

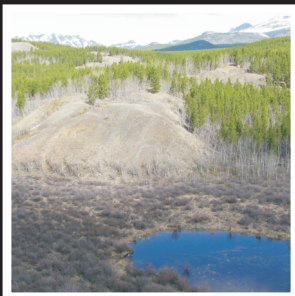


Takhini Hot Springs Ltd.

INTEGRATED GEOTHERMAL ASSESSMENT, TAKHINI HOT SPRINGS, YUKON

June 30, 2009
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Takhini Hot Springs Ltd.

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INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, YUKON

W23101139

June 2009



EXECUTIVE SUMMARY

Takhini Hot Springs Ltd. retained EBA Engineering Consultants Ltd. to conduct an integrated geothermal reconnaissance study at their property north of Whitehorse, Yukon. The broad purpose of this program was to observe, analyze, and interpret the geological, hydrogeochemical, and geothermal features to characterize the geothermal conditions at the THS site, and assess the potential for multiple uses of geothermal resources as part of the planned site expansion.

Major work tasks and methods included:

- Review of existing background information and air photo interpretation;
- Remote sensing imagery;
- Airborne thermal infrared survey;
- Geological and water monitoring ground reconnaissance;
- Chemical and isotope analysis to interpret water sample quality and, using geothermometry techniques, infer maximum groundwater temperature at depth for hot spring waters; and,
- Interpretation of field findings and development of conceptual geological and hydrogeological model.

This program involved reconnaissance level field, laboratory, and office work but did not incorporate any intrusive field work (e.g., drilling or subsurface testing), although this may follow in future phases leading to the development of the geothermal resource.

The fieldwork for this study was carried out in November 2008 (water monitoring) and May 2009 (aerial thermal infrared survey, geological ground reconnaissance, and water monitoring).

The principal findings of this geothermal assessment can be summarized as follows:

- Five areas of potential thermal anomalies were identified from the thermal infrared survey.
- The temperature of the Takhini Hot Spring (Hot Spring) at the cistern remained rather constant over the monitoring period from November 2008 until May 2009. The average temperature recorded was 46.6°C with a variation of 0.7°C. There were no obvious effects on the temperature from moderate seismic events during this period of time.
- Water chemistry-based geothermometry indicates that the Hot Spring water was exposed to temperatures as high as 96°C in the subsurface during flow to the hot spring.
- Water stable isotope results indicate that the spring water is of local meteoric origin.
- Tritium isotope data show that the hot spring water is more than 50 years old.
- A hot spring model typical of many hot springs of the Canadian Cordillera associated with deep flow systems in layered carbonate rock appears to be the most likely geothermal model for the Takhini Hot Springs. In this model, local meteoric water

infiltrates through fractured rock to the warm geothermal reservoir at depth, and then migrates along a steeply-inclined geologic structure (fault) to the surface to discharge as hot springs; additional heat sources such as shallow magma are not essential for the development of such a geothermal system.

- Untreated Takhini Hot Spring water is not suitable for human consumption as the fluoride concentration does not meet the maximum acceptable concentration in the Guidelines for Canadian Drinking Water Quality. Therefore, production of bottled “mineral” or “spring” water is not an option because alteration of the original source water is not permitted by regulation. Water treatment would be required to render the water usable as bottled water; however, the water could not be identified as “spring” or “mineral” water in accordance with existing regulations.
- Water from the cold water well does meet all GCDWQ health-based guidelines for the parameters analyzed, and could potentially be bottled as a “mineral” water.
- Potential water use options include spa/pool, space heating, hydrotherapy, bottling mineral water from the cold water well, bottling of treated water from the Hot Spring or cold water well, and greenhouse heating. Depending on decisions to pursue further geothermal exploration, the moderate geothermal temperature indicated for this site might also support electrical power generation using current medium temperature power generating technology (organic Rankine cycle). Actual subsurface temperatures and well yields for such a use could be determined through an intrusive exploration program.

Based on the results of this study EBA makes the following recommendations for future resource assessment of the THS site:

- Takhini Hot Springs Ltd. should consider the potential water use options presented in this report and make decisions regarding whether to complete additional research and testing that may be required for each option. For example, if THS wishes to pursue bottled water production, additional testing is required.
- Carry out shallow soil temperature monitoring in areas of potential thermal infrared (TIR) anomalies to identify additional possible target locations for geophysical investigations.
- Geophysical surveys located in the area of the Hot Spring would be a cost-effective next step to better define subsurface geology structure and would be critical for borehole location if future drilling is advanced. Survey gridlines should be laid out perpendicular to the postulated north-south oriented fault aligned with the Hot Springs and in areas of identified shallow soil/rock thermal anomalies.
- Using the information obtained from the geophysical investigations, carry out characterization drilling to better understand thermal gradient and sub-surface geology and hydrogeology.
- Following the results of geophysics and characterization drilling, in consultation with Takhini Hot Springs Ltd., assess the potential for exploitation of the Hot Spring system at depth.

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1.0 INTRODUCTION

1.1 GENERAL

EBA Engineering Consultants Ltd. (EBA) is pleased to submit this Issued for Review report to Takhini Hot Springs Ltd. (THS) for the integrated geothermal assessment of the THS site (the Site). This work is based on the following proposal letters:

- Initial proposal dated April 30, 2008, for initial water sampling, satellite and thermal infrared (TIR) airborne survey work;
- Supplementary proposal dated July 18, 2008, to include ground geology and water monitoring and sampling reconnaissance work; and,
- A project planning summary letter (amalgamating all the work tasks) dated November 5, 2008.

In general, the following phases can constitute a framework for exploring and exploiting high-temperature geothermal resources:

- Phase 1 – Geothermal Reconnaissance Studies;
- Phase 2 – Pre-Feasibility Studies;
- Phase 3 – Feasibility and Resource Confirmation Studies;
- Phase 4 – Geothermal Resource Development; and
- Phase 5 – Plant and Infrastructure Design, Installation and Commissioning.

This sequence of phases is all-inclusive for the full sequence of development, and is broader than the phase list included in our initial proposals. The program presented here falls within Phase 1 above. Depending on results of each phase, and decisions made by the owners, the geothermal development can progress through these phases to a completed development.

We (EBA) understand that THS is considering a substantial expansion and multiple uses of geothermal resources at the THS site, potentially to include:

- Expanded and improved Hot Spring pool and spa facilities;
- A luxury hotel on site, incorporating hot water from the spring;
- Expanded recreational facilities on the THS site;
- Potential power generation on site from geothermal resources; and;
- Multiple water uses (e.g., for pool/spa use, space heating, on site agriculture, bottled water and/or power generation).

The type and schedule of such expansion will depend on the nature and extent of the geothermal resources on site, decision-making by THS, and funding sources available for this growth.

1.2 PURPOSE AND SCOPE

The broad purpose of this program was to observe, analyze, and interpret the geological, hydrogeochemical, and geothermal features to characterize the geothermal conditions at the THS site, and assess the potential for multiple uses of geothermal resources as part of the planned site expansion.

Twelve separate work tasks were identified as part of this program, as summarized in Table 1.

TABLE 1: SUMMARY OF WORK TASKS		
Task No.	Task Title	Scope Details
1	Project initiation, Project Management, Client Liaison	Administrative and accounting tasks
2	Water sampling, Monitoring, Temperature data logger	Water samples for inorganic and isotope geochemistry, temperature measurement and trend logging at the Hot Spring cistern
3	Interim Report (Technical Memo on Task 2)	Progress report
4	Remote Sensing Imagery (using existing satellite images)	Using existing satellite imagery to attempt to identify broad thermal anomalies on THS site
5	Thermal Infrared Flying Survey	Using TIR camera from helicopter to attempt to identify specific warm areas on THS site for ground follow-up
6	Review existing reports on geologic & hydrogeologic setting	Review previous work on site relating to geology or hydrochemistry for geothermal resources
7	Air Photo Interpretation and Target Selection	Review existing air photos to attempt to identify promising targets for ground follow-up
8	Geological and Water Monitoring Ground Reconnaissance	Geological observations and mapping at selected sites and anomaly targets; water sampling for chemical and isotopic analysis
9	Water Chemistry Interpretation and Geothermometry	Laboratory analysis of inorganic water quality and stable environmental isotopes (deuterium and O-18) to characterize the nature and source of Hot Spring waters
10	Geological Model for THS	Develop conceptual geological/geothermal model of the geothermal flow system at THS site based on existing information
11	Water Use Options for THS	Describe potential options for Hot Spring water use (e.g., thermal, therapeutic, bottled source, energy)
12	Report (for all tasks) and SSC	Project summary report; Issued for Review and following comments from THS, Issued for Use.

This program involved reconnaissance level field, laboratory and office work, but did not incorporate any intrusive field work (e.g., drilling or subsurface testing). Such work would follow in Phases 2, 3 or 4 presented in Section 1.1.

This report presents all of the findings, analysis, conclusions, and recommendations for this program. Two interim reports were prepared for THS in November 2008 and January 2009 and are included in Appendix A. Additional supplementary information is attached or presented in appendices.

1.3 PROJECT TEAM

The project team consisted of the following team members:

H. Scott Schillereff, Ph.D., P.Geo.

Principal Consultant and Geoexchange Group Leader, EBA Kelowna

Scott initiated the project and acted as the Project Manager until March 2009. He also provided senior advice and review during the duration of the project.

Ryan Martin, M.Eng., P.Eng.

Hydrogeology Team Leader, EBA Whitehorse

Ryan acted as the Project Manager from March 2009 to the end of the project and was involved with the water monitoring, data interpretation, and reporting.

Stephan Klump, Dipl.-Geol., Ph.D.

Hydrogeologist, EBA Whitehorse

Stephan was involved with the water monitoring, geological mapping, data interpretation, and preparation of the interim and final reports.

Jack T. Dennet, P.Geo.

Senior Project Geoscientist, EBA Whitehorse

Jack conducted the air photo interpretation, geological mapping and ground reconnaissance. He was also involved with data interpretation and preparation of this report.

George R. Carlson, M.Sc., CWB[®], P.Biol.

Natural Sciences Group Leader, EBA Kelowna

George conducted the remote sensing imagery task and led the airborne thermal infrared survey. He was also involved with data interpretation and reporting.

Grant J. Eliuk

Spectrum Infrared Ltd.

Spectrum Infrared Ltd. was contracted by EBA to conduct the airborne thermal infrared survey.

1.4 BACKGROUND INFORMATION REVIEW

A summary of the background information reviewed for this study, the principal findings, and relevance to this project is summarized in Table 2 attached at the end of this report.

A complete list of references is included at the end of this report.

2.0 METHODS

2.1 REMOTE SENSING IMAGERY AND LOW-LEVEL THERMAL INFRARED SURVEY

The objective of the Remote Sensing Imagery task was to analyze existing satellite data to determine if any thermal anomalies could be detected in the Takhini Hot Springs project area. This task was proposed originally as a “proof of concept” since thermal data from satellite sensors had not been applied in this manner in latitudes this far north. This approach was at a macro or regional scale. The Thermal Infrared (TIR) Survey task was proposed as an assessment at a finer scale of thermal anomalies identified in the satellite data, and to determine if this technology could be used to more accurately locate subsurface hot geothermal anomalies.

The following methods were employed in the completion of the Remote Sensing Imagery task:

1. EBA identified potential sources of thermal satellite data for the Takhini Hot Springs area, which met the following criteria.
 - Temporal (time): late September/early October; or first 2 weeks May – cold temperatures with minimal snow cover; early morning (prior to sunrise if possible) and evening (after sunset). The goal is to avoid too much solar gain, or heating of the earth’s surface.
 - Spatial (area): satellite images for the Takhini area.
 - Available satellites with TIR bands: LANDSAT 7 and ASTER. LANDSAT scenes cover 185 km x 185 km, a much larger area than ASTER, 120 km x 150 km.
2. The following websites were searched for publicly available satellite imagery:
 - Canada Center for Remote Sensing: http://ccrs.nrcan.gc.ca/index_e.php
 - USGS: <http://edcsns17.cr.usgs.gov/EarthExplorer/>
<http://glovis.usgs.gov/>
<http://edcwww.cr.usgs.gov/>
 - NASA: <https://zulu.ssc.nasa.gov/mrsid/>
 - Geomatics: http://www.iunctus.com/?gclid=CKCinuyh8JYCFRs-awod7R4_rQ
 - Global Land Cover Facility: <http://glcf.umiaccs.umd.edu/data/landsat/>

At this point the task was suspended, as there was no available thermal imagery suitable for the study area. No further work with satellite imagery was completed; however, since the project site occupies a small land area, the TIR survey was modified to assess the site without satellite reference data.

