to 50	Stiff	8 to 15
Very Dense	Over 50	Very Stiff	15 to 30
		Hard	Over 30

The moisture conditions of cohesionless and cohesive soils are defined as follows.

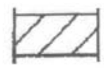
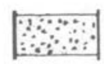
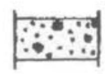
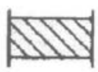
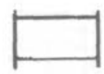
COHESIONLESS SOILS	COHESIVE SOILS		
Dry	DTPL	-	Drier Than Plastic Limit
Moist	APL	-	About Plastic Limit
Wet	WTPL	-	Wetter Than Plastic Limit
Saturated	MWTPL	-	Much Wetter Than Plastic Limit

STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.

	Standpipe and Designation		Cement Seal
	Piezometer and Designation		Granular Pack
	Gas Monitor and Designation		Granular Backfill
	Borehole Seal (Peltonite, Bentonite or Hole Plug)		Native Soil Backfill/Cave

Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS =	Split Spoon	GS =	Grab Sample
ST =	Thin Walled Shelby Tube	CS =	Channel Sample
AS =	Auger Flight Sample	WS =	Wash Sample
CC =	Continuous Core	RC =	Rock Core

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60º steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as $\frac{xBlows}{mm}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W_P - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W_L - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

REMARKS

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

BOREHOLE NO. BH00-1

PROJECT NAME: SEBRIGHT QUARRY **PROJECT NO.:** 920365.01

CLIENT: GIOFAM INVESTMENTS INC. **DATE:** NOVEMBER 2, 2000

BOREHOLE TYPE: HQ DIAMOND DRILL HOLE **GEOLOGIST:** JSA

GROUND ELEVATION: 244.61 m ASL **REVIEWER:** AJC

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE: TYPE	SAMPLE: 'N' VALUE	SAMPLE: % WATER	SAMPLE: % RECOVERY	SAMPLE: RQD (%)	CONE PENETRATION "N" VALUE 10 20 30 / SHEAR STRENGTH	WATER CONTENT % 10 20 30 / W_P W_L	REMARKS
0 – 10.6	GNEISS/MIGMATITE: MEDIUM GREY TO SALMON PINK, TONALITE TO GRANITIC GNEISS CONTAINING QUARTZ, FELDSPAR, AND MICA (± AMPHIBOLE) FINE TO MEDIUM-GRAINED WELL DEVELOPED FOLIATION AT VARIOUS ANGLES TO CORE AXIS, MEDIUM TO HARD WITH BLOCKY TO MASSIVE SUBHORIZONTAL FRACTURING, GENERALLY FRESH APPEARANCE, 10-20% PINK, COARSE TO VERY COARSE, SYENITIC VEINS UP TO 15 cm WIDE.			RC			100	96			CONTINUOUS CORE SAMPLE RECOVERY AND RQD CALCULATED FOR ENTIRE LENGTH OF CORE
10.6	BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 10.6 m.										

Depth scale (m): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

BOREHOLE NO. BH00-2

PROJECT NAME: SEBRIGHT QUARRY | PROJECT NO.: 920365.01

CLIENT: GIOFAM INVESTMENTS INC. | DATE: NOVEMBER 2, 2000

BOREHOLE TYPE: HQ DIAMOND DRILL HOLE | GEOLOGIST: JSA

GROUND ELEVATION: 256.33 m ASL | REVIEWER: AJC

DEPTH (m)		STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE 'N' VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE 10 20 30 / SHEAR STRENGTH	WATER CONTENT % 10 20 30 / W_P W_L	REMARKS
0–2–4–6–8–10		GNEISS/MIGMATITE: MEDIUM GREY TO SALMON PINK, TONALITE TO GRANITIC GNEISS CONTAINING QUARTZ, FELDSPAR, AMPHIBOLE AND MICA, FINE TO MEDIUM-GRAINED MASSIVE TO WELL FOLIATED, MEDIUM TO HARD WITH BLOCKY TO MASSIVE SUBHORIZONTAL FRACTURING, GENERALLY FRESH APPEARANCE, 20–30% PINK, COARSE TO VERY COARSE, SYENITE TO GRANITE VEINS UP TO 30 cm WIDE AND SEVERAL OF MASSIVE SYENITE ZONES UP TO 1.3 m WIDE. 3.5–4.5 PINK, VERY COARSE TO PEGMATITIC SYENITE 6.2–7.4 PINK, VERY COARSE TO PEGMATITIC SYENITE			RC			100	98			CONTINUOUS CORE SAMPLE RECOVERY AND RQD CALCULATED FOR ENTIRE LENGTH OF CORE
12–14–16–18–20	10.8	BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 10.8 m.										

BOREHOLE NO. BH00-3

PROJECT NAME: SEBRIGHT QUARRY

PROJECT NO.: 920365.01

CLIENT: GIOFAM INVESTMENTS INC.

DATE: NOVEMBER 2, 2000

BOREHOLE TYPE: HQ DIAMOND DRILL HOLE

GEOLOGIST: JSA

GROUND ELEVATION: 254.61 m ASL

REVIEWER: AJC

DEPTH (m)		STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	'N' VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE 10 20 30 / SHEAR STRENGTH	WATER CONTENT % 10 20 30 / W_P W_L	REMARKS
0		GNEISS/MIGMATITE: MEDIUM GREY TO SALMON PINK, GRANITIC GNEISS CONTAINING QUARTZ, FELDSPAR AND MICA, FINE TO MEDIUM-GRAINED, MASSIVE TO WELL FOLIATED, MEDIUM TO HARD WITH BLOCKY TO MASSIVE SUBHORIZONTAL FRACTURING, FRESH TO SLIGHTLY WEATHERED APPEARANCE, 10–20% PINK, COARSE TO VERY COARSE, SYENITE VEINS UP TO 15 cm WIDE AND SEVERAL ZONES OF MASSIVE GRANITE UP TO 2.0 m WIDE.			RC			99	95			CONTINUOUS CORE SAMPLE RECOVERY AND RQD CALCULATED FOR ENTIRE LENGTH OF CORE CORE SUBMITTED FOR OPSS AGGREGATE QUALITY TESTING
2												
4												
6												
8												
10												
12		12.0–14.0 MASSIVE GRANITE, 30–40% QUARTZ										
14	14.8											
16		BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 14.8 m.										
18												
20												

BOREHOLE NO. BH03-1

PROJECT NAME: SEBRIGHT QUARRY **PROJECT NO.:** 920365.03

CLIENT: GIOFAM INVESTMENTS INC. **DATE:** DEC. 15, 2003

BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL **SUPERVISOR:** CJR

GROUND ELEVATION: 244.58 m ASL **REVIEWER:** PAM / JTB

STRATIGRAPHIC DESCRIPTION (DEPTH 0 – 19.8 m)

GNEISS MIGMATITE:
HARD, FRESH SALMON PINK, BLACK, WHITE AND GREY, COARSE-GRAINED GNEISS WITH A PROMINENT FOLIATION OCCASIONALLY CROSSCUT BY PINK AND GREY QUARTZO-FELDSPATHIC COARSE-GRAINED, EQUIGRANULAR GRANITIC DIKELETS. THE FOLIATION RANGES FROM 45° to 90° TO THE CORE AXIS AND IS FREQUENTLY CROSSCUT BY IRREGULAR GRANITIC ROCK. OCCASIONALLY GRANITIC LAYERS (TYPICALLY 50 mm THICK) RUN PARALLEL TO THE FOLIATION.

- MODERATELY WEATHERED FROM 0 TO 0.3 m, SLIGHT ALTERATION OF POTASSIUM FELDSPAR FROM 0.3 m TO 1.5 m.
- GRANITIC LAYERS UP TO 6% BY VOLUME.

THREE JOINT SETS CROSSCUT THE FOLIATION AND ARE AS FOLLOWS: J1 AT 90° TO CORE AXIS, J2 AT 45° TO CORE AXIS AND J3 AT 70° TO CORE AXIS.

- J1 0.8 m, 0.9 m, 0.94 m (CLEAN AND FRESH)
- J1 7.4 m (CLEAN AND FRESH)
- J2 8.4 m (OLIVE GREEN CHLORITE, SMOOTH)

- J3 13.9 m, (DARK BROWN STAIN)

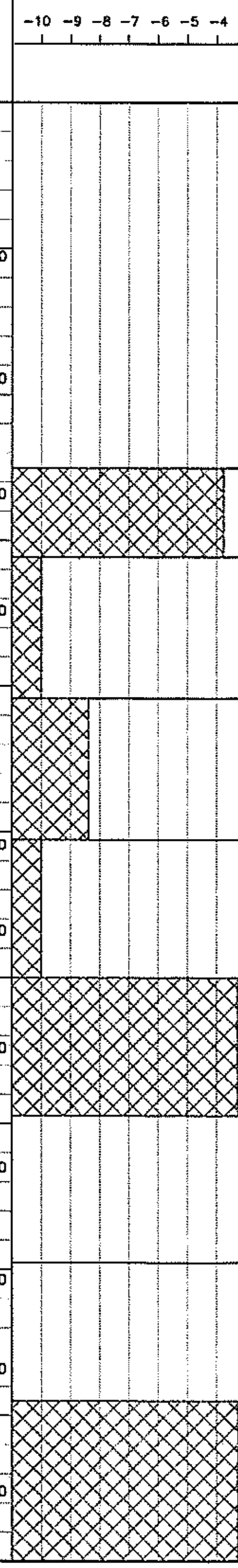
- J3 18.7 m, 18.8 m (LIGHT RUSTY STAIN)
- J3 19.0 m (CLEAN)

19.8 — BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 19.8 m.

SAMPLE

TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)
		1		
		1		
RC		2/1	96	73
		0		
		0		
RC		0	100	100
		0		
		0/0		
		0		
RC		0	100	100
		0		
		0/0		
		0		
RC		0/0	100	100
		0		
		0		
		0/0		
RC		0	100	100
		0/1		
		0		
		0		
RC		1	98	98
		0/0		
		0		
		0		
RC		0	100	100
		0/0		
		0		
RC		0/0	100	100
		0		
		0		
		0		
RC		1/0	96	100
		0		
		0		
		1		
RC		0/0	96	100
		0		
		0/0		
		0		
RC		0	96	100
		0/0		
		0		
RC		0/0	96	100
		0		
		0		
		0		
RC		2/1	100	100
		0		
		0		

HYDRAULIC CONDUCTIVITY (LOG) (m / s)



REMARKS

MONITORING WELLS IN SAME BOREHOLE.

MINERAL COMPOSITION (APPROX.)

QUARTZ	30 %
FELDSPAR	40 %
BIOTITE	15 %
AMPHIBOLE	15 %

BOREHOLE NO. BH03-4

PROJECT NAME: SEBRIGHT QUARRY — **PROJECT NO.:** 920365.03

CLIENT: GIOFAM INVESTMENTS INC. — **DATE:** DEC. 11-12, 2003

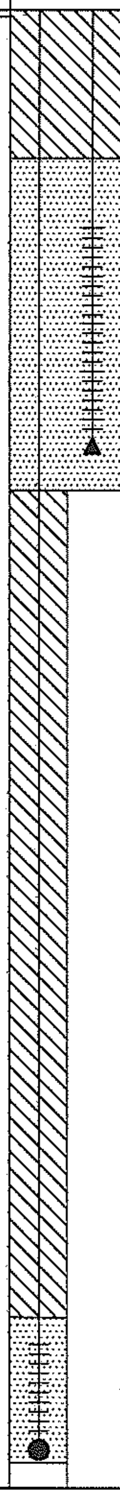
BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL — **SUPERVISOR:** CJR

GROUND ELEVATION: 236.55 m ASL — **REVIEWER:** PAM / JTB

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.1	TOPSOIL:
	GNEISS MIGMATITE: HARD, FRESH SALMON PINK, BLACK, WHITE AND GREY, COARSE-GRAINED GNEISS WITH A PROMINENT FOLIATION OCCASIONALLY CROSSCUT BY PINK AND GREY QUARTZO-FELDSPATHIC COARSE-GRAINED, EQUIGRANULAR GRANITIC DIKELETS. THE GNEISSOCITY RANGES FROM 40° to 90° TO THE CORE AXIS AND IS FREQUENTLY CROSSCUT BY IRREGULAR GRANITIC ROCK. OCCASIONALLY GRANITIC LAYERS (TYPICALLY 10 mm THICK) RUN PARALLEL TO THE FOLIATION.
	– MODERATELY WEATHERED FROM 0.1 m TO 0.2 m. – GRANITIC LAYERS UP TO 20% BY VOLUME.
	THREE JOINT SETS CROSSCUT THE FOLIATION AND ARE AS FOLLOWS: J1 AT 90° TO CORE AXIS, J2 AT 60° TO CORE AXIS AND J3 AT 15° TO CORE AXIS.
	– J3 1.6 m TO 2.6 m (REHEALED) – J3 3.0 m TO 3.7 m (REHEALED) – J1 3.8 m (DARK RUSTY BROWN STAIN) – J1 4.4 m (CLEAN) – J2 4.47 m (CLEAN, WITHIN A FRACTURE ZONE) – J3 4.9 m TO 5.1 m (REHEALED) – 5.5 m TO 5.7 m (RUSTY STAIN, SMOOTH) – J3 6.6 m TO 7.1 m (REHEALED) – J1 6.7 m (WHITE CaCO3 STAINING) – J1 7.21 m (WHITE CaCO3 STAINING)
	– J1 15.0 m (CLEAN)
20.0	BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 20.0 m.

STRATIGRAPHY

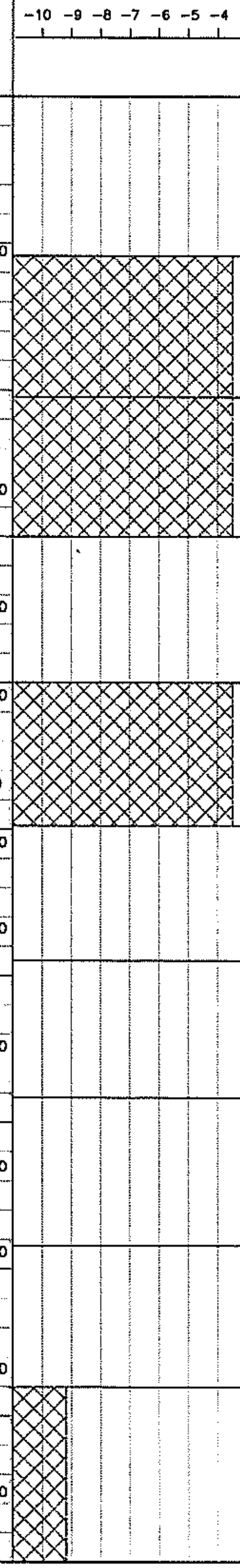
MONITOR DETAILS (I, II)



SAMPLE

TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)
		3		
RC		3	92	53
		1/1		
		0		
		0		
RC		0	100	100
		0		
		0/0		
		0		
RC		0	100	88
		1		
		0/2		
		0		
RC		0/0	100	100
		1		
		0		
		0/1		
RC		0	100	100
		1/0		
		0		
RC		0	100	100
		0		
		0/0		
RC		0	100	100
		0		
RC		0	100	100
		0/0		
		0		
RC		0/0	100	100
		0		
		0		
		0		
RC		0/0	100	100
		0		
		0		
		0		
RC		0/0	100	100
		0		
		2/0		
RC		0	100	100
		0		
		0/0		
		0		
RC		0/0	100	100
		0		
		0		
		0		
RC		0/0	100	100
		0		
		0		

HYDRAULIC CONDUCTIVITY (LOG) (m / s)



REMARKS

MINERAL COMPOSITION (APPROX.)

QUARTZ	30 %
FELDSPAR	40 %
BIOTITE	15 %
AMPHIBOLE	15 %

MONITORING WELLS IN SAME BOREHOLE

BOREHOLE NO. BH03-5

PROJECT NAME: SEBRIGHT QUARRY **PROJECT NO.:** 920365.03
CLIENT: GIOFAM INVESTMENTS INC. **DATE:** DEC. 9-10, 2003
BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL **SUPERVISOR:** CJR
GROUND ELEVATION: 247.61 m ASL **REVIEWER:** PAM / JTB

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	REMARKS
0.3	TOPSOIL:	
3.8	SANDY CLAYEY SILT: BROWN SANDY CLAYEY SILT, TRACE GRAVEL, WET.	MONITORING WELLS IN SAME BOREHOLE.
10.0	SHALE/SANDSTONE: DARK REDDISH BROWN TO BLUISH GREEN SHALE ALTERNATING SHALE AND SANDSTONE. FISSILE LAYERS AT 5.3 m TO 5.6 m, 6.2 m TO 6.3 m AND 6.5 m TO 6.6 m. MODERATELY WEATHERED FROM 3.8 m TO 7.2 m. THERE ARE TWO JOINT SETS, J1 AT 40° TO CORE AXIS, AND J2 AT 70° TO CORE AXIS. – PARTING AT 90° TO CORE AXIS – 4.0 m (RUSTY YELLOW STAIN) – J1 4.1 m (RUSTY YELLOW STAIN) – J2 4.2 m (CaCO3 VEIN, 2 mm) – J1 4.7 m TO 4.8 m (CaCO3 VEIN, 8 mm) – J2 4.9 m (CaCO3 VEIN, 2 mm) – J2 5.3 m (RUSTY YELLOW STAIN) – J1 6.2 m (RUSTY YELLOW STAIN)	
17.3	GRANITE: HARD, SALMON PINK AND GREY COARSE-GRAINED GRANITE. ALTERATION OF MAFIC MINERALS TO DARK BROWN AND INCREASED FRACTURE FREQUENCY FROM 10.0 m TO 10.5 m. MINOR ALTERATION OF MAFIC MINERALS FROM 10.5 m TO 11.5 m. THE 3 JOINT SETS ARE: J1 90° TO CORE AXIS, J2 AT 50° TO CORE AXIS AND J3 10° TO CORE AXIS. –J1 6 JOINTS FROM 10.2 m TO 10.7 m (CLEAN). – J2 10.8 m (CLEAN) – J3 11.2 m TO 11.5 m (REHEALED) – J1 3 JOINTS FROM 11.5 m TO 12.0 m (1 WITH A 5 mm CaCO3 VEIN). – J2 12.5 m (CLEAN) – J3 13.3 m TO 13.9 m (REHEALED) – J3 15.0 m TO 15.3 m (CLEAN)	MINERAL COMPOSITION (APPROX.) QUARTZ 30 % FELDSPAR 56 % BIOTITE 8 % AMPHIBOLE 6 %
	GNEISS/MIGMATITE: HARD, BLACK AND WHITE COARSE-GRAINED GNEISS/MIGMATITE SOMETIMES WITH A WEAK FOLIATION OFTEN CROSSCUT BY IRREGULAR WHITE QUARTZO-FELDSPATHIC SECTIONS. OCCASIONAL QUARTZO-FELDSPATHIC DIKELETS TYPICALLY 27 mm THICK, LESS THAN 1% BY VOLUME.	MINERAL COMPOSITION (APPROX.) QUARTZ 45 % FELDSPAR 10 % BIOTITE 35 % AMPHIBOLE 10 %

SAMPLE

TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)
		2		
RC		1	83	38
		5/1		
		5		
RC		1/0	100	52
		3		
		4		
		1/2		
RC		0	100	65
		0/0		
		0		
RC		1	99	100
		0		
		0/0		
RC		0	100	72
		3		
RC		2	100	79
		2/1		
		3		
RC		0/2		
		0		
		1		
		0		
RC		1/1	99	100
		1		
		0		
RC		0	99	100
		0/1		
		1		
		0/1		
RC		0	100	92
		0		
		0/0		
RC		0		
		0/0		
RC		0	100	100
		0		
		0		
RC		0/0	100	100
		0		
		0		

STRATIGRAPHY | MONITOR DETAILS I II | HYDRAULIC CONDUCTIVITY (LOG) (m / s) −10 −9 −8 −7 −6 −5 −4

BOREHOLE NO. BH03-5

PROJECT NAME: SEBRIGHT QUARRY
PROJECT NO.: 920365.03
CLIENT: GIOFAM INVESTMENTS INC.
DATE: DEC. 9-10, 2003
BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL
SUPERVISOR: CJR
GROUND ELEVATION: 247.61 m ASL
REVIEWER: PAM / JTB

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS I II	SAMPLE: TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)	HYDRAULIC CONDUCTIVITY (LOG) (m / s) −10 −9 −8 −7 −6 −5 −4	REMARKS
20	GNEISS/MIGMATITE: HARD, BLACK AND WHITE COARSE–GRAINED ROCK SOMETIMES WITH A WEAK FOLIATION OFTEN CROSSCUT BY IRREGULAR WHITE QUARTZO–FELDSPATHIC SECTIONS. OCCASIONAL QUARTZO–FELDSPATHIC DIKELETS TYPICALLY 27 mm THICK, LESS THAN 1% BY VOLUME. – J1 3 JOINTS AT 21.4 m (CaCO3 COAT) – J1 4 JOINTS FROM 22.6 m TO 22.9 m (CLEAN)					0				
				RC		0/0	100	100		
						3				
						0/1				
22						0				
				RC		1	100	79		
						3				
						0/0				
						0				
24				RC		0	100	99		
24.4	BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 24.4 m.									
26										
28										
30										
32										
34										
36										
38										
40										

Revision 2/ Aug 2003

BOREHOLE NO. BH03-6

PROJECT NAME: SEBRIGHT QUARRY

PROJECT NO.: 920365.03

CLIENT: GIOFAM INVESTMENTS INC.

DATE: DEC. 8, 2003

BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL

SUPERVISOR: CJR

GROUND ELEVATION: 245.20 m ASL

REVIEWER: PAM / JTB

Stratigraphic Description

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0 – 0.3	TOPSOIL:
0.3 – 4.1	SANDY CLAYEY SILT: BROWN SANDY CLAYEY SILT, TRACE GRAVEL, WET TO SATURATED.
4.1 – 5.1	SANDSTONE: MEDIUM HARD MODERATELY WEATHERED, MOTTLED GREY WITH PINK SANDSTONE, COARSE. FOUR NOTABLE PARTINGS AT 90° TO THE CORE AXIS FROM 4.2 m TO 4.9 m (CLEAN).
5.1 – 13.7	GNEISS/MIGMATITE: MEDIUM HARD, MOSTLY BLACK WITH SOME WHITE, MEDIUM GRAINED GNEISS/MIGMATITE, SOMETIMES WITH A WEAK TO PROMINENT FOLIATION OCCASIONALLY CROSSCUT BY IRREGULAR WHITE QUARTZO-FELDSPATHIC SECTIONS. THE FOLIATION IS TYPICALLY 30° TO 50° TO CORE AXIS. ALTERATION OF MAFICS TO OLIVE GREEN AND DARK BROWN FROM 5.1 m TO 6.8 m. OCCASIONAL QUARTZO-FELDSPATHIC DIKELETS TYPICALLY 25 mm TO 120 mm THICK, LESS THAN 2% BY VOLUME. THERE IS ONE JOINT SET AT 60° TO THE CORE AXIS. – J1 AT 6.7 m (DARK BROWN STAIN) – J1 AT 9.1 m (CLEAN)
13.7 –	GNEISS/MIGMATITE: HARD, FRESH, SALMON PINK, BLACK, WHITE AND GREY, COARSE-GRAINED GNEISS WITH A PROMINENT FOLIATION OCCASIONALLY CROSSCUT BY PINK AND GREY QUARTZO-FELDSPATHIC COARSE-GRAINED, EQUIGRANULAR GRANITIC DIKELETS. THE GNEISSIC BANDING IS TYPICALLY 40° TO THE CORE AXIS AND IS FREQUENTLY CROSSCUT BY IRREGULAR GRANITIC ROCK. – GRANITIC LAYERS UP TO 20% BY VOLUME. THERE IS ONE JOINT SET AT 80° TO 90° TO CORE AXIS AND MOST HAVE THIN COATINGS OF GYPSUM OR A LIGHT RUSTY BROWN STAIN. – J1 14.1 m – J1 16.2 m, 16.8 m, 17.1 m – J1 17.9 m, 18.3 m, 18.6 m, 18.7 m – J1 19.3 m, 19.4 m, 19.9 m, 20.3 m

Sample

TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)
RC		2	19	20
		1/2		
		1		
RC		2/1	28	26
		0		
		1		
		0/0		
RC		0	100	100
		0/0		
		0		
		0		
RC		0	100	100
		1/0		
		0		
RC		0	100	100
		0		
		0/0		
		0		
RC		0/0	100	100
		1		
		0		
		0		
RC		0/0	100	100
		0		
		1		
		0		
RC		0/0	100	100
		0		
		0/0		
		1		
RC		0	100	100
		1/2		
		0		
RC		1/1	100	100
		2		
		1		
		0		
		1/0		
RC		1	100	100
		1		

HYDRAULIC CONDUCTIVITY (LOG) (m / s): −10 −9 −8 −7 −6 −5 −4

MONITOR DETAILS: I II

Remarks

MONITORING WELLS IN SAME BOREHOLE.

MINERAL COMPOSITION (APPROX.) (5.1 m – 13.7 m)

Mineral	%
QUARTZ	20 %
FELDSPAR	20 %
BIOTITE	30 %
AMPHIBOLE	30 %

MINERAL COMPOSITION (APPROX.) (from 13.7 m)

Mineral	%
QUARTZ	30 %
FELDSPAR	40 %
BIOTITE	10 %
AMPHIBOLE	20 %

BOREHOLE NO. BH03-6

PROJECT NAME: SEBRIGHT QUARRY

PROJECT NO.: 920365.03

CLIENT: GIOFAM INVESTMENTS INC.

DATE: DEC. 8, 2003

BOREHOLE TYPE: HQ (64 mm) DIAMOND DRILL

SUPERVISOR: CJR

GROUND ELEVATION: 245.20 m ASL

REVIEWER: PAM / JTB

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS I II	SAMPLE TYPE	'N' VALUE	FRACTURE FREQUENCY (per 0.3 m)	% RECOVERY	RQD (%)	HYDRAULIC CONDUCTIVITY (LOG) (m/s) −10 −9 −8 −7 −6 −5 −4	REMARKS
20–24.5	GNEISS/MIGMATITE: HARD, FRESH, SALMON PINK, BLACK, WHITE AND GREY, COARSE–GRAINED GNEISS WITH A PROMINENT FOLIATION OCCASIONALLY CROSSCUT BY PINK AND GREY QUARTZO–FELDSPATHIC COARSE–GRAINED, EQUIGRANULAR GRANITIC DIKELETS. THE GNEISSIC BANDING IS TYPICALLY 40° TO THE CORE AXIS AND IS FREQUENTLY CROSSCUT BY IRREGULAR GRANITIC ROCK. – J1 22.0 m, 22.5 m – J1 24.2m					0				
				RC		0/0	100	100		
						0				
						0/1				
22						1				
				RC		0	100	100		
						0				
						0/0				
				RC		0	100	100		
24						1				
24.5	BOREHOLE TERMINATED IN GNEISS/MIGMATITE AT 24.5 m.									
26										
28										
30										
32										
34										
36										
38										
40										

BOREHOLE NO. BH04-7

PROJECT NAME: SEBRIGHT QUARRY **PROJECT NO.:** 920365.04

CLIENT: GIOFAM INVESTMENTS INC. **DATE:** SEPTEMBER 15-16, 2004

BOREHOLE TYPE: HOLLOW STEM AUGER (108 mm) & HQ (64 mm) ROCK CORE **SUPERVISOR:** PAM

GROUND ELEVATION: 228.81 m ASL **REVIEWER:** JTB

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	TYPE	'N' VALUE	% RECOVERY	RQD (%)
0.1	TOPSOIL: DARK BROWN SILT.	1SS	11	58	N/A
4.4	SILTY CLAY TO CLAYEY SILT: BROWN BECOMING GREY AT 2.9 m SILTY CLAY TO CLAYEY SILT, TRACE TO SOME DISEMINATED SAND, WTPL, FIRM TO SOFT.	2SS	5	44	N/A
		3SS	4	100	N/A
		4SS	3	100	N/A
		5SS	1	100	N/A
		6SS	<1	94	N/A
18.5	GNEISS/MIGMATITE: HARD, FRESH, BLACK, WHITE AND SALMON PINK, COARSE-GRAINED GNEISS, SOMETIMES MIGMATIZED, WITH RARE MAFIC RICH LAYERS AND OCCASIONALLY CROSS-CUT BY PEGMATITE DIKES. PROMINENT FOLIATION AT 40° TO 70° TO CORE AXIS. PINK AND GREY PEGMATITE COARSE GRAINED QUARTZO-FELDSPATHIC DIKLETS, 100 mm TO 1400 mm THICK, APPROXIMATELY 20% BY VOLUME.	1RC		100	100
		2RC		100	72
		3RC		100	100
		4RC		100	100
		5RC		100	81
		6RC		100	100
		7RC		100	95
		8RC		100	95
		9RC		100	95
	– FRACTURE ZONES 25 mm AT 18.1 m AND 18.2 m.	10RC		100	86
	BOREHOLE TERMINATED AT 18.5 m IN GNEISS/MIGMATITE.				

Column headings also include: STRATIGRAPHY; MONITOR DETAILS (I, II); HYDRAULIC CONDUCTIVITY (LOG) (m / s) −10 −9 −8 −7 −6 −5 −4; REMARKS. Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

REMARKS:

MONITORING WELLS IN SEPARATE BOREHOLES

MINERAL COMPOSITION (Approximate)

GNEISS/MIGMATITE

Mineral	%
QUARTZ	30%
FELDSPAR	30%
BIOTITE	10%
HORNBLENDE	30%

BOREHOLE NO. BH04-8

PROJECT NAME: SEBRIGHT QUARRY **PROJECT NO.:** 920365.04

CLIENT: GIOFAM INVESTMENTS INC. **DATE:** SEPTEMBER 13-14, 2004

BOREHOLE TYPE: HOLLOW STEM AUGER (108 mm) AND HQ (64 mm) ROCK CORE **SUPERVISOR:** PAM

GROUND ELEVATION: 231.27 m ASL **REVIEWER:** JTB

Stratigraphic Description

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0 – 0.2	TOPSOIL: DARK BROWN SILT, TRACE CLAY, LOOSE.
0.2 – 3.4	CLAYEY SILT TO SITLY CLAY: DARK BROWN TO LIGHT GREY MOTTLED CLAYEY SILT TO SILTY CLAY, SOME SAND AT 3.4 m, WTPL, STIFF.
3.4 – 17.3	GNEISS/MIGMATITE: HARD, FRESH, BLACK, WHITE AND SALMON PINK, COARSE-GRAINED GNEISS, MIGMATIZED, WITH RARE MAFIC RICH LAYERS AND OCCASIONALLY CROSS-CUT BY PEGMATITE DIKES. MAFIC LAYERS ARE FRESH, BLACK, COARSE GRAINED, FOLIATED, HORNBLENDE AND BIOTITE RICH, 180 mm TO 355 mm THICK AND UP TO 6% BY VOLUME. THE PINK AND GREY PEGMATITES ARE COARSE GRAINED QUARTZO-FELDSPATHIC DIKES, 200 mm TO 400 mm, APPROXIMATELY 15% BY VOLUME.
17.3	BOREHOLE TERMINATED AT 17.3 m IN GNEISS/MIGMATITE.

STRATIGRAPHY | MONITOR DETAILS I II

Sample

TYPE	'N' VALUE	% RECOVERY	RQD (%)
1SS	8	67	N/A
2SS	16	70	N/A
3SS	9	100	N/A
4SS	10	100	N/A
5SS	N/R	2	N/A
1RC		100	11
2RC		96	0
3RC		99	89
4RC		100	93
5RC		100	100
6RC		100	97
7RC		100	100
8RC		100	89
9RC		98	84
10RC		100	100
11RC		100	85

HYDRAULIC CONDUCTIVITY (LOG) (m / s)

−10 −9 −8 −7 −6 −5 −4

REMARKS

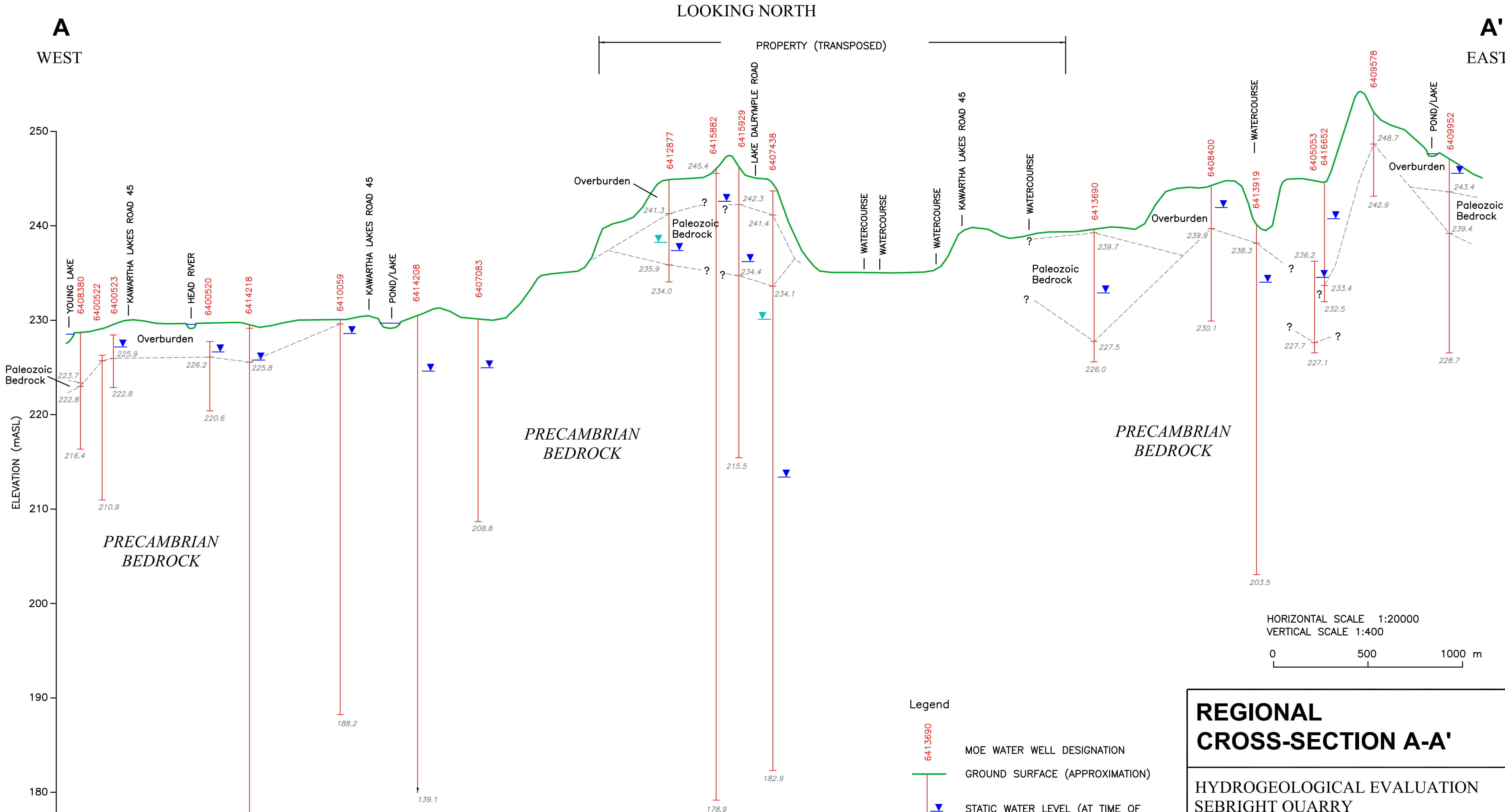
MONITORING WELLS IN SEPARATE BOREHOLES

MINERAL COMPOSITION (Approx)

GNEISS/MIGMATITE

QUARTZ	30%
FELDSPAR	30%
BIOTITE	10%
AMPHIBOLITE	30%

Depth scale (m): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20



Legend

- MOE WATER WELL DESIGNATION (6413690)
- GROUND SURFACE (APPROXIMATION)
- STATIC WATER LEVEL (AT TIME OF CONSTRUCTION)
- DEPTH TO WATER MAY 9, 2006
- STRATIGRAPHIC CONTACT (mASL) (227.5)
- BOTTOM OF WELL (mASL) (226.0)

NOTES:
1. MOE WELLS AND BOREHOLES ARE INTERPRETED AS REPRESENTATIVE OR REGIONAL CONDITIONS. NOT ALL WELLS ARE PRESENTED.
2. TOPOGRAPHY IS BASED ON OBM MAPPING AND MOE WELL RECORD COLLAR ELEVATIONS. ELEVATIONS ARE APPROXIMATED TO ACCOUNT FOR WELL INTERPRETATIONS, DRAINS, AND ROADS.
3. REFER TO FIGURE 6 FOR LOCATION DETAILS AND MOE RECORD LOCATIONS.
4. mASL INDICATES METRES ABOVE SEA LEVEL.
5. STRATIGRAPHY BETWEEN WELLS IS INFERRED BASED ON WELL INFORMATION. INFERRED STRATIGRAPHY IS PROVIDED FOR PRESENTATION PURPOSES ONLY.