The following methods were employed in the completion of the airborne Thermal Infrared Survey task:

- Spectrum Infrared Ltd., Calgary, AB, was contracted to conduct an airborne helicopter TIR survey of the Takhini Hot Springs area. A safety briefing was completed prior to the helicopter survey flight. The pilot was also instructed how to position the aircraft to allow data acquisition while in flight;
- Lift off occurred at approximately 05:00 on May 7, 2009, from Trans North Helicopters, Whitehorse. Ferry time to Takhini Hot Springs was approximately 10 minutes;
- The area was surveyed along various flight lines and aspects; total flying time was approximately one hour;
- A P660 SC Flir Infrared Scanner was used to image the ground surface. Initial survey altitude was approximately 5,500 feet ASL (above sea level), descending to approximately 3,500 ft ASL. An emissivity (measure of energy radiated from the earth's surface) setting of 0.95 was used. Relative humidity was recorded at 45%, with an ambient temperature of 0°C. The thermal data images were recorded on a Sony 505 digital camera DVD;
- Following the flight, the raw footage recorded on the DVD was reviewed at EBA's Whitehorse office to insure complete data recording and quality. Areas noted as thermal anomalies or areas of interest were identified and recorded on aerial photographs of the area for post processing analysis;
- Draft maps of the locations of the potential thermal anomalies were provided to the geologic team for further analysis during ground reconnaissance; and,
- Post-processing was completed using FLIR proprietary software to scan the recorded images and separate obvious heat sources due to solar gain (heating of the earth's surface then releasing that heat during cooler periods) and human activity. The data was further analyzed using the FLIR software to adjust level and span, or thermal focus, to facilitate interpretation of the remaining anomalies.

2.2 AIR PHOTO INTERPRETATION

Terrain and geology of the THS study area were mapped by stereographic air photograph interpretation. Surficial geology was mapped by delineating terrain polygons with unique geomorphological characteristics. A base map of the study area was prepared with the preliminary terrain polygons identified on an orthophotograph to guide terrain field-checking and geological mapping.

Field-checking of terrain was carried out in conjunction with geological mapping. Following field-checking, preliminary terrain mapping was revised and terrain typing was completed. Results of the air photograph interpretation are presented in Section 3.2.

2.3 GEOLOGICAL GROUND RECONNAISSANCE

Field mapping of geology was carried out by S. Klump and J. Dennett on May 11, 2009. Weather conditions were excellent and there was no snow cover. G. Umbrich, a principal of Takhini Hot Springs Resort, met with EBA personnel to point out the extent and location of property boundaries and to identify various trails to expedite access. On June 22, 2009, J. Dennett completed additional field work to augment the initial geological observations.

Foot traverses were mainly limited to areas of extensive bedrock on the property. Some areas outside the property were studied to better understand the area geology. In addition to general observations, detailed lithological descriptions and structural measurements were recorded at specific field stations. Terrain field-checking was carried out in conjunction with the geological mapping. Lithology and structure of the study area are discussed in Section 3.3.

2.4 WATER SAMPLING

EBA collected water samples from the Hot Spring, the water well, and further surface water sources on or in close proximity of the THS property. Samples of the Hot Spring and the water well were taken in November 2008 and May 2009 to assess potential seasonal changes of water chemistry. A sample from Flat Creek west of the THS property was collected in November 2008 to provide surface water background data, representing upstream conditions. In addition to the Hot Spring and water well, EBA also sampled a pond near the THS Retreat, which had shown as a thermal anomaly on the thermal infrared survey, the property discharge, and a lake near the THS property in May 2009. All sampling locations are shown in Figures 2 and 3.

Field parameters (temperature, pH, electrical conductivity, total dissolved solids, dissolved oxygen, alkalinity, ferrous iron, and turbidity) were measured at the time of sampling. The field instruments were calibrated at the day of sampling. Table 3 summarizes field instruments used along with their resolution and accuracy.

TABLE 3: SUMMARY OF FIELD WATER CHEMISTRY INSTRUMENTS

Parameter	Instrument	Resolution	Accuracy
UTM Coordinates	Magellan Meridian Platinum handheld GPS	1 m	~7 m
pH	Hanna HI 991300	0.01 pH units	0.1
EC	Hanna HI 991300	0.01 $\mu\text{S}/\text{cm}$	2% full scale
TDS	Hanna HI 991300	1 ppm	2% full scale
Temperature	Hanna HI 991300	0.1°C	0.5°C
Dissolved O ₂	YSI 550A	0.01 mg/L	0.1 mg/L
Turbidity	Hanna HI 98703	0.1 NTU	0.1 NTU
Alkalinity	Hach Alkalinity Test Kit AL-AP MG-L	5 mg/L (5-100 mg/L); 20 mg/L (20-400 mg/L)	10 mg/L (5-100 mg/L); 40 mg/L (20-400 mg/L)
Ferrous Iron	Hach Ferrous Iron Test Kit IR-18C	0.1 mg/L	0.2 mg/L
Temperature Logging	Solinst Levellogger Junior, Model 3001	0.1°C	0.1°C

Water samples were analyzed for hardness, alkalinity, cations and anions, dissolved metals and environmental isotopes of oxygen (oxygen-18) and hydrogen (deuterium and tritium). The major ion chemistry was included in order to classify the waters and determine their general chemical character. The metals analyses were used to support geothermometer calculations, specifically using sodium (Na), potassium (K), calcium (Ca), magnesium (Mg) and silicon (Si). Silicon was used to calculate the equivalent silica (SiO₂) concentration for use in the silica-based geothermometer formulas. The stable isotopes of water were included in order to plot them against a meteoric water line, to determine if the sample waters were of meteoric origin, or were fractionated to enriched oxygen-18 values which can be an isotopic characteristic of geothermal waters. The radioactive hydrogen isotope tritium (³H) was included to obtain information on the subsurface residence time of the water.

Water samples were collected in new, laboratory-supplied sample containers in accordance with laboratory recommended sampling procedures. Dissolved metals samples were field-filtered through a 0.45 μm filter and preserved with nitric acid (HNO₃). EBA field-diluted a sample (1 part sample, 9 parts de-ionized water) for a diluted silicon analysis. This dilution retards silicon precipitation prior to analysis. Using this ratio, the laboratory result for the diluted sample can be multiplied by 10 to get the original concentration prior to dilution.

Water samples were shipped on ice by air cargo to the laboratories. Inorganic water chemistry was analyzed by Cantest Environmental in Burnaby, British Columbia, and Bodycote Testing Group in Surrey, British Columbia. Isotope analyses were conducted by University of Waterloo, Environmental Isotope Laboratory in Waterloo, Ontario.

2.5 WATER TEMPERATURE MONITORING

Water sample temperatures were monitored and recorded during all water sampling events. Temperatures were collected with a Hanna field instrument; and temperatures were recorded as soon as the instrument stabilized. In addition to temperature measurements during sampling of the Hot Spring, a data logger recording pressure and temperature was installed in the cistern to continuously monitor the water temperature of the Hot Spring. Temperature and pressure was recorded in hourly intervals from November 25, 2008, until May 11, 2009. The datalogger was purchased by THS as part of this project, and remains deployed within the cistern recording temperature on an hourly basis. Additional information on the data logger used is provided in Table 3.

2.6 HOT SPRING FLOW MONITORING

The Takhini Hot Spring discharges to a wood cribbed “cistern” that is housed in a small building. The outflow from the cistern is controlled by a 200 mm diameter discharge pipe with the invert elevation approximately 1.3 m higher than the base of the cistern. The Hot Springs water flows under gravity; and can be diverted to fill the pools, or discharged directly to rip-rap lined ditch that leads to a retention pond downstream of the spring.

While EBA representatives were at the Takhini Hot Springs Site on May 12, 2009, the main pool was undergoing maintenance and all flow from the spring was being diverted directly to the discharge pond via the ditch. EBA used a graduated 50 L container to measure discharge flow rates. Five consecutive discharge volumes were collected to minimize error. The average flow rate is considered to be a relatively accurate estimate of the instantaneous flow at the time of measurement.

2.7 CONCEPTUAL GEOLOGICAL AND HYDROGEOLOGICAL MODEL

To initiate development of the conceptual geological and hydrogeological model for the Takhini Hot Springs, background research was conducted to study other areas that may have a similar geological and hydrogeological setting. The conceptual model was further developed once the results of all other data from original research were received and interpreted. The following information was compiled and integrated to develop the geological and hydrogeological model:

- Review of existing reports on geological and hydrogeological setting;
- Water chemistry interpretation and geothermometry;
- Bedrock and surficial geological mapping; and
- Stereographic projection of structural data.

3.0 RESULTS

3.1 REMOTE SENSING IMAGERY AND LOW-LEVEL THERMAL INFRARED SURVEY

Five areas of potential thermal anomalies were identified from the TIR helicopter survey data and are presented and discussed in the following figures and text. One of the potential anomalies occurs off the property but may have significance in a regional context. The following figures and discussion highlight the potential thermal anomalies observed and describe the results of the post processing analysis.

Figure 4 shows the Takhini Hot Springs project site and four areas of potential thermal activity. The areas of potential thermal activity were defined by the Spectrum Infrared Ltd. based on post-processing of the collected infrared data and expert judgment. Areas that are likely influenced by solar gain, i.e., solar heating of the ground surface and subsequent release of that heat during cooler periods, were not included in the areas of potential thermal activity.

Figure 5 is a thermogram showing three areas of potential thermal activity or thermal anomalies identified from the TIR survey, labelled Ar2-Ar4, respectively. (Ar1 represents the approximate property boundary from an oblique angle). Figure 6 is an aerial photograph of the overall area and is provided to reference the reader to the location of the thermogram in Figure 5. The crosshairs identify several points where temperatures were calculated using the temperature at Sp2 as a reference point. Sp1 is located at the discharge pond for the Hot Spring. The temperature values calculated at the crosshairs in the thermogram for each of the anomalies (other than Sp2) are known as 'quantitative infrared'. Ar2, Ar3, Ar4, Ar5 and Ar6 show the general patterns of potential thermal activity in this area, which is known as 'qualitative infrared'.

Figures 7 and 8 (page 10) display a thermogram and aerial photo, respectively, for the project site from northeast to southwest. In Figure 7, Sp2 is a reference point for the Hot Springs discharge pond, and Sp3 references ambient earth temperatures. Sp1 is the temperature of the lake to the northeast of the Hot Springs. Area Ar6 has been identified as a potential area of thermal activity, with elevated temperatures between the start point of the Ar6 polygon and the end point at Sp1. Ar5 shows a thermal pattern off the property that may be associated with the Hot Springs.

Figure 9 (page 12) is a thermogram revealing additional detail from a lower altitude of the potential thermal anomaly shown in Figure 7 (Ar6). It also highlights an additional point of interest.

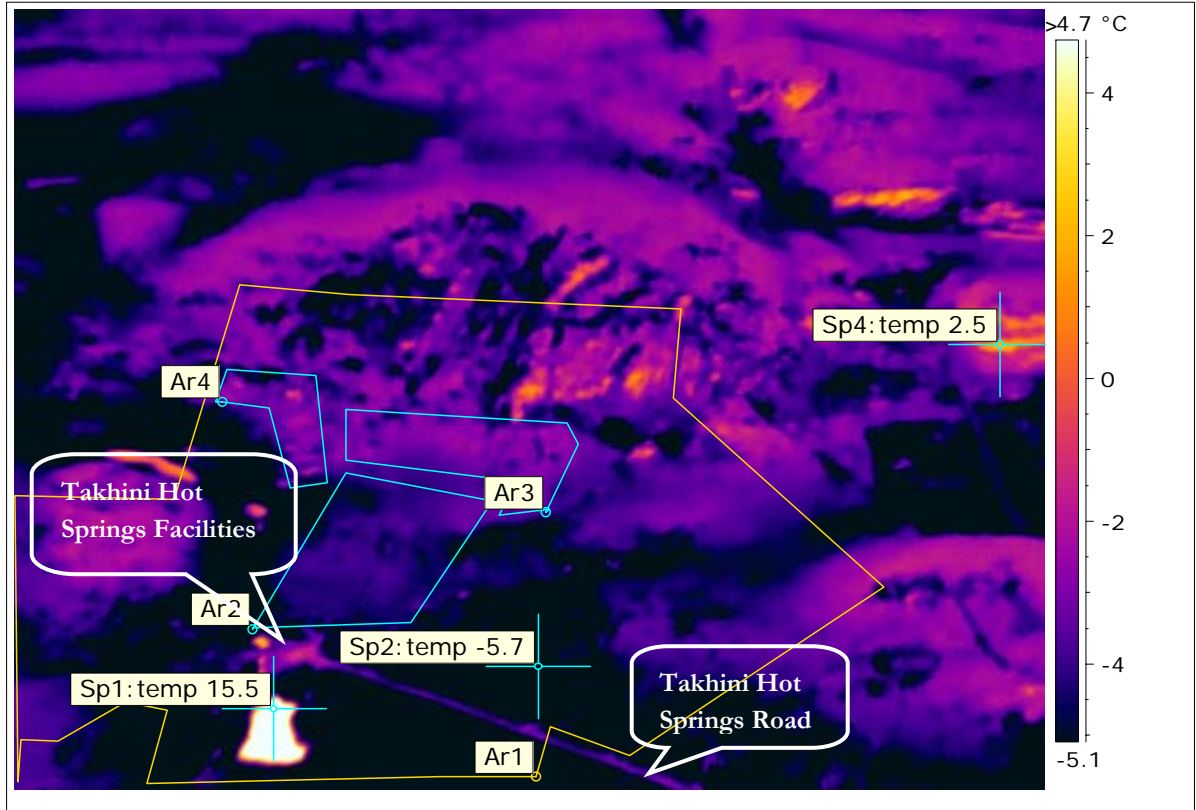


Figure 5. Thermogram of the Takhini Hot Springs area. View is from approximately 5,500 ft ASL, looking southeast to northwest.