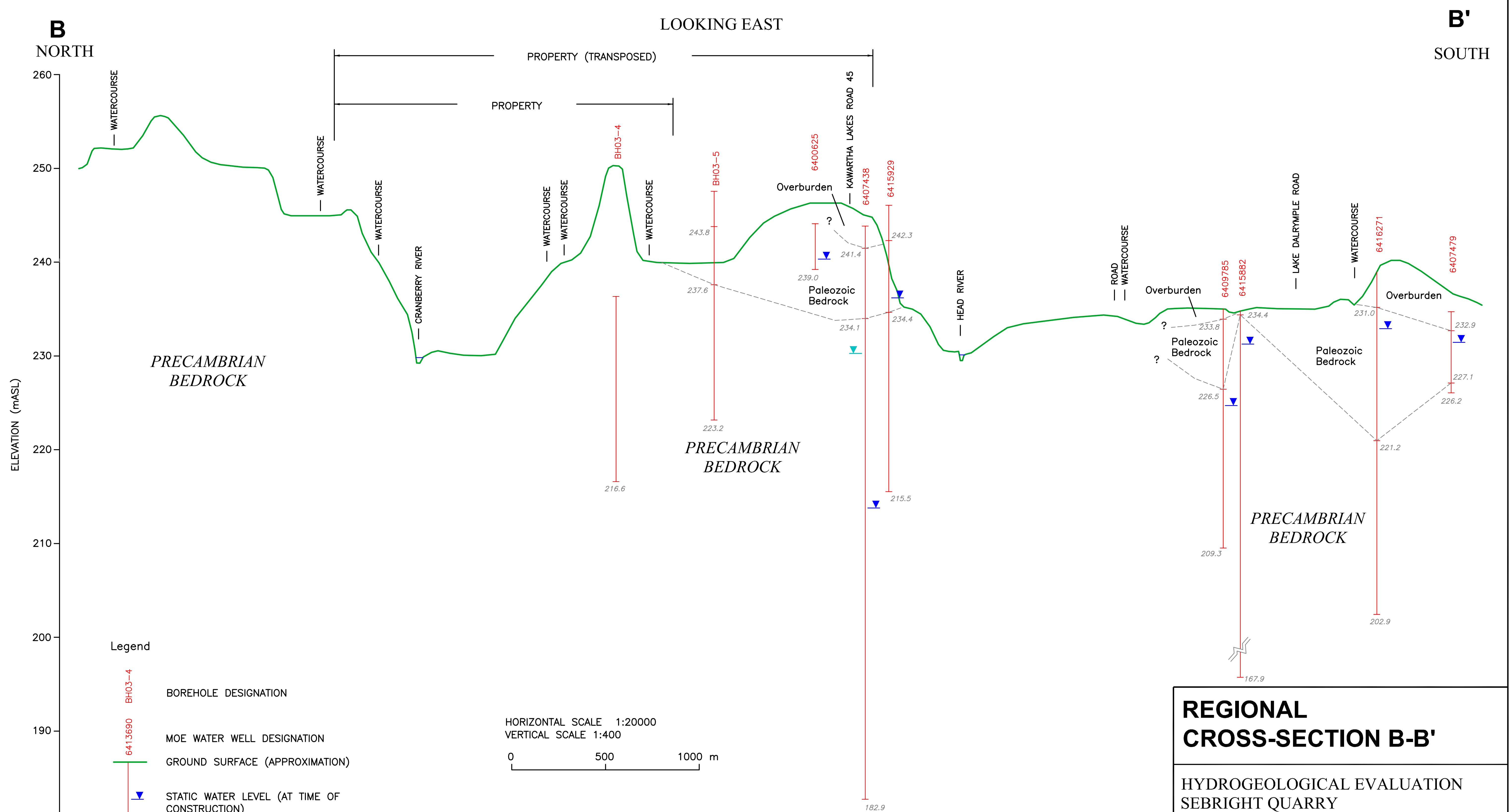
REGIONAL CROSS-SECTION A-A'

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505FA1-CR

GENIVAR

Figure A-1

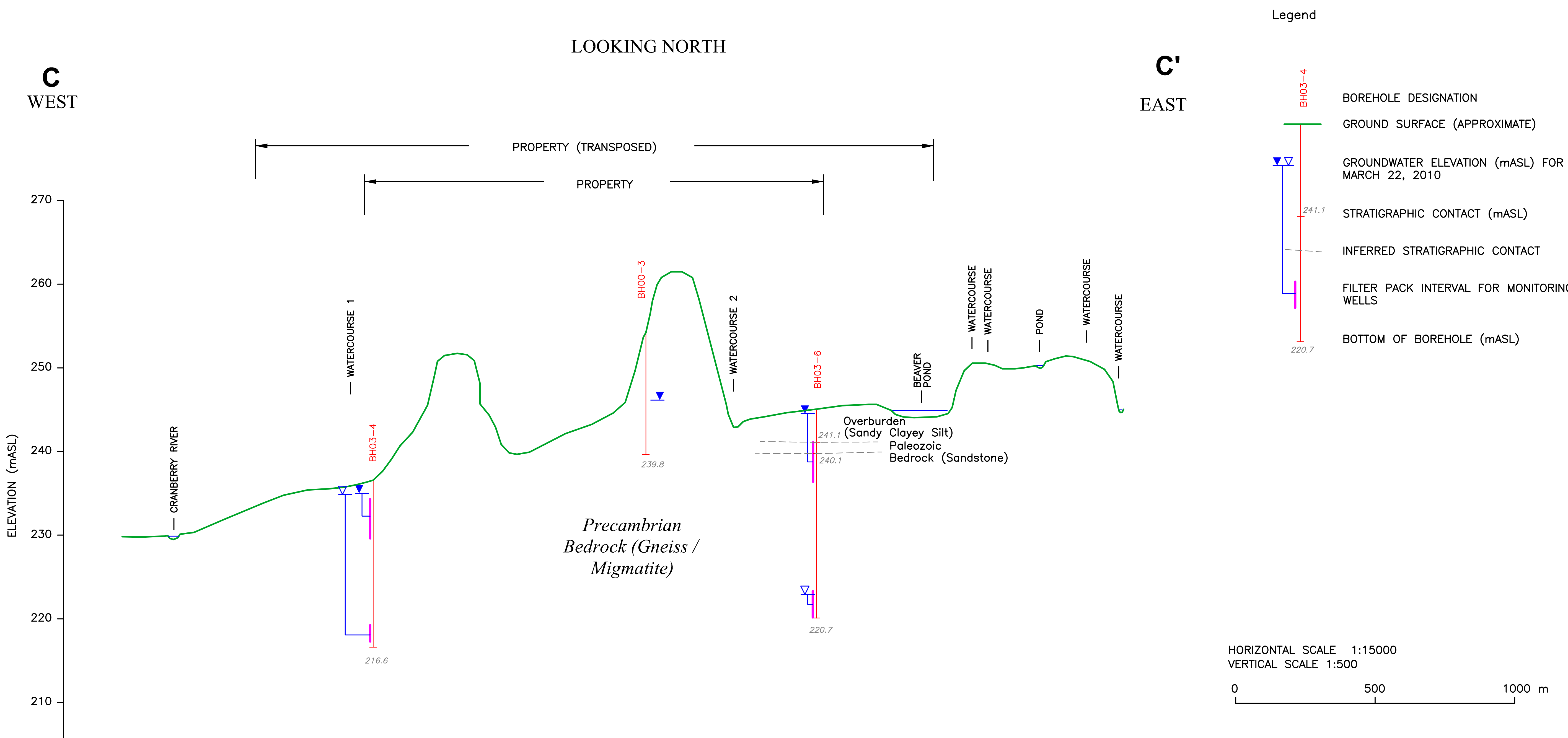


NOTES:
1. MOE WELLS AND BOREHOLES ARE INTERPRETED AS REPRESENTATIVE OR REGIONAL CONDITIONS. NOT ALL WELLS ARE PRESENTED.
2. TOPOGRAPHY IS BASED ON OBM MAPPING AND MOE WELL RECORD COLLAR ELEVATIONS. ELEVATIONS ARE APPROXIMATED TO ACCOUNT FOR WELL INTERPRETATIONS, DRAINS, AND ROADS.
3. REFER TO FIGURE 6 FOR LOCATION DETAILS AND MOE RECORD LOCATIONS.
4. mASL INDICATES METRES ABOVE SEA LEVEL.
5. STRATIGRAPHY BETWEEN WELLS IS INFERRED BASED ON WELL INFORMATION. INFERRED STRATIGRAPHY IS PROVIDED FOR PRESENTATION PURPOSES ONLY.

REGIONAL CROSS-SECTION B-B'

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505FA2-CR
GENIVAR	Figure A-2

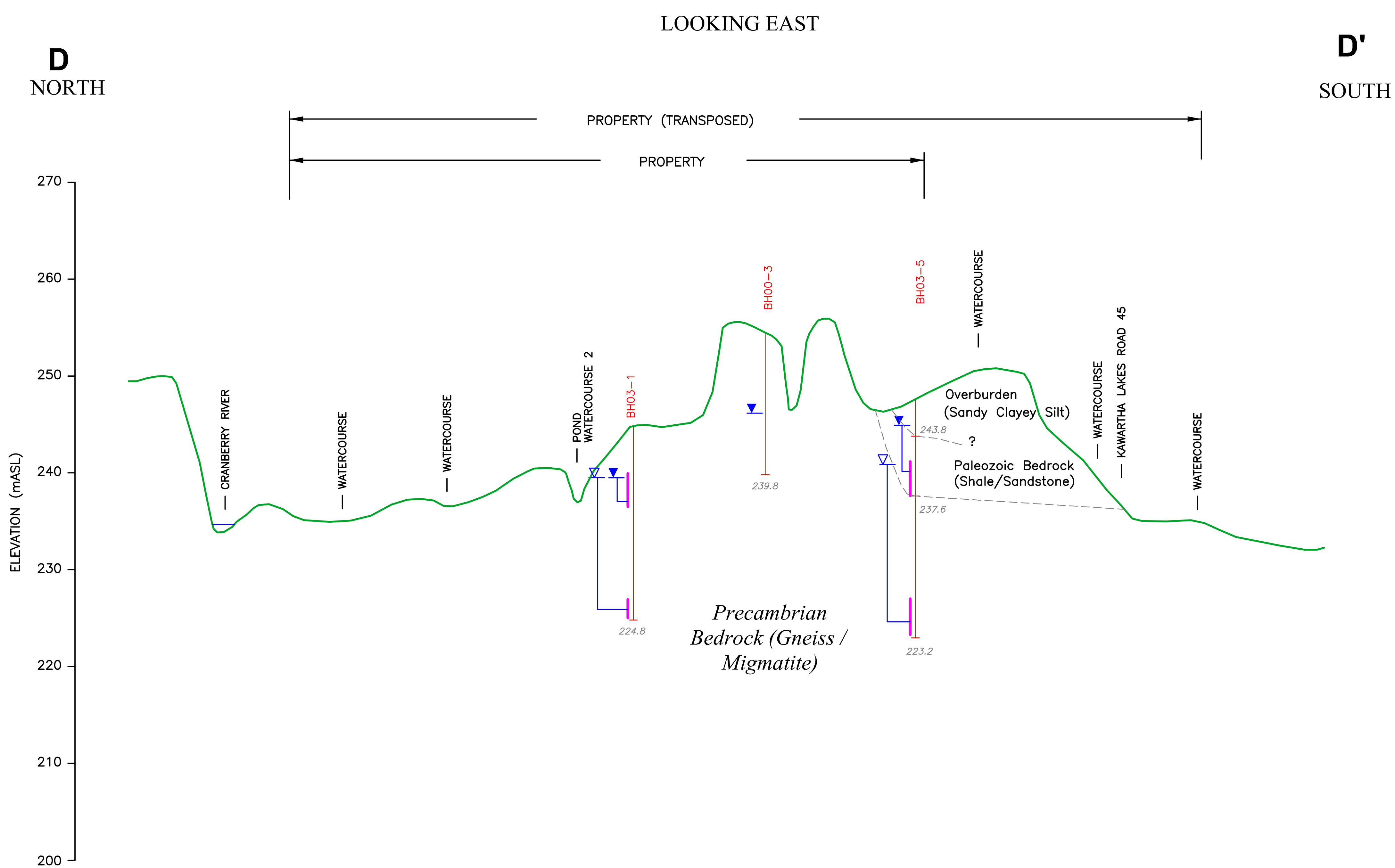


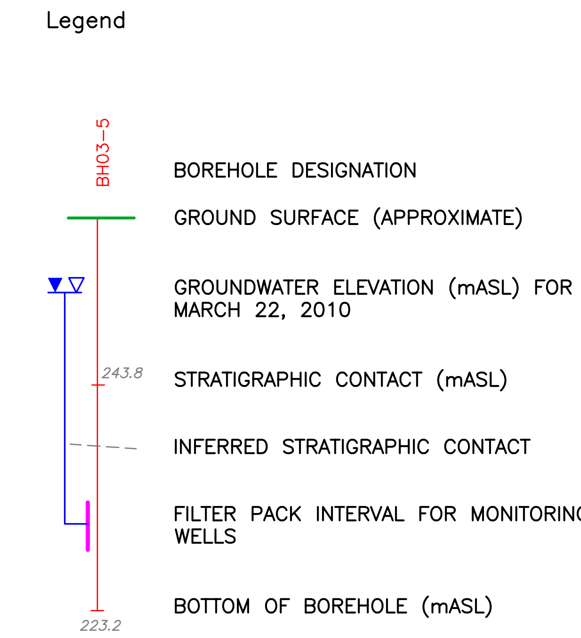
NOTES:
1. mASL INDICATES METRES ABOVE SEA LEVEL.
2. STRATIGRAPHIC CONTACT ELEVATIONS ARE APPROXIMATE AND ARE BASED ON BOREHOLE LOG INFORMATION.
3. STRATIGRAPHY BETWEEN BOREHOLES IS INFERRED BASED ON BOREHOLE LOG INFORMATION. INFERRED STRATIGRAPHY IS PROVIDED FOR PRESENTATION PURPOSES ONLY.
4. TOPOGRAPHY IS BASED ON SITE MAPPING AND BOREHOLE ELEVATIONS. ELEVATIONS ARE APPROXIMATE TO ACCOUNT FOR BOREHOLE INTERPRETATIONS, DRAINS, AND ROADS.
5. SEE FIGURE 3 FOR CROSS-SECTION LOCATIONS.

LOCAL CROSS-SECTION C-C'

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505FA3-CR
GENIVAR	Figure A-3





HORIZONTAL SCALE 1:15000
VERTICAL SCALE 1:500

0 500 1000 m

NOTES:
1. mASL INDICATES METRES ABOVE SEA LEVEL.
2. STRATIGRAPHIC CONTACT ELEVATIONS ARE APPROXIMATE AND ARE BASED ON BOREHOLE LOG INFORMATION.
3. STRATIGRAPHY BETWEEN BOREHOLES IS INFERRED BASED ON BOREHOLE LOG INFORMATION. INFERRED STRATIGRAPHY IS PROVIDED FOR PRESENTATION PURPOSES ONLY.
4. TOPOGRAPHY IS BASED ON SITE MAPPING AND BOREHOLE ELEVATIONS. ELEVATIONS ARE APPROXIMATE TO ACCOUNT FOR BOREHOLE INTERPRETATIONS, DRAINS, AND ROADS.
5. SEE FIGURE 3 FOR CROSS-SECTION LOCATIONS.

LOCAL CROSS-SECTION D-D'

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALES: AS SHOWN
PROJECT: 920365.05	FILE NO.: 0-92036505FA4-CR
GENIVAR	Figure A-4

TABLE A-1
PRESSURE PACKER TESTING SUMMARY
SEBRIGHT QUARRY

MONITOR	GROUND SURFACE ELEVATION (m ASL)	TOP OF CASING ELEVATION (m ASL)	TEST DEPTH (m BTOC)	TEST DEPTH (m BGS)	TEST INTERVAL (m ASL)	BULK HYDRAULIC CONDUCTIVITY (m/s)
BH03-1	244.58	245.23	7.6 - 5.7	6.9 - 5.0	237.6 - 239.6	2×10^{-4}
			8.8 - 6.9	8.2 - 6.2	236.4 - 238.4	$<1 \times 10^{-10}$
			10.7 - 8.8	10.1 - 8.2	234.5 - 236.4	4×10^{-9}
			12.7 - 10.7	12.0 - 10.1	232.6 - 234.5	$<1 \times 10^{-10}$
			14.6 - 12.7	13.9 - 12.0	230.6 - 232.6	$>5 \times 10^{-4}$
			16.5 - 14.6	15.9 - 13.9	228.7 - 230.6	$<1 \times 10^{-10}$
			18.5 - 16.5	17.8 - 15.9	226.8 - 228.7	$<1 \times 10^{-10}$
			20.5 - 18.5	19.8 - 17.8	224.8 - 226.8	$>5 \times 10^{-4}$
BH03-4	236.55	237.37	4.9 - 3.0	4.1 - 2.2	232.4 - 234.4	$>5 \times 10^{-4}$
			6.9 - 4.9	6.1 - 4.1	230.5 - 232.4	5×10^{-4}
			8.8 - 6.9	8.0 - 6.1	228.6 - 230.5	$<1 \times 10^{-10}$
			10.7 - 8.8	9.9 - 8.0	226.6 - 228.6	3×10^{-4}
			12.7 - 10.7	11.8 - 9.9	224.7 - 226.6	$<1 \times 10^{-10}$
			14.6 - 12.7	13.8 - 11.8	222.8 - 224.7	$<1 \times 10^{-10}$
			16.5 - 14.6	15.7 - 13.8	220.9 - 222.8	$<1 \times 10^{-10}$
			18.5 - 16.5	17.6 - 15.7	218.9 - 220.9	$<1 \times 10^{-10}$
			20.5 - 18.5	19.6 - 17.6	216.9 - 218.9	6×10^{-10}
BH03-5	247.61	248.39	10.8 - 8.8	10.0 - 8.1	237.6 - 239.6	4×10^{-9}
			12.7 - 10.8	11.9 - 10.0	235.7 - 237.6	4×10^{-4}
			14.6 - 12.7	13.9 - 11.9	233.8 - 235.7	2×10^{-4}
			16.6 - 14.6	15.8 - 13.9	231.8 - 233.8	2×10^{-4}
			18.5 - 16.6	17.7 - 15.8	229.9 - 231.8	4×10^{-5}
			20.4 - 18.5	19.6 - 17.7	228.0 - 229.9	4×10^{-10}
			22.4 - 20.4	21.6 - 19.7	226.0 - 228.0	5×10^{-4}
			23.1 - 21.1	22.3 - 20.4	225.3 - 227.3	$>5 \times 10^{-4}$
			25.1 - 23.1	24.3 - 22.3	223.3 - 225.3	7×10^{-4}
BH03-6	245.20	245.66	7.6 - 5.6	7.1 - 5.2	238.1 - 240.0	3×10^{-7}
			9.5 - 7.6	9.0 - 7.1	236.2 - 238.1	$<1 \times 10^{-10}$
			11.4 - 9.5	11.0 - 9.0	234.2 - 236.2	$<1 \times 10^{-10}$
			13.4 - 11.4	12.9 - 11.0	232.3 - 234.2	2×10^{-7}
			15.3 - 13.4	14.8 - 12.9	230.4 - 232.3	$<1 \times 10^{-10}$
			17.2 - 15.3	16.8 - 14.8	228.5 - 230.4	$<1 \times 10^{-10}$
			19.1 - 17.2	18.7 - 16.8	226.5 - 228.5	$<1 \times 10^{-10}$
			21.1 - 19.1	20.6 - 18.7	224.6 - 226.5	$<1 \times 10^{-10}$
			23.0 - 21.1	22.5 - 20.6	222.7 - 224.6	$<1 \times 10^{-10}$
			25.0 - 23.0	24.5 - 22.5	220.7 - 222.7	9×10^{-9}

TABLE A-1
PRESSURE PACKER TESTING SUMMARY
SEBRIGHT QUARRY

MONITOR	GROUND SURFACE ELEVATION (m ASL)	TOP OF CASING ELEVATION (m ASL)	TEST DEPTH (m BTOC)	TEST DEPTH (m BGS)	TEST INTERVAL (m ASL)	BULK HYDRAULIC CONDUCTIVITY (m/s)
BH04-7	228.82	229.42	7.1 - 5.1	6.5 - 4.5	222.3 - 224.3	5×10^{-8}
			9.1 - 7.1	8.5 - 6.5	220.3 - 222.3	7×10^{-10}
			11.1 - 9.1	10.5 - 8.5	218.3 - 220.3	5×10^{-8}
			13.1 - 11.1	12.5 - 10.5	216.3 - 218.3	1×10^{-9}
			15.1 - 13.1	14.5 - 12.5	214.3 - 216.3	1×10^{-8}
			17.1 - 15.1	16.5 - 14.5	212.3 - 214.3	9×10^{-8}
			19.1 - 17.1	18.5 - 16.5	210.3 - 212.3	1×10^{-7}
BH04-8	231.39	232.04	5.9 - 3.9	5.2 - 3.2	226.1 - 228.1	$1 \text{ X } 10^{-6}$
			7.9 - 5.9	7.2 - 5.2	224.1 - 226.1	3×10^{-8}
			9.9 - 7.9	9.2 - 7.2	222.1 - 224.1	7×10^{-10}
			11.9 - 9.9	11.3 - 9.2	220.1 - 222.1	$7 \text{ X } 10^{-6}$
			13.9 - 11.9	13.3 - 11.3	218.1 - 220.1	4×10^{-9}
			15.9 - 13.9	15.3 - 13.3	216.1 - 218.1	3×10^{-9}
			17.9 - 15.9	17.3 - 15.3	214.1 - 216.1	3×10^{-8}

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm BTOC' indicates metres below top of casing.
3) 'm BGS' indicates metres below ground surface.
4) 'm/s' indicates metres per second.

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6404293	Victoria	Dalton	01	009	1970	17	654676	4754115	800	15	10	0.1	Water supply	Domestic	0	8	Grey	Topsoil			25	Fresh
															8	23	Grey	Granite			112	
															23	36	Red	Granite				
															36	95	Black	Granite				
															95	112	Grey	Granite				
6415796	Victoria	Dalton	01	017	1998	17	999999	9999999		14	5	0.1	Water supply	Domestic	0	2	Black	Topsoil			55	Fresh
															2	10	Grey	Clay	Sand	Hard		
															10	15	Red	Limestone	Soft			
															15	45	Red	Granite	Soft			
															45	50	Green	Granite	Hard			
															50	60	Red	Granite	Soft			
6415902	Victoria	Dalton	01	017	1999	17	999999	9999999		12	5	0.1	Water supply	Domestic	0	8	Red	Sand	Gravel	Clay	55	Fresh
															8	39	Grey	Stones				
															39	58	Red	Granite	Hard			
6409785	Victoria	Dalton	01	020	1985	17	999999	9999999		27	6	0.9	Water supply	Domestic	0	1	Brown	Topsoil			34	Fresh
															1	4	Brown	Clay	Stones	Soft		
															4	28	Brown	Shale	Soft			
															28	63	Black	Granite	Hard			
															63	78	Brown	Granite	Soft			
															78	84	Black	Granite	Soft			
6415882	Victoria	Dalton	01	021	1998	17	999999	9999999		12	5	0.0	Water supply	Domestic	0	2	Brown	Sand			215	Fresh
															2	105	Black	Granite				
															105	150	Grey	Granite				
															150	160	Red	Granite				
															160	210	Black	Granite				
															210	220	Red	Granite				
6407971	Victoria	Carden	01	025	1979	17	647046	4950267	760	12	0	0.0	Water supply	Domestic	0	13		Prev. Drilled			39	Fresh
															13	18	Red	Granite	Soft			
															18	39	Red	Granite	Loose			
															39	53	Black	Granite	Hard			
6416275	Victoria	Dalton	01	026	1999	17	999999	9999999		14	50	0.7	Water supply	Domestic	0	21		Clay	Sandy		85	Fresh
															21	90	Black	Granite				
6406846	Victoria	Dalton	01	027	1976	17	647746	4951617	755			n/a	Abandoned-Supply		0	4		Clay				
															4	97	Black	Granite				
6406847	Victoria	Dalton	01	027	1976	17	647796	4951667	755	8	20	0.0	Water supply	Stock/Domestic	0	4		Clay			485	Unknown
															4	526	Black	Granite				
6406704	Victoria	Dalton	01	030	1976	17	646846	4950317	760	17		n/a	Water supply	Domestic	0	18	Red	Clay	Hardpan	Sand	38	Fresh
															18	31	Red	Granite				
															31	71	Black	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6414454	Victoria	Dalton	01	030	1994	17	999999	9999999				n/a	Water supply	Domestic	0	33	Brown	Sand	Clay			Fresh
															33	200	Black	Granite	Layered			
6404039	Victoria	Dalton	01	032	1969	17	645796	4950537	790	30	3	0.1	Water supply	Domestic	0	1	Brown	Clay			40	Fresh
															1	37	Grey	Limestone			65	
															37	65	Red	Limestone				
															65	66	Red	Granite				
6408607	Victoria	Dalton	01	032	1978	17	648146	4950067	775	18	3	0.2	Water supply	Domestic	0	3	Grey	Clay	Stones	Hardpan	36	Fresh
															3	8	Grey	Limestone	Fractured			
															8	20	Grey	Limestone				
															20	35	Red	Limestone				
															35	44	White	Quartz				
															44	46	Red	Limestone				
6400519	Victoria	Dalton	02	011	1963	17	656544	4954990	864	22	1	0.1	Water supply	Domestic	0	4		Clay	Stones		35	Fresh
															4	8		Shale	Granite			
															8	30	Black	Granite				
															30	35	Red	Granite				
															35	43	Green	Granite				
6404912	Victoria	Dalton	02	011	1972	17	653855	4954067	800	15	0	0.0	Water supply	Domestic	0	9		Previously Dug			40	Fresh
															9	25		Limestone				
															25	125		Granite				
6405062	Victoria	Dalton	02	011	1972	17	653525	4954527	800	4	1	0.0	Water supply	Domestic	0	4	Brown	Topsoil			114	Fresh
															4	60	Red	Rock				
															60	114	Grey	Rock				
6408364	Victoria	Dalton	02	011	1979	17	653445	4954667	825		2	n/a	Water supply	Domestic	0	3	Brown	Fill			184	Unknown
															3	189	Black	Granite				
6416473	Victoria	Dalton	02	013	2000	17	999999	9999999		8	5	0.1	Water supply	Domestic	0	8	Brown	Clay	Sandy		40	Fresh
															8	21	Brown	Limestone			51	
															21	30	Green	Limestone				
															30	51	Red	Limestone				
															51	51	Red	Granite				
6409275	Victoria	Dalton	02	014	1983	17	999999	9999999			7	n/a	Water supply	Domestic	0	9		Sand	Boulders		125	Fresh
															9	27	White	Limestone				
															27	135	Black	Granite				
6413690	Victoria	Dalton	02	016	1991	17	999999	9999999		19	8	0.3	Water supply	Domestic	0	1	Black	Topsoil			40	Fresh
															1	20	Brown	Limestone	Soft		45	
															20	30	Green	Limestone				
															30	40	Red	Limestone				
															40	45	Red	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6410071	Victoria	Dalton	02	026	1986	17	999999	9999999				n/a	Abandoned-Supply	Not used	0	6	Brown	Clay	Soft			
															6	25	Brown	Granite	Hard			
															25	110	Grey	Granite	Hard			
															110	126	Brown	Granite	Hard			
															126	195	Black	Granite	Hard			
6410112	Victoria	Dalton	02	026	1986	17	999999	9999999				n/a	Abandoned-Supply	Not used	0	6	Brown	Clay	Soft			
															6	25	Brown	Granite	Hard			
															25	110	Grey	Granite	Hard			
															110	127	Brown	Granite	Hard			
															127	258	Black	Granite	Hard			
6416091	Victoria	Dalton	02	026	1999	17	999999	9999999				n/a	Abandoned-Supply		0	1		Topsoil				
															1	5		Sand				
															5	100		Granite				
6416239	Victoria	Dalton	02	026	2000	17	999999	9999999		10	2	n/a	Water supply	Domestic	0	92		Prev. Drilled				
															92	300	Black	Granite				
6416357	Victoria	Dalton	02	029	2000	17	999999	9999999		25	7	0.0	Water supply	Domestic	0	10	Red	Clay			202	Fresh
															10	35	Red	Limestone				
															35	205	Red	Granite				
6404733	Victoria	Dalton	02	030	1971	17	646371	4951467	755	8	2	0.1	Water supply	Domestic	0	8	Brown	Clay			30	Fresh
															8	10	Green	Limestone				
															10	35	Red	Limestone				
															35	60	Black	Granite				
6405112	Victoria	Dalton	02	030	1972	17	646356	4952017	775	22	4	0.4	Water supply	Domestic	0	17	Brown	Clay			32	Fresh
															17	32	Red	Limestone				
6406039	Victoria	Dalton	02	030	1974	17	646369	4952098	775	12	5	0.2	Water supply	Domestic	0	7	Brown	Clay	Sand		30	Fresh
															7	15	Grey	Limestone			45	
															15	18	Red	Limestone				
															18	47	Red	Granite				
6408606	Victoria	Dalton	02	030	1978	17	646296	4951967	775			n/a	Abandoned-Supply	Not used	0	24	Grey	Clay	Sand			
															24	390	Black	Granite	Hard			
6416583	Victoria	Dalton	02	030	2001	17	999999	9999999		25	8	0.2	Water supply	Domestic	0	18	Brown	Clay			65	Fresh
															18	30	Red	Shale				
															30	35	Grey	Limestone				
															35	75	Grey	Granite				
6416805	Victoria	Dalton	02	030	2001	17	999999	9999999		15	2	0.0	Water supply	Domestic	0	2	Brown	Topsoil			120	Fresh
															2	14	Brown	Sand	Boulders			
															14	17	Grey	Hardpan				
															17	125	Black	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6400524	Victoria	Dalton	02	032	1948	17	645657	4950913	775	16		n/a	Water supply	Domestic	0	2		Topsoil			16	Fresh
															2	12	Grey	Shale				
															12	34	White	Limestone				
6407453	Victoria	Dalton	02	032	1976	17	645796	4950967	765	10	10	0.3	Water supply	Domestic	0	4	Black	Topsoil	Clay		48	Fresh
															4	16	Grey	Clay	Sand			
															16	61	Red	Granite				
6415881	Victoria	Dalton	02	032	1998	17	999999	9999999		14		n/a	Water supply	Domestic	0	20	Brown	Sand			60	Unknown
															20	30	Black	Granite			275	
															30	200	Black	Granite				
															200	224	Black	Granite				
															224	250	Green	Granite				
															250	275	Black	Granite				
6412839	Victoria	Dalton	03	008	1990	17	999999	9999999		5	1	0.1	Water supply	Domestic	0	3	Black	Topsoil			19	Fresh
															3	6	Red	Limestone				
															6	19	Red	Limestone	Soft			
															19	115	Red	Granite	Soft			
															115	260	Black	Granite				
6409952	Victoria	Dalton	03	011	1984	17	999999	9999999		2	1	0.0	Water supply	Domestic	0	12	Brown	Sand	Clay		25	Fresh
															12	25	Red	Shale				
															25	60	Black	Granite				
6409578	Victoria	Dalton	03	012	1984	17	999999	9999999			2	n/a	Water supply	Domestic	0	11	Brown	Clay			15	Fresh
															11	13	Brown	Granite				
															13	30	Red	Granite				
6412165	Victoria	Dalton	03	012	1989	17	999999	9999999		10	40	0.8	Water supply	Domestic	0	23	Brown	Sand			60	Fresh
															23	94	Grey	Granite				
6415883	Victoria	Dalton	03	012	1998	17	999999	9999999			5	n/a	Water supply	Domestic	0	6	Brown	Sand			80	Fresh
															6	85	Black	Granite				
6405053	Victoria	Dalton	03	013	1972	17	652476	4954817	775	5	50	2.2	Water supply	Domestic	0	1		Topsoil			28	Fresh
															1	15	Brown	Sand				
															15	28	Grey	Clay	Sand			
															28	30		Gravel				
6416652	Victoria	Dalton	03	013	2001	17	999999	9999999		12	20	0.7	Water supply	Domestic	0	8	Brown	Sand			41	Fresh
															8	38	Brown	Clay				
															38	41	Grey	Granite				
6409786	Victoria	Dalton	03	014	1985	17	999999	9999999		15	10	0.1	Water supply	Domestic	0	2	Brown	Topsoil			96	Fresh
															2	87	Black	Granite				
															87	90	Red	Granite				
															90	105	Black	Granite				
6413433	Victoria	Dalton	03	014	1991	17	999999	9999999		20	2	n/a	Water supply	Domestic	0	20		Previously Dug				
															20	300	Red	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6413919	Victoria	Dalton	03	014	1992	17	999999	9999999		17	15	0.3	Water supply	Domestic	0	6	Grey	Clay			60	Fresh
															6	120	Black	Granite				
6408400	Victoria	Dalton	03	015	1980	17	651996	4954717	800	6	20	0.6	Water supply	Domestic	0	13	Grey	Clay	Sand	Fill	38	Fresh
															13	45	Red	Granite				
6400525	Victoria	Dalton	03	020	1948	17	649642	4954149	800	6		n/a	Water supply	Stock	0	6		Previously Dug			10	Fresh
															6	16	Red	Sandstone				
6407438	Victoria	Dalton	03	020	1977	17	649776	4953917	800	50	70	0.5	Water supply	Domestic	0	8	Brown	Overburden			198	Fresh
															8	32	Red	Shale				
															32	200	Red	Granite				
6415929	Victoria	Dalton	03	021	1998	17	999999	9999999		32	2	0.3	Water supply	Domestic	0	12		Clay	Stones		38	Fresh
															12	38	Grey	Limestone	Layered			
															38	100	Black	Granite				
6412877	Victoria	Dalton	03	022	1990	17	999999	9999999		25	10	0.9	Water supply	Domestic	0	12	Black	Topsoil			36	Fresh
															12	20		Limestone	Fractured			
															20	30	Grey	Limestone				
															30	36	Red	Granite				
6407083	Victoria	Dalton	03	024	1975	17	648396	4953267	760	18	10	0.2	Water supply	Domestic	0	75	Black	Granite			74	Fresh
6414208	Victoria	Dalton	03	025	1993	17	999999	9999999		19	10	0.0	Water supply	Domestic	0	1	Black	Topsoil			290	Fresh
															1	300	Black	Granite				
6410059	Victoria	Dalton	03	026	1986	17	999999	9999999		5	5	0.0	Water supply	Domestic	0	2	Black	Topsoil	Soft		137	Unknown
															2	35	Brown	Granite	Hard			
															35	70	Black	Granite	Hard			
															70	136	Grey	Granite	Hard			
															136	137	Brown	Granite	Hard			
6410805	Victoria	Dalton	03	027	1987	17	999999	9999999		8	1	0.0	Water supply	Domestic	0	5	Grey	Clay			100	Fresh
															5	360	Red	Granite				
6414218	Victoria	Dalton	03	027	1993	17	999999	9999999		12	25	0.1	Abandoned-Supply	Domestic	0	1	Brown	Topsoil			200	Fresh
															1	8	Brown	Clay				
															8	12	Brown	Sand				
															12	200	Black	Granite				
6414219	Victoria	Dalton	03	027	1993	17	999999	9999999		6	10	1.7	Water supply	Domestic	0	2	Brown	Sand			12	Fresh
															2	40	Black	Granite				
6400520	Victoria	Dalton	03	028	1966	17	646921	4953138	747	3	5	0.3	Water supply	Domestic	0	5	Brown	Clay			22	Fresh
															5	15	Red	Granite				
															15	23	Black	Granite				
6405063	Victoria	Dalton	03	028	1973	17	646646	4952957	785	10		n/a	Water supply	Domestic	0	1		Topsoil			45	Unknown
															1	12	Red	Shale				
															12	100	Grey	Granite	Rock			

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6406038	Victoria	Dalton	03	028	1974	17	646646	4952909	750	8	20	1.1	Water supply	Domestic	0	3	Brown	Sand	Stones		26	Fresh
															3	10	Black	Granite				
															10	28	Black	Granite				
6400521	Victoria	Dalton	03	029	1964	17	646529	4952634	750	8	8	4.0	Water supply	Domestic	0	8		Previously Dug			10	Fresh
															8	16	Grey	Granite				
6400522	Victoria	Dalton	03	029	1967	17	646441	4952778	742			n/a	Abandoned-Supply		0	2	Grey	Topsoil				
															2	50	Blue	Granite				
6405121	Victoria	Dalton	03	029	1972	17	646596	4952807	750	4	3	0.0	Water supply	Domestic	0	2	Brown	Clay			195	Fresh
															2	212	Black	Granite				
6407630	Victoria	Dalton	03	029	1978	17	646546	4952817	750	10	1	0.5	Water supply	Domestic	0	4	Brown	Sand			12	Fresh
															4	10	Red	Granite	Soft			
															10	75	Grey	Granite	Hard			
6408285	Victoria	Dalton	03	029	1979	17	646396	4952417	750	7	6	1.5	Water supply	Domestic	0	10	Brown	Sand	Clay		11	Fresh
															10	11		Shale				
															11	15	Grey	Limestone				
															15	30	Black	Granite				
6408380	Victoria	Dalton	03	029	1980	17	646396	4952567	750			n /a	Unfinished		0	2	Black	Topsoil				
															2	5	Brown	Sand	Gravel			
															5	16	Brown	Sand	Clay			
															16	19	Brown	Sandstone				
															19	26	Brown	Granite				
															26	32	Black	Granite				
															32	40	Grey	Granite				
6411249	Victoria	Dalton	03	029	1988	17	999999	9999999		14	5	n/a	Observation wells	Not used	0	2	Black	Topsoil	Packed			Unknown
															2	12	Grey	Limestone	Soft	Dense		
															12	400	Grey	Unknown	Soft	Dense		
6412167	Victoria	Dalton	03	029	1989	17	999999	9999999		8	1	0.0	Water supply	Domestic	0	12	Brown	Sand			30	Fresh
															12	19	Red	Granite	Soft			
															19	110	Grey	Granite				
6413689	Victoria	Dalton	03	029	1991	17	999999	9999999		9	15	0.2	Water supply	Domestic	0	13	Brown	Clay	Sandy		77	Fresh
															13	16	Red	Granite				
															16	77	Black	Granite				
															77	78	Red	Granite				
6400523	Victoria	Dalton	03	030	1965	17	646513	4952699	749	4	10	0.8	Water supply	Domestic	0	5	Brown	Clay			16	Fresh
															5	8		Hardpan	Medium Sand			
															8	10		Granite				
															10	18	Red	Granite				
6404708	Victoria	Dalton	03	030	1971	17	645771	4953017	745			n/a	Abandoned-Supply	Not used	0	5	Brown	Topsoil	Sand			
															5	105	Grey	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6412810	Victoria	Dalton	03	030	1990	17	999999	9999999		5	5	0.2	Water supply	Domestic	0	10	Brown	Sand	Soft		30	Fresh
															10	120	Black	Granite	Hard			
6416240	Victoria	Dalton	03	030	2000	17	999999	9999999		15	70	1.2	Water supply	Domestic	0	19	Grey	Clay			72	Fresh
															19	75	Black	Granite				
6405099	Victoria	Dalton	03	031	1972	17	645666	4952957	745	5	50	0.2	Water supply	Domestic	0	5	Brown	Topsoil	Sand		302	Fresh
															5	300	Grey	Granite				
															300	302	Red	Granite				
6408388	Victoria	Dalton	03	032	1980	17	645096	4952867	750	4		n/a	Water supply	Domestic	0	8		Previously Dug			13	Fresh
															8	13	Brown	Silt	Fine Sand			
															13	53	Brown	Granite				
															53	92	Black	Granite				
															92	93	Brown	Granite				
															93	116	Grey	Granite				
6415579	Victoria	Dalton	03	032	1997	17	999999	9999999		20	5	n/a	Water supply	Domestic	0	13	Brown	Sand				
															13	100	Red	Granite				
6412039	Victoria	Dalton	04	020	1989	17	999999	9999999		10	10	0.1	Water supply	Domestic	0	10	Brown	Clay	Soft		83	Fresh
															10	30	Grey	Clay	Soft			
															30	83	Black	Granite	Hard			
6416271	Victoria	Carden	04	025	2000	17	999999	9999999		20	2	0.0	Water supply	Domestic	0	12		Stones	Clay		90	Fresh
															12	60		Limestone				
															60	120		Granite				
6407479	Victoria	Carden	05	024	1977	17	651046	4951067	770	10	6	0.4	Water supply	Domestic	0	2	Black	Topsoil	Stones	Loose	25	Fresh
															2	6	Grey	Clay	Stones	Hard		
															6	25	Red	Limestone	Clay	Soft		
															25	28	Red	Granite	Crystalline			
6415922	Victoria	Dalton	05	031	1999	17	999999	9999999		15	4	0.1	Water supply	Domestic	0	9	Brown	Sand			80	Fresh
															9	160	Black	Granite				
6415427	Victoria	Carden	06	025	1997	17	999999	9999999		4	3	0.2	Water supply	Domestic	0	1	Black	Topsoil			22	Fresh
															1	4	Brown	Clay				
															4	8	Brown	Limestone	Shale			
															8	22	Brown	Limestone	Rock			
6414009	Victoria	Dalton	06	026	1992	17	999999	9999999		10	4	0.1	Water supply	Municipal	0	1	Black	Topsoil			42	Fresh
															1	33	Red	Sand	Gravel			
															33	49	Red	Granite	Unknown			
6414430	Victoria	Dalton	06	027	1993	17	999999	9999999		12	8	0.3	Water supply	Domestic	0	20	Red	Granite			43	Fresh
															20	42	Red	Granite				
															42	43	Black	Granite	Fractured			
6414420	Victoria	Dalton	06	029	1990	17	999999	9999999		10	4	n/a	Water supply	Domestic	0	10		Clay				
															10	480	Black	Granite				

TABLE A-2
MOE WATER WELL RECORDS
SEBRIGHT QUARRY

Well ID	County	Township	Con.	Lot	Drilled Year	UTM Zone	UTM East NAD 27	UTM North NAD 27	Elev. (fasl)	Static Level (ft)	Rec. Pump Rate (gpm)	Specific Capacity (gpm/ft water head)	Status	Use	GEOLOGY						Water Depth (ft)	Water Found
															Depth To Top (ft)	Depth To Base (ft)	Colour	Primary	Secondary	Tertiary		
6415956	Victoria	Dalton	07	028	1999	17	999999	9999999		20	8	0.4	Water supply	Domestic	0	22	Brown	Sand			40	Fresh
															22	40	Brown	Sand	Gravel			
6416653	Victoria	Dalton	07	029	2001	17	999999	9999999		20	10	0.1	Water supply	Domestic	0	30		Sand	Clay		120	Fresh
															30	120	Red	Granite				
6410234	Victoria	Dalton	08	025	1986	17	999999	9999999		20		n/a	Water supply	Stock	0	200		Prev. Drilled				
															200	255	Brown	Granite	Hard			
															255	335	Grey	Granite	Hard			
															335	410	Black	Granite	Hard			
6410262	Victoria	Dalton	08	025	1986	17	999999	9999999		9	1	0.0	Water supply	Domestic	0	8	Brown	Clay	Soft		30	Fresh
															8	30	Grey	Silt	Clay	Soft		
															30	38	Brown	Granite	Hard			
															38	120	Black	Granite	Hard			
															120	126	Brown	Granite	Hard			
															126	165	Black	Granite	Hard			
6413274	Victoria	Dalton	08	025	1991	17	999999	9999999		40	6	0.0	Water supply	Domestic	0	5		Sand			30	Fresh
															5	10		Clay				
															10	30		Sand	Stones	Dry		
															30	60		Sand	Gravel			
6413275	Victoria	Dalton	09	026	1991	17	999999	9999999		30	2	0.0	Water supply	Domestic	0	18	Brown	Sand			210	Fresh
															18	240	Red	Granite				

NOTES:

1) 'ft' indicates feet.
2) 'fasl' indicates feet above sea level.
3) 'gpm' indicates gallons per minute.

TABLE A-3
RESIDENTAL WELL SURVEY SUMMARY
SEBRIGHT QUARRY

WELL LOCATION ADDRESS	WELL CONSTRUCTION SUMMARY				POSSIBLE MOE REFERENCE	WATER LEVEL		PREVIOUS PROBLEMS HISTORY	SAMPLING HISTORY	
	DATE CONSTRUCTED	TYPE	DIAMETER (m)	USE		DATE	DEPTH (mbg)		DATE	SAMPLE ID
59 Dartmoor Rd.										
61 Dartmoor Rd.	approx. 1981	dug	1.32	domestic		13-Jun-06	1.32	water shortage summer 2005	13-Jun-06	61 DARTMOOR RD
108 Dartmoor Rd.	1998	drilled	0.15	domestic	6415902	not permitted		No	not permitted	
126 Dartmoor Rd.	1999	drilled	0.15	domestic	6415796	not permitted		No	9-May-06	126 DARTMOOR RD
136 Dartmoor Rd.	approx. 1998	drilled	0.15	domestic and livestock				water shortages in the summer, however fast recovery		
217 Dartmoor Rd.		drilled/dug	0.15/1.32	domestic				No		
538 Monck Rd.	1990	drilled	`	domestic and livestock	6412877	9-May-06	6.62	No	9-May-06	538 MONCK RD
574 Monck Rd.					6445929					
594 Monck Rd.	1977	drilled	0.15	domestic and livestock	6407438	9-May-06	13.6	No	9-May-06	594 MONCK RD

TABLE A-3
RESIDENTAL WELL SURVEY SUMMARY
SEBRIGHT QUARRY

WELL LOCATION ADDRESS	WELL CONSTRUCTION SUMMARY				POSSIBLE MOE REFERENCE	WATER LEVEL		PREVIOUS PROBLEMS HISTORY	SAMPLING HISTORY	
	DATE CONSTRUCTED	TYPE	DIAMETER (m)	USE		DATE	DEPTH (mbg)		DATE	SAMPLE ID
633 Monck Rd.				vacant						
655 Monck Rd.	approx. 2005	drilled	0.15	domestic						
776 Monck Rd.	approx. 1988	drilled	0.15	domestic and livestock		unable to access		No	13-Jun-06	776 MONCK RD
789 Monck Rd.	1991	drilled	0.15	domestic and livestock	6413690			No		
844 Monck Rd.	1980	drilled	0.15	domestic	6408400	13-Jun-06	2.7	No	13-Jun-06	844 MONCK RD
870 Monck Rd.	1991	drilled	0.15	domestic	6413433	13-Jun-06	4.23	No	13-Jun-06	870 MONCK RD
874 Monck Rd.	unknown	drilled	0.15	domestic		unable to access		No	13-Jun-06	874 MONCK RD
884 Monck Rd.	1985	drilled	0.15	domestic	6409786	13-Jun-06	1.4	No	13-Jun-06	884 MONCK RD
886 Monck Rd.										
890 Monck Rd.	approx. 1966	drilled	0.15	domestic				No		
906 Monck Rd.	1991	drilled	0.15	domestic		unable to access		No	13-Jun-06	906 MONCK RD
912 Monck Rd.										
915 Monck Rd.	approx. 1986	drilled	0.15	domestic		unable to access		No	13-Jun-06	915 MONCK RD
932 Monck Rd.										

TABLE A-3
RESIDENTAL WELL SURVEY SUMMARY
SEBRIGHT QUARRY

WELL LOCATION ADDRESS	WELL CONSTRUCTION SUMMARY				POSSIBLE MOE REFERENCE	WATER LEVEL		PREVIOUS PROBLEMS HISTORY	SAMPLING HISTORY	
	DATE CONSTRUCTED	TYPE	DIAMETER (m)	USE		DATE	DEPTH (mbg)		DATE	SAMPLE ID
940 Monck Rd.										
970 Monck Rd.										
29 Watt Lane										

Notes:

1) Well locations shown on Figure 6 of report text.
2) 'm' indicates metres.
3) 'mbg' indicates metres below grade.
4) Blank indicates resident was not home during the time period the survey was conducted.

Appendix B

Hydrogeologic Details

- Monitoring Well Details Sheet – Table B-1
- Groundwater Elevations – Table B-2
- Groundwater Hydrographs – Figures B-1 to B-7
- Groundwater Levels – Residential – Table B-3
- General Chemical Results – Groundwater – Table B-4
- General Chemical Results – Residential – Table B-5

TABLE B-1
MONITORING WELL DETAILS SHEET
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	MONITOR TYPE	GROUND SURFACE ELEVATION (m ASL)	TOP OF CASING ELEVATION (m ASL)	SCREEN INTERVAL (mASL)			FILTER PACK INTERVAL (m ASL)			BENTONITE SEAL INTERVAL (m ASL)		
BH03-1	II	S	244.58	245.23	236.7	-	238.9	236.4	-	239.6	239.6	-	244.7
	I	P	244.58	245.26	224.9	-	226.3	224.9	-	226.5	226.5	-	236.4
BH03-4	II	S	236.55	237.37	230.5	-	233.5	230.0	-	234.6	234.6	-	236.6
	I	P	236.55	237.37	216.9	-	218.4	216.9	-	218.9	218.9	-	230.0
BH03-5	II	S	247.61	248.39	238.6	-	241.6	238.3	-	241.6	241.6	-	247.7
	I	P	247.61	248.39	224.4	-	225.9	223.4	-	227.0	227.0	-	238.3
BH03-6	II	S	245.20	245.66	237.2	-	240.2	236.7	-	241.2	241.2	-	245.2
	I	P	245.20	245.66	220.8	-	222.3	220.7	-	223.6	223.6	-	236.7
BH04-7	II	S	228.81	229.67	225.1	-	226.5	224.8	-	227.0	227.0	-	228.8
	I	P	228.82	229.42	211.2	-	212.6	210.5	-	212.9	212.9	-	228.8
BH04-8	II	S	231.27	232.04	228.3	-	230.0	228.2	-	230.2	230.2	-	231.0
	I	P	231.39	232.04	215.2	-	216.7	214.1	-	216.8	216.8	-	231.2

NOTES:

1) 'm ASL' indicates metres above sea level.
2) S indicates standpipe with water levels typically within screen interval.
3) P indicates piezometer with water levels typically above screen interval.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	27-Oct-03		24-Feb-04 to 17-Mar-04		April 1, 2004		April 2, 2004		April 27, 2004	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23							4.93	240.30	5.13	240.10
	I	244.58	245.26							5.02	240.24		
	OH	244.58	244.58			5.56	239.02			5.06	239.52		
BH00-1	OH*	244.61	244.61	4.20	240.41								
BH00-2	OH	256.33	256.33	9.50	246.83							8.54	247.79
BH00-3	OH	254.61	254.61	7.90	246.71								
BH03-4	II	236.55	237.37							2.13	235.24	2.34	235.03
	I	236.55	237.37							2.07	235.30		
	OH	236.55	236.55			2.61	233.94			2.21	234.34		
BH03-5	II	247.61	248.39							5.19	243.20	4.01	244.38
	I	247.61	248.39							7.47	240.92	7.67	240.72
	OH	247.61	247.61			8.10	239.51	7.75	239.86				
BH03-6	II	245.20	245.66							0.75	244.91	1.01	244.65
	I	245.20	245.66							0.54	245.12	0.65	245.01
	OH	245.20	245.20			1.16	244.04	0.75	244.45				
BH04-7	II	228.82	229.42										
	I	228.81	229.67										
BH04-8	II	231.39	232.02										
	I	231.27	232.04										

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	May 18, 2004		September 13, 2004		October 18, 2004		November 17, 2004		December 13, 2004	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	5.62	239.61	6.12	239.11	6.12	239.11	6.15	239.08	5.34	239.89
	I	244.58	245.26	5.69	239.57	8.34	236.92	8.55	236.71	7.65	237.61	5.40	239.86
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	4.91	239.70	6.97	237.64	6.76	237.85	5.86	238.75	4.18	240.43
BH00-2	OH	256.33	256.33	8.22	248.11	6.87	249.46	6.71	249.62	6.54	249.79	6.16	250.17
BH00-3	OH	254.61	254.61	7.99	246.62	7.99	246.62	8.65	245.96	7.99	246.62		
BH03-4	II	236.55	237.37	2.48	234.89	4.58	232.79	5.00	232.37	4.15	233.22	2.46	234.91
	I	236.55	237.37	2.44	234.93	4.54	232.83	4.95	232.42	4.12	233.26	2.41	234.96
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	4.35	244.04	7.21	241.18	7.60	240.79	7.75	240.64	7.37	241.02
	I	247.61	248.39	7.75	240.64	9.20	239.19	9.68	238.72	9.58	238.81	8.52	239.87
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	1.18	244.48	3.73	241.93	4.03	241.63	4.05	241.61	3.44	242.22
	I	245.20	245.66	0.66	245.00	2.31	243.35	2.79	242.87	2.81	242.85	2.79	242.87
	OH	245.20	245.20										
BH04-7	II	228.82	229.42					2.03	227.39	1.73	227.69	0.78	228.64
	I	228.81	229.67					1.36	228.31	1.68	227.99	Frozen	
BH04-8	II	231.39	232.02					3.05	228.97	3.20	228.82	1.66	230.36
	I	231.27	232.04					2.46	229.58	2.58	229.46	1.6	230.44

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	January 24, 2005		February 17, 2005		March 18, 2005		April 14, 2005		May 19, 2005	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	5.03	240.20	5.03	240.20	5.94	239.29	5.32	239.91	5.52	239.71
	I	244.58	245.26	5.02	240.24	5.08	240.18	5.98	239.28	5.37	239.89	5.65	239.61
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	4.00	240.61	4.26	240.35	4.83	239.78	4.63	239.98	4.64	239.97
BH00-2	OH	256.33	256.33	5.55	250.78	5.54	250.79	5.63	250.70	5.44	250.89	5.04	251.29
BH00-3	OH	254.61	254.61	7.38	247.23	7.35	247.26			8.00	246.61	7.99	246.62
BH03-4	II	236.55	237.37	2.10	235.27	2.22	235.15	2.62	234.75	2.34	235.03	2.39	234.98
	I	236.55	237.37	2.05	235.32	2.18	235.19	2.57	234.80	2.28	235.09	2.33	235.04
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	7.01	241.38	3.94	244.45	4.70	243.69	2.98	245.41	4.08	244.31
	I	247.61	248.39	8.15	240.24	7.70	240.69	7.94	240.45	7.60	240.79	7.77	240.62
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	3.02	242.64	1.77	243.89	2.37	243.29	0.94	244.73	1.17	244.49
	I	245.20	245.66	2.24	243.42	2.43	243.23	2.32	243.34	1.94	243.72	1.66	244.00
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	0.53	228.89	Frozen		Frozen		0.85	228.57	0.9	228.52
	I	228.81	229.67	1.3	228.37	Frozen		Frozen		Flowing	>229.67	Flowing	>229.67
BH04-8	II	231.39	232.02	1.16	230.86	1.08	230.94	1.32	230.70	1.25	230.77	1.33	230.69
	I	231.27	232.04	0.8	231.24	Frozen		Frozen		0.61	231.43	0.71	231.33

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	June 20, 2005		July 14, 2005		August 31, 2005		September 28, 2005		October 20, 2005	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	5.96	239.27	7.55	237.68	6.00	239.23	7.83	237.40	7.82	237.41
	I	244.58	245.26	6.04	239.22	6.10	239.16	8.65	236.61	8.71	236.55	8.58	236.68
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	4.71	239.90	5.35	239.26	6.47	238.14	6.00	238.61	6.34	238.27
BH00-2	OH	256.33	256.33	4.70	251.63	4.50	251.83	5.79	250.54	4.07	252.26	4.00	252.33
BH00-3	OH	254.61	254.61	7.98	246.63	7.98	246.63	8.03	246.58	7.95	246.66	7.97	246.64
BH03-4	II	236.55	237.37	2.93	234.44	4.15	233.22	5.03	232.34	5.38	231.99	5.33	232.04
	I	236.55	237.37	2.89	234.48	4.11	233.26	4.99	232.38	12.65	224.72	9.82	227.55
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	4.99	243.40	5.54	242.85	7.07	241.32	8.72	239.67	DRY	<238.93
	I	247.61	248.39	8.10	240.29	8.72	239.67	9.60	238.79	10.00	238.39	10.09	238.30
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	2.25	243.41	3.21	242.45	3.96	241.70	4.16	241.50	4.25	241.41
	I	245.20	245.66	1.69	243.97	2.59	243.07	3.53	242.13	20.96	224.70	20.88	224.78
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	1.13	228.29	1.65	227.77	2.31	227.11	2.73	226.69	2.79	226.63
	I	228.81	229.67	Flowing	>229.67	0.05	229.62	0.55	229.12	0.73	228.94	0.79	228.88
BH04-8	II	231.39	232.02	1.88	230.14	2.40	229.62	2.19	229.83	3.56	228.46	3.66	228.36
	I	231.27	232.04	1.29	230.75	1.68	230.36	2.36	229.68	2.67	229.37	2.83	229.21

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	November 30, 2005		January 27, 2006		March 23, 2006		May 8, 2006		July 31, 2006	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23			5.19	240.04	5.26	239.97	5.78	239.45	6.14	239.09
	I	244.58	245.26			5.25	240.01	5.32	239.94	5.83	239.43	7.79	237.47
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	4.92	239.69	4.54	240.07	4.55	240.06	5.00	239.61	6.55	238.06
BH00-2	OH	256.33	256.33	3.20	253.13	3.16	253.17	3.42	252.91	3.46	252.87	3.36	252.97
BH00-3	OH	254.61	254.61	9.00	245.61	Frozen		7.97	246.64	7.98	246.63	7.98	246.63
BH03-4	II	236.55	237.37	2.30	235.07	2.33	235.04	2.32	235.05	2.58	234.79	4.62	232.75
	I	236.55	237.37	6.19	231.18	3.73	233.64	2.61	234.76	2.53	234.84	4.58	232.79
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	6.55	241.84	3.71	244.68	3.02	245.37	3.02	245.37	6.84	241.55
	I	247.61	248.39	8.21	240.18	7.77	240.62	7.65	240.74	7.65	240.74	9.18	239.21
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	3.46	242.20	1.79	243.87	1.06	244.60	1.03	244.63	3.48	242.18
	I	245.20	245.66	20.78	224.88	20.12	225.54	19.63	226.03	19.07	226.59	21.21	224.45
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	0.76	228.66	0.78	228.64	Frozen		1.17	228.25	2.00	227.42
	I	228.81	229.67	0.57	229.10	Frozen		0.06	229.61	0.56	229.11	0.20	229.47
BH04-8	II	231.39	232.02	1.45	230.57	1.13	230.89	1.16	230.86	1.67	230.35	2.66	229.36
	I	231.27	232.04	1.32	230.72	0.65	231.39	0.68	231.36	0.97	231.07	2.00	230.04

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	September 21, 2006		November 28, 2006		January 24, 2007		March 22, 2007		May 24, 2007	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	6.08	239.15	5.35	239.88	5.57	239.66	5.05	240.18	5.83	239.40
	I	244.58	245.26	8.14	237.12	5.4	239.86	5.58	239.68	5.24	240.02	5.92	239.34
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	5.72	238.89	1.29	243.32	4.84	239.77	-0.03	244.64	4.94	239.67
BH00-2	OH	256.33	256.33	3.22	253.11	2.46	253.87	2.25	254.08	2.62	253.71	2.90	253.43
BH00-3	OH	254.61	254.61	7.95	246.66	7.96	246.65	7.99	246.62	7.95	246.66	7.99	246.62
BH03-4	II	236.55	237.37	5.27	232.10	2.34	235.03	2.43	234.94	2.06	235.31	2.57	234.8
	I	236.55	237.37	5.22	232.15	2.3	235.07	2.38	234.99	2.01	235.36	2.52	234.85
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	DRY	<238.94	3.46	244.93	3.76	244.63	3.17	245.22	4.51	243.88
	I	247.61	248.39	10.02	238.37	7.71	240.68	7.77	240.62	7.58	240.81	7.99	240.4
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	4.07	241.59	1.49	244.17	1.32	244.34	1.70	243.96	1.65	244.01
	I	245.20	245.66	20.80	224.86	20.38	225.28	20.00	225.66	19.54	226.12	19.15	226.51
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	2.67	226.75	0.77	228.65	0.85	228.57	Frozen		1.11	228.31
	I	228.81	229.67	0.62	229.05	Frozen	>229.67	Frozen	>229.67	0.14	229.53	0.00	229.67
BH04-8	II	231.39	232.02	3.55	228.47	1.17	230.85	1.18	230.84	0.97	231.05	1.69	230.33
	I	231.27	232.04	2.65	229.39	0.51	231.53	0.6	231.44	0.56	231.48	0.92	231.12

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	July 20, 2007		September 20, 2007		November 15, 2007		January 16, 2008		March 24, 2008	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	6.00	239.23	6.11	239.12	5.63	239.60	5.35	239.88	5.17	240.06
	I	244.58	245.26	6.78	238.48	6.63	238.63	5.66	239.60	5.42	239.84	5.25	240.01
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	3.31	241.30	5.38	239.23	4.90	239.71	4.75	239.86	4.58	240.03
BH00-2	OH	256.33	256.33	2.27	254.06	2.20	254.13	2.34	253.99	1.82	254.51	1.70	254.63
BH00-3	OH	254.61	254.61	7.94	246.67	7.99	246.62	7.98	246.63	7.97	246.64	7.98	246.63
BH03-4	II	236.55	237.37	3.33	234.04	3.69	233.68	2.47	234.90	2.54	234.83	2.31	235.06
	I	236.55	237.37	5.66	231.71	4.21	233.16	3.15	234.22	2.30	235.07	2.27	235.10
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	5.69	242.70	7.56	240.83	5.44	242.95	2.75	245.64	3.61	244.78
	I	247.61	248.39	8.09	240.30	9.32	239.07	8.54	239.85	7.58	240.81	7.69	240.70
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	2.92	242.74	3.62	242.04	3.24	242.42	1.18	244.48	0.23	245.43
	I	245.20	245.66	23.80	221.86	23.51	222.15	22.87	222.79	22.50	223.16	21.93	223.73
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	1.39	228.03	2.07	227.35	0.92	228.50	0.76	228.66	Frozen	
	I	228.81	229.67	0.24	229.43	0.43	229.24	0.00	229.67	Frozen		Frozen	
BH04-8	II	231.39	232.02	2.37	229.65	2.99	229.03	1.58	230.44	Dry	<231.39	1.10	230.92
	I	231.27	232.04	1.66	230.38	2.13	229.91	0.57	231.47	0.53	231.51	Frozen	

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	May 22, 2008		July 29, 2008		September 29, 2008		November 13, 2008		January 29, 2009	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	5.54	239.69	5.95	239.28	6.14	239.09	5.64	239.59	6.01	239.22
	I	244.58	245.26	5.60	239.66	5.99	239.27	7.41	237.85	5.75	239.51	6.13	239.13
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	4.67	239.94	5.09	239.52	6.46	238.15	0.10	244.51	6.74	237.87
BH00-2	OH	256.33	256.33	1.29	255.04	1.29	255.04	0.98	255.35	0.32	256.01	0.59	255.74
BH00-3	OH	254.61	254.61	7.95	246.66	7.97	246.64	7.96	246.65	8.59	246.02	Frozen	
BH03-4	II	236.55	237.37	2.34	235.03	2.63	234.74	3.75	233.62	2.21	235.16	2.56	234.81
	I	236.55	237.37	2.26	235.11	6.58	230.79	4.17	233.20	3.29	234.08	2.57	234.80
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	3.83	244.56	4.52	243.87	6.80	241.59	5.14	243.25	4.18	244.21
	I	247.61	248.39	7.73	240.66	7.92	240.47	8.59	239.80	7.91	240.48	7.72	240.67
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	1.20	244.46	2.61	243.05	3.46	242.20	2.88	242.78	1.40	244.26
	I	245.20	245.66	21.48	224.18	24.30	221.36	24.04	221.62	23.87	221.79	23.55	222.11
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	0.86	228.56	1.12	228.30	1.60	227.82	0.69	228.73	0.96	228.46
	I	228.81	229.67	0.11	229.56	0.04	229.63	0.53	229.14	0.00	229.67	Frozen	
BH04-8	II	231.39	232.02	1.21	230.81	1.51	230.51	2.16	229.86	0.34	231.68	1.32	230.70
	I	231.27	232.04	0.72	231.32	0.74	231.30	1.21	230.83	1.02	231.02	0.61	231.43

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	March 26, 2008		May 27, 2009		July 23, 2009		September 24, 2009		November 27, 2009	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	5.27	239.96	5.83	239.40	6.05	239.18	6.04	239.19	5.64	239.59
	I	244.58	245.26	5.38	239.88	5.90	239.36	6.95	238.31	7.18	238.08	5.70	239.56
	OH	244.58	244.58										
BH00-1	OH*	244.61	244.61	6.70	237.91	4.87	239.74	5.65	238.96	4.90	239.71	6.71	237.90
BH00-2	OH	256.33	256.33	0.81	255.52	0.42	255.91	0.48	255.85	0.40	255.93	0.06	256.27
BH00-3	OH	254.61	254.61	7.99	246.62	7.93	246.68	7.92	246.69	7.99	246.62	8.46	246.15
BH03-4	II	236.55	237.37	2.22	235.15	2.67	234.70	3.87	233.50	3.89	233.48	2.30	235.07
	I	236.55	237.37	2.46	234.91	2.67	234.70	7.03	230.34	4.33	233.04	2.97	234.40
	OH	236.55	236.55										
BH03-5	II	247.61	248.39	3.26	245.13	4.10	244.29	5.45	242.94	7.13	241.26	3.92	244.47
	I	247.61	248.39	7.55	240.84	7.71	240.68	8.44	239.95	8.92	239.47	7.62	240.77
	OH	247.61	247.61										
BH03-6	II	245.20	245.66	0.98	244.68	1.37	244.29	3.08	242.58	3.40	242.26	1.82	243.84
	I	245.20	245.66	23.15	222.51	22.66	223.00	24.13	221.53	23.89	221.77	23.67	221.99
	OH	245.20	245.20										
BH04-7	II	228.82	229.42	Frozen		1.25	228.17	1.62	227.80	1.69	227.73	0.75	228.67
	I	228.81	229.67	0.01	229.66	0.07	229.60	0.58	229.09	0.55	229.12	-0.01	229.68
BH04-8	II	231.39	232.02	1.13	230.89	1.80	230.22	2.24	229.78	2.29	229.73	1.07	230.95
	I	231.27	232.04	0.45	231.59	0.89	231.15	1.39	230.65	1.29	230.75	0.32	231.72

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

TABLE B-2
GROUNDWATER ELEVATIONS
SEBRIGHT QUARRY

LOCATION DESIGNATION	MONITOR DESIGNATION	GROUND SURFACE ELEVATION (m ASL)	T.O.P. ELEVATION (m ASL)	January 19, 2010		March 22, 2010		May 27, 2010		July 22, 2010		September 30, 2010		November 22, 2010	
				Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)	Depth (m)	Elevation (m asl)
BH03-1	II	244.58	245.23	6.05	239.18	5.73	239.50	6.01	239.22	5.97	239.26	5.54	239.69	5.90	239.33
	I	244.58	245.26	6.21	239.05	5.75	239.51	6.11	239.15	6.06	239.20	5.59	239.67	5.85	239.41
	OH	244.58	244.58												
BH00-1	OH*	244.61	244.61	6.71	237.90	6.71	237.90	4.99	239.62	4.82	239.79	4.85	239.76	4.90	239.71
BH00-2	OH	256.33	256.33	0.33	256.00	0.55	255.78	0.56	255.77	0.15	256.18	0.03	256.30	0.21	256.12
BH00-3	OH	254.61	254.61	Frozen		8.46	246.15	8.00	246.61	7.98	246.63	7.95	246.66	8.45	246.16
BH03-4	II	236.55	237.37	2.48	234.89	2.37	235.00	2.98	234.39	2.53	234.84	2.26	235.11	2.35	235.02
	I	236.55	237.37	2.60	234.77	2.51	234.86	2.48	234.89	6.13	231.24	3.26	234.11	2.64	234.73
	OH	236.55	236.55												
BH03-5	II	247.61	248.39	4.86	243.53	3.48	244.91	4.38	244.01	4.09	244.30	3.33	245.06	4.68	243.71
	I	247.61	248.39	7.84	240.55	7.52	240.87	7.82	240.57	7.61	240.78	7.45	240.94	7.70	240.69
	OH	247.61	247.61												
BH03-6	II	245.20	245.66	2.40	243.26	1.14	244.52	1.64	244.02	1.42	244.24	1.43	244.23	1.83	243.83
	I	245.20	245.66	23.23	222.43	22.74	222.92	22.17	223.49	23.64	222.02	23.05	222.61	22.63	223.03
	OH	245.20	245.20												
BH04-7	II	228.82	229.42	0.92	228.50	0.87	228.55	1.35	228.07	1.09	228.33	0.75	228.67	0.84	228.58
	I	228.81	229.67	Frozen		Frozen		0.06	229.61	-0.02	229.69	-0.01	229.68	-0.01	229.68
BH04-8	II	231.39	232.02	1.37	230.65	1.20	230.82	1.97	230.05	1.37	230.65	1.06	230.96	1.15	230.87
	I	231.27	232.04	0.56	231.48	0.55	231.49	1.06	230.98	0.64	231.40	0.25	231.79	0.32	231.72

NOTES:
1) 'm ASL' indicates metres above sea level.
2) 'm' indicates metres.
3) 'OH' indicates open hole.
4) 'OH*' indicates original borehole at this location was retained as an open hole.
5) November 2006 water levels obtained over one week.
6) A negative depth indicates water level was above top of pipe.