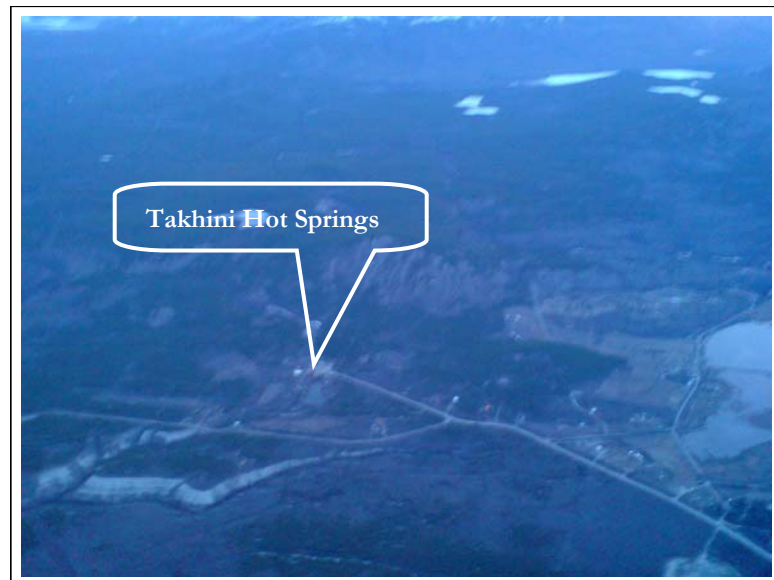


Figure 6. Aerial photograph of the project area looking southeast to northwest. Thermogram in Figure 5 is of the area in the center of the photo.

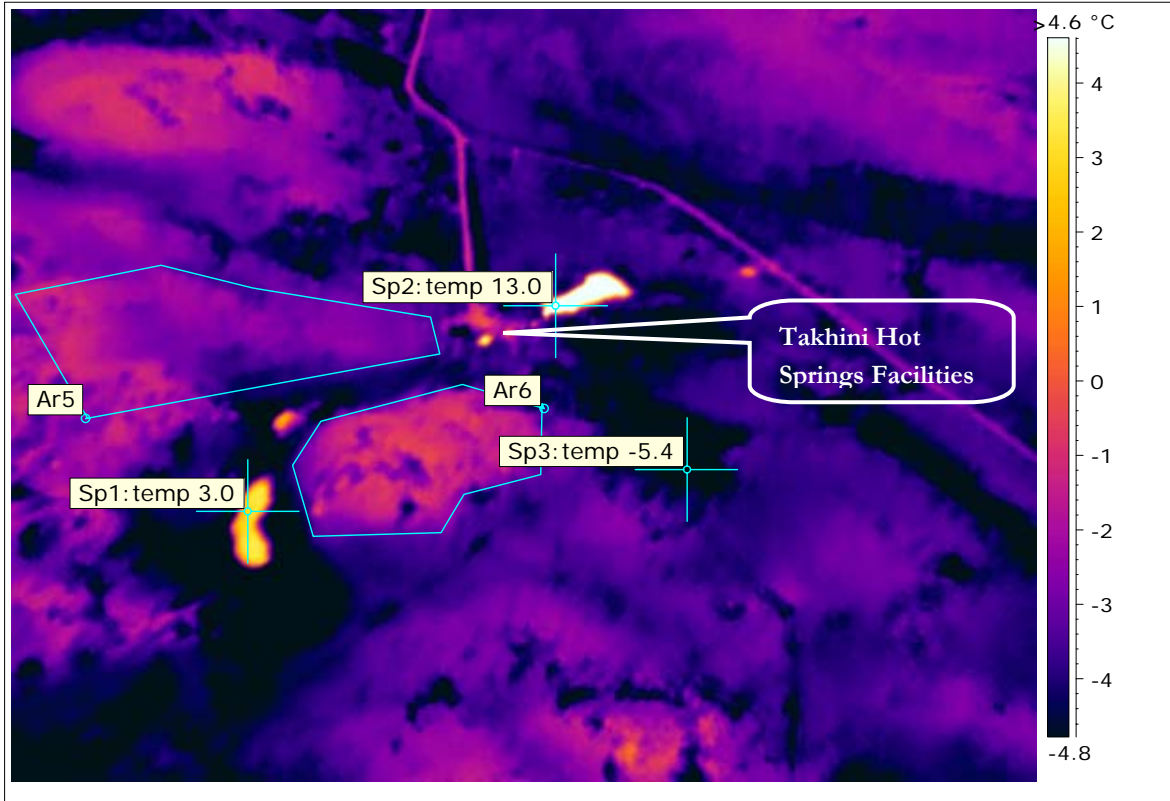


Figure 7. Thermogram of the Takhini Hot Springs area from approximately 3,500 ft ASL looking north to south.



Figure 8. Aerial photograph of the project area looking north to south. The preceding thermogram (Figure 7) is of the area in the center of the photo.

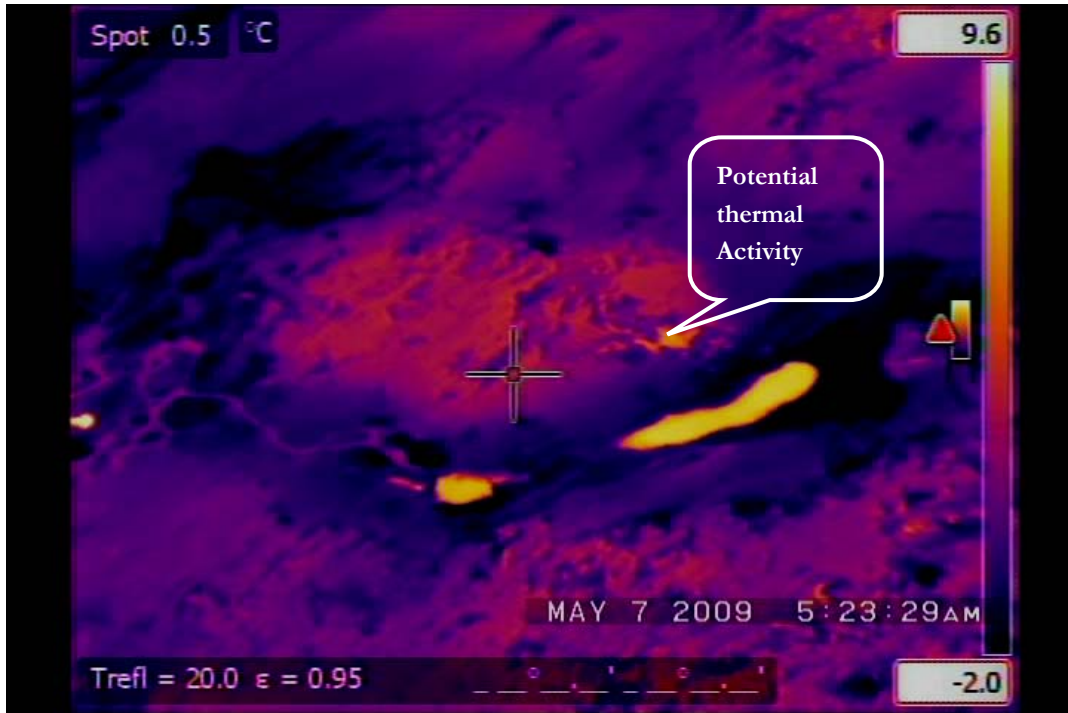


Figure 9. Thermogram at higher level of detail for Ar6.

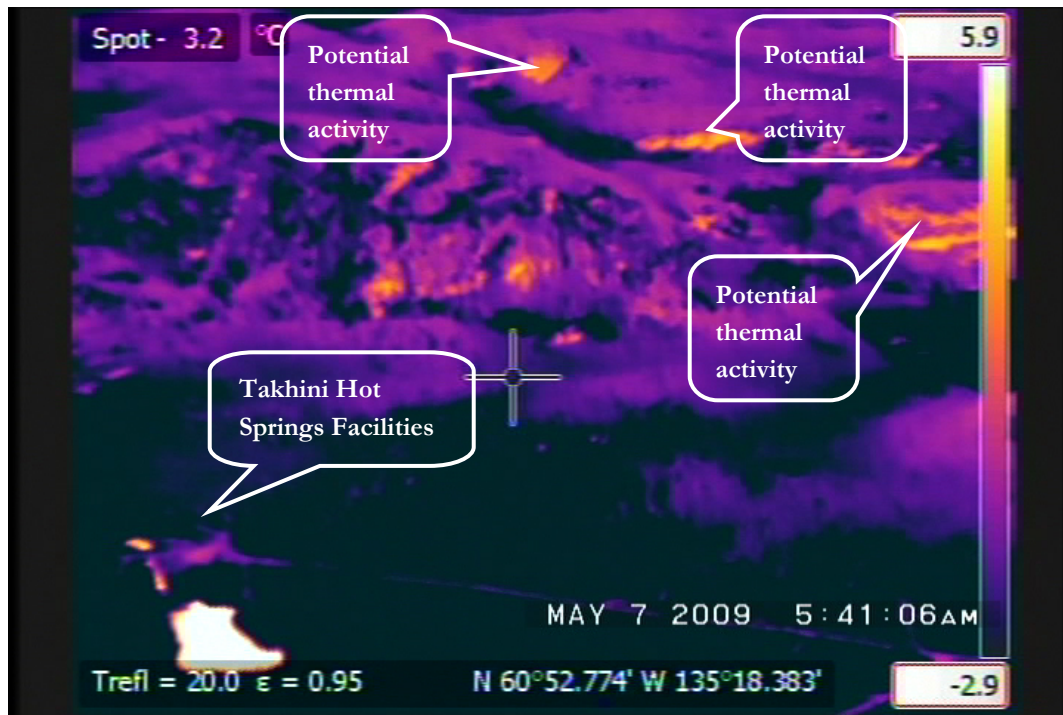


Figure 10: Thermogram noting several points of interest indicating "potential thermal activity".

The thermogram shown in Figure 10 above reveals several “points of interest”, some of which have been labelled (please note the labelled points are off the property). The lighter areas in this thermogram reveal potentially heightened thermal activity in areas associated with rock outcrops, which may be the result of solar gain, or heating of the earth’s surface during the day and releasing that stored thermal energy at cooler times. This thermal signature could also possibly be associated with geothermal activity. Further study will be required to determine the source of the anomalies.

It is also important to note the thermal patterns seen at the crosshair and along the base of the mountain. This thermal pattern may be associated with faulting.

A DVD containing a digital recording of the airborne TIR survey is provided with the Spectrum Report in Appendix A.

3.2 AIR PHOTO INTERPRETATION

Research of suitable air photograph coverage of the study area was successful in locating relatively recent, good quality images at two scales. 1:40,000 scale air photographs flown in 2007 were useful for a regional overview of terrain and surficial geology. 1:10,000 scale photographs were used to map detailed terrain features, surficial geology and structure (Table 4).

TABLE 4 AIR PHOTOGRAPH COVERAGE OF STUDY AREA

Flight Line	Air Photo Nos.	Scale	Date
A28543	357-359	1:40,000	July 25, 2007
A28116	30-33	1:10,000	August 3, 1994

Air photograph interpretation of terrain resulted in the delineation of three main terrain types: glaciolacustrine plain in the south, mixed hummocky or ridged bedrock and glacial drift in the central study area, and moderate to moderately steep gradient bedrock in the north. These three general areas are divided into smaller polygons that are described in the terrain mapping legend (Figure 11). Detailed descriptions of Quaternary deposition and bedrock are summarized in Section 3.3.