FIGURE B-1
GROUNDWATER HYDROGRAPHS

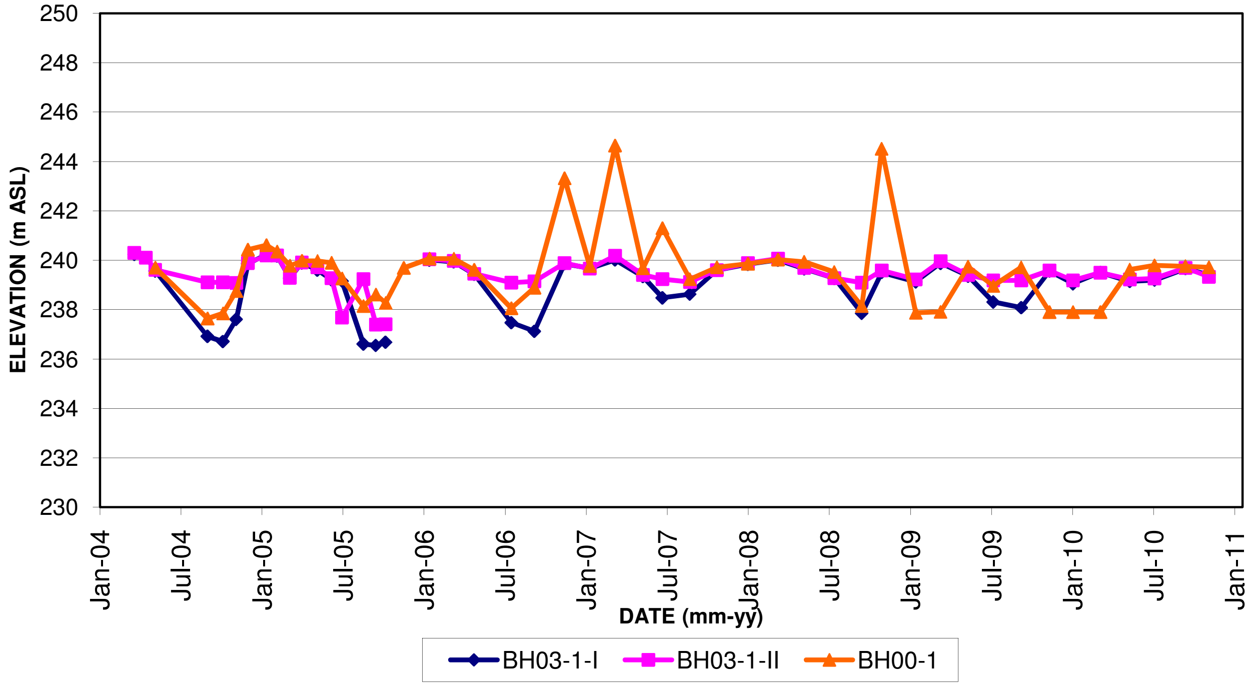


FIGURE B-2
GROUNDWATER HYDROGRAPHS

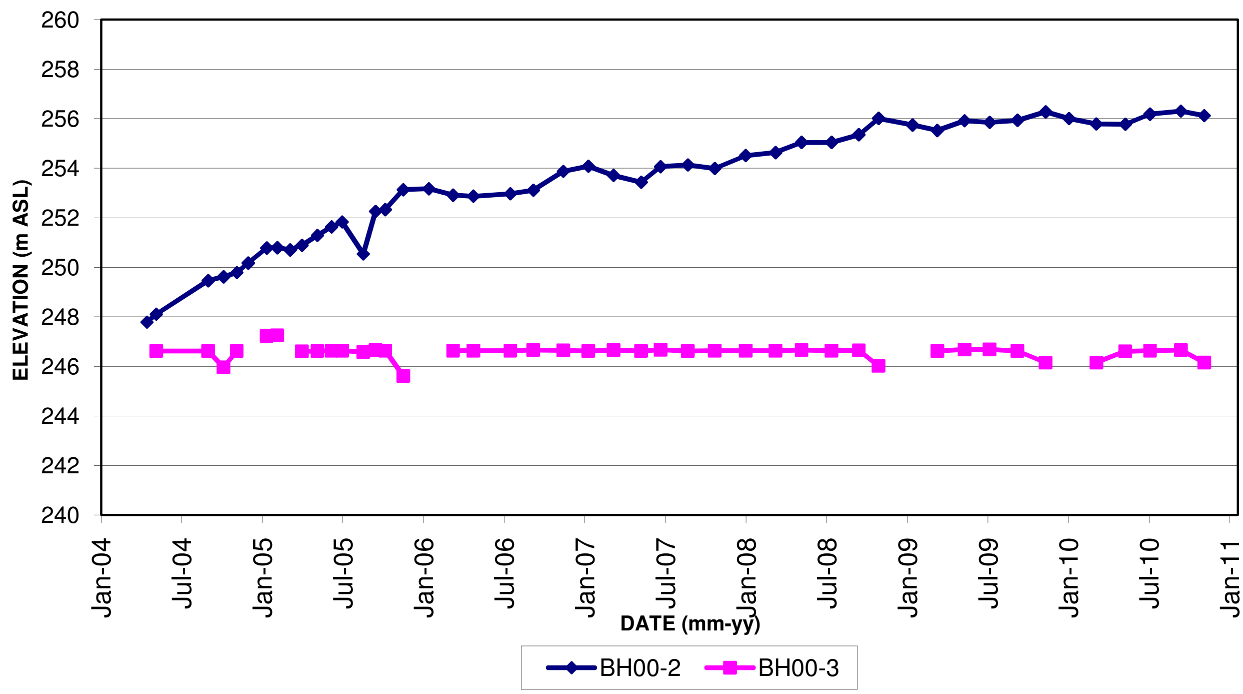


FIGURE B-3
GROUNDWATER HYDROGRAPHS

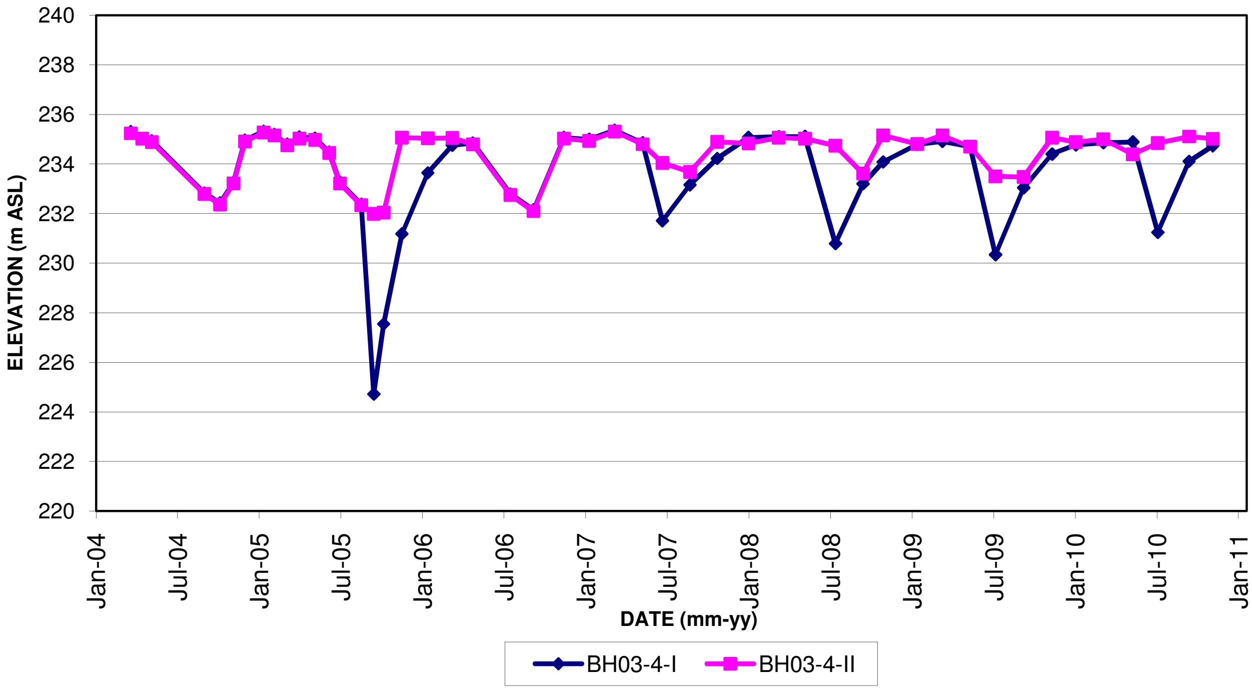


FIGURE B-4
GROUNDWATER HYDROGRAPHS

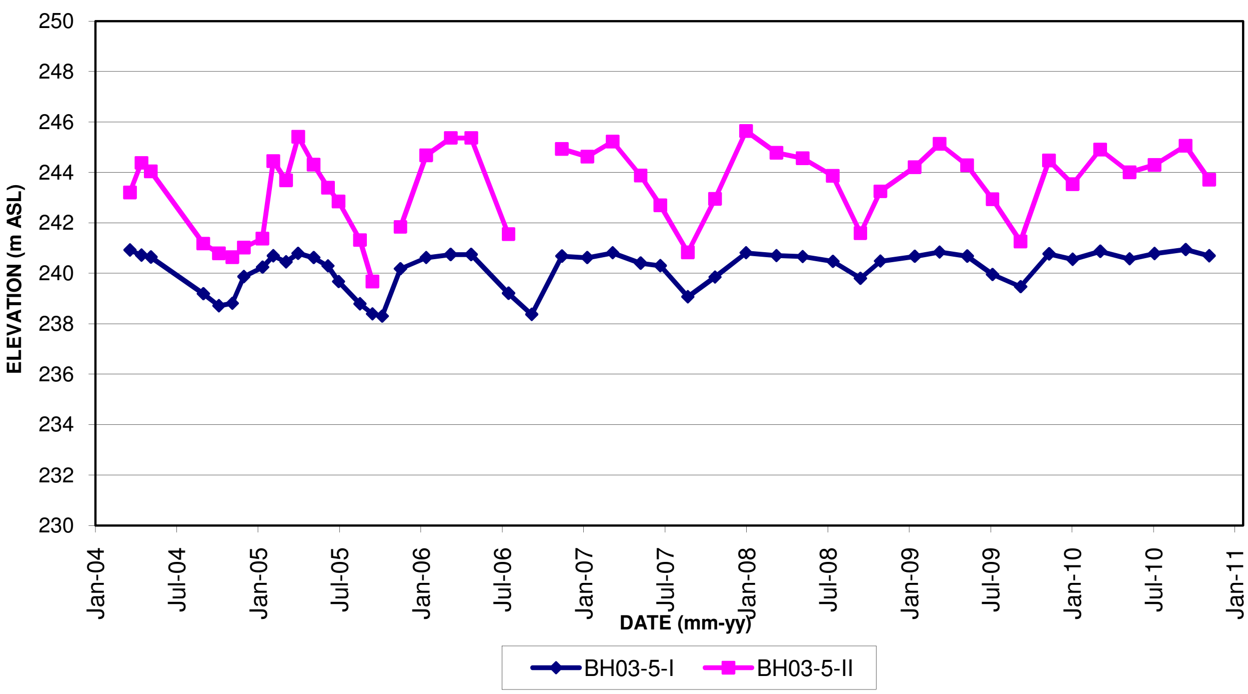


FIGURE B-5
GROUNDWATER HYDROGRAPHS

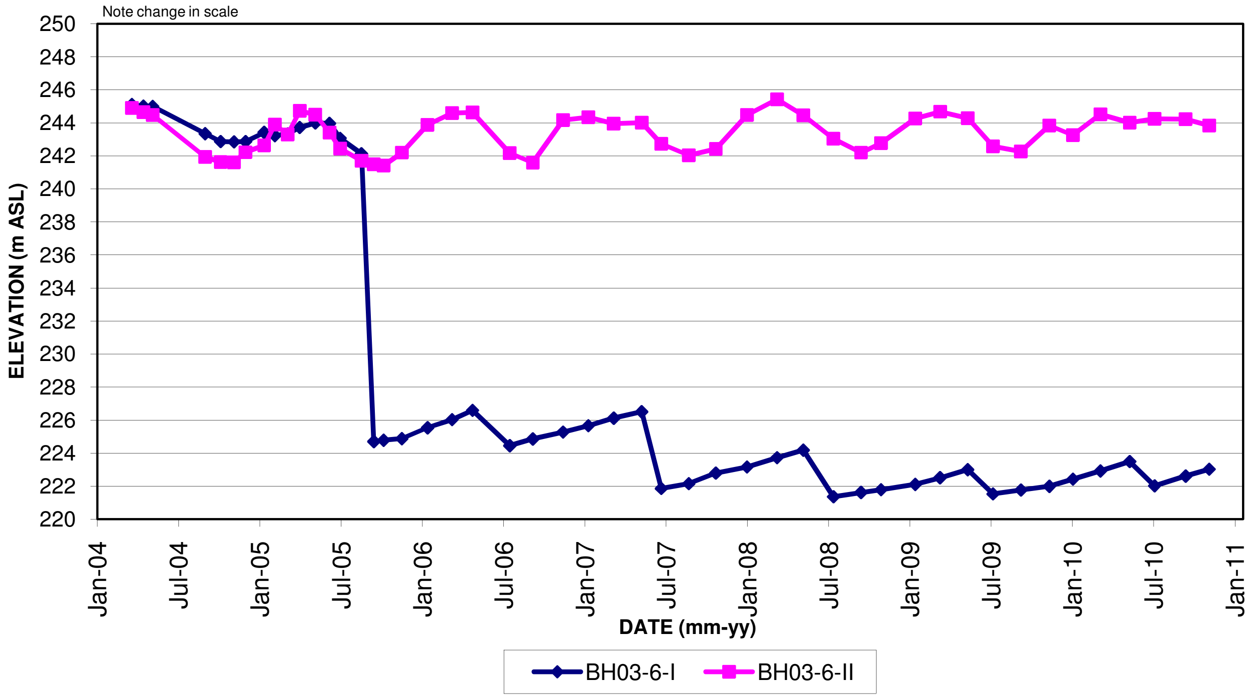


FIGURE B-6
GROUNDWATER HYDROGRAPHS

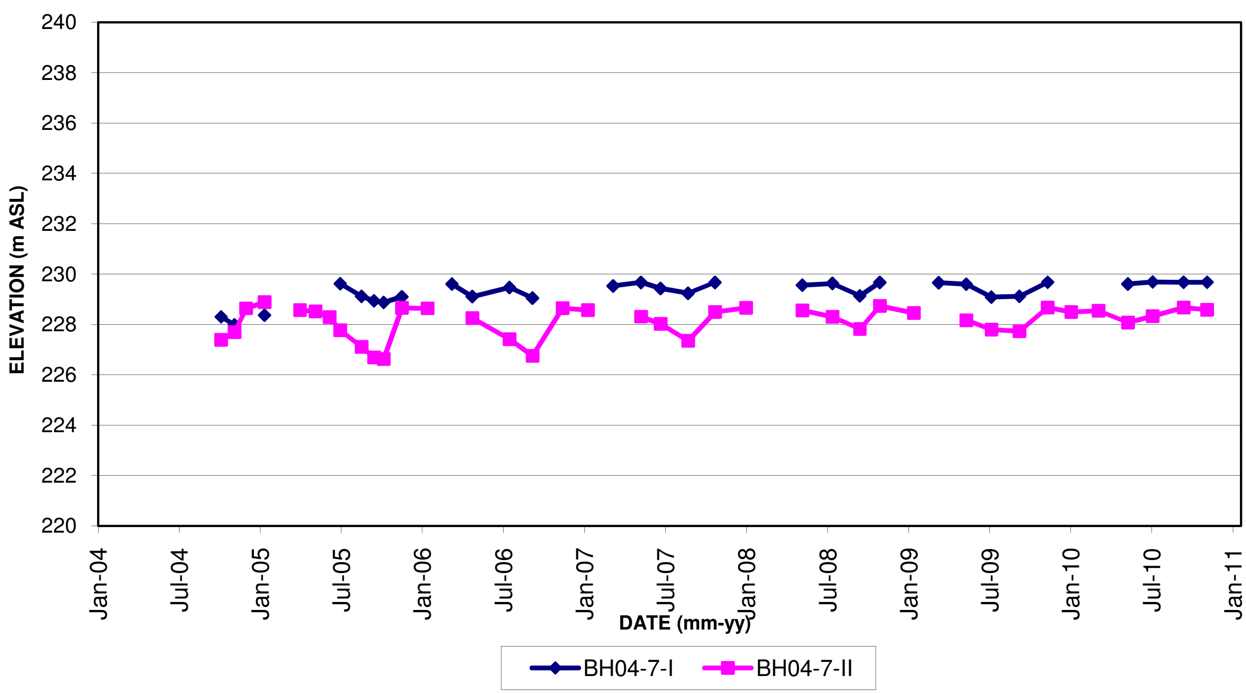


FIGURE B-7
GROUNDWATER HYDROGRAPHS

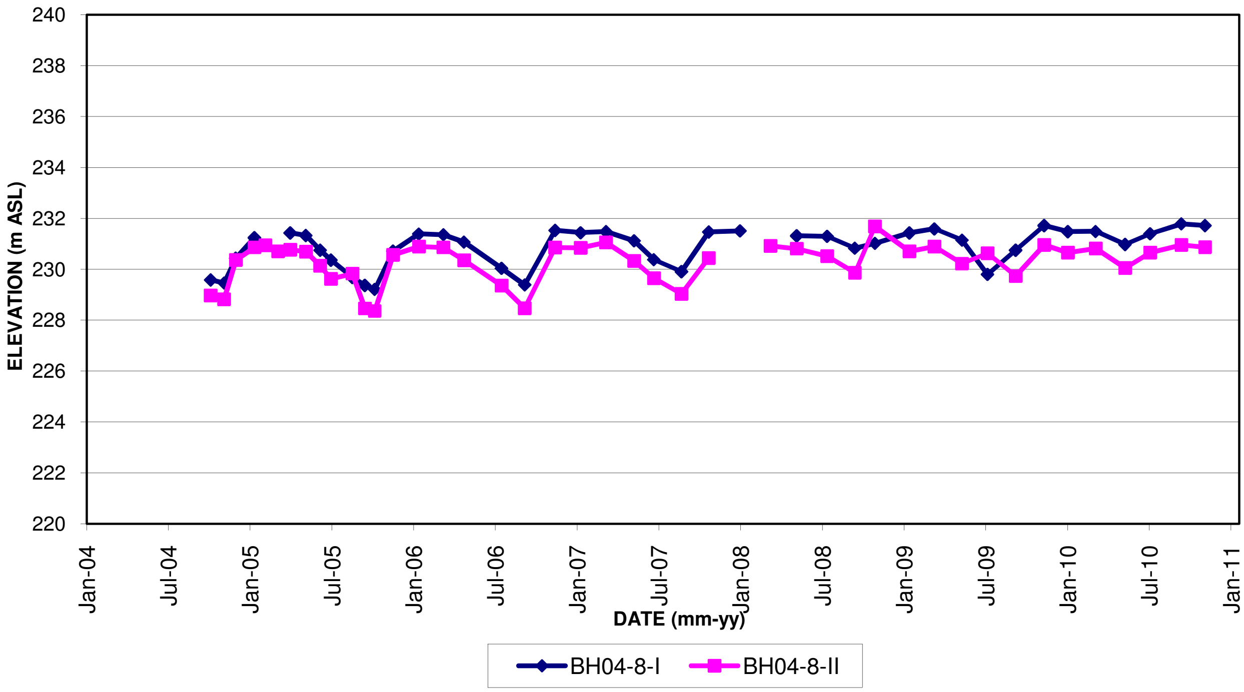


TABLE B-3
GROUNDWATER LEVELS - RESIDENTIAL
SEBRIGHT QUARRY

LOCATION	CONSTRUCTION TYPE	DATE	WATER LEVEL (mbg)
61 Dartmoor Rd	Dug	13-Jun-06	1.32
126 Dartmoor Rd	Drilled	9-May-06	
538 Monck Rd	Drilled	9-May-06	6.62
594 Monck Rd	Drilled	9-May-06	13.60
776 Monck Rd	Drilled	13-Jun-06	
844 Monck Rd	Drilled	13-Jun-06	2.70
870 Monck Rd	Drilled	13-Jun-06	4.23
874 Monck Rd	Drilled	13-Jun-06	
884 Monck Rd	Drilled	13-Jun-06	1.40
906 Monck Rd	Drilled	13-Jun-06	
915 Monck Rd	Drilled	13-Jun-06	

Notes:
1) "mbg" indicates metres below grade.
2) Blank indicates water level could not be obtained.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-1-I		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		12.7	14.9	13.3
pH (field)	pH		7.20	7.70	8.00
Conductivity (field)	uS/cm		36	42	51
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		41.9	37	36
Dissolved Organic Carbon	mg/L	5.0 (AO)	0.7	0.6	0.7
pH	pH	6.5-8.5 (OG)	6.67	6.8	**6.3**
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	**13.1**	**11**	**12**
Chloride (Cl)	mg/L	250 (AO)	<1	<1	<1
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.3	<0.1	<0.1
Phosphate-P	mg/L		<1	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	7	6	6
Anion Sum	meq/L		0.431	0.346	0.364
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		13.1	11	12
Calculated TDS	mg/L	500 (AO)	24.7	20	27
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		0.416	0.383	0.326
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**16**	**16**	**13**
Ion Balance (% Difference)	%		1.76	5.05	
Dissolved Aluminum (Al)	ug/L		38	100	27
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	22	24	25
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	<10	<10	<10
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		4700	4900	3800
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		0.8	0.9	0.6
Dissolved Copper (Cu)	ug/L	1000 (AO)	5.8	6	2
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	78	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		940	890	810
Dissolved Manganese (Mn)	ug/L	50 (AO)	15	14	9
Dissolved Molybdenum (Mo)	ug/L		6.9	4	3
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		740	610	650
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3200	2900	3300
Dissolved Silver (Ag)	ug/L		<0.5	0.4	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	1900	1100	1200
Dissolved Strontium (Sr)	ug/L		47	39	36
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	10	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.1	0.2	<0.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	14	17	5
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			57	150

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-1-I**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		12.8	10.9	10.5
pH (field)	pH		8.77	7.90	7.25
Conductivity (field)	uS/cm		41	34	30
Ammonia (Total - N)	mg/L		0.12	<0.05	<0.05
Conductivity	uS/cm		35	36	34
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.1	0.7	1.8
pH	pH	6.5-8.5 (OG)	6.9	6.6	6.8
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	**10**	**10**	**9**
Chloride (Cl)	mg/L	250 (AO)	<1	<1	<1
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	0.1	<0.1
Phosphate-P	mg/L		<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	5	5	4
Anion Sum	meq/L		0.315	0.316	0.273
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		10	10	9
Calculated TDS	mg/L	500 (AO)	23	24	22
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		0.304	0.335	0.308
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**12**	**13**	**12**
Ion Balance (% Difference)	%				
Dissolved Aluminum (Al)	ug/L		45	54	61
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	21	23	24
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	<10	<10	<10
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		3500	3900	3500
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	0.6	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	3	4	2
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		740	870	750
Dissolved Manganese (Mn)	ug/L	50 (AO)	8	7	8
Dissolved Molybdenum (Mo)	ug/L		2	2	2
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		610	660	610
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		2700	3000	2700
Dissolved Silver (Ag)	ug/L		<0.1	0.2	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	950	1100	1100
Dissolved Strontium (Sr)	ug/L		38	43	38
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.2	0.2	0.3
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	10	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		200	66	50

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-1-II**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		18.8	12.7	15.5
pH (field)	pH		7.36	7.41	7.89
Conductivity (field)	uS/cm		720	394	404
Ammonia (Total - N)	mg/L		0.49	<0.05	0.15
Conductivity	uS/cm		714	436	513
Dissolved Organic Carbon	mg/L	5.0 (AO)	**9.1**	2.9	2.2
pH	pH	6.5-8.5 (OG)	8.0	8.1	8.1
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	214	130	148
Chloride (Cl)	mg/L	250 (AO)	10	4	5
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.5	1.3	1.4
Phosphate-P	mg/L		<1	<0.01	0.03
Sulphate (SO4)	mg/L	500 (AO)	170	84	100
Anion Sum	meq/L		8.13	4.55	5.29
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		212	128	146
Calculated TDS	mg/L	500 (AO)	499	259	334
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	1	2
Cation Sum	meq/L		8.77	4.21	5.76
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**160**	**120**	**150**
Ion Balance (% Difference)	%		3.83	3.93	4.27
Dissolved Aluminum (Al)	ug/L		9.8	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	0.7
Dissolved Arsenic (As)	ug/L	25 (IMAC)	2.3	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	17	16	17
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	50	82	110
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		50000	38000	47000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		0.6	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	5.7	6	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		7800	6200	8200
Dissolved Manganese (Mn)	ug/L	50 (AO)	**980**	**290**	**290**
Dissolved Molybdenum (Mo)	ug/L		65	84	95
Dissolved Nickel (Ni)	ug/L		2.8	<1	1
Dissolved Potassium (K)	ug/L		2400	2100	2400
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		7600	5500	6700
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	130000	40000	61000
Dissolved Strontium (Sr)	ug/L		320	250	380
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	9.2	3.8	6.2
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	10	7	<5
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			1300	2200

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-1-II**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		12.2	10.7	15.4
pH (field)	pH		7.89	7.80	6.99
Conductivity (field)	uS/cm		300	487	400
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		279	445	492
Dissolved Organic Carbon	mg/L	5.0 (AO)	0.8	2.3	1.9
pH	pH	6.5-8.5 (OG)	8.1	8.1	8.1
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	98	113	116
Chloride (Cl)	mg/L	250 (AO)	3	5	7
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.8	1.6	1.4
Phosphate-P	mg/L		<0.01	0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	39	80	100
Anion Sum	meq/L		2.92	4.17	4.78
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		96	111	115
Calculated TDS	mg/L	500 (AO)	181	278	291
Carb. Alkalinity (calc. as CaCO3)	mg/L		1	1	1
Cation Sum	meq/L		3.25	5.04	4.44
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	97	**120**	**110**
Ion Balance (% Difference)	%		5.34	9.40	3.69
Dissolved Aluminum (Al)	ug/L		<5	<5	5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	0.6
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	10	17	12
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	74	83	68
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		29000	38000	32000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	6	2	2
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		5800	6100	6300
Dissolved Manganese (Mn)	ug/L	50 (AO)	**150**	**280**	6
Dissolved Molybdenum (Mo)	ug/L		53	65	51
Dissolved Nickel (Ni)	ug/L		<1	<1	1
Dissolved Potassium (K)	ug/L		1500	1900	1900
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		4800	5600	5600
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	29000	59000	52000
Dissolved Strontium (Sr)	ug/L		270	350	300
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	5	6.2	5.7
Dissolved Vanadium (V)	ug/L		<1	1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	7	<5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		310	620	320

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-4-I**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		11.2	12.5	11
pH (field)	pH		7.47	7.30	7.22
Conductivity (field)	uS/cm		721	2431	1955
Ammonia (Total - N)	mg/L		1.05	0.16	<0.05
Conductivity	uS/cm		1000	2380	910
Dissolved Organic Carbon	mg/L	5.0 (AO)	**22.9**	2.8	1.8
pH	pH	6.5-8.5 (OG)	8.0	7.7	7.5
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	199	71	82
Chloride (Cl)	mg/L	250 (AO)	12.8	30	5
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.3	1	0.5
Phosphate-P	mg/L		<1	<0.01	0.09
Sulphate (SO4)	mg/L	500 (AO)	323	**1220**	328
Anion Sum	meq/L		11.1	27.8	8.66
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		197	71	82
Calculated TDS	mg/L	500 (AO)	**723**	**1910**	**590**
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	<1	<1
Cation Sum	meq/L		12.1	29.1	9.13
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**170**	**790**	**280**
Ion Balance (% Difference)	%		4.28	2.43	2.62
Dissolved Aluminum (Al)	ug/L		39	<5	7
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	1.7	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	87	93	32
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	88	1200	340
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		55000	270000	99000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	1.1	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	5.6	3	4
Dissolved Iron (Fe)	ug/L	300 (AO)	**320**	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	0.6	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		7700	30000	8900
Dissolved Manganese (Mn)	ug/L	50 (AO)	**300**	**600**	**320**
Dissolved Molybdenum (Mo)	ug/L		1100	250	49
Dissolved Nickel (Ni)	ug/L		2.2	<1	2
Dissolved Potassium (K)	ug/L		12000	11000	3300
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		7500	6600	7200
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	190000	**300000**	77000
Dissolved Strontium (Sr)	ug/L		460	6100	2600
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	7.3	3	1.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	47	370	45
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			130	100

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-4-I		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9	11.1	12.2
pH (field)	pH		7.65	7.56	6.71
Conductivity (field)	uS/cm		1698	1849	1960
Ammonia (Total - N)	mg/L		0.28	<0.05	<0.05
Conductivity	uS/cm		2650	2420	2520
Dissolved Organic Carbon	mg/L	5.0 (AO)	2.7	1.9	3.5
pH	pH	6.5-8.5 (OG)	7.8	6.6	7.7
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	68	53	46
Chloride (Cl)	mg/L	250 (AO)	31	31	32
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	0.01
Nitrate (N)	mg/L	10.0 (MAC)	5.0	2.3	1.5
Phosphate-P	mg/L		<0.01	0.05	0.02
Sulphate (SO4)	mg/L	500 (AO)	**1340**	**1100**	**1200**
Anion Sum	meq/L		30.5	26.0	27.0
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		67	53	45
Calculated TDS	mg/L	500 (AO)	**2000**	**1800**	**1870**
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		26.3	26.9	27.9
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**640**	**680**	**690**
Ion Balance (% Difference)	%		7.35	1.79	1.51
Dissolved Aluminum (Al)	ug/L		<30	12	9
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<3	0.6	0.6
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<5	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	56	51	47
Dissolved Beryllium (Be)	ug/L		<3	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	1200	1500	1600
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.5	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		210000	230000	230000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<30	<5	<5
Dissolved Cobalt (Co)	ug/L		<3	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	<5	2	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<500	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<3	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		25000	25000	27000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**390**	**240**	**110**
Dissolved Molybdenum (Mo)	ug/L		190	120	120
Dissolved Nickel (Ni)	ug/L		<5	<5	2
Dissolved Potassium (K)	ug/L		8200	6300	6500
Dissolved Selenium (Se)	ug/L	10 (MAC)	<10	<2	<2
Dissolved Silicon (Si)	ug/L		6600	5500	5900
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	**310000**	**310000**	**320000**
Dissolved Strontium (Sr)	ug/L		5500	6600	7300
Dissolved Thallium (Tl)	ug/L		<0.3	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<30	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	3.4	1.3	1.6
Dissolved Vanadium (V)	ug/L		<5	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	160	130	120
Dissolved Phosphorus (P)	ug/L		<500	<100	<100
Dissolved Bismuth (Bi)	ug/L		<5	<1	<1
Total Suspended Solids	mg/L		2700	53	130

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-4-II**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		13.5	11.8	12.2
pH (field)	pH		7.34	7.01	7.78
Conductivity (field)	uS/cm		196	42	110
Ammonia (Total - N)	mg/L		0.24	<0.05	<0.05
Conductivity	uS/cm		122	106	60
Dissolved Organic Carbon	mg/L	5.0 (AO)	3.2	2.7	3.0
pH	pH	6.5-8.5 (OG)	7.4	7.3	6.5
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	56.9	43	**24**
Chloride (Cl)	mg/L	250 (AO)	<1	3	1
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	0.02
Nitrate (N)	mg/L	10.0 (MAC)	<0.2	<0.1	<0.1
Phosphate-P	mg/L		<1	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	2	17	9
Anion Sum	meq/L		1.18	1.32	0.70
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		56.8	43	24
Calculated TDS	mg/L	500 (AO)	66.5	61	48
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		1.43	0.692	0.600
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**47**	**25**	**24**
Ion Balance (% Difference)	%		9.45	31.3	
Dissolved Aluminum (Al)	ug/L		19	42	60
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	1.5	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	28	41	62
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	11	<10	<10
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		15000	7900	7100
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	5	1.7
Dissolved Copper (Cu)	ug/L	1000 (AO)	3.7	9	4
Dissolved Iron (Fe)	ug/L	300 (AO)	**1000**	57	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		2300	1400	1400
Dissolved Manganese (Mn)	ug/L	50 (AO)	**270**	45	26
Dissolved Molybdenum (Mo)	ug/L		91	32	21
Dissolved Nickel (Ni)	ug/L		1.3	1	1
Dissolved Potassium (K)	ug/L		2900	1900	1500
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		8000	5000	5200
Dissolved Silver (Ag)	ug/L		<0.5	0.3	0.4
Dissolved Sodium (Na)	ug/L	200000 (AO)	8500	3100	2000
Dissolved Strontium (Sr)	ug/L		170	80	87
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.2	<0.1	<0.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	6.5	13	10
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			8100	6500

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-4-II		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		8.9	9.1	10.9
pH (field)	pH		8.14	7.77	7.25
Conductivity (field)	uS/cm		54	59	58
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		56	60	57
Dissolved Organic Carbon	mg/L	5.0 (AO)	2.8	1.5	2.4
pH	pH	6.5-8.5 (OG)	7.3	**6.3**	6.9
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	**21**	**27**	**23**
Chloride (Cl)	mg/L	250 (AO)	<1	1	1
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	0.02	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	8	6	6
Anion Sum	meq/L		0.59	0.69	0.63
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		21	27	23
Calculated TDS	mg/L	500 (AO)	43	46	41
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		0.587	0.589	0.525
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**23**	**24**	**21**
Ion Balance (% Difference)	%				
Dissolved Aluminum (Al)	ug/L		71	64	51
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	77	88	87
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	<10	<10	16
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		6800	6900	6300
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		0.8	0.7	0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	5	4	4
Dissolved Iron (Fe)	ug/L	300 (AO)	120	150	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		1400	1600	1300
Dissolved Manganese (Mn)	ug/L	50 (AO)	31	34	35
Dissolved Molybdenum (Mo)	ug/L		11	7	10
Dissolved Nickel (Ni)	ug/L		<1	<1	1
Dissolved Potassium (K)	ug/L		1300	1100	990
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		5000	5200	4400
Dissolved Silver (Ag)	ug/L		0.3	0.2	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	1900	1700	1700
Dissolved Strontium (Sr)	ug/L		89	92	95
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.1	<0.1	0.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	5	5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		8200	2100	1900

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-5-I**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		13.5	15.2	11.1
pH (field)	pH		7.58	7.46	7.65
Conductivity (field)	uS/cm		572	651	350
Ammonia (Total - N)	mg/L		<0.05	<0.05	0.07
Conductivity	uS/cm		570	661	664
Dissolved Organic Carbon	mg/L	5.0 (AO)	0.5	0.5	0.5
pH	pH	6.5-8.5 (OG)	8.1	8.2	8.0
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	289	290	275
Chloride (Cl)	mg/L	250 (AO)	1	3	4
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.4	0.2	0.2
Phosphate-P	mg/L		<1	<0.01	0.07
Sulphate (SO4)	mg/L	500 (AO)	59.6	74	82
Anion Sum	meq/L		7.09	7.45	7.34
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		286	286	272
Calculated TDS	mg/L	500 (AO)	370	390	410
Carb. Alkalinity (calc. as CaCO3)	mg/L		3	5	3
Cation Sum	meq/L		7.5	7.6	8.25
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**310**	**300**	**320**
Ion Balance (% Difference)	%		2.84	1.03	5.83
Dissolved Aluminum (Al)	ug/L		7.9	<5	6
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	32	36	40
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	220	280	280
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		70000	69000	71000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	1.1	4	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		34000	32000	36000
Dissolved Manganese (Mn)	ug/L	50 (AO)	2.5	<2	<2
Dissolved Molybdenum (Mo)	ug/L		2.7	2	1
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		3800	3800	4000
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3100	3300	4000
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	27000	34000	38000
Dissolved Strontium (Sr)	ug/L		980	1000	1000
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	2.2	3.2	3.2
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	6	<5
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			3	10

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-5-I**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9.3	11.0	11.0
pH (field)	pH		8.15	7.83	7.57
Conductivity (field)	uS/cm		573	639	662
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		671	689	705
Dissolved Organic Carbon	mg/L	5.0 (AO)	0.4	0.5	1.6
pH	pH	6.5-8.5 (OG)	8.3	7.8	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	264	278	275
Chloride (Cl)	mg/L	250 (AO)	5	5	5
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.1	0.2	0.2
Phosphate-P	mg/L		<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	102	93	96
Anion Sum	meq/L		7.57	7.64	7.64
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		260	276	271
Calculated TDS	mg/L	500 (AO)	414	413	413
Carb. Alkalinity (calc. as CaCO3)	mg/L		5	2	4
Cation Sum	meq/L		7.66	7.67	7.58
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**300**	**300**	**290**
Ion Balance (% Difference)	%		0.62	0.23	0.39
Dissolved Aluminum (Al)	ug/L		6	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	40	41	41
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	260	250	250
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		67000	68000	66000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	4	2	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		31000	31000	31000
Dissolved Manganese (Mn)	ug/L	50 (AO)	<2	<2	<2
Dissolved Molybdenum (Mo)	ug/L		2	1	5
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		3900	4000	4000
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3500	3400	3500
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	38000	38000	38000
Dissolved Strontium (Sr)	ug/L		1100	1200	1200
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	3.7	3.9	3.9
Dissolved Vanadium (V)	ug/L		<1	1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	<5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		<10	<10	<10

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-5-II**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		16	11.8	10.7
pH (field)	pH		7.67	7.28	7.45
Conductivity (field)	uS/cm		461	454	424
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		459	446	477
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.2	0.9	1
pH	pH	6.5-8.5 (OG)	8.1	8.1	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	286	255	257
Chloride (Cl)	mg/L	250 (AO)	1	2	2
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.3	<0.1	<0.1
Phosphate-P	mg/L		<1	0.03	<0.01
Sulphate (SO4)	mg/L	500 (AO)	5	9	12
Anion Sum	meq/L		5.87	5.35	5.43
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		283	252	253
Calculated TDS	mg/L	500 (AO)	283	255	271
Carb. Alkalinity (calc. as CaCO3)	mg/L		3	3	4
Cation Sum	meq/L		6.2	5.37	5.83
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**300**	**260**	**290**
Ion Balance (% Difference)	%		2.74	0.177	3.52
Dissolved Aluminum (Al)	ug/L		5.4	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	130	120	150
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	50	23	26
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		68000	61000	63000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	2.1	57	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		32000	27000	31000
Dissolved Manganese (Mn)	ug/L	50 (AO)	<2	<2	<2
Dissolved Molybdenum (Mo)	ug/L		<1	<1	<1
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		1600	640	820
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3400	2500	2900
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	2600	2000	1900
Dissolved Strontium (Sr)	ug/L		180	93	110
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.3	0.1	0.2
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	<5	<5
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			290	1200