3.3 GEOLOGICAL GROUND RECONNAISSANCE

3.3.1 Bedrock Geology

The following five sedimentary rock types were identified during the geological ground reconnaissance:

3. greywacke, sandstone/quartzite/grit with green quartzitic alteration
4. red, siliceous siltstone
5. argillite

6. pebble conglomerate

7. limestone

Integration of the detailed mapping results from 43 field stations resulted in the association of the first four lithologies into one unit that correlates with the Lewes River Group 3a (Wheeler 1961) and the Upper Triassic Mandanna member of the Aksala Group (YGS MapMaker Online). The limestone unit correlates with the Lewes River Group 3c and the Upper Triassic Hancock member of the Aksala Group. A detailed description of these units by the authors is reproduced in Table 5.

TABLE 5 REGIONAL GEOLOGY UNITS		
Author and Unit	Age	Description
Wheeler, 1961		
Lewes River Group, Unit 3a	Upper Triassic	greywacke, siltstone, argillite, conglomerate and tuffaceous equivalents
Lewes River Group, Unit 3c	Upper Triassic	limestone, limestone breccia
Mandanna member. of Aksala Group, Unit uTrAK3	Upper Triassic, Carnian to Norian	red weathering, medium bedded, green and red greywacke and pebble conglomerate; red shale partings and minor interbedded, red, bioturbated siltstone; crystal-rich greywacke and shale; coarse-grained, tan to brown, massive, lithic arenite
Hancock member of Aksala Group, Unit uTrAK2	Upper Triassic, Carnian to Norian	massive to thick bedded limestone; minor thin bedded argillaceous to sooty limestone; coarsely crystalline, massive dolostone; minor laminated chert; massive to poorly bedded, limestone conglomerate debris flows and fanglomerate ()

The Lewes River Group 3a greywacke (Aksala 3 equivalent) is the most extensive unit in the area and was found at all but six field stations. Limestone (Lewes River 3c – Aksala 3 equivalent) was uncommon and where encountered in the study area was not extensive, with the exception of the occurrence of a wide band of limestone northeast of the Takhini Hot Springs Property. This limestone occurrence appears to be truncated at a northwest-southeast trending linear depression that is assumed to be related to a geological structure (Figure 11).

Structural data collected at field stations were plotted on a stereographic projection to illustrate dominant jointing and bedding orientations in the study area (Figure 12). The dominant bedding orientation strikes north to north-northwest, dipping moderately to the west. Although variable, the stereographic projection indicates that a prominent jointing orientation dips steeply to the east/southeast.

Local mapping indicates that the general geology is a sequence of typically medium grey to red-grey weathering meta-sedimentary rocks dominated by greywacke. In general, the greywacke texture was a fairly consistent, medium- to fine-grained matrix with 10 to 20 percent medium- to coarse-grained grit. Colour of the fresh surface was medium grey to

green with a hue modified by translucent minerals in the matrix and larger grains that are assumed to be muscovite mica. Alteration was common and variable, and where advanced, it was medium green to light green, aphanitic quartzite. Interbedded with greywacke are red siliceous siltstone (common), argillite, pebble conglomerate, and limestone.

Regional mapping indicates northwest-southeast-oriented folding axes to the northeast and southwest of the study area. It is likely that folding contributes to the geological structure in the study area, but bedding observed during the field program was consistent.

3.3.2 Surficial Geology and Terrain

Terrain in the study area is dominated by moderate slopes (27% to 49% gradient) to moderately steep slopes (50% to 70% gradient) at upper elevations in the north. There is much evidence of glacial scouring in this area and much of the rock is smooth and rounded. The rock is fluted, with low relief, elongate north-south oriented ridges separated by narrow shallow depressions of unconsolidated material (till) that probably represent weaker planes of bedding or faulting.

The central sections of the study area have somewhat irregular terrain with hummocky and shallow rolling surface expression with some linear and circular depressions. Higher relief hummocks of bedrock dominate the north central areas, separated by glacial till (silt with trace gravel, cobble and boulders). Soil texture typical of glaciofluvial material was observed outside the THS property area (field station J22 – sand and gravel, trace to some cobble and boulders) and there may be other unexposed pockets of favourable granular material in the area.

In the southerly sections of the central study area, relief is reduced and hummocks are more likely to be the result of deglaciation, although some hummocks are capped with bedrock. Rounded depressions may be the result of ice-melt features of deglaciation and linear depressions are assumed to be related to weaker zones of bedrock (faults) scoured by ice and glacial outwash. Glacial erratics of granitic boulders were observed and silt till with sub-rounded boulders and cobbles was exposed at up-rooted trees and on road cuts.

Bedrock in the southern area is completely masked by a plain of glaciolacustrine silts that were probably deposited during inundation by glacial Lake Champlain.

3.4 TEMPERATURE MONITORING

3.4.1 Instantaneous Temperature Observations

Instantaneous water temperature readings obtained by EBA from various locations at the THS property are compared with those reported by Hemmera in Table 6 below:

TABLE 6: WATER TEMPERATURE (°C) MONITORING AT VARIOUS LOCATIONS ON THS PROPERTY			
Location	Hemmera	EBA	EBA
Date:	Mar. 22, 2006	Nov. 25, 2008	May11, 2009
Hot Spring	46.5	46.6	46.4
Cold Well	5.6	5.0	5.9
Retention Pond Outflow	3.3	-	14.5
Creek at THS property boundary	0.0	-	12.4

The following observations are made from the temperature monitoring completed at various locations at the THS property:

- The temperature of the water collected from the cistern was relatively consistent between the three different monitoring events; which were completed in different seasons of the year;
- The cold water well temperature also remains relatively constant over the three monitoring events; and,
- As expected, the temperatures of the retention pond outflow and the creek temperature at the THS property line appear to be significantly influenced seasonally by the climate.

3.4.2 Continuous Temperature Monitoring

The datalogger data from the date of deployment to the last date on site May 11, 2009 was plotted on a time scale as Figure 13. Over the monitoring period, the temperature of the Hot Spring at the cistern remained quite constant with a 0.7°C variation from the minimum observed temperature of 46.2 to a maximum temperature of 46.9 and an average of 46.6°C.

3.5 HOT SPRING FLOW MONITORING

The average flow was calculated as 6.6 L/s (105 USgpm). This is consistent with the “long-documented” flow reported by Hemmera (6.5 L/s (103 USgpm)).



Photo 1: Spring water discharge location to ditch upstream of retention pond. Location of flow monitoring on May 11, 2009.

3.6 WATER CHEMISTRY AND ISOTOPE ANALYSIS

Table 7 presents a summary of the chemistry and isotope analytical results. The laboratory reports and certificates are included as Appendix B. To evaluate the quality of the analysis EBA calculated the ion balance for each sample, i.e., the balance between sum of anion and cation equivalent charges. Usually, an ion balance of within $\pm 5\%$ is considered satisfactory. The calculated ion balances vary from -1.5% to 4.7% , i.e., all ion balances are smaller than 5% , which suggests that analytical errors are within acceptable limits and all major cations and anions were included in the analyses.

The water samples can be classified based on their major ion chemical composition, taking into account all major anions and cations exceeding $10 \text{ meq}\%$ ¹. The water or hydrochemical facies is determined by listing the ions with concentrations greater than $10 \text{ meq}\%$ in decreasing order (cations are listed first). Figure 14 shows a trilinear Piper plot illustrating the classification of hydrogeochemical water types.

Calcium was the dominating cation in all samples collected. The Hot Spring water can be characterized as a calcium-sulphate (Ca-SO_4) type and is distinct from other groundwater and surface water samples. The spring water shows the highest mineralization with total dissolved solids (TDS) exceeding $1,000 \text{ mg/L}$ and is very hard with a hardness of about $1,800$ to $1,900 \text{ mg/L CaCO}_3$. The pH is near neutral (7.2 – 7.5) and the dissolved oxygen concentration is very low (0.5 mg/L). Because the water sample was collected from the

¹ The unit $\text{meq}\%$ represents the percentage of cations and anions calculated from their milliequivalents per litre (meq/L). The unit meq/L is the molar concentration multiplied by the charge of the ions.

cistern it can be assumed that some atmospheric oxygen had been introduced into the water and that the actual spring water is likely to be virtually free of dissolved oxygen. The Hot Spring water had slightly elevated dissolved and total arsenic and sulphur concentrations compared to other samples and water quality guidelines. All other analyzed metal concentrations were unobtrusive. The dissolved silicon concentration was 19.8 and 21.3 mg/L at the two sampling events, respectively. The diluted silicon sample collected during the first sampling event yielded a very similar silicon concentration (20 mg/L after correction for dilution), indicating that there was no significant loss of silicon due to cooling of the sample and associated precipitation of silica during the filtering process. Therefore, silicon concentrations from undiluted samples can be used for geothermometer calculations.

The water sample collected at the property discharge point is very similar chemically to the Hot Spring sample.

The samples collected from the water well and from the lake west of the THS property can be both classified as calcium-magnesium-sulphate-bicarbonate (Ca-Mg-SO₄-HCO₃) type water. The groundwater sample from the water well was moderately mineralized with a TDS content of 500 to 650 mg/L and was very hard with a hardness of about 600 mg/L CaCO₃. The pH was near neutral (~7.8) and dissolved oxygen concentration was low (0.6–1.1 mg/L).

The water sample from the lake west of the THS property is chemically similar to the sample from the water well but considerably less mineralized with a TDS content of about 260 mg/L. The lake water was moderately hard (260 mg/L CaCO₃) with a near neutral pH of 7.8.

Bicarbonate instead of sulphate was the dominating anion in the surface water samples from Flat Creek and the pond near the THS Retreat. The Flat Creek water sample, which represents surface water baseline chemistry conditions from the upstream area of the THS property, can be characterized as a calcium-bicarbonate (Ca-HCO₃) type water. The water sample had a slightly alkaline pH of 8.2 and a low mineralization with a TDS concentration of 63 mg/L. The water sample was soft with a hardness of 73 mg/L CaCO₃. The sample from the pond near the THS Retreat is very similar chemically to the sample from Flat Creek and can be classified as a calcium-magnesium-bicarbonate (Ca-Mg-HCO₃) type water. The pH of the sample was neutral (7.1) and mineralization was low (TDS of 100 mg/L). The water was soft with a hardness of 95 mg/L.

Figure 15 presents the results of the oxygen-18 and deuterium stable isotope analyses along with the Global (GMWL) and Local (LMWL) Meteoric Water Lines. The results are expressed in per mil units (parts per thousand) relative to Standard Mean Ocean Water (SMOW). All samples plot close to the LMWL for Whitehorse, except for the sample taken from the pond which plots below the LMWL. This shift may be explained by isotopic fractionation due to evaporation.

The tritium concentrations in the Hot Spring and the water well were both very low and close to detection limit. The tritium concentration in the sample from the pond was about 8.5 TU².

3.7 COLD WATER WELL FOR POTABLE WATER SUPPLY

The “cold” water well that supplies potable water to the facilities is located approximately 600 m east south-east of the Hot Spring and is reported on the drillers well record to be 132 m in depth. According to the records, the well was drilled through 4.3 m of overburden (silt, gravel, and clay) and the 150 mm diameter steel casing was installed to 12.5 m, which suggests that the bedrock from 4.3 m to 12.5 m is highly weathered and not competent above 12.5 m. The driller noted that there was water seeping into the well at approximately 3 gpm from a depth of 50 m bg. The well log indicates that the static water level was 27.4 m bg at the time of drilling, however, Aqua Tech Supplies and Services have left a note in the pump house building indicating that the static water level was 55.8 m bg at the time the pump was installed. According to the Hemmera report, a formal pumping test has not been completed for the cold water well.

4.0 ANALYSIS AND DISCUSSION

4.1 REMOTE SENSING IMAGERY AND THERMAL INFRARED SURVEY

The initial ‘macro level’ analysis of satellite imagery could not be completed because suitable data sets could not be found. Alternative approaches to this situation may include: 1) obtain satellite data from non-optimal time periods and apply processing techniques to overcome limitations; or 2) acquire imagery through a ‘satellite tasking request.’ Neither option would be cost effective for such a small area and, therefore, are not recommended given that there is good coverage of the entire property with the TIR survey.

Based on the results of the May 7, 2009, helicopter TIR survey and subsequent post processing of the data collected, five potential thermal anomalies were identified in the general project area. Therefore, follow-up ground surveys are recommended.

4.2 CONTINUOUS TEMPERATURE LOGGING

EBA reviewed the temperature data for possible trends that might provide useful information regarding the origin and fate of the spring water.

The data was viewed to determine whether there was any seasonal changes that might be obvious over time, or when compared with reported ambient air temperatures. Some observations are below:

- The average temperature over the winter was 46.6 while the temperature over the spring (since March 21) has been slightly warmer at 46.8°C. However, some of the

² TU – Tritium Unit: 1 TU corresponds to $^3\text{H}/^2\text{H} = 10^{-18}$ or 1 TU = 0.1181 Bq/kg (3.193 pCi/kg)

warmest temperatures observed (46.9°C) occurred in the winter months. The coldest temperatures were sporadically observed in the winter, between November 25 and January 27. There was no obvious evidence that the spring temperature is affected by season.

- We didn't observe any temperature decrease during snow melt, and this is an indication that there is no substantial mixing of shallow groundwater with the Hot Spring. This is substantiated as well by the water chemistry results (see Piper Plot), and residence time, which suggest that there is no considerable mixture of shallower, younger groundwater from a different source.
- There is no evidence of any direct influence of atmospheric temperatures on the spring temperature within the cistern.

The data were also compared with seismic events to see if there was a notable increase or decrease in the cistern temperature as a result of these events. As indicated on Figure 13, three seismic events were recorded in the Yukon and surrounding regions during the time of temperature monitoring.

- On December 2, 2008, at 6:47 pm, a magnitude 3.9 earthquake occurred 27 km west of Haines Junction, at 8:12 p.m. a magnitude 4.3 earthquake occurred 29 km west of Haines Junction. The temperature of the spring water within the cistern gradually rose from 46.5°C to 46.8°C over the next two days. On December 4, 2009 the temperature was 46.8°C from 5:00 am to 4:00 p.m. The temperature then gradually dropped back down to 46.5°C. This temperature fluctuation may or may not have been associated with the seismic event.
- Another earthquake occurred 50 km ESE of Burwash, YT, on April 26, 2009, at 7:58 p.m. This earthquake was gently felt in Haines Junction, Whitehorse, Burwash Landing, and Marsh Lake. No change in temperature data was observed on April 26, and the temperature varied from 46.8°C to a few measurements where it was 46.7°C over the following week.
- Based on these results, the seismic events that occurred during the period of monitoring did not appear to have a substantial effect on the temperature of the Hot Springs.

4.3 WATER CHEMISTRY AND STABLE ISOTOPE ANALYSIS

The fact that the stable isotope results of the samples collected from the Hot Spring plot close to the LMWL and close to other local groundwater and surface water samples indicates that the spring water is of local meteoric origin (Figure 15). Stable isotopic fractionation which can be typical for high-temperature geothermal waters with high residence times was not observed.

The groundwater and surface water samples collected show distinct hydrogeochemical characteristics (see Figure 14). The samples collected from the Hot Spring can be classified as highly mineralized Ca-SO₄ type water. Especially the very high sulphate concentration is characteristic for the Hot Spring water. Surface water samples from Flat Creek and the

pond close to the THS Retreat are HCO_3 -dominated whereas the samples from the water well and the lake are SO_4 - HCO_3 -dominated. This may indicate that the latter samples are influenced by both local surface water or shallow groundwater and a deep groundwater component.

The classification of the Hot Spring samples as Ca- SO_4 type water likely indicates an origin of the water in sedimentary rocks. Preliminary geochemical modelling to calculate saturation indices for various minerals suggests that calcite (CaCO_3) and dolomite ($\text{CaMg}(\text{CO}_3)_2$) are slightly supersaturated whereas gypsum (CaSO_4) is approximately saturated.

Hemmera (2006) and Crandall and Sadlier-Brown (1977) speculated that the Takhini Hot Spring might be associated with the limestone unit which outcrops to the northwest of the THS site. The water chemistry of the Hot Spring samples, especially the high calcium and sulphate concentrations may suggest that the water was in contact with gypsum/anhydrite-bearing rocks. Limestone is sometimes associated with gypsum or anhydrite; however, no gypsum or anhydrite was observed in the field and this hypothesis remains speculative. A more detailed geochemical and mineralogical description of the limestone unit would be required along with more in-depth geochemical modeling to further assess the hypothesis that the Hot Spring is associated with this limestone unit.

EBA compared the chemistry results with the Canadian Council of Ministers of the Environment (CCME) surface water quality guidelines for the protection of aquatic life (only applicable for surface water) and with the Guidelines for Canadian Drinking Water Quality (GCDWQ, see Table 7). GCDWQ are either health-based and listed as maximum acceptable concentrations (MAC) or established based on aesthetic considerations and listed as aesthetic objectives (AO)

The surface water sample collected from the pond near the THS Retreat slightly exceeded the CCME guidelines for aluminum and copper. The water from the lake to the west of the THS site slightly exceeded the CCME guideline for iron. The fluoride concentration of 2.8 mg/L in the sample collected at the property discharge considerably exceeded the CCME guideline for fluoride of 0.12 mg/L.

The samples from the Hot Spring and the “cold” water well were compared to the GCDWQ to assess the suitability of these waters for human consumption. The water sample from the “cold” water well met all GCDWQ for the parameters tested on the dates sampled, with the exception of iron and total dissolved solids which slightly exceeded the AO. The reported total iron concentration was 1.0 mg/L, and the AO is 0.3 mg/L. Iron exceedances of the AO are not uncommon in groundwater, and are not considered a health concern by Health Canada (Health Canada 1987). At concentrations above 0.3 mg/L, the precipitation of excessive iron after contact with atmospheric oxygen may impart an objectionable reddish-brown colour to water and stain laundry and plumbing fixtures. Iron may also promote the growth of certain micro-organisms, leading to the deposition of a slimy coating in water distribution pipes or holding tanks. Although the zinc concentration of about 0.3 mg/L in the sample from the water well was well below the guideline value of 5 mg/L, it is significantly elevated compared to the other water samples collected.

The guideline for total dissolved solids is also an aesthetic objective. The slight exceedance of this objective is not considered a health concern by Health Canada. Concentrations of total dissolved solids above 500 mg/L result in excessive scaling in water pipes, water heaters, boilers and household appliances. High concentrations of total dissolved solids also adversely affect the taste of the water.

The samples collected from the Hot Spring also exceeded the GCDWQ guideline for iron. In addition, the water samples also exceeded the AO for sulphate by a factor of about three, and the MAC for fluoride by a factor of about two. Therefore, the Hot Spring water should be considered unsuitable for human consumption, especially because of the exceedance of the fluoride concentration which is a health-based guideline.

4.3.1 Bottled Water Potential

Some people value drinking natural mineralized spring water (“mineral water”) for perceived health benefits. EBA understands that THS has interest in providing “Takhini” spring water for sale to resort guests and potentially for sale to the public. Any bottled water offered for sale in Canada is subject to the Food and Drugs Act (FDA) and the Consumer Packaging and Labelling Act. Pre-packaged water is classified as a food for the purposes of the FDA. Pre-packaged water must further adhere to the standards and specific requirements of Division 12 of the Food and Drug Regulations (FDR). Source water used must be proven to be potable and a quality control program should be in place to confirm that the microbial requirements of the Regulations are consistently met. The FDR also stipulate that spring or mineral water may not be subjected to any treatment that would modify the original composition of the water with the exception of carbon dioxide for carbonation, ozone for disinfection during the bottling process and fluoride for the prevention of dental carries.

Bottled water falls under Canadian federal jurisdiction, and therefore, a full baseline chemical analysis for all GCDWQ parameters with maximum acceptable concentrations would be required prior to a final evaluation of the potential for THS water to be bottled and sold. For this study, EBA analyzed the water samples obtained for the typical drinking water package, which includes those parameters typically analyzed for small public drinking water systems in Yukon, and therefore, some GCDWQ parameters that fall within this full baseline chemical analysis have not yet been analyzed (radionuclides, and organics etc.). The following observations can be made based on the analyses completed:

1. The Takhini Hot Spring water is not considered suitable for bottling as a “spring”, or “mineral” water due the exceedance of the GCDWQ maximum acceptable concentration for fluoride, and the very high sulfate (1640 – 1740 mg/L) concentration at the source. However, water from the Takhini Hot Spring source could potentially be treated to meet the GCDWQ and sold as bottled water that is not labelled as a spring or mineral water. Treatment to reduce the TDS, hardness, iron and sulphate would also be strongly recommended to make the water more aesthetically appealing. Pilot scale testing and additional analytical testing would be

required to confirm that the treated water would meet all GCDWQ including parameters that have not been tested such as radionuclide and organic parameters.

2. As mentioned previously, the water samples collected from the cold water well at the THS site did not have any concentrations in exceedence of maximum acceptable concentrations within the GCDWQ for the parameters analyzed on the dates sampled. This water source may be suitable for bottling a “mineral” water. However, the hardness concentration is in the range considered to be unacceptable for most domestic purposes (> 500 mg/L), and water analyzed from this well had sulphate concentrations just below the AO of 500 mg/L. TDS and iron are also in exceedence of GCDWQ aesthetic objectives. EBA understands that for water to be considered potable, it must meet all MACs, however, that aesthetic objectives are subject to individual preference. Although hardness, TDS, and iron are in the range that may not be acceptable to some consumers, it is possible that the water could still be bottled and sold without treatment. Bottle water operations commonly use ozonation for water disinfection. The process of ozonation would likely reduce the iron concentration. Further studies would be required to confirm this, and additional analytical testing would be required to confirm that the source water would meet all GCDWQ maximum acceptable concentrations including parameters that have not yet been tested (i.e. radionuclide and organic parameters).
3. To pursue either of these potential bottled water options, THS would require necessary permits to run a water processing/bottling operation. As indicated above, the inspection, treatment and labelling processes would be regulated under the FDA, and Consumer Packaging and Labelling Act.

4.4 GEOTHERMOMETRY

4.4.1 Selection of Geothermometers

There are a wide range of empirical chemical geothermometer formulas in the literature. One group is based on the equilibrium reached among alkali elements (sodium (Na), potassium (K) and calcium (Ca)) where reservoir rocks contain abundant quartz and feldspar (Fournier and Truesdell 1973). Another group is based on the solubility of various mineralogical forms of silica (SiO_2) in hot geothermal waters. Silica solubility is rate-dependent, so waters that gain silica at elevated temperatures only slowly release that silica as the waters cool (i.e., as they move upwards and discharge at the surface). For this reason, the silica content of discharging geothermal waters can be used to calculate the approximate maximum subsurface temperature at which the water acquired the silica content.

Some of the prominent formulas are presented in Table 8.

TABLE 8: COMMON GEOTHERMOMETER FORMULAS

#	Formula	Source	Comment
Alkali-based formulas			
1	$T^{\circ}\text{C} = \{1647 / [(\log(\text{Na}/\text{K}) + B(\log(\sqrt{\text{Ca}}/\text{Na}) + 2.06) + 2.47)]\} - 273.15$	Fournier and Truesdell, 1973	B = 4/3 below 100°C and 1/3 above 100°C; useable for T>70°C, best 180–300°C
2	$T^{\circ}\text{C} = [1217 / (\log(\text{Na}/\text{K}) + 1.483)] - 273.15$	Fournier 1981	Alkali formula using Na and K only
3	$T^{\circ}\text{C} = [876.3 / (\log(\text{Na}/\text{K}) + 0.8775)] - 273.15$	Diaz-Gonzalez and Santoyo, 2008	Updated using world database of geothermal fluids
4	$T^{\circ}\text{C} = [1289 / (\log(\text{Na}/\text{K}) + 1.635)] - 273.15$	Verma and Santoyo 1995	Updated using an error propagation method, with Fournier's original data
Silica-based formulas			
5	$T^{\circ}\text{C} = [1309 / (5.19 - \log\text{SiO}_2)] - 273.15$	Fournier 1981	Silica form is quartz with no steam loss; best for T>180°C
6	$T^{\circ}\text{C} = [1522 / (5.75 - \log\text{SiO}_2)] - 273.15$	Fournier 1981	Silica form is quartz with steam loss from reservoir; best for T>180°C
7	$T^{\circ}\text{C} = [1032 / (4.69 - \log\text{SiO}_2)] - 273.15$	Garcher and Arehart 2008	Silica form is chalcedony; best for T =180-140°C
8	$T^{\circ}\text{C} = [731 / (4.52 - \log\text{SiO}_2)] - 273.15$	Garcher and Arehart 2008	Form is amorphous silica; best for T<140°C
9	$T^{\circ}\text{C} = -44.119 + 0.24469(\text{SiO}_2) - 1.7414 \text{E-}4(\text{SiO}_2)^2 + 79.305\log(\text{SiO}_2)$	Verma and Santoyo 1995	Updated using an error propagation method, with Fournier's original data; useful for T = 20-210°C

Note: all concentrations in molality (mg/kg). For water with density ~1 kg/L, concentrations of mg/L can be used.

Due to the high calcium content of the sample from the Takhini Hot Springs along with significant concentrations of sodium and potassium, we have chosen to use the classic alkali formula no. 1 (Fournier and Truesdell 1973) with the constant term B = 1/3 (assuming subsurface temperatures are over 100°C).