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-5-II**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		8.4	10.8	10.5
pH (field)	pH		8.07	7.78	7.44
Conductivity (field)	uS/cm		382	448	482
Ammonia (Total - N)	mg/L		0.15	<0.05	<0.05
Conductivity	uS/cm		455	464	530
Dissolved Organic Carbon	mg/L	5.0 (AO)	2	0.7	1.7
pH	pH	6.5-8.5 (OG)	8.1	8.2	8.0
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	246	254	280
Chloride (Cl)	mg/L	250 (AO)	2	1	2
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	0.02
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<0.01	<0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	8	7	7
Anion Sum	meq/L		5.13	5.26	5.81
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		243	250	278
Calculated TDS	mg/L	500 (AO)	250	257	281
Carb. Alkalinity (calc. as CaCO3)	mg/L		3	4	2
Cation Sum	meq/L		5.2	5.43	5.85
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**260**	**270**	**290**
Ion Balance (% Difference)	%		0.66	1.55	0.30
Dissolved Aluminum (Al)	ug/L		<5	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	130	130	170
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	23	22	28
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		59000	62000	65000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	3	<1	2
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		26000	28000	30000
Dissolved Manganese (Mn)	ug/L	50 (AO)	<2	<2	<2
Dissolved Molybdenum (Mo)	ug/L		<1	<1	1
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		770	760	840
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		2500	2500	2700
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	1300	1200	1600
Dissolved Strontium (Sr)	ug/L		99	92	110
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.1	0.1	0.2
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	<5	11
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		360	860	490

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-6-I		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		10.7	13.5	13.8
pH (field)	pH		7.45	7.33	7.22
Conductivity (field)	uS/cm		781	3560	>3999
Ammonia (Total - N)	mg/L		1.4	1.94	0.19
Conductivity	uS/cm		999	3980	8700
Dissolved Organic Carbon	mg/L	5.0 (AO)	9	9.5	8.4
pH	pH	6.5-8.5 (OG)	7.9	8.0	7.7
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	168	212	176
Chloride (Cl)	mg/L	250 (AO)	31.2	596	1900
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	0.13	0.06
Nitrate (N)	mg/L	10.0 (MAC)	0.3	1.5	7.2
Phosphate-P	mg/L		<1	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	345	964	1600
Anion Sum	meq/L		11.4	41.2	90.2
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		167	210	175
Calculated TDS	mg/L	500 (AO)	780	2760	5590
Carb. Alkalinity (calc. as CaCO3)	mg/L		1	2	<1
Cation Sum	meq/L		14.3	49.5	92.4
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	380	910	1700
Ion Balance (% Difference)	%		11.3	9.05	1.22
Dissolved Aluminum (Al)	ug/L		9	7	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	0.6
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	2
Dissolved Barium (Ba)	ug/L	1000 (MAC)	39	56	62
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	88	360	820
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		130000	310000	530000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<5	3.4
Dissolved Copper (Cu)	ug/L	1000 (AO)	1.1	<5	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	5500	410	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		12000	34000	98000
Dissolved Manganese (Mn)	ug/L	50 (AO)	430	760	1300
Dissolved Molybdenum (Mo)	ug/L		34	63	90
Dissolved Nickel (Ni)	ug/L		1.5	<5	5
Dissolved Potassium (K)	ug/L		4200	6600	12000
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	6
Dissolved Silicon (Si)	ug/L		3500	5500	6300
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	150000	710000	1300000
Dissolved Strontium (Sr)	ug/L		550	2200	6200
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.1
Dissolved Titanium (Ti)	ug/L		<5	<5	5
Dissolved Uranium (U)	ug/L	20 (MAC)	3.9	10	12
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	160	590
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			160	550

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-6-I		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9.8	11.2	14.5
pH (field)	pH		7.42	7.09	6.98
Conductivity (field)	uS/cm		>3999	>3999	>3999
Ammonia (Total - N)	mg/L		0.25	<0.05	0.08
Conductivity	uS/cm		14500	17400	18500
Dissolved Organic Carbon	mg/L	5.0 (AO)	**6.2**	4.0	4.5
pH	pH	6.5-8.5 (OG)	7.7	7.0	7.6
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	139	125	103
Chloride (Cl)	mg/L	250 (AO)	**3600**	**4600**	**4900**
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.1	<0.01	0.01
Nitrate (N)	mg/L	10.0 (MAC)	**12**	**17**	**15**
Phosphate-P	mg/L		<0.01	0.01	0.02
Sulphate (SO4)	mg/L	500 (AO)	**2600**	**2600**	**2700**
Anion Sum	meq/L		158	188	200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		138	125	102
Calculated TDS	mg/L	500 (AO)	**10100**	**12000**	**12200**
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		175	215	203
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**2700**	**3000**	**3000**
Ion Balance (% Difference)	%		4.89	6.82	0.760
Dissolved Aluminum (Al)	ug/L		<50	62	<50
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<5	<5	5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<10	<10	<10
Dissolved Barium (Ba)	ug/L	1000 (MAC)	57	<50	<50
Dissolved Beryllium (Be)	ug/L		<5	<5	5
Dissolved Boron (B)	ug/L	5000 (IMAC)	1600	1600	1800
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<1	<1	6
Dissolved Calcium (Ca)	ug/L		810000	870000	880000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<50	<50	<50
Dissolved Cobalt (Co)	ug/L		10	<5	7
Dissolved Copper (Cu)	ug/L	1000 (AO)	<10	39	<10
Dissolved Iron (Fe)	ug/L	300 (AO)	<1000	<1000	<1000
Dissolved Lead (Pb)	ug/L	10 (MAC)	<5	<5	5
Dissolved Magnesium (Mg)	ug/L		160000	200000	200000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**1800**	**290**	**1700**
Dissolved Molybdenum (Mo)	ug/L		100	120	120
Dissolved Nickel (Ni)	ug/L		13	11	17
Dissolved Potassium (K)	ug/L		18000	20000	19000
Dissolved Selenium (Se)	ug/L	10 (MAC)	**28**	**<20**	**<20**
Dissolved Silicon (Si)	ug/L		6100	6400	4700
Dissolved Silver (Ag)	ug/L		<1	<1	<1
Dissolved Sodium (Na)	ug/L	200000 (AO)	**2800000**	**3600000**	**3300000**
Dissolved Strontium (Sr)	ug/L		12000	15000	16000
Dissolved Thallium (Tl)	ug/L		<0.5	<0.5	2.3
Dissolved Titanium (Ti)	ug/L		<50	<50	<50
Dissolved Uranium (U)	ug/L	20 (MAC)	12	9	17
Dissolved Vanadium (V)	ug/L		<10	<10	<10
Dissolved Zinc (Zn)	ug/L	5000 (AO)	1300	1100	1000
Dissolved Phosphorus (P)	ug/L		<1000	<100	<1000
Dissolved Bismuth (Bi)	ug/L		<10	<10	<10
Total Suspended Solids	mg/L		380	570	170

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH03-6-II		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		11.2	10.3	12.6
pH (field)	pH		7.92	7.52	8.05
Conductivity (field)	uS/cm		505	422	296
Ammonia (Total - N)	mg/L		0.42	0.1	0.07
Conductivity	uS/cm		510	358	409
Dissolved Organic Carbon	mg/L	5.0 (AO)	12.5	4.6	2.6
pH	pH	6.5-8.5 (OG)	8.1	8.2	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	185	174	184
Chloride (Cl)	mg/L	250 (AO)	7	3	3
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.2	<0.1	<0.1
Phosphate-P	mg/L		<1	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	88.4	22	31
Anion Sum	meq/L		5.74	4.03	4.41
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		183	172	181
Calculated TDS	mg/L	500 (AO)	321	219	237
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	3	3
Cation Sum	meq/L		5.76	4.70	4.76
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	150	150	200
Ion Balance (% Difference)	%		0.139	7.77	3.85
Dissolved Aluminum (Al)	ug/L		32	<5	6
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	58	65	53
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	120	220	190
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		35000	34000	43000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	2.2	110	1
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	170	260
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		15000	17000	22000
Dissolved Manganese (Mn)	ug/L	50 (AO)	98	77	47
Dissolved Molybdenum (Mo)	ug/L		72	60	33
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		3200	2900	4000
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3000	3300	3600
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	61000	35000	16000
Dissolved Strontium (Sr)	ug/L		470	520	700
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	3.7	2.3	2.8
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	8	19
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			2800	850

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH03-6-II**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9.8	10.3	11.4
pH (field)	pH		8.44	8.10	8.05
Conductivity (field)	uS/cm		360	345	350
Ammonia (Total - N)	mg/L		0.1	<0.05	<0.05
Conductivity	uS/cm		419	348	417
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.7	2.9	0.9
pH	pH	6.5-8.5 (OG)	8.2	7.6	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	194	163	191
Chloride (Cl)	mg/L	250 (AO)	3	3	3
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	33	21	27
Anion Sum	meq/L		4.65	3.77	4.44
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		191	162	188
Calculated TDS	mg/L	500 (AO)	242	204	212
Carb. Alkalinity (calc. as CaCO3)	mg/L		3	<1	3
Cation Sum	meq/L		4.72	4.31	3.70
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**210**	**190**	**160**
Ion Balance (% Difference)	%		0.82	6.73	9.13
Dissolved Aluminum (Al)	ug/L		13	6	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	54	46	65
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	210	200	160
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		45000	38000	31000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	<1	1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	230	140	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		24000	22000	21000
Dissolved Manganese (Mn)	ug/L	50 (AO)	30	32	25
Dissolved Molybdenum (Mo)	ug/L		24	35	32
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		3700	3700	3400
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		3500	3500	2600
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	9600	11000	7500
Dissolved Strontium (Sr)	ug/L		780	700	660
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	2.8	1.4	1.0
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	<5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		410	220	260

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH04-7-I		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		11.9	12.2	12.0
pH (field)	pH		7.81	7.74	7.25
Conductivity (field)	uS/cm		1150	230	2035
Ammonia (Total - N)	mg/L		0.8	<0.05	0.19
Conductivity	uS/cm		1950	2300	2540
Dissolved Organic Carbon	mg/L	5.0 (AO)	**7.0**	1.3	3.4
pH	pH	6.5-8.5 (OG)	8.2	6.7	7.8
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	121	56	59
Chloride (Cl)	mg/L	250 (AO)	22	26	29
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	0.03	<0.01	0.02
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	0.2
Phosphate-P	mg/L		<0.01	<0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	**989**	**1300**	**1400**
Anion Sum	meq/L		23.6	28.0	31.3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		119	56	59
Calculated TDS	mg/L	500 (AO)	**1600**	**1900**	**2060**
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	<1	<1
Cation Sum	meq/L		25.0	28.9	28.9
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**880**	**1200**	**1200**
Ion Balance (% Difference)	%		2.87	1.57	3.91
Dissolved Aluminum (Al)	ug/L		6	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	40	48	42
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	670	910	930
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		290000	430000	430000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		0.7	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	7	1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	**3600**	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		38000	36000	36000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**1700**	**1600**	**1000**
Dissolved Molybdenum (Mo)	ug/L		23	8	13
Dissolved Nickel (Ni)	ug/L		<1	<5	2
Dissolved Potassium (K)	ug/L		3400	2100	2300
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		7500	5900	6700
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	160000	100000	110000
Dissolved Strontium (Sr)	ug/L		4200	7600	7800
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	5.1	5.2	5.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	40	25	<30
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		20000	180	9000

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH04-7-II**		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		14.5	12.4	12.6
pH (field)	pH		7.65	7.39	7.91
Conductivity (field)	uS/cm		627	703	580
Ammonia (Total - N)	mg/L		0.22	0.07	0.28
Conductivity	uS/cm		638	695	732
Dissolved Organic Carbon	mg/L	5.0 (AO)	3.7	3.5	2.7
pH	pH	6.5-8.5 (OG)	8.0	8.1	8.0
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	188	183	169
Chloride (Cl)	mg/L	250 (AO)	1	2	2
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.2	<0.1	<0.1
Phosphate-P	mg/L		<1	<0.01	0.03
Sulphate (SO4)	mg/L	500 (AO)	187	188	205
Anion Sum	meq/L		7.68	7.63	7.7
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		186	181	167
Calculated TDS	mg/L	500 (AO)	454	446	485
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	2	2
Cation Sum	meq/L		8.3	7.99	8.58
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**330**	**330**	**370**
Ion Balance (% Difference)	%		3.87	2.36	5.42
Dissolved Aluminum (Al)	ug/L		<5	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	0.9
Dissolved Arsenic (As)	ug/L	25 (IMAC)	5	5	2
Dissolved Barium (Ba)	ug/L	1000 (MAC)	44	57	100
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	91	100	130
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		86000	86000	98000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	<1	<1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	**1000**	**480**	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		29000	29000	31000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**310**	**260**	**170**
Dissolved Molybdenum (Mo)	ug/L		2.9	3	3
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		1800	1800	2200
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		10000	9500	9700
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	35000	29000	24000
Dissolved Strontium (Sr)	ug/L		1400	1400	1900
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	1.7	1.9	2.7
Dissolved Vanadium (V)	ug/L		<1	1	5
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	<5	<5
Dissolved Phosphorus (P)	ug/L		52	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			24000	16000

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH04-7-II**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		10.2	10.1	10.8
pH (field)	pH		8.40	7.96	7.85
Conductivity (field)	uS/cm		550	>1000	690
Ammonia (Total - N)	mg/L		0.15	0.14	0.19
Conductivity	uS/cm		722	722	725
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.2	1.0	2.2
pH	pH	6.5-8.5 (OG)	8.2	7.6	8.1
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	164	168	158
Chloride (Cl)	mg/L	250 (AO)	2	2	2
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	0.03
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.03	0.01	0.02
Sulphate (SO4)	mg/L	500 (AO)	213	220	220
Anion Sum	meq/L		7.79	8.05	7.81
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		162	167	157
Calculated TDS	mg/L	500 (AO)	483	486	478
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	<1	2
Cation Sum	meq/L		8.09	7.67	7.63
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**350**	**340**	**330**
Ion Balance (% Difference)	%		1.88	2.39	1.18
Dissolved Aluminum (Al)	ug/L		<5	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	3	2	1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	68	57	58
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	130	120	130
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		94000	92000	90000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	3	<1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	110
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		29000	26000	27000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**190**	**200**	**180**
Dissolved Molybdenum (Mo)	ug/L		1	1	16
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		1600	1400	1400
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		9900	9600	10000
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	22000	20000	20000
Dissolved Strontium (Sr)	ug/L		1700	1700	1900
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	1	0.8	0.9
Dissolved Vanadium (V)	ug/L		1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	6	<5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		3900	4600	1800

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH04-8-I		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		13.8	12.1	11.5
pH (field)	pH		7.35	7.21	7.46
Conductivity (field)	uS/cm		899	1315	1073
Ammonia (Total - N)	mg/L		0.38	0.1	0.08
Conductivity	uS/cm		1160	1320	1340
Dissolved Organic Carbon	mg/L	5.0 (AO)	5.7	1.5	1.5
pH	pH	6.5-8.5 (OG)	8.0	8.0	8.0
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	173	166	158
Chloride (Cl)	mg/L	250 (AO)	5	6	7
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	0.01	0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.2	<0.1	<0.1
Phosphate-P	mg/L		<1	<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	488	540	526
Anion Sum	meq/L		13.8	14.7	14.3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		172	164	157
Calculated TDS	mg/L	500 (AO)	899	933	959
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	2	2
Cation Sum	meq/L		14.9	14.2	15.5
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	480	480	520
Ion Balance (% Difference)	%		4.05	1.76	4.17
Dissolved Aluminum (Al)	ug/L		7.6	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	30	18	20
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	370	430	530
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		160000	160000	170000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	2.7	1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	180	95	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		22000	20000	23000
Dissolved Manganese (Mn)	ug/L	50 (AO)	680	300	320
Dissolved Molybdenum (Mo)	ug/L		11	7	8
Dissolved Nickel (Ni)	ug/L		<1	<1	<1
Dissolved Potassium (K)	ug/L		3200	3300	3000
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		8200	7500	8200
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	120000	100000	120000
Dissolved Strontium (Sr)	ug/L		4800	5200	6300
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	8.2	8.2	8.8
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	54	30	11
Dissolved Phosphorus (P)	ug/L		<50	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			550	370

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH04-8-I**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9.9	10.1	11.1
pH (field)	pH		7.87	7.57	7.26
Conductivity (field)	uS/cm		1076	1098	1202
Ammonia (Total - N)	mg/L		0.09	<0.05	0.08
Conductivity	uS/cm		1320	1310	1340
Dissolved Organic Carbon	mg/L	5.0 (AO)	2.0	1.3	3.1
pH	pH	6.5-8.5 (OG)	8.1	7.5	7.9
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	156	157	148
Chloride (Cl)	mg/L	250 (AO)	6	6	6
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<0.01	<0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	**539**	**520**	**520**
Anion Sum	meq/L		14.5	14.0	13.9
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		154	156	147
Calculated TDS	mg/L	500 (AO)	**946**	**950**	**915**
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	<1	1
Cation Sum	meq/L		14.4	15.7	14.2
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**480**	**520**	**480**
Ion Balance (% Difference)	%		0.23	5.55	0.91
Dissolved Aluminum (Al)	ug/L		<5	<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	21	19	16
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	490	490	510
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		160000	170000	160000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	2	2	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	110	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		21000	23000	21000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**200**	**230**	**280**
Dissolved Molybdenum (Mo)	ug/L		8	9	12
Dissolved Nickel (Ni)	ug/L		<1	<1	1
Dissolved Potassium (K)	ug/L		3000	3300	2900
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		7500	8400	7600
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	110000	120000	100000
Dissolved Strontium (Sr)	ug/L		5900	6300	6300
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	8.8	8.9	8.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	19	14	10
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		1400	3700	29

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		ODWQS	BH04-8-II		
Sampling Date			31-Aug-05	9-May-06	24-May-07
Temperature (field)	C		18.7	11.5	13.2
pH (field)	pH		7.20	7.45	7.70
Conductivity (field)	uS/cm		436	373	266
Ammonia (Total - N)	mg/L		0.1	<0.05	<0.05
Conductivity	uS/cm		379	401	299
Dissolved Organic Carbon	mg/L	5.0 (AO)	6.6	2.7	2.7
pH	pH	6.5-8.5 (OG)	7.6	7.5	7.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	117	59	83
Chloride (Cl)	mg/L	250 (AO)	2	2	<1
p-Alkalinity	mg/L		<1	<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.3	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.3	<0.1	<0.1
Phosphate-P	mg/L		<1	0.03	<0.01
Sulphate (SO4)	mg/L	500 (AO)	86.6	133	62
Anion Sum	meq/L		4.22	4.00	2.95
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		116	59	82
Calculated TDS	mg/L	500 (AO)	252	242	201
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		4.93	3.86	3.23
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	150	120	91
Ion Balance (% Difference)	%		7.75	1.79	4.51
Dissolved Aluminum (Al)	ug/L		1000	28	15
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	44	13	9
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	<10	<10	<10
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	0.1
Dissolved Calcium (Ca)	ug/L		28000	20000	13000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		3.1	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	4.7	8	2
Dissolved Iron (Fe)	ug/L	300 (AO)	1600	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	0.8	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		20000	16000	14000
Dissolved Manganese (Mn)	ug/L	50 (AO)	350	11	2
Dissolved Molybdenum (Mo)	ug/L		4	3	3
Dissolved Nickel (Ni)	ug/L		3.5	1	<1
Dissolved Potassium (K)	ug/L		1300	1000	740
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		17000	12000	14000
Dissolved Silver (Ag)	ug/L		<0.5	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	41000	34000	32000
Dissolved Strontium (Sr)	ug/L		140	110	82
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		31	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.3	<0.1	<0.1
Dissolved Vanadium (V)	ug/L		4.4	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	16	31	<5
Dissolved Phosphorus (P)	ug/L		150	<50	<50
Dissolved Bismuth (Bi)	ug/L				
Total Suspended Solids	mg/L			610	600

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-4
GENERAL CHEMICAL RESULTS - GROUNDWATER
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**BH04-8-II**		
Sampling Date			22-May-08	27-May-09	27-May-10
Temperature (field)	C		9.8	9.8	13.1
pH (field)	pH		8.25	7.69	6.90
Conductivity (field)	uS/cm		233	206	215
Ammonia (Total - N)	mg/L		<0.05	<0.05	<0.05
Conductivity	uS/cm		240	212	217
Dissolved Organic Carbon	mg/L	5.0 (AO)	2.1	1.9	3.5
pH	pH	6.5-8.5 (OG)	7.9	7.6	7.7
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	87	91	99
Chloride (Cl)	mg/L	250 (AO)	2	2	2
p-Alkalinity	mg/L				
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01	0.03
Nitrate (N)	mg/L	10.0 (MAC)	0.2	0.7	0.3
Phosphate-P	mg/L		0.04	0.02	0.02
Sulphate (SO4)	mg/L	500 (AO)	40	18	13
Anion Sum	meq/L		2.65	2.30	2.34
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		87	91	98
Calculated TDS	mg/L	500 (AO)	173	143	144
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1
Cation Sum	meq/L		2.71	2.15	2.21
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	80	**64**	**64**
Ion Balance (% Difference)	%				
Dissolved Aluminum (Al)	ug/L		9	17	8
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	7	7	7
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5	<0.5
Dissolved Boron (B)	ug/L	5000 (IMAC)	11	<10	<10
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		12000	9800	9400
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	5	3	1
Dissolved Iron (Fe)	ug/L	300 (AO)	<100	<100	<100
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		12000	9700	9800
Dissolved Manganese (Mn)	ug/L	50 (AO)	<2	<2	<2
Dissolved Molybdenum (Mo)	ug/L		2	1	4
Dissolved Nickel (Ni)	ug/L		<1	<1	1
Dissolved Potassium (K)	ug/L		630	420	590
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2	<2
Dissolved Silicon (Si)	ug/L		13000	12000	13000
Dissolved Silver (Ag)	ug/L		<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	25000	19000	21000
Dissolved Strontium (Sr)	ug/L		73	61	63
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	<0.1	<0.1	<0.1
Dissolved Vanadium (V)	ug/L		<1	<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	7	<5	<5
Dissolved Phosphorus (P)	ug/L		<100	<100	<100
Dissolved Bismuth (Bi)	ug/L		<1	<1	<1
Total Suspended Solids	mg/L		550	280	200

NOTES:
1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration does not satisfy ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**538 MONCK RD**	**594 MONCK RD**
Sampling Date			9-May-06	9-May-06
Temperature (field)	C		12.3	14.7
pH (field)	pH		7.23	7.39
Conductivity (field)	uS/cm		815	759
Ammonia (Total - N)	mg/L		<0.05	<0.05
Conductivity	uS/cm		744	828
Dissolved Organic Carbon	mg/L	5.0 (AO)	0.6	0.9
pH	pH	6.5-8.5 (OG)	8.2	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	329	327
Chloride (Cl)	mg/L	250 (AO)	39	69
p-Alkalinity	mg/L		<1	<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	0.5	2.6
Phosphate-P	mg/L		<0.01	<0.01
Sulphate (SO4)	mg/L	500 (AO)	46	17
Anion Sum	meq/L		8.69	9.03
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		325	323
Calculated TDS	mg/L	500 (AO)	436	462
Carb. Alkalinity (calc. as CaCO3)	mg/L		5	4
Cation Sum	meq/L		8.63	9.55
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**400**	**420**
Ion Balance (% Difference)	%		0.358	2.81
Dissolved Aluminum (Al)	ug/L		<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	80	89
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5
Dissolved Bismuth (Bi)	ug/L		<1	<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	85	99
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		96000	95000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	23	32
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	2.3
Dissolved Magnesium (Mg)	ug/L		39000	44000
Dissolved Manganese (Mn)	ug/L	50 (AO)	<2	<2
Dissolved Molybdenum (Mo)	ug/L		<1	<1
Dissolved Nickel (Ni)	ug/L		<1	<1
Dissolved Potassium (K)	ug/L		3400	4700
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2
Dissolved Silicon (Si)	ug/L		3200	3300
Dissolved Silver (Ag)	ug/L		<0.1	0.3
Dissolved Sodium (Na)	ug/L	200000 (AO)	13000	25000
Dissolved Strontium (Sr)	ug/L		1200	400
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	1.7	0.9
Dissolved Vanadium (V)	ug/L		<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	10	15
Dissolved Phosphorus (P)	ug/L		<50	<50
Total Suspended Solids	mg/L		<1	1

NOTES:

1) ODWQS - Ontario Drinking Water Standards (revised June 2006).
2) MAC - Maximum Acceptable Concentration.
3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**776 MONCK RD**	**844 MONCK RD**
Sampling Date			13-Jun-06	13-Jun-06
Temperature (field)	C		15.7	13
pH (field)	pH		6.8	7.2
Conductivity (field)	uS/cm		2552	1213
Ammonia (Total - N)	mg/L		<0.05	0.11
Conductivity	uS/cm		3070	1420
Dissolved Organic Carbon	mg/L	5.0 (AO)	**5.2**	3
pH	pH	6.5-8.5 (OG)	7.6	7.7
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	127	169
Chloride (Cl)	mg/L	250 (AO)	**896**	**284**
p-Alkalinity	mg/L			
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1
Phosphate-P	mg/L		0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	36	52
Anion Sum	meq/L		28.5	12.5
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		126	169
Calculated TDS	mg/L	500 (AO)	**1570**	**707**
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1
Cation Sum	meq/L		26.6	13.4
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**490**	**430**
Ion Balance (% Difference)	%		3.56	3.41
Dissolved Aluminum (Al)	ug/L		<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<5	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	360	330
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5
Dissolved Bismuth (Bi)	ug/L		<1	<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	26	78
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		140000	130000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5
Dissolved Cobalt (Co)	ug/L		0.6	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	62	5
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	**3000**
Dissolved Lead (Pb)	ug/L	10 (MAC)	0.9	1.1
Dissolved Magnesium (Mg)	ug/L		34000	22000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**1300**	**730**
Dissolved Molybdenum (Mo)	ug/L		<1	<1
Dissolved Nickel (Ni)	ug/L		2	<1
Dissolved Potassium (K)	ug/L		6900	3100
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2
Dissolved Silicon (Si)	ug/L		4600	7300
Dissolved Silver (Ag)	ug/L		<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	**380000**	110000
Dissolved Strontium (Sr)	ug/L		2000	4000
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	1.6	3.2
Dissolved Vanadium (V)	ug/L		<5	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	21	<5
Dissolved Phosphorus (P)	ug/L		<50	<50
Total Suspended Solids	mg/L		<1	8

NOTES:

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3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**870 MONCK RD**	**874 MONCK RD**
Sampling Date			13-Jun-06	13-Jun-06
Temperature (field)	C		12.8	12.2
pH (field)	pH		7.73	7.53
Conductivity (field)	uS/cm		443	820
Ammonia (Total - N)	mg/L		<0.05	0.11
Conductivity	uS/cm		533	1010
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.2	1.7
pH	pH	6.5-8.5 (OG)	8.2	8
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	121	148
Chloride (Cl)	mg/L	250 (AO)	55	167
p-Alkalinity	mg/L			
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1
Phosphate-P	mg/L		0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	42	66
Anion Sum	meq/L		4.85	9.03
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		119	146
Calculated TDS	mg/L	500 (AO)	270	**504**
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	2
Cation Sum	meq/L		5.05	9.07
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**190**	**300**
Ion Balance (% Difference)	%		2.03	0.21
Dissolved Aluminum (Al)	ug/L		<5	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	53	42
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5
Dissolved Bismuth (Bi)	ug/L		<1	<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	150	200
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		62000	96000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	<1	<1
Dissolved Iron (Fe)	ug/L	300 (AO)	<50	120
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		8300	14000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**82**	**63**
Dissolved Molybdenum (Mo)	ug/L		<1	1
Dissolved Nickel (Ni)	ug/L		<1	<1
Dissolved Potassium (K)	ug/L		1400	2300
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2
Dissolved Silicon (Si)	ug/L		5600	5800
Dissolved Silver (Ag)	ug/L		<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	28000	70000
Dissolved Strontium (Sr)	ug/L		2500	4100
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	2.1	2.8
Dissolved Vanadium (V)	ug/L		<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	<5	10
Dissolved Phosphorus (P)	ug/L		<50	<50
Total Suspended Solids	mg/L		<1	<1

NOTES:

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3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**884 MONCK RD**	**906 MONCK RD**
Sampling Date			13-Jun-06	13-Jun-06
Temperature (field)	C		13.2	12.1
pH (field)	pH		7.22	7.78
Conductivity (field)	uS/cm		1302	1081
Ammonia (Total - N)	mg/L		<0.05	0.18
Conductivity	uS/cm		1540	1320
Dissolved Organic Carbon	mg/L	5.0 (AO)	2	0.8
pH	pH	6.5-8.5 (OG)	7.9	8.1
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	228	119
Chloride (Cl)	mg/L	250 (AO)	**260**	98
p-Alkalinity	mg/L			
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	<0.1
Phosphate-P	mg/L		0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	92	349
Anion Sum	meq/L		13.8	12
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		226	98
Calculated TDS	mg/L	500 (AO)	**779**	**774**
Carb. Alkalinity (calc. as CaCO3)	mg/L		2	1
Cation Sum	meq/L		14.6	12.9
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**460**	**380**
Ion Balance (% Difference)	%		2.61	3.69
Dissolved Aluminum (Al)	ug/L		9	<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	70	5
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5
Dissolved Bismuth (Bi)	ug/L		<1	<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	230	640
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		130000	130000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	79	2
Dissolved Iron (Fe)	ug/L	300 (AO)	**470**	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	**75**	0.5
Dissolved Magnesium (Mg)	ug/L		30000	13000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**290**	39
Dissolved Molybdenum (Mo)	ug/L		1	5
Dissolved Nickel (Ni)	ug/L		<1	<1
Dissolved Potassium (K)	ug/L		3300	1700
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2
Dissolved Silicon (Si)	ug/L		6300	5000
Dissolved Silver (Ag)	ug/L		<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	120000	120000
Dissolved Strontium (Sr)	ug/L		4400	3700
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	6.4	2.7
Dissolved Vanadium (V)	ug/L		<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	22	<5
Dissolved Phosphorus (P)	ug/L		<50	<50
Total Suspended Solids	mg/L		1	<1

NOTES:

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3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**915 MONCK RD**	**61 DARTMOOR RD**
Sampling Date			13-Jun-06	13-Jun-06
Temperature (field)	C		13.5	13.5
pH (field)	pH		7.63	7.41
Conductivity (field)	uS/cm		345	456
Ammonia (Total - N)	mg/L		0.06	<0.05
Conductivity	uS/cm		417	560
Dissolved Organic Carbon	mg/L	5.0 (AO)	1	2.3
pH	pH	6.5-8.5 (OG)	8.1	8.1
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	99	207
Chloride (Cl)	mg/L	250 (AO)	1	11
p-Alkalinity	mg/L			
Nitrite (N)	mg/L	1.0 (MAC)	<0.01	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1	2.2
Phosphate-P	mg/L		0.01	0.01
Sulphate (SO4)	mg/L	500 (AO)	54	44
Anion Sum	meq/L		3.56	5.52
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		118	205
Calculated TDS	mg/L	500 (AO)	208	301
Carb. Alkalinity (calc. as CaCO3)	mg/L		1	2
Cation Sum	meq/L		4.14	5.94
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**190**	**270**
Ion Balance (% Difference)	%		7.57	3.66
Dissolved Aluminum (Al)	ug/L		<5	7
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	<1	<1
Dissolved Barium (Ba)	ug/L	1000 (MAC)	43	140
Dissolved Beryllium (Be)	ug/L		<0.5	<0.5
Dissolved Bismuth (Bi)	ug/L		<1	<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	120	69
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L		65000	82000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5	<5
Dissolved Cobalt (Co)	ug/L		<0.5	<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	2	170
Dissolved Iron (Fe)	ug/L	300 (AO)	140	<50
Dissolved Lead (Pb)	ug/L	10 (MAC)	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L		6900	17000
Dissolved Manganese (Mn)	ug/L	50 (AO)	**230**	<2
Dissolved Molybdenum (Mo)	ug/L		2	<1
Dissolved Nickel (Ni)	ug/L		<1	<1
Dissolved Potassium (K)	ug/L		1300	4400
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2	<2
Dissolved Silicon (Si)	ug/L		5800	3400
Dissolved Silver (Ag)	ug/L		<0.1	<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	6400	9000
Dissolved Strontium (Sr)	ug/L		5800	630
Dissolved Thallium (Tl)	ug/L		<0.05	<0.05
Dissolved Titanium (Ti)	ug/L		<5	<5
Dissolved Uranium (U)	ug/L	20 (MAC)	2.5	1.8
Dissolved Vanadium (V)	ug/L		<1	<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	95	5
Dissolved Phosphorus (P)	ug/L		<50	<50
Total Suspended Solids	mg/L		<1	<1

NOTES:

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3) IMAC - Interim Maximum Acceptable Concentration.
4) OG - Operational Guideline.
5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

TABLE B-5
GENERAL CHEMICAL RESULTS - RESIDENTIAL
SEBRIGHT QUARRY

Monitoring Well Designation		**ODWQS**	**126 DARTMOOR RD**
Sampling Date			9-May-06
Temperature (field)	C		13.5
pH (field)	pH		7.38
Conductivity (field)	uS/cm		914
Ammonia (Total - N)	mg/L		0.62
Conductivity	uS/cm		919
Dissolved Organic Carbon	mg/L	5.0 (AO)	1.6
pH	pH	6.5-8.5 (OG)	8.2
Alkalinity (Total as CaCO3)	mg/L	30-500 (OG)	298
Chloride (Cl)	mg/L	250 (AO)	6
p-Alkalinity	mg/L		<1
Nitrite (N)	mg/L	1.0 (MAC)	<0.01
Nitrate (N)	mg/L	10.0 (MAC)	<0.1
Phosphate-P	mg/L		<0.01
Sulphate (SO4)	mg/L	500 (AO)	198
Anion Sum	meq/L		10.3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		294
Calculated TDS	mg/L	500 (AO)	**583**
Carb. Alkalinity (calc. as CaCO3)	mg/L		4
Cation Sum	meq/L		10.5
Dissolved Hardness (CaCO3)	mg/L	80-100 (OG)	**400**
Ion Balance (% Difference)	%		1.35
Dissolved Aluminum (Al)	ug/L		<5
Dissolved Antimony (Sb)	ug/L	6 (IMAC)	<1
Dissolved Arsenic (As)	ug/L	25 (IMAC)	**<1**
Dissolved Barium (Ba)	ug/L	1000 (MAC)	12
Dissolved Beryllium (Be)	ug/L		<0.5
Dissolved Bismuth (Bi)	ug/L		<1
Dissolved Boron (B)	ug/L	5000 (IMAC)	1400
Dissolved Cadmium (Cd)	ug/L	5 (MAC)	<0.1
Dissolved Calcium (Ca)	ug/L		110000
Dissolved Chromium (Cr)	ug/L	50 (MAC)	<5
Dissolved Cobalt (Co)	ug/L		<0.5
Dissolved Copper (Cu)	ug/L	1000 (AO)	8
Dissolved Iron (Fe)	ug/L	300 (AO)	89
Dissolved Lead (Pb)	ug/L	10 (MAC)	0.5
Dissolved Magnesium (Mg)	ug/L		33000
Dissolved Manganese (Mn)	ug/L	50 (AO)	15
Dissolved Molybdenum (Mo)	ug/L		<1
Dissolved Nickel (Ni)	ug/L		<1
Dissolved Potassium (K)	ug/L		6600
Dissolved Selenium (Se)	ug/L	10 (MAC)	<2
Dissolved Silicon (Si)	ug/L		5200
Dissolved Silver (Ag)	ug/L		<0.1
Dissolved Sodium (Na)	ug/L	200000 (AO)	52000
Dissolved Strontium (Sr)	ug/L		3900
Dissolved Thallium (Tl)	ug/L		<0.05
Dissolved Titanium (Ti)	ug/L		<5
Dissolved Uranium (U)	ug/L	20 (MAC)	0.5
Dissolved Vanadium (V)	ug/L		<1
Dissolved Zinc (Zn)	ug/L	5000 (AO)	9
Dissolved Phosphorus (P)	ug/L		<50
Total Suspended Solids	mg/L		<1

NOTES:

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3) IMAC - Interim Maximum Acceptable Concentration.
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5) AO - Aesthetic Objective.
6) Shading indicates concentration exceeds ODWQS.