For a silica geothermometer, we chose to use formula No. 9 (Verma and Santoyo 1995) since this is an update of Fournier's original formula and is applicable for temperatures ranging from 20 to 210°C. These formulae fit the hydrochemical setting and temperature ranges expected for the three search areas, and provide a reasonable estimate of subsurface temperatures for purposes of this reconnaissance study.

In applying the silica geothermometer, we assumed that for the waters sampled in this program, silicon (Si) is always bound as silica (SiO₂). In this study, the dilute sample silicon (Si) concentrations reported by the laboratory were first multiplied by 10 to determine the undiluted silicon concentration at the sampling point. The corrected silicon concentrations were then multiplied by 2.14 which is the ratio of atomic weights of Si and SiO₂. This calculated SiO₂ value was then used in the silica geothermometer formula. Note that the

analytical results for silicon and diluted silicon are essentially identical which indicates that no significant amounts of silicon were lost during sampling due to cooling of the sample and associated precipitation of silicon.

4.4.2 Calculated Geothermometer-Temperatures

Table 9 shows the calculated subsurface temperatures using the alkali (Na-K-Ca) and silica geothermometer formulas for the sample taken from the Takhini Hot Springs. The calculated temperatures based on the analytical results from both sampling events in November 2008 and May 2009 are essentially identical.

The temperature obtained from the Na-K-Ca geothermometer (Fournier and Truesdell 1973) strongly depends on the chosen parameter $B = 1/3$ for temperatures $>100^{\circ}\text{C}$ or $B = 4/3$ for temperatures $<100^{\circ}\text{C}$. As mentioned above, EBA used $B = 1/3$ assuming that the maximum reservoir temperature is $>100^{\circ}\text{C}$. Assuming a reservoir temperature of $<100^{\circ}\text{C}$ and using $B = 4/3$, would yield a temperature of only 21°C which is obviously erroneous since the surface spring temperature is about 46°C . Furthermore, the ideal temperature range for the use of the Na-K-Ca geothermometer is $180\text{-}300^{\circ}\text{C}$, which is likely to be higher than the maximum temperature of the Takhini Hot Spring.

EBA therefore suggests that the silica-based geothermometer provides the more reasonable estimate of the maximum reservoir temperature. That is, based on current information and the use of the silica-based geothermometer, the hottest temperature that the spring water was exposed to along its subsurface flow path has been estimated to be about 96°C . It is important to note that the geothermometers do not provide any information on the depth and location of these temperature conditions.

TABLE 9: ESTIMATED SUBSURFACE TEMPERATURES USING GEOTHERMOMETERS

Sample	Na-K-Ca	SiO ₂
Takhini Hot Springs	170°C	96°C

4.5 GROUNDWATER RESIDENCE TIME

The residence time of groundwater can be estimated using the radioactive hydrogen isotope tritium (^3H) with a half life of 4,500 days. Tritium occurs in the water cycle with a natural background concentration of about 5 TU. The major portion of the modern tritium in the water cycle originates from thermonuclear bomb test in the 1960s with a distinct peak in 1963/64 with atmospheric tritium concentrations of several thousand TU in the northern hemisphere. Since then atmospheric tritium concentrations have been declining due to a global ban of atmospheric nuclear bomb tests and present-day concentrations are similar to natural pre-bomb levels.

Local atmospheric input functions vary significantly and EBA therefore selected the input function measured at Anchorage, Alaska which represents the closest available to the

Takhini Hot Springs. Figure 16 shows the atmospheric input function for Anchorage and the decay-corrected input function for the year 2008 when the sample from the THS was collected. The decay-corrected input function for 2008 shows the tritium concentration in a water parcel recharged at a certain time in the past assuming piston flow conditions, i.e., no advective or dispersive mixing. The decay-corrected input function can therefore be directly compared with the measured tritium concentration in the sample from the THS.

Figure 16 attached shows that the measured tritium concentration in the samples from the Hot Spring and the “cold” water well of 0.8 ± 0.3 TU and 0.8 ± 0.6 TU is considerably lower than the decay-corrected atmospheric input function. Hence, the residence time of the water seems to be more than 50 years. The small amount of tritium in the sample, which is close to the detection limit of the analytical method, might be the results of the admixture of a minor component of younger groundwater (< 10%) during ascent of the geothermal water. The uncontaminated geothermal water component probably does not contain any detectable tritium concentration. A more accurate determination of the residence time is not possible based on currently available data. For example, the radiocarbon (^{14}C) dating method could be used to further assess the residence of the water.

The tritium concentration of 8.4 ± 0.9 TU in the sample from the pond near the THS Retreat is similar to modern atmospheric tritium concentrations and therefore indicates that the pond water most likely originates from recent precipitation and/or snow melt.

4.6 GEOLOGY AND CONCEPTUAL GEOLOGICAL AND HYDROGEOLOGICAL MODEL FOR THE TAKHINI HOT SPRING

Ice sheets covered the region during the Pleistocene (1.8 million to 10,000 Before Present (BP)) and much of the lower elevation landscape is shaped by glacial material deposited during deglaciation. Silt deposits in the Takhini River Valley appear to be continuous with large deposits to the west in the Mendenhall and Dezadeash River valleys deposited in proglacial Lake Champagne. These unconsolidated deposits mask bedrock at the hot springs site and a conceptual geological and hydrogeological model for the Takhini Hot Spring was developed based on geological mapping to the north.

The distant proximity and age of granitic intrusive rock to the Takhini Hot Springs and the results of water testing suggest that the origin of the Hot Springs is more likely due to deep fault circulation than to remnant heat from a shallow intrusive. This was also the conclusion of earlier reports (Hemmera 2006).

Of the three categories of thermal springs identified in western Canada (Gabrielse 1992), Class I (springs associated with deep flow systems in layered carbonate rock) is the most likely category in which to place the Takhini Hot Springs. Apart from an Early Tertiary biotite granite pluton located about 4 km to the east; there is no evidence to suggest that suggest that Takhini is a Class II Springs (issuing from fractures in granite or metamorphic rocks). The closest known occurrences of young volcanics are many kilometres to the south and as such Class III is not likely to categorize the Takhini Hot Springs.

Poor exposure of bedrock in the lower elevations of the study area, particularly in the immediate area of the Hot Springs, precluded definitive identification of a geological structure that would correlate with a known hot springs model. Air photo interpretation and identification of recessive weathering linear features during the fieldwork were used to map potential faults in the area, one of which is aligned to intersect the Hot Springs.

In southern BC, Eocene Epoch (56 to 40 m.y. BP) or later brittle fault systems provide a high-permeability flow path that allows for deep circulation of meteoric water. Circulation depth, and thus temperature, is largely influenced by fault plane geometry. Studies in southern BC associate most of the thermal springs in this area to six major fault systems associated with major river valleys (Gabrielse 1992). It cannot be discounted that, rather than associated with relatively small faults, the Takhini Hot Spring could be associated with a large valley fault system of the Takhini River. Additional heat sources, such as magma, are not essential for the development of a geothermal system in the Cordillera, as the normal geothermal gradients are sufficient.

Results of the present and previous studies, and current knowledge of Cordilleran hot springs, suggest a deep flow system. Extensive Quaternary sediment cover has precluded the mapping of large regional faults associated with the Takhini and Yukon River valleys near the study area. However, it is probable that the source of the Takhini Hot Springs is related to a major fault system associated with a major river valley. A conceptual model to illustrate the probable structure and hydrogeology of a deep flow system that could characterize the Takhini Hot Spring mechanism is included (Figure 17).

Figure 17 illustrates surface water percolating downward through a vertical fault zone of rock fractured from crustal deformation processes (faulting and folding). At sufficient depth, cold groundwater originating from higher elevation surface sources is heated when it comes in contact with warm rocks. With the appropriate conditions, hot water is piped to the surface through a fault zone where mineral precipitates deposited by thermal fluids have sealed fractures sealed by mineral precipitates deposited by thermal fluids to restrict lateral movement flow. If the plumbing system is consistently sealed and the system inflow pressure is suitable, heated water will reach the surface.

4.7 POTENTIAL WATER USE OPTIONS

Table 10 presents a summary of potential water use options and details.

TABLE 10: POTENTIAL WATER USE OPTIONS AT TAKHINI HOT SPRINGS SITE		
Category	Use	Details
Thermal	Spa/Pool	The current use; could be expanded or used in more diverse spa applications depending on design of flow distribution system
	Space Heating	Spring water could potentially be used for building space heating. Due to natural groundwater chemistry, we recommend an <u>indirect</u> application (spring water flowing through a heat exchanger transferring the heat to a secondary building side). The secondary side might incorporate a heat pump to raise water temperatures to higher levels (e.g., for heating domestic hot water).
Therapeutic	Hydrotherapy	Some people value natural mineralized waters for hydrotherapeutic benefits. To pursue this potential application, THS should consult a hydrotherapy specialist to assess if this water chemistry would be considered favourable and desirable in that market.
	Bottled Mineral or Spring Water	Refer to Section 4.3.1.
Agricultural	Greenhouse	Warm “spent” spring water (outflow from pool/spa) might have a secondary use for an extended growing season or year-round greenhouse irrigation or hydroponic agricultural operation. This would require expertise in greenhouse design and operation in the Whitehorse setting. If workable from a growing perspective, a greenhouse operation would need appropriate design and permitting for a commercial operation.
Energy	Electricity Generation	If the deeper geothermal resource on the THS site is found to be suitable, groundwater from beneath the site might potentially be used to generate electricity. At the subsurface temperatures currently indicated for the site, an Organic Rankine Cycle process would likely be required (similar to that used at Chena Hot Springs in Alaska). Such units typically produce in the 100s of KW range – enough for some or all on-site use, but not likely a major source useful to export power to the grid. This potential would be confirmed with the results of intrusive drilling and testing in later phases (e.g., Phase 2 or 3). Also, there is a risk that using deep groundwater for power production could affect surface flows of the spring, affecting multiple uses of that resource. Detailed characterization and subsurface testing can help to show if both uses are compatible.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The Integrated Geothermal Assessment of the Takhini Hot Springs property was completed in general accordance with the purpose and scope provided in Section 1.2. The following conclusions are made from this study:

- Five areas of potential thermal anomalies were identified from the TIR helicopter survey data. One of the potential anomalies occurs off the property but may have significance in a regional context.
- Over the monitoring period, the temperature of the Hot Spring at the cistern remained quite constant with a 0.7°C variation from the minimum observed temperature of 46.2°C to a maximum temperature of 46.9°C and an average of 46.6°C. Spring temperatures show little seasonal effect, nor effects from moderate seismic events in the region during the monitoring period.
- Geothermometry indicates that the Hot Spring water was exposed to temperatures as high as 96°C (205°F) in the subsurface during flow to the Hot Spring.
- The fact that the stable isotope results of the samples collected from the Hot Spring plot close to the LMWL and close to other local groundwater and surface water samples indicates that the spring water is of local meteoric origin.
- Tritium isotope data show that the Hot Spring water is more than 50 years old.
- Untreated Takhini Hot Spring water is not suitable for human consumption as the fluoride concentration does not meet the maximum acceptable concentration in the Guidelines for Canadian Drinking Water Quality. Therefore, production of bottled “mineral” or “spring” water is not an option because alteration of the original source water is not permitted by regulation. Water treatment would be required to render the water usable as bottled water; however, the water could not be identified as “spring” or “mineral” water in accordance with existing regulations.
- Water from the cold water well does meet all GCDWQ health-based guidelines for the parameters analyzed, and could potentially be bottled as a “mineral” water.
- Potential water use options include spa/pool, space heating, hydrotherapy, bottling mineral water from the cold water well, bottling of treated water from the Hot Spring or cold water well, and greenhouse heating. Depending on decisions to pursue further geothermal exploration, the moderate geothermal temperature indicated for this site might also support electrical power generation using current medium temperature power generating technology (organic Rankine cycle). Actual subsurface temperatures and well yields for such a use could be determined through an intrusive exploration program.

5.2 RECOMMENDATIONS

Based on the results of this study EBA makes the following recommendations for future assessment of the resources at the THS site:

- Takhini Hot Springs Ltd. should consider the potential water use options presented herein and make decisions regarding whether to complete additional research and testing that may be required for each option. For example, if THS wishes to pursue bottled water production, additional testing is required.
- Complete shallow soil monitoring in areas of potential thermal infrared (TIR) geothermal anomalies to identify additional possible target locations for geophysical investigations.
- Complete geophysical investigations (e.g., Total Field Magnetism and Horizontal Loop EM) to characterize sub-surface geology structures and better understand the geothermal source and possible opportunities to utilize this energy. A geophysical survey located in the area of the Hot Springs would likely be a cost-effective step to define subsurface geology structure and would be critical for borehole location if future drilling is advanced. Survey gridlines perpendicular to the perceived north-south oriented fault and extending north and south of the Hot Springs are recommended. Unconsolidated Quaternary material is thought to be shallow in the vicinity of the Hot Springs, so the results of geophysics would provide some mapping of structural data that can't otherwise be mapped because bedrock is masked by glaciolacustrine silts.
- Using the information obtained from the geophysical investigations, carry out characterization drilling (e.g., 300 m deep small diameter diamond drill holes) to better understand thermal gradient and sub-surface geology and hydrogeology.
- Following the results of geophysics and characterization drilling, assess the potential for exploitation of the Hot Springs system at depth in consultation with Takhini Hot Springs Ltd.