Appendix C

Surface Water Data

- Surface Water Flow Rates – Table C-1
- Surface Water Flow Graph – Figure C-1
- General Chemical Results – Surface Water – Table C-3
- Time-Concentration Graphs – Figures C-2 to C-4
- Organic Chemical Results – Surface Water – Table C-3

TABLE C-1
SURFACE WATER FLOW RATES
SEBRIGHT QUARRY

	FLOW RATE (m^3/s)						
DATE	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SWA**	**SWB**
14-Sep-04	1.47	Standing Water	1.00	Dry			
18-Oct-04	2.00	0.02	1.46	Dry			
17-Nov-04	2.26	<0.01	3.04	Standing Water			
13-Dec-04	Frozen	Frozen	Frozen	Frozen			
24-Jan-05	Frozen	Frozen	Frozen	Frozen			
17-Feb-05	Frozen	Frozen	Frozen	Frozen			
18-Mar-05	Frozen	Frozen	Frozen	Frozen			
14-Apr-05	2.83	0.02	3.35	0.01			
19-May-05	1.01	0.01	1.45	<0.01			
20-Jun-05	1.44	<0.01	0.77	Standing Water			
14-Jul-05	0.56	Standing Water	0.45	Standing Water			
31-Aug-05	0.10	Dry	0.06	Dry			
28-Sep-05	0.14	Dry	0.07	Dry			
20-Oct-05	0.21	<0.01	0.05	Dry			
30-Nov-05	2.61	0.03	2.65	0.01			
8-May-06	0.23	<0.01	0.18	<0.1		Dry	Standing Water
31-Jul-06	0.98	Dry	0.12	Dry		Dry	Standing Water
21-Sep-06	0.28	Dry	0.04	Dry		Dry	Standing Water
28-Nov-06	2.02	0.18	2.04	<0.01		<0.01	Standing Water
24-Jan-07	Frozen	Frozen	Frozen	Frozen		Frozen	Frozen
22-Mar-07	Frozen	0.16	Frozen	Frozen		Frozen	Frozen
19-Apr-07	1.11	0.03	1.30	0.01		0.04	Minimal flow
8-May-07	0.17	<0.01	0.18	<0.01		<0.01	Minimal flow
23-May-07	0.36	0.01	0.30	<0.01		<0.01	Minimal flow
20-Jul-07	0.13	<0.01	0.08	<0.01		0.01	Minimal flow
20-Sep-07	0.19	Dry	0.05	Dry	0.27	Dry	Minimal flow
15-Nov-07	0.86	0.02	0.60	<0.01	1.06	<0.01	Minimal flow
16-Jan-08	Frozen	0.03	Frozen	0.01	-	<0.01	Frozen
25-Mar-08	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
23-May-08	0.63	0.01	0.73	<0.01	0.47	<0.01	Minimal flow
29-Jul-08	0.34	<0.01	0.73	<0.01	0.99	<0.01	Minimal flow
29-Sep-08	0.30	<0.01	0.17	Standing Water	0.05	Standing Water	Minimal flow
13-Nov-08	2.44	0.06	5.41	0.06	2.86	0.02	Minimal flow

TABLE C-1
SURFACE WATER FLOW RATES
SEBRIGHT QUARRY

	FLOW RATE (m^3/s)						
DATE	**SW1**	**SW2**	**SW3**	**SW4**	**SW5**	**SWA**	**SWB**
29-Jan-09	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
26-Mar-09	-	0.03	Frozen	0.03	-	0.02	Frozen
27-May-09	4.97	<0.01	1.83	<0.01	3.80	<0.01	Minimal flow
23-Jul-09	2.51	<0.01	2.15	Dry	1.53	Standing Water	Minimal flow
24-Sep-09	0.07	<0.01	0.13	Dry	0.05	Standing Water	Minimal flow
27-Nov-09	1.67	0.02	1.63	<0.01	1.61	<0.01	Minimal flow
19-Jan-10	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
22-Mar-10	-	0.02	-	<0.01	-	Standing Water	Standing Water
27-May-10	0.04	<0.01	0.38	<0.01	0.44	<0.01	Minimal flow
22-Jul-10	0.02	<0.01	0.67	<0.01	0.86	<0.01	Standing Water
30-Sep-10	2.19	0.03	1.65	0.02	1.52	<0.01	Minimal flow
22-Nov-10	0.40	<0.01	0.58	0.04	0.43	<0.01	Minimal flow

NOTES:
1) 'm^3/s' indicates cubic metres per second.
2) Surface water stations SWA and SWB were added to the monitoring program in May 2006.
3) November 2006 monitoring event completed over one week.
4) '-' indicates measurement not obtained due to cold water temperatures.

FIGURE C-1
SURFACE WATER FLOW GRAPH

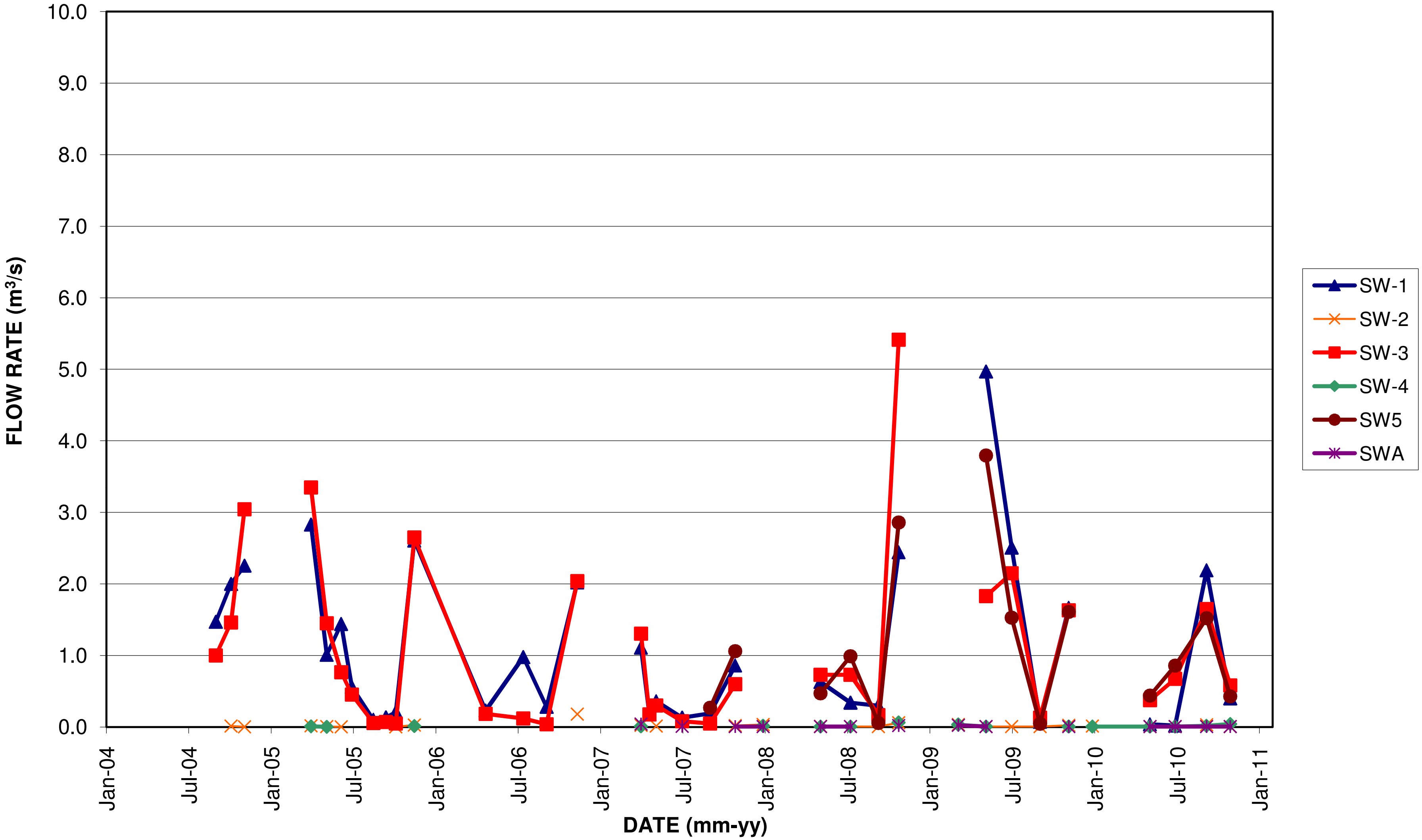


TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW1**									
Sampling Date			31-Aug-05	30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		23.2	5.4	19.7	17.1	3.8	14.2	17.2	23.9	24.3	6.2
pH (field)	pH	6.5 - 8.5	7.6	9.3	7.2	5.6	6.4	8.2	7.4	7.3	8.2	8.3
Conductivity (field)	uS/cm		35	19	19	43	11	15	16	7	23	13
Turbidity (field)	NTU		17.0		8.2	6.0	0.8	4.3	1.4	5.4	6.9	0.7
Dissolved Oxygen (field)	mg/L									11.0		11.8
Turbidity	NTU					2.4	1.5	4.34	1.4	5.4	2.3	0.9
Total Ammonia-N	mg/L		<0.05	0.05	<0.05	0.09	0.09	0.07	<0.05	<0.05	0.07	0.1
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		28	31	27	53	23	20	26	28	32	25
Total Organic Carbon	mg/L		7.2	7.2	6.7	8	6.7	6.4	7.8	8.3	8.7	7.9
pH	pH	6.5 - 8.5	7.2	7.0	10.0	7.4	6.9	6.7	6.3	6.6	7.0	6.9
Alkalinity (Total as CaCO3)	mg/L		11.5	6	24	16	5	3	6	10	10	6
Chloride (Cl)	mg/L		<1	<1	1	2	<1	<1	<1	<1	<1	2
Nitrite (N)	mg/L		<0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<1	0.011	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		13.5	5	3	6	3	3	3	3	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		11.5	6	10	16	5	3	6	10	10	6
Calculated TDS	mg/L		26.2								17	15
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	9	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L		0.307									
Dissolved Hardness (CaCO3)	mg/L		14	11	10	19	7	7	9	10	13	9
Total Aluminum (Al)	ug/L	75	22	71	84	66	79	85	83	56	45	52
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		13	12	14	23	12	13	16	14	16	11
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		3900	3100	3000	5900	2300	2200	2500	3000	4100	2600
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	<1	2	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	1400	340	780	1000	390	700	940	730	1500	380
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		1000	1000	820	1500	680	680	760	820	1100	760
Total Manganese (Mn)	ug/L		180	56	150	310	22	36	190	130	320	20
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		<200	440	290	510	270	330	300	<200	260	230
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1700	960	280	700	610	780	370	230	780	810
Total Silver (Ag)	ug/L	0.1	**<0.5**	**<0.5**	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		490	960	1400	1900	660	710	800	760	660	670
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	3	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	<5	5	<5	<5	<5	6	7	<5	6	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03		0.022	0.015	0.021	0.013	0.021	0.015	0.032	0.03	0.016
Total Suspended Solids	mg/L				2	2	<1	<3	<10	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW1**						**Range**	**Arithmetic**	**Standard**	**Geometric**
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10		**Mean**	**Deviation**	**Mean**
Temperature (field)	C		16.6	17.8	16.2	18.9	24.1	15	3.8 - 24.3	16.5	6.5	14.7
pH (field)	pH	6.5 - 8.5	7.0	7.3	8.0	7.3	7.2	6.7	5.6 - 9.3	7.5	0.9	7.4
Conductivity (field)	uS/cm		8	18	18	20	42	12	7 - 43	20	11	18
Turbidity (field)	NTU		3.2	9.0	2.0	6.0	8.9	1.2	0.7 - 17.0	5.4	4.4	3.7
Dissolved Oxygen (field)	mg/L		10.2	4.0	6.8	7.0	6.1	9.6	4.0 - 11.8	8.3	2.7	7.9
Turbidity	NTU		3.19	1.3	1.4	1.4	2.6	1.2	0.9 - 5.4	2.3	1.4	2.0
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.1	0.05	0.03	0.04
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		22	33	21	27	28	21	20 - 53	28	8	27
Total Organic Carbon	mg/L		6.4	9.2	6.8	8.3	8.6	8.7	6.4 - 9.2	7.7	0.9	7.6
pH	pH	6.5 - 8.5	6.9	7.4	6.5	6.9	7.1	6.6	6.3 - 10.0	7.1	0.8	7.0
Alkalinity (Total as CaCO3)	mg/L		6	12	5	9	8	6	3 - 24	9	5	8
Chloride (Cl)	mg/L		<1	1	<1	<1	1	<1	0.5 - 2	0.8	0.5	0.7
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.3			
Nitrate (N)	mg/L		<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01 - 0.2	0.06	0.04	0.05
Phosphate-P	mg/L		<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <1			
Sulphate (SO4)	mg/L		3	2	2	2	1	<1	0.5 - 13.5	4	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		6	12	5	9	8	6	3 - 16	8	3	7
Calculated TDS	mg/L		11			15			11 - 26.2	17	6	16
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - 9	1.0	2.1	0.6
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		7	12	7	11	10	8	7 - 19	10	3	10
Total Aluminum (Al)	ug/L	75	71	76	38	58	79	69	22 - 85	65	18	61
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		13	17	110	16	21	14	11 - 110	21	24	17
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	<10	15	<10	<10	<10	<10 - 15	6	3	5
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		2400	3900	16000	3500	3000	2300	2200 - 16000	3981	3342	3396
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	0.8	<0.5	0.7	<0.5	<0.5 - 0.8	0.3	0.2	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	<1	<1 - 2	0.6	0.4	0.5
Total Iron (Fe)	ug/L	300	700	1100	570	1400	1600	880	340 - 1600	901	406	810
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Magnesium (Mg)	ug/L		630	1100	6500	900	800	640	630 - 6500	1231	1423	970
Total Manganese (Mn)	ug/L		94	310	98	310	400	46	20 - 400	167	126	115
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		<200	330	270	260	260	230	230 - 510	306	82	298
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		480	1400	370	890	460	1000	230 - 1700	739	401	642
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		670	780	690	740	720	640	490 - 1900	828	347	782
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 3	0.7	0.6	0.6
Total Zinc (Zn)	ug/L	20	6	5	<5	<5	<5	<5	<5 - 7	4	2	3
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.033	0.031	0.034	0.031	0.032	0.017	0.013 - 0.034	0.024	0.008	0.023
Total Suspended Solids	mg/L		<10	<10	<10	1	<10	<10	<1 - <10			

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW2**							
Sampling Date			30-Nov-05	8-May-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		5.3	19.5	5.1	13	20.5	25.6	23.2	6.4
pH (field)	pH	6.5 - 8.5	8.3	7.0	6.4	7.6	7.4	7.6	7.9	7.8
Conductivity (field)	uS/cm		63	81	68	35	75	86	86	81
Turbidity (field)	NTU			15.7	0.6	2.1	0.2	2.5		1.2
Dissolved Oxygen (field)	mg/L							7.9		7.3
Turbidity	NTU				0.7	2.07	0.2	2.48	2.1	1.8
Total Ammonia-N	mg/L		<0.05	<0.05	0.11	0.08	<0.05	<0.05	0.09	0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		80	83	80	90	100	107	94	537
Total Organic Carbon	mg/L		10.3	9.3	12.3	6.2	8.8	9.8	10.7	9.1
pH	pH	6.5 - 8.5	7.7	8.3	7.6	7.7	7.2	7.1	7.4	3.0
Alkalinity (Total as CaCO3)	mg/L		32	45	36	40	45	52	43	<1
Chloride (Cl)	mg/L		1	<1	1	<1	<1	<1	<1	1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.1	<0.1	0.2	<0.1	1.3	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.015	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02
Sulphate (SO4)	mg/L		8	3	3	5	3	3	4	135
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		32	45	36	40	45	52	43	<1
Calculated TDS	mg/L								49	156
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L									
Dissolved Hardness (CaCO3)	mg/L		36	43	38	41	45	52	47	47
Total Aluminum (Al)	ug/L	75	100	1400	52	46	350	27	35	67
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		59	96	63	89	100	91	96	78
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	12	<10	<10	13	10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		9800	11000	9500	11000	12000	13000	13000	12000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	<1	2	<1	2	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	240	2200	250	270	830	350	610	570
Total Lead (Pb)	ug/L	1 (3)	<0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		4100	4500	4000	4500	4900	5100	4900	5000
Total Manganese (Mn)	ug/L		10	290	8	13	110	44	89	93
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		850	390	860	840	300	<200	<200	680
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	5	<2
Total Silicon (Si)	ug/L		1900	1600	1500	660	370	310	1400	1100
Total Silver (Ag)	ug/L	0.1	**<0.5**	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1200	980	990	1100	970	740	650	1400
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	4	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	8	12	9	6	7	<5	8	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	0.027	0.14	0.03	0.026	0.036	0.015	0.034	0.018
Total Suspended Solids	mg/L			110	<0.5	<3	<10	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW2**						**Range**	**Arithmetic Mean**	**Standard Deviation**	**Geometric Mean**
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		17.4	13.8	15.1	15.7	27.2	16.6	5.1 - 27.2	16.0	7.0	14.2
pH (field)	pH	6.5 - 8.5	7.1	7.2	7.9	7.6	7.4	6.5	6.4 - 8.3	7.4	0.5	7.4
Conductivity (field)	uS/cm		70	109	137	120	138	99	35 - 138	89	29	84
Turbidity (field)	NTU		2.1	5.7	3.2	5.5	1.6	1.1	0.2 - 15.7	3.5	4.2	2.0
Dissolved Oxygen (field)	mg/L		8.2	6.8	6.6	7.0	5.9	9.0	5.9 - 9.0	7.3	1.0	7.3
Turbidity	NTU		1.1	1	2.3	1.4	2.5	1	0.2 - 2.5	1.6	0.8	1.3
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.11	0.04	0.03	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		99	136	138	131	132	112	80 - 537	137	117	117
Total Organic Carbon	mg/L		6.8	11.1	7.9	9.9	11.2	8.8	6.2 - 12.3	9.4	1.7	9.3
pH	pH	6.5 - 8.5	7.9	7.6	7.5	7.5	7.9	7.1	3.0 - 8.3	7.2	1.3	7.1
Alkalinity (Total as CaCO3)	mg/L		49	71	69	68	67	56	32 - 71	52	13	50
Chloride (Cl)	mg/L		<1	1	<1	<5	<1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 1.3	0.2	0.3	0.1
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		2	<1	<1	<5	<1	<1	<1 - 135	12	35	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		49	70	69	68	66	56	<1 - 70	48	19	36
Calculated TDS	mg/L		50			67			49 - 156	81	51	71
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		50	68	64	69	63	58	36 - 69	52	11	50
Total Aluminum (Al)	ug/L	75	27	15	37	**230**	55	42	15 - 1400	177	364	69
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		81	99	110	110	140	110	59 - 140	94	21	92
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	11	<10	13	12	<10	<10	<10 - 13	8	4	7
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		12000	17000	15000	17000	17000	14000	9500 - 17000	13093	2578	12863
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	0.8	0.5	0.5	<0.5	<0.5	<0.5 - 1.3	0.4	0.3	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	**20**	<1 - 20	2	5	1
Total Iron (Fe)	ug/L	300	**400**	**380**	**530**	**1100**	**1300**	**420**	240 - 2200	675	542	539
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1.4	0.3	0.3	0.3
Total Magnesium (Mg)	ug/L		5400	7900	6400	7900	6900	6000	4000 - 7900	5536	1297	5405
Total Manganese (Mn)	ug/L		50	44	95	140	130	32	8 - 290	82	74	53
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		<200	530	250	660	320	360	<200 - 860	453	283	354
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - 5	1.3	1.1	1.1
Total Silicon (Si)	ug/L		310	1300	370	1400	750	1800	310 - 1900	1055	579	873
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		680	1300	670	1200	940	770	650 - 1400	971	246	942
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 4	0.8	0.9	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	<5	<5	<5	<5	<5 - 12	5	3	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.02	0.02	**0.04**	**0.11**	0.026	0.014	0.014 - 0.14	0.04	0.04	0.03
Total Suspended Solids	mg/L		<10	<10	10	2	<10	<10	<0.5 - 110	13	29	5

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW3**									
Sampling Date			31-Aug-05	30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		24.5	4.8	18.2	16.8	4.3	15.1	17.1	22.4	25.4	6.6
pH (field)	pH	6.5 - 8.5	7.4	9.0	7.4	6.1	6.2	8.1	7.6	7.2	7.7	8.5
Conductivity (field)	uS/cm		38	28	19	28	13	24	16	24	34	12
Turbidity (field)	NTU				1.8	3.7	0.6	6.3	1.1	3.0	5.0	3.0
Dissolved Oxygen (field)	mg/L									5.4		11.6
Turbidity	NTU				1.4	2	1.3	6.33	1.1	3	2.1	13.4
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	0.09	0.09	<0.05	<0.05	<0.05	<0.05	0.06
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		29		28	40	23	22	29	32	40	24
Total Organic Carbon	mg/L		7.4	7.2	6.6	8	7.1	6.6	8.3	8.4	8.6	8.2
pH	pH	6.5 - 8.5	7.0		7.3	7.4	6.8	6.7	6.4	6.6	6.9	6.5
Alkalinity (Total as CaCO3)	mg/L		11.6		9	17	5	5	8	13	14	4
Chloride (Cl)	mg/L		<1	1	1	1	<1	<1	<1	1	<1	1
Nitrite (N)	mg/L		<0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		<1	0.028	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		13.4	13	3	2	4	3	3	3	3	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		11.6		9	17	5	5	8	13	14	4
Calculated TDS	mg/L		26.6								21	13
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1		<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L		0.337									
Dissolved Hardness (CaCO3)	mg/L		14	22	10	16	8	7	9	12	18	9
Total Aluminum (Al)	ug/L	75	47	110	89	44	79	76	83	82	45	69
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		18	15	15	18	12	13	18	18	23	13
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		4200	3600	3100	4400	3900	2300	2800	3400	5400	2700
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	13	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	1500	270	760	680	400	690	1000	870	1600	490
Total Lead (Pb)	ug/L	1 (3)	<0.5	0.6	1.3	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		1200	1100	860	1600	750	680	840	990	1700	820
Total Manganese (Mn)	ug/L		150	53	170	270	25	39	260	180	220	64
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		310	530	340	560	280	310	320	<200	<200	280
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1600	1100	310	460	640	790	370	300	760	800
Total Silver (Ag)	ug/L	0.1	**<0.5**	**<0.5**	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		610	970	810	1100	680	720	820	760	640	740
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	<5	6	<5	<5	6	7	8	6	5	19
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03		0.029	0.019	0.024	0.011	0.018	0.02	0.036	0.032	0.019
Total Suspended Solids	mg/L				2	3	<1	<3	<10	<10	<10	93

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW3**						**Range**	**Arithmetic**	**Standard**	**Geometric**
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10		**Mean**	**Deviation**	**Mean**
Temperature (field)	C		15.4	18.6	15.9	18.8	25.8	15.5	4.3 - 25.8	16.6	6.7	14.8
pH (field)	pH	6.5 - 8.5	7.2	6.9	8.4	7.2	6.7	6.0	6.0 - 9.0	7.4	0.9	7.3
Conductivity (field)	uS/cm		11	32	17	25	25	13	11 - 38	22	8	21
Turbidity (field)	NTU		2.5	7.6	3.8	18.2	1.7	2.1	0.6 - 18.2	4.3	4.5	3.0
Dissolved Oxygen (field)	mg/L		9.3	3.4	6.0	3.8	4.5	9.5	3.4 - 11.6	6.7	3.1	6.1
Turbidity	NTU		1.5	1.6	1.7	2.0	2.6	1.4	1.1 - 13.4	3.0	3.3	2.2
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.09	0.04	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		24	41	28	32	28	22	22 - 41	29	6	29
Total Organic Carbon	mg/L		6.3	8.6	6.9	8.3	8.7	8.9	6.3 - 8.9	7.8	0.9	7.7
pH	pH	6.5 - 8.5	7.0	6.8	6.5	6.6	7.0	6.4	6.4 - 7.4	6.8	0.3	6.8
Alkalinity (Total as CaCO3)	mg/L		6	13	6	10	9	6	4 - 17	9	4	8
Chloride (Cl)	mg/L		1	2	1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.3			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.2			
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <1			
Sulphate (SO4)	mg/L		3	3	2	<5	1	<1	<1 - 13.4	3.9	3.7	2.9
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		6	13	6	10	9	6	4 - 17	9	4	8
Calculated TDS	mg/L		12			15			12 - 26.6	17.5	6.2	16.7
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L								0.337 - 0.337			
Dissolved Hardness (CaCO3)	mg/L		9	18	8	13	10	9	7 - 22	12	4	11
Total Aluminum (Al)	ug/L	75	69	47	22	95	86	75	22 - 110	70	23	65
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		14	20	160	19	22	15	12 - 160	26	36	19
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	<10	10	<10	<10	<10	<10 - 10	5	1	5
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		2600	5200	22000	3900	3100	2600	2300 - 22000	4700	4704	3857
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	0.5	0.7	<0.5	<0.5 - 0.7	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	4	<1	<1	<1	<1	<1 - 13	2	3	1
Total Iron (Fe)	ug/L	300	640	1500	<100	1600	1600	930	<100 - 1600	911	511	713
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1.3	0.4	0.3	0.3
Total Magnesium (Mg)	ug/L		760	1600	7900	1000	810	740	680 - 7900	1459	1749	1121
Total Manganese (Mn)	ug/L		98	430	52	460	440	44	25 - 460	185	151	127
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		200	490	650	300	260	260	<200 - 650	331	155	294
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		510	1400	1800	880	490	1100	300 - 1800	832	460	720
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		710	1100	1200	900	710	670	610 - 1200	821	181	804
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Zinc (Zn)	ug/L	20	6	6	<5	<5	<5	<5	<5 - 19	5	4	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.017	0.03	0.024	0.048	0.027	0.017	0.011 - 0.048	0.025	0.009	0.023
Total Suspended Solids	mg/L		<10	<10	<10	1	<10	<10	<1 - 93	10	24	4

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW4**									
Sampling Date			8-May-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07	23-May-08	29-Sep-08	27-May-09
Temperature (field)	C		17.9	4.7	15	14.9	16.5	19.2	6.9	14.1	13.2	12.5
pH (field)	pH	6.5 - 8.5	7.0	6.4	7.6	7.2	7.2	7.6	7.4	7.1	7.0	7.9
Conductivity (field)	uS/cm		133	103	102	124	138	119	96	102	161	184
Turbidity (field)	NTU		16.1	1.2	1.2	0.1		1.5	2.3	2.9	10.6	8.9
Dissolved Oxygen (field)	mg/L						6.2		9.0	10.9	1.8	6.0
Turbidity	NTU			1.5	1.17	6.8		1.9	0.8	3.1	19	0.9
Total Ammonia-N	mg/L		<0.05	0.07	<0.05	<0.05	<0.05	0.09	0.1	<0.05	<0.05	<0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		136	116	119	157	164	138	121	143	195	183
Total Organic Carbon	mg/L		6.5	7.7	5.3	6.6	6.9	9.4	7.9	6.8	16.2	8.2
pH	pH	6.5 - 8.5	7.8	7.7	7.6	7.5	7.5	7.5	7.6	8.0	7.6	7.6
Alkalinity (Total as CaCO3)	mg/L		71	54	57	80	86	58	54	75	92	96
Chloride (Cl)	mg/L		1	1	1	<1	1	<1	1	<1	3	<1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01		<0.01	<0.01
Sulphate (SO4)	mg/L		2	7	5	1	<1	13	8	<0.1	6	<1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		71	54	56	80	85	57	53	74	91	95
Calculated TDS	mg/L							80	70	77		
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		75	55	56	71	79	67	56	72	98	89
Total Aluminum (Al)	ug/L	75	310	100	59	72	81	94	57	270	690	120
Total Antimony (Sb)	ug/L	20	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		160	98	120	160	160	130	100	140	230	20
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	10	<10	12	13	<10	14	<10	12	14	<10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		19000	17000	15000	20000	21000	19000	15000	19000	26000	2300
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	<0.5
Total Copper (Cu)	ug/L	1 (5)	2	1	<1	<1	<1	<1	<1	<1	1	<1
Total Iron (Fe)	ug/L	300	650	79	51	120	90	200	<100	300	1500	1100
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
Total Magnesium (Mg)	ug/L		6600	5700	6600	7700	7600	7100	5800	7500	10000	690
Total Manganese (Mn)	ug/L		220	2	3	38	71	18	17	62	1100	310
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	1	<1
Total Potassium (K)	ug/L		860	800	910	880	620	860	570	570	3000	200
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		2800	3000	1800	2400	2800	4400	3600	2900	6200	280
Total Silver (Ag)	ug/L	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1700	1400	1500	1700	1600	2100	1500	1400	2000	510
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	1	<1	<1	1	<1	<1	<1	<1	2	<1
Total Zinc (Zn)	ug/L	20	8	7	<5	<5	8	<5	<5	6	10	5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	0.014	0.006	0.014	0.007	0.028	0.031	0.011	0.016	0.11	0.019
Total Suspended Solids	mg/L		74	<0.5	<3	<10	<10	<10	<10	<10	89	<10

NOTES:
1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW4**		**Range**	**Arithmetic**	**Standard**	**Geometric**
Sampling Date			27-May-10	30-Sep-10		**Mean**	**Deviation**	**Mean**
Temperature (field)	C		25.3	14.8	4.7 - 25.3	14.6	5.3	13.5
pH (field)	pH	6.5 - 8.5	7.1	6.5	6.4 - 7.9	7.2	0.4	7.2
Conductivity (field)	uS/cm		234	147	96 - 234	137	41	132
Turbidity (field)	NTU		3.2	0.5	0.1 - 16.1	4.4	5.2	2.1
Dissolved Oxygen (field)	mg/L		4.3	5.8	1.8 - 10.9	6.3	3.0	5.5
Turbidity	NTU		2.3	0.5	0.5 - 19	3.8	5.6	2.0
Total Ammonia-N	mg/L		<0.05	<0.05	<0.05 - 0.1	0.04	0.03	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		228	169	116 - 228	156	34	153
Total Organic Carbon	mg/L		10.0	9.7	5.3 - 16.2	8.4	2.8	8.1
pH	pH	6.5 - 8.5	8.0	7.3	7.3 - 8.0	7.6	0.2	7.6
Alkalinity (Total as CaCO3)	mg/L		119	89	54 - 119	78	20	75
Chloride (Cl)	mg/L		<1	<1	<1 - 3	0.9	0.7	0.8
Nitrite (N)	mg/L		<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1 - <0.1			
Phosphate-P	mg/L		<0.01	0.01	<0.01 - 0.01	0.01	0.00	0.01
Sulphate (SO4)	mg/L		<1	<1	<0.1 - 13	3.7	4.1	1.5
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		118	89	53 - 118	77	20	75
Calculated TDS	mg/L				70 - 80	76	5	76
Carb. Alkalinity (calc. as CaCO3)	mg/L		1	<1	<1 - 1	0.5	0.1	0.5
Cation Sum	me/L							
Dissolved Hardness (CaCO3)	mg/L		110	86	55 - 110	76	17	74
Total Aluminum (Al)	ug/L	75	12	31	12 - 690	158	190	94
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		270	120	20 - 270	142	64	124
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	10	11	<10 - 14	10	4	9
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		30000	21000	2300 - 30000	18692	6693	16527
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5 - 1.3	0.37	0.31	0.31
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1 - 2	0.7	0.5	0.6
Total Iron (Fe)	ug/L	300	**370**	<100	50 - 1500	380	472	193
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5 - 0.9	0.3	0.2	0.3
Total Magnesium (Mg)	ug/L		11000	8900	690 - 11000	7099	2574	6168
Total Manganese (Mn)	ug/L		730	20	2 - 1100	216	349	51
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1 - 1	0.5	0.1	0.5
Total Potassium (K)	ug/L		810	1100	200 - 3000	932	691	780
Total Selenium (Se)	ug/L	100	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		3200	3600	280 - 6200	3082	1420	2595
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Sodium (Na)	ug/L		2000	1400	510 - 2100	1568	416	1493
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1 - <0.1			
Total Vanadium (V)	ug/L	6	<1	<1	<1 - 2	0.7	0.5	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	<5 - 10	4.9	2.8	4.2
Total Zirconium (Zr)	ug/L	4	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.014	0.014	0.006 - 0.11	0.024	0.028	0.017
Total Suspended Solids	mg/L		<10	<10	<0.5 - 89	17	30	6

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW5**							**Range**	**Arithmetic**	**Standard**	**Geometric**
Sampling Date			15-Nov-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10		**Mean**	**Deviation**	**Mean**
Temperature (field)	C		6.1	18.5	18.7	15.7	18.8	25.1	15.7	6.1 - 25.1	16.9	5.7	15.8
pH (field)	pH	6.5 - 8.5	8.6	7.1	7.1	8.6	7.1	7.1	6.1	6.1 - 8.6	7.4	0.9	7.3
Conductivity (field)	uS/cm		15	28	26	12	24	30	13	12 - 30	21	8	20
Turbidity (field)	NTU		0.7	2.0	9.0	10.3	5.1	2.4	1.3	0.7 - 10.3	4.4	3.9	3.0
Dissolved Oxygen (field)	mg/L		11.6	12.3	5.4	5.9	4.2	4.2	8.8	4.2 - 12.3	7.5	3.4	6.8
Turbidity	NTU		1.6	1.8	1.9	2.3	1.7	2.7	1.1	1.1 - 2.7	1.9	0.5	1.8
Total Ammonia-N	mg/L		0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.08	0.03	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		24	23	37	24	31	29	24	23 - 37	27	5	27
Total Organic Carbon	mg/L		7.4	6.3	8.2	7.3	8.3	9.3	8.8	6.3 - 9.3	7.9	1.0	7.9
pH	pH	6.5 - 8.5	6.7	6.5	6.8	6.5	6.6	7.0	6.5	6.5 - 7.0	6.7	0.2	6.7
Alkalinity (Total as CaCO3)	mg/L		5	73	12	7	10	9	7	5 - 73	18	25	11
Chloride (Cl)	mg/L		<1	<1	2	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Phosphate-P	mg/L		<0.01		<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		3	<1	3	2	<5	1	<1	<1 - <5			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		5	9	12	7	10	9	7	5 - 12	8	2	8
Calculated TDS	mg/L		13	13			14			13 - 14	13.3	0.6	13.3
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L												
Dissolved Hardness (CaCO3)	mg/L		9	9	15	9	13	10	10	9 - 15	11	2	11
Total Aluminum (Al)	ug/L	75	41	78	59	5	58	83	72	5 - 83	57	27	44
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.29	0.09	0.28
Total Arsenic (As)	ug/L	5	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Barium (Ba)	ug/L		12	15	18	5	19	21	14	5 - 21	15	5	14
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.3	0.1	0.3
Total Boron (B)	ug/L	200	<10	<10	<10	10	<10	<10	<10	<10 - 10	6	2	6
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Calcium (Ca)	ug/L		2600	2700	4500	200	4100	3100	2700	200 - 4500	2843	1383	2156
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	5	<5	<5	<5	<5 - 5	3	1	3
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	0.5	<0.5	0.6	<0.5	0.25 - 0.6	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Iron (Fe)	ug/L	300	350	700	1400	100	1600	1500	900	100 - 1600	936	588	690
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5 - 0.5	0.3	0.1	0.3
Total Magnesium (Mg)	ug/L		750	790	1400	50	1100	810	810	50 - 1400	816	411	606
Total Manganese (Mn)	ug/L		18	100	350	2	400	430	41	2 - 430	192	193	71
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Nickel (Ni)	ug/L	25	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Potassium (K)	ug/L		230	210	470	200	280	280	270	200 - 470	277	91	267
Total Selenium (Se)	ug/L	100	<2	<2	<2	2	<2	<2	<2	<2 - 2	1.1	0.4	1.1
Total Silicon (Si)	ug/L		710	520	1200	50	820	460	1200	50 - 1200	709	414	518
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Sodium (Na)	ug/L		700	750	1100	100	860	690	630	100 - 1100	690	303	578
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05 - 0.05	0.03	0.01	0.03
Total Tungsten (W)	ug/L	30	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.06	0.02	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Zinc (Zn)	ug/L	20	<5	6	<5	5	<5	<5	6	<5 - 6	3.9	1.7	3.5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	1	<1	<1	<1	<1 - 1	0.6	0.2	0.6
Total Phosphorus (P)	mg/L	0.03	0.012	0.026	0.019	0.036	0.033	0.028	0.017	0.012 - 0.036	0.024	0.009	0.023
Total Suspended Solids	mg/L		<10	<10	<10	<10	1	<10	12	1 - 12	5	3	5

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWA**								
Sampling Date			30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		4.9	21.2	16	4.2	16	12.6	16.6	20.3	8.2
pH (field)	pH	6.5 - 8.5	8.2	6.9	6.1	6.4	7.6	7.1	7.1	7.5	7.5
Conductivity (field)	uS/cm		39	136	166	108	110	176	204	91	111
Turbidity (field)	NTU			5.6	6.8	1.5	2.5	2.9	8.3		1.3
Dissolved Oxygen (field)	mg/L								6.4		7.9
Turbidity	NTU				3.7	2.2	2.47	2.9	8.3	5.6	2.1
Total Ammonia-N	mg/L		<0.05	<0.05	0.09	<0.05	0.06	<0.05	<0.05	0.06	0.06
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		65	134	194	123	125	22	188	98	151
Total Organic Carbon	mg/L		17.2	11	19.9	14	8.1	13.9	14.4	11.3	13.4
pH	pH	6.5 - 8.5	7.2	7.8	8.1	7.8	7.9	7.6	7.5	7.4	7.8
Alkalinity (Total as CaCO3)	mg/L		24	71	110	56	62	116	100	44	73
Chloride (Cl)	mg/L		1	<1	2	2	<1	<1	<1	1	2
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Sulphate (SO4)	mg/L		3	1	<1	7	2	<1	<1	5	3
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		24	71	108	55	62	115	100	44	73
Calculated TDS	mg/L									55	82
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L										
Dissolved Hardness (CaCO3)	mg/L		27	70	98	55	62	10	94	48	77
Total Aluminum (Al)	ug/L	75	410	150	97	110	61	170	69	200	31
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		45	120	250	100	110	230	160	97	120
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	16	<10	14	11	12	11	<10	22	11
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		6900	17000	26000	16000	16000	29000	24000	13000	19000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	1.2	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	2	2	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	1100	400	440	430	380	230	1900	850	610
Total Lead (Pb)	ug/L	1 (3)	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		3400	7100	9700	6400	6800	11000	8600	5200	7600
Total Manganese (Mn)	ug/L		74	14	18	13	49	810	1000	45	66
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Potassium (K)	ug/L		4800	420	2000	1100	820	1500	760	1100	660
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		2000	320	890	1800	770	2200	1300	3000	2500
Total Silver (Ag)	ug/L	0.1	**<0.5**	0.2	<0.1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1100	1000	1400	1300	1100	1400	1100	840	1400
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	0.1	<0.1		<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	1	<1	<1	<1	<1	2	1	<1	<1
Total Zinc (Zn)	ug/L	20	10	<5	<5	<5	9	8	6	8	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	0.199	0.019	0.044	0.027	0.024	0.022	0.032	0.071	0.026
Total Suspended Solids	mg/L			5	3	13	5	19	<10	<10	<10

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWA**						**Range**	**Arithmetic Mean**	**Standard Deviation**	**Geometric Mean**
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10				
Temperature (field)	C		16.8	13.2	15.9	20.0	24.6	16.2	4.2 - 24.6	15.1	5.8	13.7
pH (field)	pH	6.5 - 8.5	6.7	7.1	7.5	7.8	7.3	6.2	6.1 - 8.2	7.1	0.6	7.1
Conductivity (field)	uS/cm		119	178	129	148	244	152	39 - 244	141	50	131
Turbidity (field)	NTU		6.5	18.4	1.9	5.9	5.3	2.1	1.3 - 18.4	5.3	4.6	4.0
Dissolved Oxygen (field)	mg/L		7.1	0.4	2.8	6.6	5.6	3.9	0.4 - 7.9	5.1	2.5	3.9
Turbidity	NTU		3.7	11	13	2.4	7.6	2.7	2.1 - 13	5.2	3.7	4.3
Total Ammonia-N	mg/L		<0.05	0.09	0.12	<0.05	0.10	<0.05	<0.05 - 0.12	0.05	0.03	0.04
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		136	203	156	157	224	169	22 - 224	143	53	128
Total Organic Carbon	mg/L		8.6	20.6	10.9	14.9	17.9	9.6	8.1 - 20.6	13.7	3.9	13.2
pH	pH	6.5 - 8.5	8.0	7.7	7.5	7.5	8.0	7.2	7.2 - 8.1	7.7	0.3	7.7
Alkalinity (Total as CaCO3)	mg/L		73	107	78	80	118	90	24 - 118	80	27	75
Chloride (Cl)	mg/L		<1	3	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.1	0.05	0.01	0.05
Phosphate-P	mg/L			<0.01	0.02	<0.05	0.02	<0.01	<0.01 - <0.05			
Sulphate (SO4)	mg/L		<1	<1	<1	<5	<1	<1	<1 - 7	2	2	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		72	106	78	80	117	90	24 - 117	80	27	74
Calculated TDS	mg/L		71			78			55 - 82	72	12	71
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	1	<1	<1 - 1	0.6	0.2	0.5
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		70	110	76	83	110	88	10 - 110	72	28	63
Total Aluminum (Al)	ug/L	75	39	95	23	160	49	42	23 - 410	114	99	85
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		130	180	95	180	220	150	45 - 250	146	57	134
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	13	<10	<10	15	10	11	<10 - 22	11	5	10
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.1			
Total Calcium (Ca)	ug/L		19000	29000	9700	21000	31000	22000	6900 - 31000	19907	7119	18512
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	2.3	<0.5	<0.5	2.0	<0.5	<0.5 - 2.3	0.6	0.7	0.4
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	<1	<1	<1 - 2	0.7	0.5	0.6
Total Iron (Fe)	ug/L	300	1000	5100	220	640	4000	610	220 - 5100	1194	1442	747
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - 1	0.3	0.2	0.3
Total Magnesium (Mg)	ug/L		7500	13000	4200	9400	12000	9200	3400 - 13000	8073	2742	7597
Total Manganese (Mn)	ug/L		89	860	8	86	900	100	8 - 1000	275	388	88
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Potassium (K)	ug/L		440	1600	<200	1100	1100	850	<200 - 4800	1223	1103	903
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		1200	3200	<50	590	2000	1900	<50 - 3200	1580	953	1090
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.7	0.1	0.2	0.1
Total Sodium (Na)	ug/L		1100	1200	450	1000	1300	940	450 - 1400	1109	253	1073
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - <0.05			
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - 2	0.7	0.4	0.6
Total Zinc (Zn)	ug/L	20	<5	<5	14	<5	<5	<5	<5 - 14	5	4	4
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.035	0.054	0.073	0.055	0.073	0.023	0.019 - 0.199	0.052	0.045	0.041
Total Suspended Solids	mg/L		<10	10	16	2	13	<10	2 - 19	8	5	7

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SWB								
Sampling Date			30-Nov-05	8-May-06	21-Sep-06	28-Nov-06	19-Apr-07	8-May-07	24-May-07	20-Jul-07	15-Nov-07
Temperature (field)	C		5.5	18.8	18.5	5.5	15	19.8	24.2	26.8	6.6
pH (field)	pH	6.5 - 8.5	8.3	7.4	**6.3**	6.5	7.5	7.3	8.0	7.7	7.7
Conductivity (field)	uS/cm		105	70	68	93	65	70	108	71	65
Turbidity (field)	NTU			2.6	6.6	1.9	2.7	1.4	4.4		1.7
Dissolved Oxygen (field)	mg/L								8.2		8.3
Turbidity	NTU				1.6	1.6	2.7	1.4	4.4	2.6	2.3
Total Ammonia-N	mg/L		<0.05	<0.05	0.07	0.07	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		97	69	74	79	77	91	94	76	90
Total Organic Carbon	mg/L		12.1	7.6	10.8	8.1	6.3	8.5	10.1	10.7	10.9
pH	pH	6.5 - 8.5	7.1	7.5	7.8	7.4	7.6	7.2	7.0	7.2	7.5
Alkalinity (Total as CaCO3)	mg/L		14	36	43	37	34	42	45	37	44
Chloride (Cl)	mg/L		1	<1	1	1	<1	<1	1	<1	1
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (N)	mg/L		4.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate-P	mg/L		0.016	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate (SO4)	mg/L		9	3	<1	3	5	4	2	1	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		14	35	43	37	34	42	45	37	44
Calculated TDS	mg/L									38	45
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	me/L										
Dissolved Hardness (CaCO3)	mg/L		42	35	37	37	36	39	43	39	42
Total Aluminum (Al)	ug/L	75	**120**	26	20	62	47	26	25	36	**160**
Total Antimony (Sb)	ug/L	20	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L		70	84	88	75	86	100	100	99	89
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Boron (B)	ug/L	200	13	<10	11	<10	<10	<10	<10	10	11
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L		9600	9000	9600	9400	9700	10000	11000	13000	10000
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	1 (5)	3	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	**520**	300	**570**	**400**	230	290	**400**	**670**	**320**
Total Lead (Pb)	ug/L	1 (3)	**1.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Magnesium (Mg)	ug/L		4700	3500	4000	3700	4100	4200	4200	5200	4600
Total Manganese (Mn)	ug/L		16	12	19	17	6	13	15	90	14
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1	1	<1
Total Potassium (K)	ug/L		1300	550	<200	950	790	650	370	<200	760
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Silicon (Si)	ug/L		1200	120	1900	940	430	110	130	1500	970
Total Silver (Ag)	ug/L	0.1	**<0.5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L		1100	870	240	900	920	900	990	740	900
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Uranium (U)	ug/L	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	20	16	<5	<5	9	<5	9	7	6	<5
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phosphorus (P)	mg/L	0.03	**0.064**	0.021	0.022	<0.004	0.027	**0.032**	**0.048**	**0.04**	0.028
Total Suspended Solids	mg/L			2	3	<0.5	<3	<10	<10	<10	<10

NOTES:
1) PWQO indicates Provincial Water Quality Objectives (1999).
2) Shading indicates concentration exceeds does not satisfy the PWQO.
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.
5) Bold indicates the method detection limit is above the PWQO.
6) Blank indicates parameter was not analysed due to a change
in the analytical package.

TABLE C-2
GENERAL CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWB**						**Range**	**Arithmetic**	**Standard**	**Geometric**
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10		**Mean**	**Deviation**	**Mean**
Temperature (field)	C		17.3	16.9	15.9	19.7	27.9	17.8	5.5 - 27.9	17.1	6.9	15.3
pH (field)	pH	6.5 - 8.5	7.1	6.3	8.1	7.1	7.4	6.5	6.3 - 8.3	7.3	0.7	7.2
Conductivity (field)	uS/cm		43	76	115	80	99	85	43 - 115	81	20	79
Turbidity (field)	NTU		2.3	7.0	2.2	6.6	4.3	1.2	1.2 - 7.0	3.5	2.1	2.9
Dissolved Oxygen (field)	mg/L		7.2	0.5	5.1	2.8	3.6	3.1	0.5 - 8.3	4.8	2.8	3.7
Turbidity	NTU		2.5	1.8	1.2	1.1	2.3	1.5	1.1 - 4.4	2.1	0.9	1.9
Total Ammonia-N	mg/L		<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05 - 0.07	0.03	0.02	0.03
Ammonia (Unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02 - <0.02			
Conductivity	uS/cm		66	89	86	87	87	97	66 - 97	84	10	83
Total Organic Carbon	mg/L		6.5	11.5	7.9	10.6	9.7	9.4	6.3 - 12.1	9.4	1.8	9.2
pH	pH	6.5 - 8.5	7.7	7.5	7.2	7.0	7.5	7.0	7.0 - 7.8	7.3	0.3	7.3
Alkalinity (Total as CaCO3)	mg/L		31	47	43	44	41	47	14 - 47	39	8	38
Chloride (Cl)	mg/L		<1	2	<1	<5	1	<1	<1 - <5			
Nitrite (N)	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01 - <0.01			
Nitrate (N)	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - 4.5	0.35	1.15	0.07
Phosphate-P	mg/L			<0.01	<0.01	<0.05	<0.01	<0.01	<0.01 - 0.025	0.01	0.01	0.01
Sulphate (SO4)	mg/L		3	<1	2	<5	2	<1	<1 - 9	2.6	2.2	1.9
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		31	47	43	44	41	47	14 - 47	39	8	38
Calculated TDS	mg/L		33			46			33 - 46	40.5	6.1	40.1
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1	<1	<1	<1	<1	<1	<1 - <1			
Cation Sum	me/L											
Dissolved Hardness (CaCO3)	mg/L		32	47	42	47	41	46	32 - 47	40	4	40
Total Aluminum (Al)	ug/L	75	23	11	60	49	39	43	11 - 160	50	40	39
Total Antimony (Sb)	ug/L	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <1			
Total Arsenic (As)	ug/L	5	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Barium (Ba)	ug/L		77	120	14	110	110	120	14 - 120	89	26	82
Total Beryllium (Be)	ug/L	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5 - <0.5			
Total Boron (B)	ug/L	200	<10	11	<10	12	<10	12	<10 - 13	8	3	7
Total Cadmium (Cd)	ug/L	0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.06
Total Calcium (Ca)	ug/L		7900	12000	2200	11000	9900	12000	2200 - 13000	9753	2466	9218
Total Chromium (Cr)	ug/L	8.9	<5	<5	<5	<5	<5	<5	<5 - <5			
Total Cobalt (Co)	ug/L	0.9	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5 - 0.8	0.3	0.1	0.3
Total Copper (Cu)	ug/L	1 (5)	<1	<1	<1	<1	1	<1	<1 - 3	0.7	0.6	0.6
Total Iron (Fe)	ug/L	300	110	590	890	920	570	560	110 - 920	489	230	432
Total Lead (Pb)	ug/L	1 (3)	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5 - 1.7	0.4	0.4	0.3
Total Magnesium (Mg)	ug/L		3600	5200	650	5400	4300	5100	650 - 5400	4163	1146	3851
Total Manganese (Mn)	ug/L		3	28	160	38	19	48	3 - 160	33	41	20
Total Molybdenum (Mo)	ug/L	40	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Nickel (Ni)	ug/L	25	<1	<1	<1	<1	<1	<1	<1 - 1	0.5	0.1	0.5
Total Potassium (K)	ug/L		<200	<200	240	<200	250	340	240 - 1300	620	341	537
Total Selenium (Se)	ug/L	100	<2	<2	<2	<2	<2	<2	<2 - <2			
Total Silicon (Si)	ug/L		<50	2400	240	1800	170	890	<50 - 2400	855	768	461
Total Silver (Ag)	ug/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 - <0.5			
Total Sodium (Na)	ug/L		590	420	740	380	790	750	240 - 1100	749	243	699
Total Thallium (Tl)	ug/L	0.3	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05 - 0.1	0.03	0.02	0.03
Total Tungsten (W)	ug/L	30	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Uranium (U)	ug/L	5	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1 - 0.2	0.06	0.04	0.05
Total Vanadium (V)	ug/L	6	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Zinc (Zn)	ug/L	20	7	<5	<5	<5	<5	<5	<5 - 16	5.1	3.9	4.1
Total Zirconium (Zr)	ug/L	4	<1	<1	<1	<1	<1	<1	<1 - <1			
Total Phosphorus (P)	mg/L	0.03	0.018	0.029	0.029	0.054	0.036	0.023	0.018 - 0.064	0.034	0.013	0.031
Total Suspended Solids	mg/L		<10	<10	<10	14	<10	<10	0.25 - 14	5	3	4

NOTES:

1) PWQO indicates Provincial Water Quality Objectives (1999).

2) Shading indicates concentration exceeds does not satisfy the PWQO.

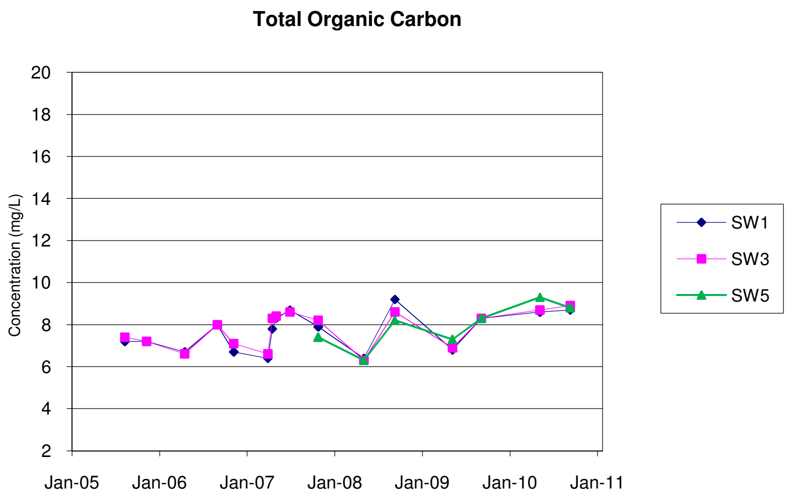
3) PWQO for copper is 5 ug/L when hardness is greater than 20 mg/L.

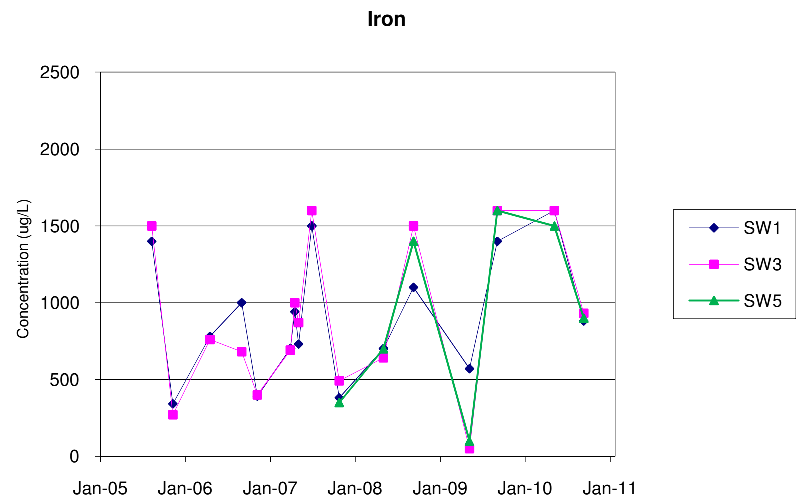
4) PWQO for lead is 3 ug/L when hardness is between 30 and 80 mg/L.

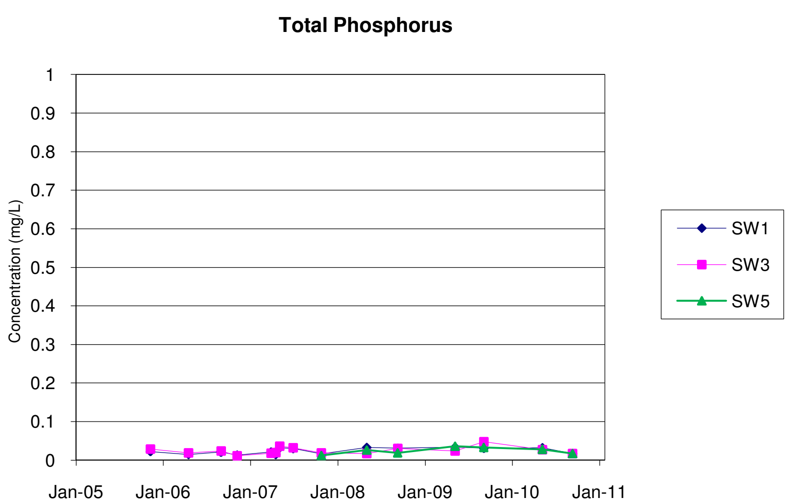
5) Bold indicates the method detection limit is above the PWQO.

6) Blank indicates parameter was not analysed due to a change in the analytical package.

FIGURE C-2
TIME-CONCENTRATION GRAPH
CRANBERRY RIVER STATIONS SW1, SW3 and SW5







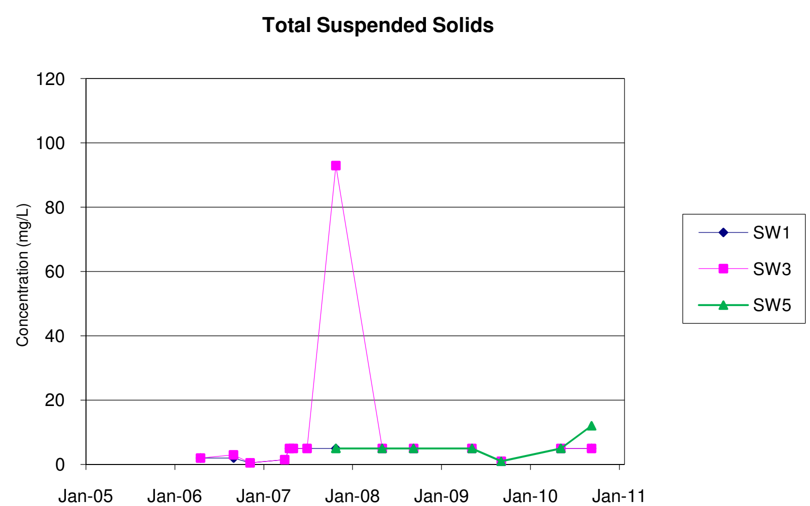
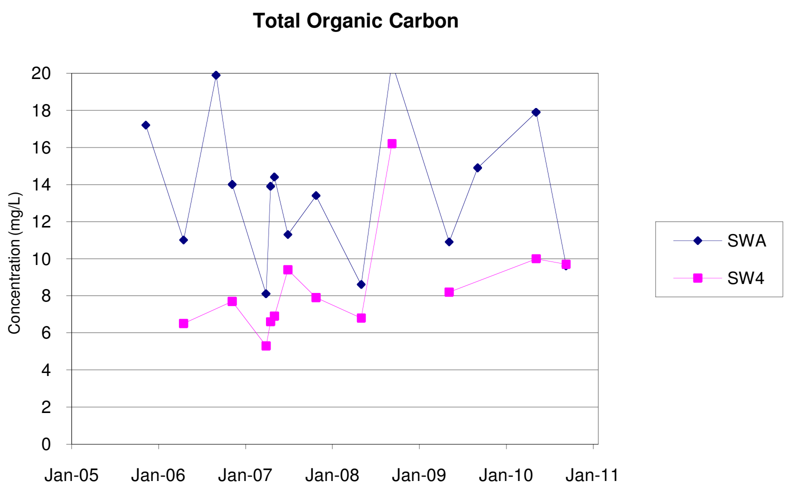
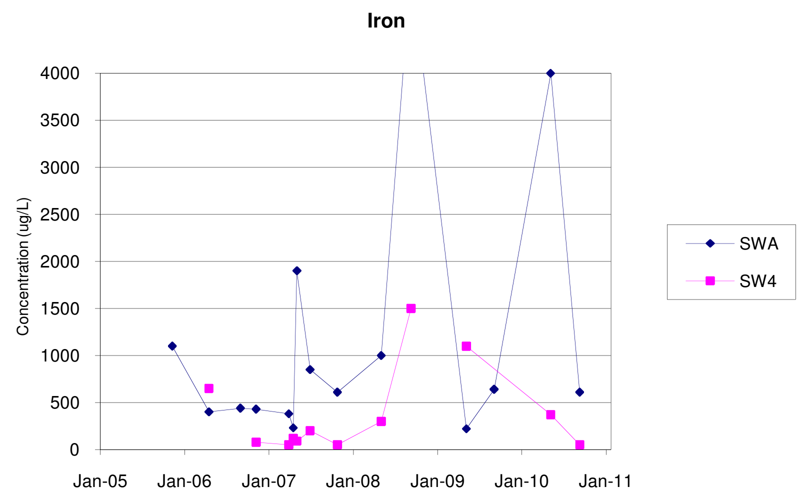
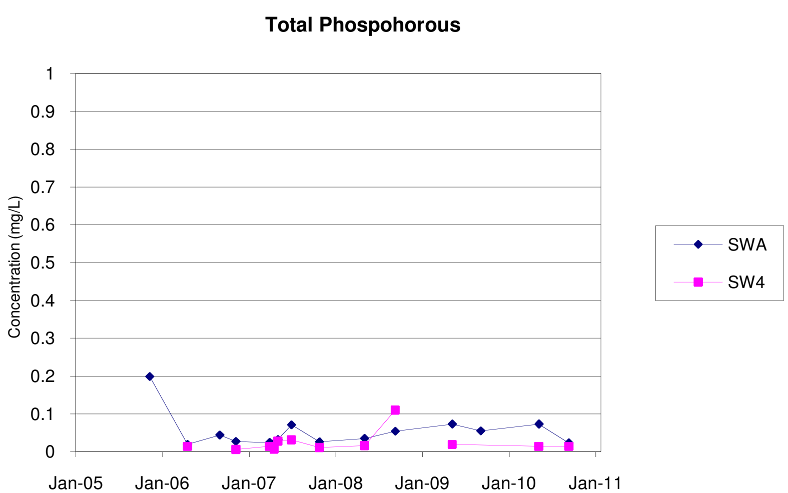


FIGURE C-3
TIME-CONCENTRATION GRAPH
WATER COURSE 1 - STATIONS SWA AND SW4







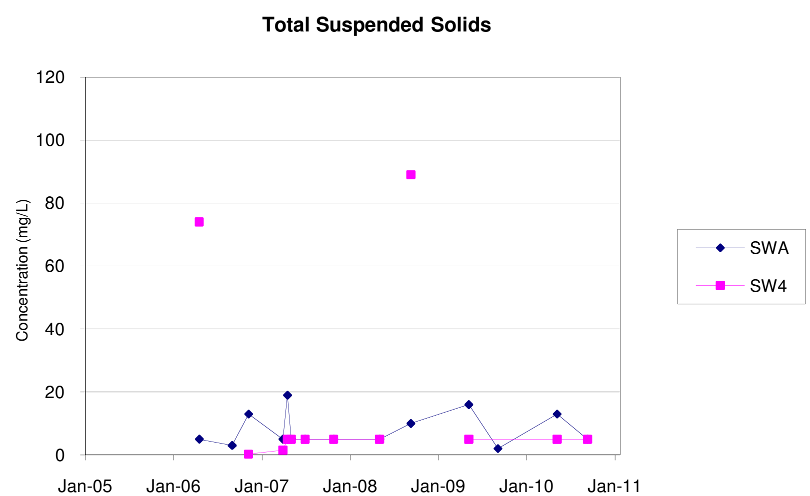
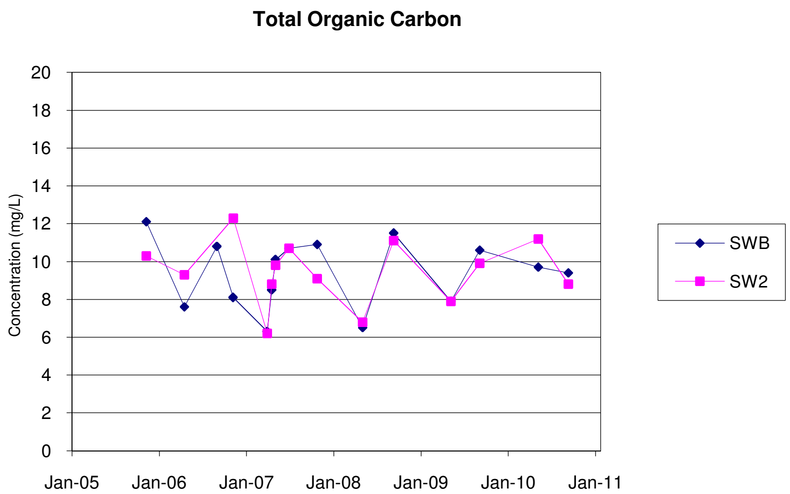
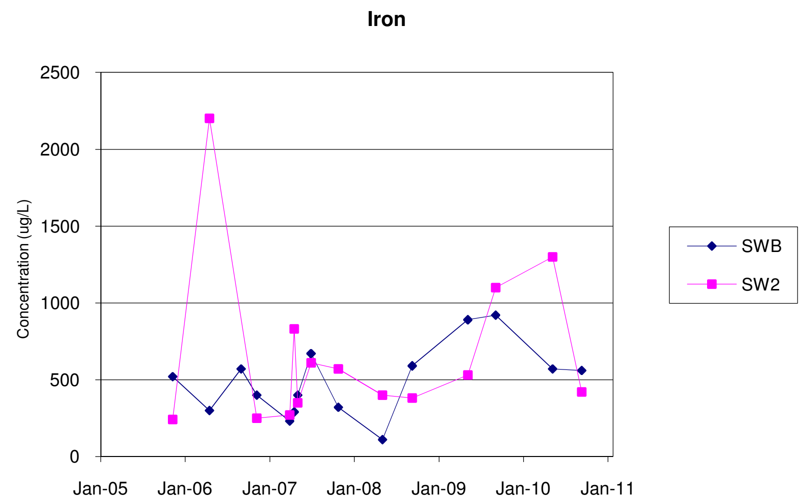
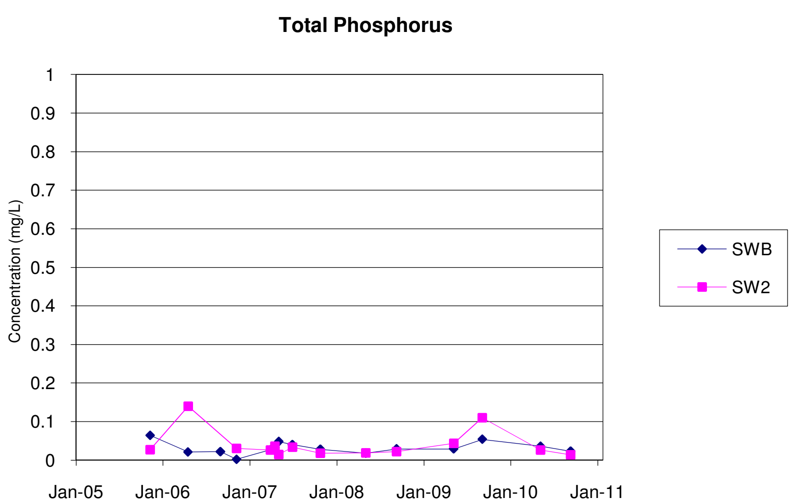


FIGURE C-4
TIME-CONCENTRATION GRAPH
WATER COURSE 2 - STATIONS SWB AND SW2







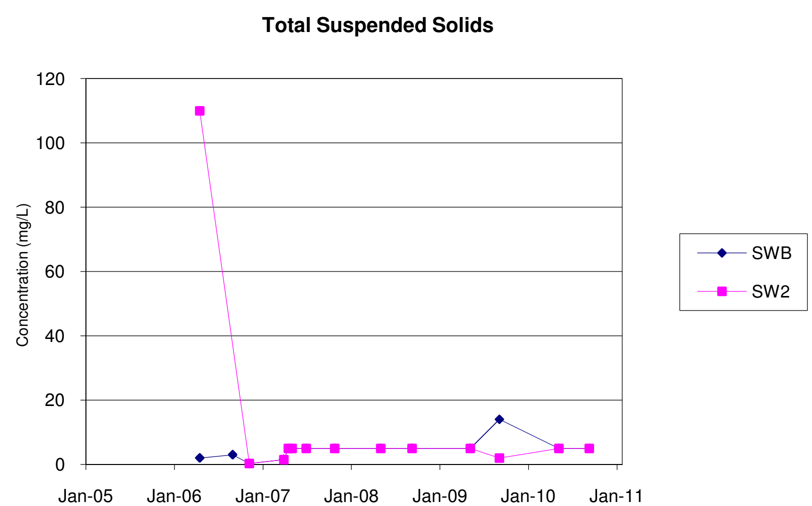


TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW 1**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.9	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.9	<0.5	<0.5	1.2
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		PWQO	SW2						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.8	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.6	<0.5	0.8	<0.5	<0.5	1.1
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW 3**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			1.0	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW4**					
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.7	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.7	<0.5	0.9
1,1,1,2-Tetrachloroethane	μg/L	20*	<0.1	-	-	-	-	-
1,1,1-Trichloroethane	μg/L	10*	<0.1	-	-	-	-	-
1,1,2,2-Tetrachloroethane	μg/L	70*	<0.2	-	-	-	-	-
1,1,2-Trichloroethane	μg/L	800*	<0.2	-	-	-	-	-
1,1-Dichloroethane	μg/L	200*	<0.1	-	-	-	-	-
1,1-Dichloroethene	μg/L	40*	<0.1	-	-	-	-	-
1,2-Dichlorobenzene	μg/L	2.5	<0.2	-	-	-	-	-
1,2-Dichloroethane	μg/L	100*	<0.1	-	-	-	-	-
1,2-Dichloropropane	μg/L	0.7*	<0.1	-	-	-	-	-
1,3-Dichlorobenzene	μg/L	2.5	<0.2	-	-	-	-	-
1,4-Dichlorobenzene	μg/L	4	<0.2	-	-	-	-	-
Acetone	μg/L		<10	-	-	-	-	-
Benzene	μg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Bromodichloromethane	μg/L	200*	<0.1	-	-	-	-	-
Bromoform	μg/L	60*	<0.2	-	-	-	-	-
Bromomethane	μg/L	0.9*	<0.5	-	-	-	-	-
Carbon Tetrachloride	μg/L		<0.1	-	-	-	-	-
Chlorobenzene	μg/L	15	<0.1	-	-	-	-	-
Chloroform	μg/L		<0.1	-	-	-	-	-
cis-1,2-Dichloroethene	μg/L		<0.1	-	-	-	-	-
cis-1,3-Dichloropropene	μg/L		<0.2	-	-	-	-	-
Dibromochloromethane	μg/L	40*	<0.2	-	-	-	-	-
Dibromoethane	μg/L	5*	<0.2	-	-	-	-	-
Dichloromethane	μg/L	100*	<0.5	-	-	-	-	-
Ethylbenzene	μg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Methyl Ethyl Ketone	μg/L		<5	-	-	-	-	-
Methyl Isobutyl Ketone	μg/L		<5	-	-	-	-	-
Methyl-t-Butyl Ether	μg/L		<0.2	-	-	-	-	-
m/p-Xylene	μg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.1	<0.4
o-Xylene	μg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2
Styrene	μg/L	4*	<0.1	-	-	-	-	-
Tetrachloroethene	μg/L	50*	<0.1	-	-	-	-	-
Toluene	μg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	μg/L		<0.1	-	-	-	-	-
trans-1,3-Dichloropropene	μg/L		<0.2	-	-	-	-	-
Trichloroethene	μg/L	20*	<0.1	-	-	-	-	-
Vinyl Chloride	μg/L	600*	<0.2	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW5**					
Sampling Date			23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L				<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L				<0.5	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5	1.2
1,1,1,2-Tetrachloroethane	µg/L	20*	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	-	-	-	-	-	-
Acetone	µg/L		-	-	-	-	-	-
Benzene	µg/L	100*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	-	-	-	-	-	-
Bromoform	µg/L	60*	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		-	-	-	-	-	-
Chlorobenzene	µg/L	15	-	-	-	-	-	-
Chloroform	µg/L		-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	-	-	-	-	-	-
Dibromoethane	µg/L	5*	-	-	-	-	-	-
Dichloromethane	µg/L	100*	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		-	-	-	-	-	-
Trichloroethene	µg/L	20*	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SW A**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			0.6	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	0.6	<0.5	<0.5	1.3
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

TABLE C-3
ORGANIC CHEMICAL RESULTS - SURFACE WATER
SEBRIGHT QUARRY

Monitoring Station		**PWQO**	**SWB**						
Sampling Date			24-May-07	23-May-08	29-Sep-08	27-May-09	24-Sep-09	27-May-10	30-Sep-10
Total oil and grease mineral/synthetic	mg/L		<0.5			<0.5	<0.5	<0.5	
Total animal/vegetable oil and grease	mg/L		<0.5			1.5	<0.5	<0.5	
Total oil and grease	mg/L		<0.5	<0.5	<0.5	1.5	<0.5	<0.5	1.1
1,1,1,2-Tetrachloroethane	µg/L	20*	<0.1	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/L	10*	<0.1	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	70*	<0.2	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	800*	<0.2	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	200*	<0.1	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	40*	<0.1	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	100*	<0.1	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	0.7*	<0.1	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2.5	<0.2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	4	<0.2	-	-	-	-	-	-
Acetone	µg/L		<10	-	-	-	-	-	-
Benzene	µg/L	100*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Bromodichloromethane	µg/L	200*	<0.1	-	-	-	-	-	-
Bromoform	µg/L	60*	<0.2	-	-	-	-	-	-
Bromomethane	µg/L	0.9*	<0.5	-	-	-	-	-	-
Carbon Tetrachloride	µg/L		<0.1	-	-	-	-	-	-
Chlorobenzene	µg/L	15	<0.1	-	-	-	-	-	-
Chloroform	µg/L		<0.1	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Dibromochloromethane	µg/L	40*	<0.2	-	-	-	-	-	-
Dibromoethane	µg/L	5*	<0.2	-	-	-	-	-	-
Dichloromethane	µg/L	100*	<0.5	-	-	-	-	-	-
Ethylbenzene	µg/L	8*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Methyl Ethyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl Isobutyl Ketone	µg/L		<5	-	-	-	-	-	-
Methyl-t-Butyl Ether	µg/L		<0.2	-	-	-	-	-	-
m/p-Xylene	µg/L	2*/30*	<0.1	<0.4	<0.4	<0.1	<0.4	<0.1	<0.4
o-Xylene	µg/L	40*	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Styrene	µg/L	4*	<0.1	-	-	-	-	-	-
Tetrachloroethene	µg/L	50*	<0.1	-	-	-	-	-	-
Toluene	µg/L	0.8*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene	µg/L		<0.1	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/L		<0.2	-	-	-	-	-	-
Trichloroethene	µg/L	20*	<0.1	-	-	-	-	-	-
Vinyl Chloride	µg/L	600*	<0.2	-	-	-	-	-	-

NOTES:

1) PWQO - Provincial Water Quality Objectives (1999).