6.0 LIMITATIONS OF REPORT

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7.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

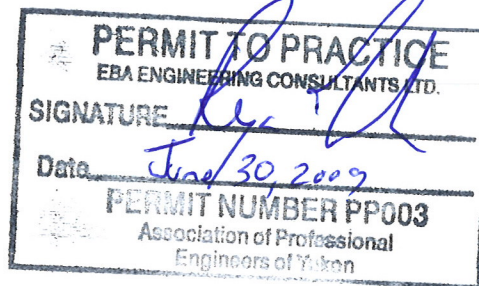
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REFERENCES

- Broadway Architects (2006) Eco-Village Resort: A fossil fuel free zone. Takhini Hot Springs Interpretive Centre, Conceptual Design Report. Report to Takhini Hot Springs Ltd.
- Crandall, J.T. and Sadlier-Brown, T.L. (1976) Data on Geothermal Areas Cordillera Yukon, Northwest Territories and Adjacent British Columbia, Canada. Department of Energy, Mines and Resources Canada.
- DECdesign Mechanical Consultants Ltd. (2006) Takhini Hot Springs Interpretive Centre – Energy Assessment. Report to Takhini Hot Springs Ltd.
- Diaz-Gonzalez, L. and E. Santoyo (2008) A New Precise Calibration of the Na/K Geothermometer using a World Database of Geothermal Fluids and Improved Geochemometric Techniques. Abstract from 2008 Goldschmidt Conference, P.A215.
- Dobrowolsky, H. (2006) Takhini Hot Springs Research Project. Midnight Arts, Report to Takhini Hot Springs Ltd.
- Fournier, R.O. (1981) Application of Water Geochemistry to Geothermal Exploration and Reservoir Engineering. Chapter 4 in Geothermal Systems: Principles and Case Histories, L. Ryback and L.J.P. Muffler, eds., Wiley Publishing, NY, pp.109-143.
- Fournier, R.O. and Truesdell, A.H. (1973) An Empirical Na-K-Ca Geothermometer for Natural Waters. *Geochim. Cosmochim. Acta*, vol. 37, pp. 1255-1275.
- Garchar, L. and G. Arehart (2008) Origin and Characterization of Geothermal Waters at Desert Queen, Nevada. *GRC Transactions*, Vol. 32, pp.147-151.
- Grasby, S.E. and Hutcheon, I. (2001) Controls on the Distribution of Thermal Springs in the Southern Canadian Cordillera. *Canadian Journal of Earth Science*, vol. 38.
- Gabrielse, H. and Yorath, C.J. (Eds.) (1992) *Geology of the Cordilleran Orogen in Canada: Geothermal Energy*.
- Hemmera Energy (2006) Geothermal energy preliminary feasibility assessment. Report to Takhini Hot Springs Ltd.
- IAEA/WMO (2006) Global Network of Isotopes in Precipitation. The GNIP Database. Accessible at: <http://isohis.iaea.org>
- Van Everdingen, R.O. (1996) Analytical results for samples from Takhini Hot Spring, Yukon Territory. Water Resources Branch, Inland Waters Directorate, Calgary, Alberta.
- Verma, S.P. and Santoyo, E. (1995) New Improved Equations for Na/K and SiO₂ Geothermometers by Error Propagation. *Proceedings of World Geothermal Congress, 1995*, p.963-968.
- Wheeler, J.O. (1961) Whitehorse Map-Area, Yukon Territory, 105D. Memoir 312, Geological Survey of Canada, Department of Mines and Technical Surveys Canada.
- Yukon Geological Survey. MapMaker Online: <http://maps.gov.yk.ca/imf.jsp?site=YGS>



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TABLES



TABLE 2: SUMMARY OF REFERENCES ON TAKHINI HOT SPRINGS BACKGROUND INFORMATION		
Reference	Principal Findings	Relevance to this Project
Van Everdingen, R.O. (1996) Analytical results for samples from Takhini Hot Spring, Yukon Territory. Water Resources Branch, Inland Waters Directorate, Calgary, Alberta.	The paper presents results of chemical analyses of the hot spring water and a nearby well and compares them with previous chemical data. The author concluded that the water samples are chemically very similar and that the highly mineralized water is supersaturated with respect to CaCO ₃ and CaSO ₄ . This is in agreement with the geochemical and mineralogical analysis of the travertine deposit and scale deposit on the pool walls of the hot spring. The travertine deposit is CaCO ₃ dominated whereas the scale deposit on the pool walls mainly consists of CaSO ₄ . The scale deposit is very similar to a fine grained layer within the travertine deposit that has been interpreted as being the result of evaporation of spring water in a quasi-stagnant pond. The author also concluded that the water from a well close to the hot spring is not suitable for human consumption due to the high concentrations of sulfate and fluoride. Furthermore, the author makes recommendations of how scale deposits on the pool walls could possibly be reduced.	This reference is of relevance to this project as it provides historical chemistry data for the hot spring which allow possible temporal changes in the hot spring water quality to be assessed. The chemistry results presented in this paper will be compared to new chemical analyses conducted as part of this project.
Dobrowolsky, H. (2006) Takhini Hot Springs Research Project. Midnight Arts, Report to Takhini Hot Springs Ltd.	Midnight Arts was contracted by Takhini Hot Springs Ltd. to conduct a research on historical information on the hot springs including various sources such as newspaper articles, maps, reports and publications, Yukon Government archive records etc. This information may be used for the planned interpretive centre.	Reference is of little relevance to this project.
Broadway Architects (2006) Eco-Village Resort: A fossil fuel free zone. Takhini Hot Springs Interpretive Centre, Conceptual Design Report. Report to Takhini Hot Springs Ltd.	This report describes the conceptual design for the Interpretive Centre planned as part of the Eco-Village Resort.	Reference is of little relevance to this project.
DECdesign Mechanical Consultants Ltd. (2006) Takhini Hot Springs Interpretive Centre – Energy Assessment. Report to Takhini Hot Springs Ltd.	The report presents an energy assessment for the planned development at the Takhini Hot Springs. The authors conclude that Takhini Hot Springs would be capable of providing the majority of required heating energy for the planned development. The system would consist of a combination of direct heat exchange and the use of heat pumps. The authors calculated that the flow rate and temperature of the hot spring water would be sufficient to heat a building area of about 18,000 square metres or 11,000 square metres if the heat loss in the existing pool is considered.	This reference is of relevance to this project as it contains important information on potential future use of the hot spring.
Hemmera Energy (2006) Geothermal energy preliminary feasibility assessment. Report to Takhini Hot Springs Ltd.	Hemmera Energy conducted a preliminary geothermal assessment of the Takhini Hot Spring exploring potential future use of the hot spring for heating or other purposes such as electricity generation or bottling of water. Hemmera concludes that the spring can be classified as a Class I hot spring (i.e., as a localized, anomalous and single-source hot spring which is not capable of producing a large scale energy system). They also conclude that any invasive attempts to produce greater amounts of hot water would likely not be worthwhile and may negatively impact the current water usage. Hemmera also makes recommendations for potential future, more detailed assessments focusing on the usage of the direct heat exchange method. Recommendations on possible improvements to the existing infrastructure have also been included.	The report provides a good overview on existing information regarding geology and hydrogeology of the Takhini Hot Spring. However, very few additional field data were collected as part of the study. Appendix A of the report contains some historical isotope and chemistry data from the spring which will be used for comparison with newly collected data as part of the present assessment.