2) * indicates Interim PWQO

Appendix D

Climatic Data

- 30 Year Normal – Table D-1
- Precipitation Summary: 2001 to 2007 – Table D-2

TABLE D-1
30 YEAR NORMAL (1971 to 2000) WATER BUDGET - ORILLIA TS
SEBRIGHT QUARRY

Month	Mean Temperature (°C)	I	Unadjusted PET (mm)	Daylight Factor	PET (mm)	Total P (mm)	P-PET (mm)	Accumulated Potential Water Loss (mm)	WHC (mm)	Change in Moisture (mm)	AET (mm)	Calculated Surplus (mm)	Calculated Deficit (mm)
JANUARY	-8.4	0.00	0.00	0.82	0.00	103.1	103.1	0	360.4	0	0	103.1	0.00
FEBRUARY	-7.7	0.00	0.00	0.82	0.00	68.1	68.1	0	428.5	0	0	68.1	0.00
MARCH	-2.1	0.00	0.00	1.03	0.00	71.3	71.3	0	499.8	0	0	71.3	0.00
APRIL	5.7	1.22	26.64	1.12	29.84	72.2	42.4	0	150	0	29.8	42.4	0.00
MAY	12.9	4.18	63.12	1.27	80.16	77.6	-2.6	2.56	147.4	-2.6	80.2	0.0	0.00
JUNE	17.1	6.40	85.00	1.28	108.80	76.4	-32.4	34.96	118	-29.4	105.8	0.0	3.00
JULY	20.6	8.48	103.47	1.30	134.52	77.4	-57.1	92.08	81	-37	114.4	0.0	20.12
AUGUST	19.4	7.75	97.12	1.20	116.54	102.4	-14.1	106.22	73	-8	110.4	0.0	6.14
SEPTEMBER	14.8	5.15	72.98	1.04	75.90	95.3	19.4	0	92.4	19.4	75.90	0.0	0.00
OCTOBER	8.2	2.11	39.12	0.95	37.16	89.7	52.5	0	144.9	52.5	37.16	0.0	0.00
NOVEMBER	2.2	0.29	9.75	0.81	7.90	102.5	94.6	0	150	5.1	7.90	89.5	0.00
DECEMBER	-4.8	0.00	0.00	0.78	0.00	107.3	107.3	0	257.3	0	0.00	107.3	0.00
Total	**6.5**	**35.58**			**590.83**	**1043.3**	**452.5**	**235.8**	**2502.7**	**0.0**	**561.6**	**481.7**	**29.3**
											Water Surplus	**481.7**	**mm**

Notes:
1) I - Heat Index
2) PET - Potential Evapotranspiration
3) P - Precipitation
4) WHC - Water Holding Capacity of soil
5) AET - Acutal Evapotranspiration
6) mm - millimetres
7) Data from the Orillia TS Climatological Station located at 44°37'N79°25'W/O, 219.5 m ASL, as reported by Environment Canada.

TABLE D-2
PRECIPITATION SUMMARY: 2001 to 2010
SEBRIGHT QUARRY

YEAR	PRECIPITATION TOTAL (mm)		
	Orilla TS	**Orillia Brain**	**Coldwater Warminster**
30 - Year Normal	1,043.3		
2001	Not available	1,121.9	929.4*
2002	Not available	991.9	919.6
2003	Not available	1,051.9	1,005.0
2004	Not available	1,099.2	998.4*
2005	Not available	1,002.1	771.6*
2006	Not available	1,164.2	679.8*
2007	Not available	1043.1*	750.0*
2008	Not available	491*	975.6*
2009	Not available	1,084.2	1,029.4
2010	Not available	653.2*	833.8*

Notes:
1) Data from the Orillia TS Climatological Station located at 44°37'N79°25'W/O, 219.5 m ASL, as reported by Environment Canada.
2) Data from the Orillia Brain Climatological Station located at 44°36'N79°44'W, 248 m ASL, as reported by Environment Canada.
3) Data from Coldwater Warminster Climatological Station located at 44°38'N79°32'W, 285 m ASL, as reported by Environment Canada.
4) * indicates total precipitation was calculated based on an incomplete set of data.

Appendix E

Curricula Vitae

- Lara Marchetti, B.Sc. Eng.
- Jason T. Balsdon, P.Eng.

GENIVAR **ENVIRONMENT**

LARA MARCHETTI, B.A.Sc., EIT

PROJECT MANAGER

AREAS OF PRACTICE

Water Resources
Waste Management
Aggregates

LANGUAGES

English
French

PROFILE

Ms. Marchetti has a Bachelor of Applied Science degree in Environmental Engineering (Chemical Specialization) from the University of Waterloo. Ms. Marchetti has experience in a variety of environmental services including regulatory water sampling and testing programs, landfill site monitoring, groundwater exploration programs, microbial contamination control plans, and hydrogeologic and geotechnical investigations for land development applications. Ms. Marchetti's input to these projects includes project management, client liaison, completion of field activities, data analysis and report preparation.

EDUCATION

B.A.Sc., University of Waterloo, Environmental Engineering – Chemical Specialization – Co-operative Program	2000-2005

ADDITIONAL TRAINING

Achieving Water Quality Standards by Effective Stormwater Management	2010
WHMIS online certificate	2010
Critical Thinking in Aquifer Test Interpretations – Short Course presented by S.S. Papadopulos & Associates Inc.	2009
The Groundwater Pollution and Hydrology course presented by Princeton Groundwater, Inc. San Francisco, California, USA.	2007
Project Management Bootcamp I	2007
24-Hour Health and Safety Training Course for Low Exposure Occupations	2007
Aquifer Test Analysis Training Course	2006
Phase I Environmental Site Assessment Course offered by the Associated Environmental Site Assessors of Canada Inc. (AESAC)	2005
Class 1 Wastewater Distribution System Operator In Training	2001
Class 1 Wastewater Treatment System Operator In Training	2001
Class 1 Water Distribution System Operator In Training	2001
Class 1 Water Treatment System Operator In Training	2001

AWARDS

Jagger Hims Limited Performance Award	2006
Dow Chemical Canada Inc. Award, University of Waterloo *The award was received in recognition of an outstanding work term report from Environmental Engineering (Chemical) for the work term of January – April 2004*	2004

PROFESSIONAL AFFILIATIONS

Professional Engineers Ontario, Engineer-In-Training	2009

CAREER

Project Manager, GENIVAR	2009 - Present
Project Manager, Jagger Hims Limited (GENIVAR acquisition)	2005 - 2009
Co-op Student, Jagger Hims Limited	2004
Co-op Student, Petro-Canada Oakville Refinery	2002 & 2003
Co-op Student, Environment Canada	2002
Co-op Student, YMCA of London, Camp Queen Elizabeth	2001

PROFESSIONAL EXPERIENCE

Water Resources

- **Durham Catholic District School Board**, Durham Region, ON (2008 - present): Co-ordinate and manage the annual water sampling and testing program for 54 schools and facilities in accordance with Ontario Regulation 243/07. Client: Durham Catholic District School Board.
- **Uxbridge Industrial Park,** Uxbridge, ON (2005-Present): Complete the annual residential water sampling program. Data is analyzed and an annual report is prepared. An aquifer vulnerability assessment was also completed. Client: Uxbridge Industrial Ltd.
- **Lebovic and Mantle Sewer Construction Dewatering**, Whitchurch-Stouffville, ON (2006-2008): Groundwater and surface water monitoring in conformance with the Permit To Take Water. Co-ordinated and scheduled field staff, analyzed data and prepared reports to the Ministry of the Environment. The project also involved meetings with the project team and Ministry of the Environment Client: Lebovic Enterprises Inc.
- **Mademont Property EIS**, Newmarket, ON (2005-2008): Completed a hydrogeological and hydrological evaluation of hydrologically sensitive features and a water budget and conservation plan for a proposed development. Project involvement included field activities, data analysis, preparation of the report and meetings with the project team and Town of Newmarket. Client: Mademont Investments.
- **University of Toronto**, Toronto, ON (2007): Completed a drinking water quality evaluation to determine possible sources of lead in the water supply. Developed a detailed water sampling program, attended meetings with the client and prepared a report. Client: University of Toronto.
- **York Region District School Board**, York Region, ON (2007): Co-ordinated and managed the 60-month water sampling program for 7 schools and facilities in accordance with Ontario Regulation 170/03. Co-ordinated field staff, analyzed water quality results and prepared a report. Client: York Region District School Board.
- **Interim Microbial Contamination Control Plan,** Region of Peel, ON (2006): Completed a detailed land-use inventory and field survey. Tasks performed included an office study, field survey, data analysis (risk ranking/categorization

of contaminant sources), client meetings, presentation of study findings, and preparation of a report. Client: Regional Municipality of Peel.

Waste Management

- **County of Simcoe Landfill Site 41**, Tiny Township, ON (2005-2010). Completed the background groundwater and surface water monitoring program and prepared an annual report. Completed the application and technical support document for a Permit To Take Water, which was related to depressurization of the confined aquifer. Monitored groundwater and surface water features in conformance with the Permit To Take Water for the site and provided monthly monitoring reports to the Ministry of the Environment. Assessed the basal stability of the excavation as required. Prepared responses to questions from the Community Monitoring Committee for the site and general public. Meetings with the client and Ministry of the Environment were also required for this project. Client: County of Simcoe.
- **Well Decommissioning & Aquifer Depressurization Well Construction**, Tiny Township, ON (2007-2009): Decommissioned on-site groundwater supply wells in conformance with O.Reg. 903. Installed two on-site pumping wells and co-ordinated hydraulic testing. Completed an assessment of the basal stability with respect to the construction of a waste cell. Client: County of Simcoe.
- **Closed MPT Landfill Site,** Tiny Township, ON (2006-2010): Oversee the annual water monitoring program required at this closed landfill site. The project involves gas monitoring, groundwater sampling, and residential well sampling. Data is analyzed and an annual report is prepared. Prepared a Guideline D-4 report for the County of Simcoe, which was related to the construction of a building within 500 m of a closed landfill site. Client: County of Simcoe.
- **Pedersen Landfill,** Uxbridge, ON (2007-2008): Completed the annual monitoring program for this closed landfill site. The project involved surface water, groundwater, and residential well sampling. Data was analyzed and an annual report was prepared. This project also involved meetings with the client and Ministry of the Environment. Client: I.B.Pedersen Ltd.

Aggregates

- **Sebright Quarry**, Sebright, ON (2007 - present): Project duties included groundwater and surface water monitoring, co-ordination of field staff, data collation, report preparation and attendance at meetings with the project team. Client: Giofam Investments Inc.

JASON T. BALSDON, M.A.Sc., P.Eng.

CONSULTING ENGINEER - DIRECTOR, ENVIRONMENT

AREAS OF PRACTICE

- Geotechnical Engineering
- ESA and Site Remediation
- Designated Substances
- Aggregates
- Mining
- Environmental Management
- Rural Servicing
- Waste Management
- Groundwater Resources
- Construction Dewatering

PROFILE

Jason Balsdon, M.A.Sc., P.Eng., is a senior engineer at GENIVAR. He has been actively involved in the fields of geological engineering and hydrogeology both academically and professionally since 1986. After graduating from geological engineering, Mr. Balsdon concentrated his broad engineering and geologic theoretical background in the field of hydrogeology at a graduate level. His research included groundwater contamination evaluation and landfill monitoring which involved thesis work on environmental isotopes as groundwater tracers and as indicators of landfill leachate contamination.

Mr. Balsdon's consulting career has covered a broad range of projects including terrain evaluation, environmental site assessments and remediation, groundwater resource management, aggregate resource management, lagoon and landfill site selection, groundwater contamination evaluation, waste management studies, and environmental management systems. Mr. Balsdon's input into these projects has included project management, client liaison, study program development, completion of field activities, data analyses, report preparation, peer review, participation in public meetings and open houses, and expert witness testimony.

EDUCATION

M.A.Sc., University of Windsor, Geological Engineering, Specializing in Hydrogeology	1986-1988
B.A.Sc., University of Windsor, Geological Engineering	1982-1986

ADDITIONAL TRAINING

Critical Thinking In Aquifer Test Interpretation, S.S. Papadopoulus and Associates

Basics of Ground Water Modelling

Field Methods in Contaminant Hydrogeology

Dense Immiscible Phase Liquid Contaminants in Porous and Fractured Media

Clayey Barriers for Mitigation of Contaminant Impact

Probabilities, Statistics and Geostatistics for Environmental Professionals

ISO 14000 Environmental Auditor Training

Land Application of Biosolids and Septage Dealing with Industrial & On-Site Contamination

Environmental Regulation and Compliance

Regulatory Review of Hydrogeology Studies – Groundwater Modelling

Environmental Law for Practising Professionals

40-Hour Health and Safety Training Course for Hazardous Waste Operations OSHA, and Refresher Courses

WHIMIS

St. John's First Aid

PROFESSIONAL AFFILIATIONS

Consulting Engineers of Ontario (1996)	CEO
Professional Engineers of Michigan (1996)	PEM
Professional Engineers of Ontario (1989)	PEO

CAREER

Director, GENIVAR	2009 - Present
President, Jagger Hims Limited (*GENIVAR acquisition)*	2005 – 2009
Manager, Jagger Hims Limited	1988 - 2005
Consulting Assistant / Research Assistant, Dr. M.G. Sklash, University of Windsor	1986 - 1988

PROFESSIONAL EXPERIENCE

Geotechnical Engineering

Provided project management and peer review for geotechnical assessments of slope stability, retaining wall construction, lagoons, basal stability in deep excavations, input to infrastructure design, foundation suitability, and construction dewatering. Example projects are provided below.

- **Essex-Windsor Regional Landfill Site**, ON (1991 to 2009): Managed a landfill design and construction project that included a geotechnical evaluation for basal stability, settlement, inward hydraulic gradients, and integrity of a natural low permeable liner. Client: Essex-Windsor Solid Waste Authority.
- **Twin Creeks Landfill Site**, ON (1997 to 2009): Provided senior expertise on the design and construction of a deep excavation and liner system for a municipal solid waste landfill site. Client: Waste Management of Canada Corporation.
- **Oxford Homes**, Georgina, ON (2001): Completed a hydrogeological and geotechnical investigation for a proposed development of a Greenfield site. Provided geotechnical input to infrastructure design and layout. Client: Oxford Homes.
- **Retaining Walls**, Various Locations, ON (2001 to 2005): Certification of several retaining wall construction projects in York County. Clients: Various.
- **Everglades Marina**, Georgina, ON (2002): Completed a geotechnical assessment for a development adjacent to Lake Simcoe to address high water table levels and organic soil. Provided geotechnical input to infrastructure design and layout, including the consideration of helical piles for foundation stability. Client: Everglades Marina.

- **Southgate Parcel**, Guelph, ON (2006): Senior technical oversight and peer review was provided for a geotechnical assessment of an undeveloped parcel of land. Included consideration of deep foundation construction and development near sensitive land uses. Client: Ontario Realty Corporation.
- **Southport Development**, ON (2008): Provided peer review services for a condominium group concerned with groundwater dewatering effects from local construction initiatives. Client: Confidential.

ESA and Site Remediation

Completed and/or peer reviewed over 200 Phase I, II, and III Environmental Site Assessments (ESAs) throughout Ontario for diverse land uses including agricultural, commercial, industrial, parklands, former landfills, community, and environmentally sensitive areas. Contaminants of concern include heavy metals, petroleum hydrocarbons, volatile organic compounds, solvents, dense nonaqueous phase liquids, and buried asbestos. As a Qualified Person obtained Records of Site Condition per Regulation 153/04 for properties based on Phase I and II ESA findings. Sample projects include the following.

- **Industrial Property Assessment**, Windsor, ON (1995): A former foundry was investigated to assess and then to delineate the coal, fuel oil, quench oil, and heavy metal contamination. Client: The Hearn Group Inc.
- **MTO Patrol Yards**, Various Locations, ON (1997-2009): Completed Phase I and II ESAs, as well as baseline assessments at over 100 Ministry of Transportation Patrol Yards and properties throughout northern, eastern, western, and central Ontario. At some sites the development and implementation of a remedial action plan was required, which included dig and dump as well as insitu and ex situ bioremediation. Client: Ministry of Transportation.
- **Ohsweken Gasoline Contamination Assessment**, ON (2000): Investigation, assessment, and remedial action plan for a multi-source gasoline contamination problem for the Six Nations community. Client: Six Nations of the Grand River.
- **Spill Remediation**, Whitevale, ON (2000-2002): Remediation of fuel oil spills by dig and dump, and insitu bioremediation. Client: Del Management Solutions Inc.
- **United Plant Farm**, Leamington, ON (2001): Site characterization and insitu bioremediation program to remediate a greenhouse facility impacted by Bunker C fuel oil. Client: Confidential.
- **Spencerville Remediation**, Spencerville, ON (2001): Review of a pump and treat system for gasoline contamination in a shallow overburden over bedrock setting. Implemented a successful alterative remediation program of source removal through dig and dump. Client: Royal Bank of Canada.
- **Porquis Junction Patrol Yard**, Porquis Junction, ON (2001 to 2007): To remediate a large gasoline contaminant plume within a water supply aquifer, completed a study that included a vapour survey, multi-aquifer testing, remedial action plan development, insitu bioremediation, chemical oxidation remediation, as well as pump and treat. Client: Ministry of Transportation.
- **Barrie TCE Remediation Program**, Barrie, ON (2001 to 2009): A multi-year program to characterize and remediate a water supply aquifer contaminated with trichloroethylene (TCE) and transformation products adjacent to a major transportation corridor. The remedial program included the use of sparge

points for the injection of ozone for chemical breakdown of the contaminants. Client: Ministry of Transportation.

- **Markham Risk Assessment**, Markham, ON (2002): Completed a contaminant impact assessment and risk assessment for a commercial property impacted by trichloroethylene and transformation products. Client: Confidential.
- **Multi-Phase ESA for Assorted Properties**, ON (2002 to 2009): Provided Phase I, II, and III environmental services for various properties throughout southern Ontario. Client: Ontario Realty Corporation.
- **Wholesale Forest Products**, Georgina, ON (2004-2008): Phase I, II, and III ESAs were completed for various parcels of a property with diverse land uses. Parcels included a former landfill site, a gravel pit, and sensitive lands near the Black River. Client: Wholesale Forest Products.
- **TCE Remediation**, Newmarket, ON (2005): Completed a trichloroethylene (TCE) investigation, delineation, and remediation program for a multiplex residential unit. Dig and dump remediation was completed within and below the building with minimal disruption to tenants. Client: Confidential.
- **Algoma District MTO Patrol Yards**, ON (2005): Remediation of gasoline and diesel contaminated soil by dig and dump, with closure testing. Client: Ministry of Transportation.
- **Coal Storage Facility**, Erieau, ON (2005 to 2008): Provided senior technical input and peer review for redevelopment of a former coal storage and loading facility adjacent to Lake Erie. The undertaking included a remediation program that involved screening and retrieving some coal and acknowledgement of a Record of Site Condition. Client: Confidential.
- **Mar Gasoline Contamination Assessment**, Albermarle, ON (2006-2008): Gasoline contamination of fractured bedrock below a residential and commercial property was investigated to identify the source, delineate the extent, and to prepare a remediation action plan. Client: Ministry of Transportation.
- **TCE Phytoremediation**, Welland, ON (2007): At an industrial site contaminated with trichloroethylene (TCE) and transformation products was investigated, contamination delineated, and a remedial action plan developed. The remediation program approved by the Ministry of the Environment included the use of phytoremediation to contain groundwater contamination to the site and to remediate contamination within the soil. Client: Confidential.

Designated Substances

Completed assessments at over 50 industrial, commercial, and residential properties for designated substances and regulated materials, including: asbestos, lead, PCBs, mercury, ozone-depleting substances, urea formaldehyde foam insulation, and benzene. Select sample projects are outlined below.

- **MTO Patrol Yards**, Various Locations, ON (1997-2009): Completed designated substance inventories at Ministry of Transportation Patrol Yards throughout northern, eastern, western, and central Ontario. Client: Ministry of Transportation.
- **Asbestos Abatement**, Windsor, ON (1999): Supervised asbestos abatement for a former commercial facility. Client: Confidential.

- **PCB Assessment for Transformer Substations**, Windsor, ON (1999 to 2001): Provided senior technical review for a PCB assessment at a number of transformer substations. Client: Windsor Utilities Commission.
- **MTO Properties**, Various Locations, ON (2006): Undertook a designated substance audit of a number of properties in Ontario. Client: Ministry of Transportation.

Aggregates

Experience with aggregates and industrial minerals has included resource assessments and hydrogeological investigations for pits and quarries within Ontario. Outlines for a few sample projects are provided below.

- **Dufferin Quarry**, Milton, ON (1988 to 1992): A detailed hydrogeological assessment was completed to prepare a conceptual hydrogeological understanding of the quarry as input to alternative land use considerations. Client: Dufferin Aggregates.
- **Sebright Quarry**, Dalton, ON (1992 to 2009): For this property in the Canadian Shield, a resource evaluation and detailed hydrogeological assessment was completed as input to approval of a hard rock quarry from a Greenfield site. Client: Giofam Investments.
- **Resource Assessment**, Leamington, ON (2000): Sand and gravel resource evaluation of agricultural properties including subsurface investigations and assessment of potential effects to an adjacent watercourse. Client: Confidential.
- **Sand and Gravel Pit Expansion**, Uxbridge, ON (2000 to 2009): Resource evaluation and hydrogeological assessment for a sand and gravel pit expansion on the Oak Ridges Moraine. Client: Vicdom Sand and Gravel (Ontario) Limited.
- **Milton Quarry PTTW**, Milton, ON (2000 to 2009): Internal peer review of hydrogeological compliance reports in accordance with a Permit To Take Water (PTTW). Client: Halton Crushed Stone.
- **Sand and Gravel Pit PTTW**, Adjala/Tosorontio, ON (2002 to 2009): Ongoing compliance monitoring of a sand and gravel extraction operation adjacent to a watercourse. Included obtaining and renewal of a Permit To Take Water (PTTW). Client: Catalina Aggregate Inc.
- **Quarry Peer Review**, Severn Township, ON (2004): Provided external hydrogeological peer review services for a proposed limestone quarry, which included a review of the impact assessment, hydrogeological modelling, and long-term predictions. Findings were provided to the Township in a public forum. Client: The Corporation of the Township of Severn.
- **Codrington Pit**, Brighton, ON (2005 to 2009): Completed a detailed hydrogeological investigation for a Greenfield site proposed for a sand and gravel pit to be operated above the water table. Client: St. Mary's Cement. Inc. (Canada).
- **Property Assessments**, Guelph, ON (2006): Completed property inspections and reviews as input to environmental due diligence. Client: CBM.
- **Melancthon Quarry**, ON (2008 to 2009): Provided hydrogeological and hydrologic expertise for proposed agricultural irrigation and a 973 hectare quarry in a Greenfield area. Client: The Highland Companies.

Mining

- **Oil Well Interference Assessment** (1995 to 1996): Completed an assessment of potential interference between producing oil wells and brine disposal wells within southwestern Ontario. Client: Farmers Oil and Gas Inc.

Environmental Management

- **Telecommunications Company**, Various Locations, ON (2001): Assisted in the development of an Environmental Management System for a large telecommunications company. Client: Rapin Pro Tech Consulting Inc.
- **Woodbridge Foam Gap Analysis**, Woodbridge, ON (1999): Completed a compliance gap analysis for a manufacturing facility. Client: Woodbridge Foam Corporation.

Rural Servicing

Rural servicing experience since 1988 has ranged from input to the design of sewage systems and water supply systems to peer review of rural servicing reports on behalf of municipalities. Three examples of external peer review projects are listed below.

- **Vespra County Estates**, Springwater, ON (2001): Provided external peer review hydrogeological expertise for a proposed residential development. Client: County of Simcoe.
- **Blairhampton Development**, Tiny, ON (2001): Provided external peer review hydrogeological expertise for a proposed residential development adjacent to Georgian Bay. Client: County of Simcoe.
- **Peer Review**, Township of Severn, ON (2006 to 2008): Hydrogeological peer review services were provided to the Township of Severn for the review of several proposed developments. Client: The Corporation of the Township of Severn.

Waste Management

Experience in the hydrogeological component of waste management has been obtained through academic studies and consulting since 1988. The variety of waste management projects throughout Ontario include waste approvals for application to soil conditioning sites, participation in waste management studies for landfill site selection, and landfill approvals in accordance with the Environmental Assessment Act (EAA) and the Environmental Protection Act (EPA). A select number of projects are summarized below.

- **Asphodel Landfill Site**, Asphodel, ON (1988 to 1993): Completed compliance monitoring and obtained approval for on-going landfilling at the Ontario Municipal Board. Client: Township of Asphodel.
- **Essex County Landfill No. 2**, Leamington, ON (1988 to 2009): Waste management work for a solid municipal waste landfill located with a sand setting involved compliance monitoring, assessment of leachate phytoremediation, approval of a closure plan, landfill remediation, and leachate management. Client: Essex-Windsor Solid Waste Authority.
- **Essex-Windsor Regional Landfill Site**, Essex County, ON (1988 to 2009): Initially completed compliance monitoring at an existing landfill, then provided hydrogeological expertise through a waste management master plan, site selection process, and detailed landfill design. Landfill expansion was approved without the need for a hearing. Work involved on-going compliance

monitoring, leachate phytoremediation assessment, and input to long-term leachate management. Client: Essex-Windsor Solid Waste Authority.

- **Essex County Landfill No. 3**, Lakeshore, ON (1988 to 2009): Waste management work at a municipal landfill site included compliance monitoring, approval of a landfill closure plan, landfill remediation, and tracer testing to assess the effectiveness of the leachate collector system. Client: Essex-Windsor Solid Waste Authority.
- **Simcoe County Landfills**, Simcoe County, ON (1988 to 2009): Provided project management and waste management peer review for hydrogeological assessments, compliance monitoring, landfill remediation, leachate management, and related activities at 15 active and closed landfill sites owned by the County of Simcoe. Client: County of Simcoe.
- **Niagara North Waste Management Master Plan**, ON (1992): Provided hydrogeological site selection as input to the waste management master plan. Client: Proctor & Redfern Limited.
- **Hazardous Waste Facility**, Lambton County, ON (1993 to 1995): Completed compliance inspections of waste cells and property, and managed detailed hydrogeological investigation and assessment of hazardous landfill site as input to expansion. Client: Laidlaw Environmental Services.
- **Lasalle Road Landfill Site**, Sarnia, ON (1995 to 2009): Hydrogeological expertise included compliance monitoring, EPA approval for an increase in additional annual waste capacity, approval of the closure plan, and assessment of leachate and industrial liquid phytoremediation program. Client: Waste Management of Canada Corporation.
- **Twin Creeks Landfill Site**, ON (1997 to 2009): Responsible for detailed hydrogeological assessment as input to EA and EPA approval for a landfill expansion in Lambton County. Supplemental work included landfill remediation, leachate management and phytoremediation, input to landfill design, and peer review of landfill expansion construction activities. Client: Waste Management of Canada Corporation.
- **Tannery Biosolids Land Application**, Eramosa, ON (1998 to 2001): Characterized tannery waste and obtained site approval for land application of the waste as a soil conditioner. Tasks also included ongoing monitoring of the land application program. Client: White Tanning Company.
- **Ethanol Plant Biosolids Land Application**, ON (1998 to 2009): Characterized biosolids waste and obtained approval for organic soil conditioning sites. On-going work included co-ordination of the land application program, compliance monitoring, and providing agronomic recommendations. Client: Commercial Alcohols.
- **Grand Bend Landfill Site**, Grand Bend, ON (2000 to 2009): Establishment of a Contaminant Attenuation Zone and multi-year compliance monitoring program for a closed landfill site within a sand setting. Client: County of Lambton.
- **Septage Site Approval**, Durham Region, ON (2000 - 2009): Obtained site approvals for land application of septage. Client: Various.
- **Kirkland Lake Landfill**, Kirkland Lake, ON (2000 to 2009): Multi-year compliance monitoring program, establishment of a Contaminant Attenuation Zone, preparation of a Design and Operations Plan, and evaluation of a sewage sludge dewatering and landfilling program. Client: Corporation of the Town of Kirkland Lake.

- **Petrolia Landfill Site**, ON (2001 - 2009): Turnkey environmental services for existing landfill remediation, EPA approval for landfill design modification, Environmental Screening Process (ESP) approval for service area expansion, watercourse relocation assessment, gas monitoring and management program, oil well decommissioning program below waste footprint, leachate characterization and management plan, and multi-year compliance monitoring. Client: Waste Management of Canada Corporation.
- **Domingos Meat Packers**, Arthur, ON (2002): Characterized abattoir waste and obtained land approvals for an organic conditioning site. Client: Domingos Meat Packers.
- **Blackwell Landfill Site**, Sarnia, ON (2003-2009): Provided hydrogeological and waste management expertise related to a perimeter groundwater collection system and air curtain to prevent off-site landfill impacts, assisted in approvals for stormwater and leachate management, and multi-year compliance monitoring. Client: Waste Management of Canada Corporation.
- **Blenheim Landfill Site**, Blenheim, ON (2003-2009): Multi-year compliance monitoring program, including assistance in obtaining approval for landfill closure and leachate management through phytoremediation. Client: Waste Management of Canada Corporation.
- **TRI-R Landfill Site**, Armour Township, ON (2003-2009): Assisted three municipalities in their long-term waste management plan, including EPA approvals for expansion of the existing landfill, on-going compliance monitoring, and seep mitigation with constructed wetlands. Client: TRI-R Committee.
- **Landfill Site Search**, ON (2006): Completed a GIS-based constraints analysis of eastern Ontario to identify potential landfill sites. Client: Confidential.
- **Ontario Parks**, Various Locations, ON (2007 to 2009): Completed hydrogeological assessments of sewage lagoons and provided remedial options including the use of constructed wetlands or spray irrigation to renovate/dispose wastewater. Client: Ontario Parks.
- **Glanbrook Landfill**, Hamilton, ON (2007 to 2009): Multi-phase undertaking that included obtaining EPA approval for the use of contaminated soil for daily cover, the completion of an Environmental Screening Processes for a service area expansion for the import of contaminated soil for daily cover, annual compliance reporting, and input to environmental due diligence. Client: City of Hamilton.
- **Closed Ancaster Landfill Site**, Ancaster, ON (2009): Determination of a Contaminant Attenuation Zone and surface water impact assessment with chemical and benthic sampling. Client: City of Hamilton.

Groundwater Resources

- **Jackson's Landing**, Georgina, ON (2001 to 2009): Detailed hydrogeological assessment for a proposed development of a Greenfield site in Georgina Township near Lake Simcoe. Included a detailed subsurface investigation and testing program to maintain protection of the local aquifers and groundwater supplies. Involved expert testimony at the Ontario Municipal Board. Client: Alliance Homes.
- **Everglades Marina**, Georgina, ON (2002): Completed a hydrogeological assessment for a development adjacent to Lake Simcoe for a communal water supply. Client: Everglades Marina.

- **Greenvilla Homes**, Georgina, ON (2003 to 2009): Hydrogeological study for a proposed development of a Greenfield site in Georgina Township near Lake Simcoe. Included a detailed hydrogeological investigation and testing program to maintain protection of the local aquifers and groundwater supplies. Involved preparation for the Ontario Municipal Board, but was resolved prior to a hearing. Client: Greenvilla Homes.
- **Crates Landing**, Georgina, ON (2005-2008): A detailed hydrogeological assessment and mitigation plan for review by regulators including the Conservation Authority was completed for a proposed development within sensitive lands adjacent to Lake Simcoe. Client: P&B Marketing Ltd.
- **Mademont Investments**, Newmarket, ON (2005-2008): Completed a detailed hydrogeological assessment for a proposed development on the Oak Ridges Moraine within the Town of Newmarket. Involved expert testimony at the Ontario Municipal Board. Client: Mademont Investments.
- **Castle Glen Residential Development**, Blue Mountains, ON (2006): Provided expert hydrogeological testimony at the Ontario Municipal Board for a proposed development on the Niagara Escarpment regarding sensitive recharge features and development in an area of shallow overburden over bedrock. Client: Castle Glen Development Corporation.
- **Ballantrae Development**, Ballantrae, ON (2007-2008): A hydrogeological and geotechnical assessment was completed for a Greenfield site to assess available groundwater resources for a communal water supply and to investigate waste water disposal options. Client: iPlan Corp.

Construction Dewatering

Provided hydrogeological expertise for construction dewatering projects within central Ontario, which included preparation of technical support documents and obtaining Permits To Take Water (PTTW). Sample projects are outlined below.

- **Subsurface Infrastructure Dewatering Program**, ON (1999 to 2009) – Completed a detailed hydrogeological study and obtained approval for a PTTW for construction dewatering for a large residential development near the Town of Whitchurch-Stouffville. Tasks included on-going monitoring and reporting in accordance with the PTTW. Client: Lebovic Enterprises.
- **Crates Landing**, Georgina, ON (2005-2008): Completed a detailed hydrogeological assessment and technical support document for a PTTW for a proposed high-rise development within sensitive lands and peat adjacent to Lake Simcoe. Client: P&B Marketing Ltd.
- **Sanitary Sewer Replacement**, Toronto, ON (2009). A PTTW was obtained for the completion of construction dewatering for a sanitary sewer replacement along St. Clair Avenue. The application provided a technical support document that also addressed the potential for local sources of subsurface contamination and water management requirements. Client: City of Toronto.

PUBLICATIONS AND PRESENTATIONS

Publications

- Balsdon, J.T. and Sklash, M.G. Environmental Isotope and Geochemical Study of Landfill Leachate Migration. In "Symposium on Ground - Water Contamination", Environment Canada, Saskatoon, June 1989.

- Jagger, D.E. and Balsdon, J.T. Landfill Development in the 1990's: A Site Characterization Case History, 48th Canadian Geotechnical Conference, Vancouver, British Columbia, September 1995.
- Jagger D.E. and Balsdon, J.T. Twenty-Five Years and Counting, Public Perceptions, Attitudes and Actions: Waste – The Social Context Conference, Edmonton, Alberta, May 2005.

LEGEND

- LICENCED BOUNDARY
- LIMIT OF EXTRACTION
- LIMIT OF EXTRACTION VERTICAL FACE
- LIMIT OF EXTRACTION CUT & FILL
- LOT/CONCESSION LINE
- 120m SETBACK
- INTERNAL HAUL ROAD
- POST & WIRE FENCE
- TRAIL
- CONTOURS & SPOT ELEVATIONS
- GENERAL DIRECTION OF DRAINAGE
- PIT ENTRANCE/EXIT
- GATE
- TREES/BUSH
- BOREHOLE (BH00–1)
- POND/SURFACE WATER AS MAPPED BY MICHASKI NIELSEN & ASSOCIATES
- INTERMITTENT WATERCOURSE
- WATERCOURSE
- DIRECTION/SEQUENCE OF EXTRACTION
- BUILDING
- MAXIMUM DEPTH OF EXCAVATION (220)
- REPTILE FENCE
- PERIMETER DITCH
- GATE

MAP SOURCE:
SKELTON BRUMWELL & ASSOCIATES INC., OPERATIONAL PLAN, PROJECT 05-2019, DRAWING 2 OF 5, MARCH 2011.

CONCEPTUAL QUARRY DEVELOPMENT PLAN

HYDROGEOLOGICAL EVALUATION
SEBRIGHT QUARRY
For Giofam Investments Inc.

DATE: APRIL 2011	SCALE: 1:6000
PROJECT: 0-920365.05	FILE NO.: 0-92036505S1-SP

GENIVAR

SHEET 1