TABLE 7: RESULTS OF CHEMICAL, BACTERIOLOGICAL AND ISOTOPE ANALYSES

Analyte	Units	Sample Name	Takhini Hot Spring	Takhini Hotspring	Takhini Hotspring	Water Well	Flat Creek	Detection Limit	Pond	Property Discharge	Takhini Hot Spring	Water Well	Lake	Water Quality Guidelines		
		Lab	CanTest			CanTest	CanTest			Bodycote	Bodycote	Bodycote	Bodycote	Bodycote	CCME Protection of Aquatic Life	Canadian Drinking Water Quality
		Lab ID	811270391			811270422	811270431			682877-1	682877-2	682877-3	682877-4	682877-5		
		Sample Date	25-Nov-08	12-Jul-72	Jul-61	25-Nov-08	25-Nov-08			12-May-09	12-May-09	12-May-09	12-May-09	12-May-09		
Sample Location	Cistem	Ref: Everdingen, 1972	Ref: Brandon, 1961	Water Well	Creek		Pond	Creek	Cistem	Water Well	Lake					
Easting (UTM, Nad83)	08 480457	08 480457	08 480457	08 480978	08 471856		08 480397	08 480319	08 480457	08 480978	08 480135					
Northing (UTM, Nad83)	6749360	6749360	6749360	6749093	6750678		6749770	6749028	6749360	6749093	6750972					
Matrix	Geothermal Groundwater	Geothermal Groundwater	Geothermal Groundwater	Groundwater	Surface water		Surface water	Surface water	Geothermal Groundwater	Groundwater	Surface water					
Detection Limit	Results	Results	Results	Results	Results	Detection Limit	Results	Results	Results	Results	Results	Results	MAC	AO		
Ion Balance	%	-1.5	0.1	0.7	0.3	1.5		2.2	4.5	4.7	0.5	0.6				
Water type		Ca-SO ₄	Ca-SO ₄	Ca-SO ₄	Ca-Mg-SO ₄ -HCO ₃	Ca-HCO ₃		Ca-Mg-HCO ₃	Ca-SO ₄	Ca-SO ₄	Ca-Mg-SO ₄ -HCO ₃	Ca-Mg-SO ₄ -HCO ₃				
Field Parameters																
Temperature	T	°C	46.2	46.7	46.7	5.0	0.0		7.6	12.4	45.7	5.9	10.7	-	15	
pH	pH units		6.70	6.89	7.75	7.19	8.19		7.12	7.19	7.17	-	-	6.5 - 9	6.5 - 8.5	
Dissolved O ₂	DO	mg/L	0.5	0.6	-	0.6	13.6		3.8	9.0	0.5	1.1	4.5	-	-	
Electrical Conductivity	EC	µS/cm at 25°C	2289	-	-	1015	128		212	2652	2607	1280	512	-	-	
Total Dissolved Solids	TDS	ppm	1145	2658.8	2627	503	63		107	1352	1330	650	262	-	500	
Ferrous Iron	Fe ²⁺	mg/L	0.9	-	-	1.1	0		0	0	0.9	1.1	0	-	-	
p-Alkalinity		mg/L CaCO ₃	0	-	-	0	0		0	0	0	0	0	-	-	
m-Alkalinity		mg/L CaCO ₃	140	-	-	220	100		90	85	100	200	140	-	-	
Physical Parameters																
pH	pH units	-	7.55	7.40	7.50	7.93	7.98	-	7.16	7.76	7.24	7.60	7.77	6.5 - 9	6.5 - 8.5	
Electrical Conductivity	EC	µS/cm at 25°C	1	3400	-	1110	150	1	196	2510	2580	1150	491	-	-	
True Color	CU	<5	5	-	-	<5	5	5	160	20	91	-	-	-	15	
Turbidity	NTU	0.1	5.1	-	-	3.0	0.6	0.1	-	1.8	1.0	1.0	-	-	-	
Hardness	mg/L	1	1770	-	-	588	73	1	95	1860	1910	612	250	-	-	
Dissolved Major Ions																
Calcium	Ca	mg/L	0.05	580	590	586	151	23.9	0.2	23.0	610	630	156	50.3	-	
Magnesium	Mg	mg/L	0.05	78.2	88.9	95.1	50.9	3.26	0.2	9.2	83	81	53.7	32.4	-	
Sodium	Na	mg/L	0.05	36.5	35.0	30.1	36.3	2.72	0.4	0.9	37	36	38.2	8.1	200	
Potassium	K	mg/L	0.1	8.7	8.5	7.7	1.0	0.7	0.4	9.0	8	9	0.8	3.3	-	
Silicon	Si	mg/L	0.25	19.8	21.5	19.2	8.0	5.4	0.05	8.16	14.2	21.3	8.06	7.00	-	
Chloride	Cl	mg/L	0.2	1.5	1.3	1.5	8.7	<0.20	0.4	2.6	2.0	1.3	10.2	2.0	250	
Fuonde	F	mg/L	0.05	3.62	3.20	4.40	<0.25	0.10	0.05	<0.05	2.8	3.0	0.13	0.07	0.12 1.5	
Nitrate - N	NO ₃	mg/L	0.05	<0.05	0.08	7.60	<0.25	<0.01	<0.01	<0.05	<0.01	<0.05	<0.01	0.01	2.9 45	
Nitrite - N	NO ₂	mg/L	-	-	-	-	-	0.005	0.007	<0.02	<0.02	0.011	<0.005	-	-	
Nitrate and Nitrite - N		mg/L	-	-	-	-	-	0.01	<0.01	<0.07	<0.07	0.01	0.01	-	-	
Sulfate (SO ₄)	SO ₄	mg/L	0.5	1740	1744	1721	440	4.56	0.9	11	1640	1640	477	132	500	
Ortho Phosphorus	P	mg/L	0.02	<0.02	-	-	<0.02	<0.02	0.002	0.263	<0.002	<0.002	<0.002	0.003	-	
Hydroside Alkalinity	OH	mg/L	0.5	<0.5	-	-	<0.5	<0.5	5	<5	<5	<5	<5	-	-	
Carbonate Alkalinity	CO ₃	mg/L	0.5	<0.5	0.0	-	<0.5	<0.5	6	<6	<6	<6	<6	-	-	
Bicarbonate Alkalinity	HCO ₃	mg/L	0.5	127	127	132	236	88.9	5	113	96	134	236	171	-	
Total Alkalinity	CaCO ₃	mg/L	0.5	104	-	-	193	72.8	5.0	93	79	110	193	140	-	
Dissolved Gases																
Hydrogen Sulfide	H ₂ S	mg/L	0.01	<0.01	-	-	-	-	-	-	-	-	-	-	0.05	
Free Carbon Dioxide	CO ₂	mg/L	2	16.7	-	-	-	-	-	-	-	-	-	-	-	
Metals - Dissolved																
Aluminum	Al	mg/L	0.005	0.013	-	-	0.008	<0.005	0.005	0.007	<0.05	<0.05	<0.005	<0.005	-	
Antimony	Sb	mg/L	0.001	0.002	-	-	<0.001	<0.001	0.0002	<0.0002	<0.002	<0.002	<0.0002	<0.0002	-	
Arsenic	As	mg/L	0.001	0.008	-	-	<0.001	<0.001	0.0002	0.0004	0.004	0.009	0.0007	0.0008	-	
Barium	Ba	mg/L	0.001	0.016	-	-	0.020	0.018	0.001	0.01	0.02	0.02	0.015	-	-	
Beryllium	Be	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0001	<0.0001	<0.001	<0.001	<0.0001	<0.0001	-	
Bismuth	Bi	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	-	
Boron	B	mg/L	0.05	0.05	-	-	<0.05	<0.05	0.002	0.027	0.05	0.05	0.036	0.020	-	
Cadmium	Cd	mg/L	0.0002	<0.0002	-	-	<0.0002	<0.0002	0.00001	0.00004	<0.0001	<0.0001	<0.00001	<0.00001	-	
Chromium	Cr	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	-	
Cobalt	Co	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0001	<0.0001	<0.001	<0.001	<0.0001	0.0001	-	
Copper	Cu	mg/L	0.001	0.001	0.002	-	<0.001	<0.001	0.001	0.004	<0.01	<0.01	0.001	0.002	-	
Gold	Au	mg/L	5E-11	<5E-11	-	-	-	-	-	-	-	-	-	-	-	
Iron	Fe	mg/L	0.05	0.53	0.60	0.62	0.62	0.06	0.01	0.05	<0.1	0.53	1.14	0.10	-	
Lead	Pb	mg/L	0.001	<0.001	<0.004	-	<0.001	<0.001	0.0001	0.0002	<0.001	0.001	0.0002	0.0001	-	
Lithium	Li	mg/L	0.001	0.027	0.031	-	0.013	0.001	0.001	0.001	0.04	0.04	0.017	0.004	-	
Manganese	Mn	mg/L	0.001	0.017	<0.005	-	0.029	0.023	0.005	0.006	<0.05	<0.05	0.033	0.028	-	
Mercury	Hg	mg/L	0.00002	<0.00002	-	-	<0.00002	<0.00002	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	
Molybdenum	Mo	mg/L	0.0005	0.0049	-	-	0.0017	0.0008	0.001	0.002	<0.01	<0.01	0.002	0.001	-	
Nickel	Ni	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0005	0.0006	<0.005	<0.005	<0.0005	<0.0005	-	
Phosphorus	P	mg/L	0.15	<0.15	-	-	<0.15	<0.15	-	-	-	-	-	-	-	
Selenium	Se	mg/L	0.001	0.001	-	-	<0.001	<0.001	0.0002	<0.0002	<0.002	<0.002	<0.0002	<0.0002	-	
Silver	Ag	mg/L	0.00025	<0.00025	-	-	<0.00025	<0.00025	0.00001	<0.00001	<0.0001	<0.0001	<0.00001	<0.00001	-	
Strontium	Sr	mg/L	0.001	14.0	14.3	-	4.05	0.15	0.001	0.323	13.0	13.3	4.40	0.620	-	
Sulfur	S	mg/L	-	-	-	-	-	0.3	-	3.6	546	547	159	44.1	-	
Tellurium	Te	mg/L	0.001	<0.001	-	-	<0.001	<0.001	-	-	-	-	-	-	-	
Thallium	Tl	mg/L	0.0001	<0.0001	-	-	<0.0001	<0.0001	0.00005	<0.00005	<0.0005	<0.0005	<0.00005	<0.00005	-	
Thorium	Th	mg/L	0.0005	<0.0005	-	-	<0.0005	<0.0005	-	-	-	-	-	-	-	
Tin	Sn	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	-	
Titanium	Ti	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0005	0.0007	0.020	0.021	0.0055	0.0021	-	
Uranium	U	mg/L	0.0005	<0.0005	-	-	0.0007	0.006	0.0007	0.006	<0.005	<0.005	0.0059	0.0043	-	
Vanadium	V	mg/L	0.001	<0.001	-	-	<0.001	<0.001	0.0001	0.0003	<0.001	<0.001	0.0002	0.0003	-	
Zinc	Zn	mg/L	0.005	<0.005	0.074	-	0.416	<0.005	0.001	0.007	0.02	0.01	0.285	0.008	-	
Zirconium	Zr	mg/L	0.01	<0.01	-	-	<0.01	<0.01	-	-	-	-	-	-	-	

TABLE 7: RESULTS OF CHEMICAL, BACTERIOLOGICAL AND ISOTOPE ANALYSES (CONTINUED)

Analyte	Units	Sample Name	Takhini Hot Spring	Takhini Hotspring	Takhini Hotspring	Water Well	Flat Creek	Pond	Property Discharge	Takhini Hot Spring	Water Well	Lake	Water Quality Guidelines			
		Lab	CanTest			CanTest	CanTest			Bodycote	Bodycote	Bodycote	Bodycote	Bodycote	CCME Protection of Aquatic Life	Canadian Drinking Water Quality
		Lab ID	811270391			811270422	811270431			682877-1	682877-2	682877-3	682877-4	682877-5		
Sample Date	25-Nov-08	12-Jul-72	Jul-61	25-Nov-08	25-Nov-08		12-May-09	12-May-09	12-May-09	12-May-09	12-May-09	12-May-09				
Sample Location	Cistem	Ref: Everdingen, 1972	Ref: Brandon, 1961	Water Well	Creek		Pond	Creek	Cistem	Water Well	Lake					
Easting (UTM, Nad83)	08 480457	08 480457	08 480457	08 480978	08 471856		08 480397	08 480319	08 480457	08 480978	08 480135					
Northing (UTM, Nad83)	6749360	6749360	6749360	6749093	6750678		6749770	6749028	6749360	6749093	6750972					
Matrix	Geothermal Groundwater	Geothermal Groundwater	Geothermal Groundwater	Groundwater	Surface water		Surface water	Surface water	Geothermal Groundwater	Groundwater	Surface water					
Detection Limit	Results	Results	Results	Results	Results	Detection Limit	Results	Results	Results	Results	Results	Results	MAC	AO		
Metals - Total																
Aluminum	Al	-	-	-	-	-	0.005	0.141	0.023	0.005	0.006	0.019	0.1	-		
Antimony	Sb	-	-	-	-	-	0.0002	0.0003	0.0015	0.0020	<0.0002	<0.0002	-	0.006		
Arsenic	As	-	-	-	-	-	0.0002	0.0003	0.0044	0.0083	0.0006	0.001	0.005	0.01		
Barium	Ba	-	-	-	-	-	0.001	0.012	0.020	0.015	0.022	0.015	-	1		
Beryllium	Be	-	-	-	-	-	0.00004	<0.00004	<0.00004	0.00014	<0.00004	<0.00004	-	-		
Bismuth	Bi	-	-	-	-	-	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-		
Boron	B	-	-	-	-	-	0.004	0.026	0.037	0.028	0.038	0.018	-	5		
Cadmium	Cd	-	-	-	-	-	0.00001	0.00005	<0.00001	<0.00001	<0.00001	0.00003	0.00039 ³	0.005		
Chromium	Cr	-	-	-	-	-	0.0004	0.0009	<0.0004	<0.0004	<0.0004	<0.0004	0.001 ⁴	0.05		
Cobalt	Co	-	-	-	-	-	0.00002	0.00016	0.00033	0.00029	0.00010	0.00013	-	-		
Copper	Cu	-	-	-	-	-	0.001	0.009	<0.001	<0.001	<0.001	0.001	0.002-0.004 ⁵	1		
Gold	Au	-	-	-	-	-	-	-	-	-	-	-	-	-		
Iron	Fe	-	-	-	-	-	0.01	0.18	0.08	0.60	1.00	0.33	0.3	0.3		
Lead	Pb	-	-	-	-	-	0.0001	0.0005	<0.0001	0.0003	0.0002	0.0002	0.001-0.007 ⁶	0.01		
Lithium	Li	-	-	-	-	-	0.001	<0.001	0.031	0.031	0.013	0.003	-	-		
Manganese	Mn	-	-	-	-	-	0.0001	0.0152	0.0298	0.0184	0.0360	0.0493	-	0.05		
Mercury	Hg	-	-	-	-	-	0.00001	0.00001	<0.00001	0.00002	0.00003	<0.00001	0.000026	0.001		
Molybdenum	Mo	-	-	-	-	-	0.00002	0.00160	0.00376	0.00484	0.00150	0.00126	0.073	-		
Nickel	Ni	-	-	-	-	-	0.001	0.001	0.004	0.004	0.001	<0.001	0.025-0.150 ⁷	-		
Phosphorus	P	-	-	-	-	-	0.01	0.433	<0.01	<0.01	<0.010	0.046	-	-		
Selenium	Se	-	-	-	-	-	0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.001	0.01		
Silver	Ag	-	-	-	-	-	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.0001	-		
Strontium	Sr	-	-	-	-	-	0.001	0.372	12.8	14.2	5.03	0.703	-	-		
Sulfur	S	-	-	-	-	-	0.1	3.7	525	532	131	40.5	-	-		
Tellurium	Te	-	-	-	-	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-		
Thallium	Tl	-	-	-	-	-	0.00001	<0.00001	0.00004	0.00010	<0.00001	<0.00001	0.0008	-		
Thorium	Th	-	-	-	-	-	0.0001	<0.0001	0.0004	0.0001	<0.0001	<0.0001	-	-		
Tin	Sn	-	-	-	-	-	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	-	-		
Titanium	Ti	-	-	-	-	-	0.0001	0.0080	0.0030	0.0028	0.0012	0.0017	-	-		
Uranium	U	-	-	-	-	-	0.0004	0.0009	0.0005	<0.0004	0.0061	0.0049	-	0.02		
Vanadium	V	-	-	-	-	-	0.00004	0.00034	0.00035	0.00010	0.00005	0.00015	-	-		
Zinc	Zn	-	-	-	-	-	0.001	0.012	0.004	0.005	0.299	0.009	0.03	5		
Zirconium	Zr	-	-	-	-	-	0.0001	0.0003	0.0006	0.0002	<0.0001	<0.0001	-	-		
Environmental Isotopes																
Oxygen-18	$\delta^{18}\text{O}$	‰	-22.4	-	-	-22.8	-21.6	-	-22.7	-	-22.8	-22.3	-	-		
Deuterium	$\delta^2\text{H}$	‰	-174.9	-	-	-181.0	-167.8	-	-186.3	-	-176.2	-176.8	-	-		
Tritium	^3H	TU ²	0.8 ± 0.3	-	-	-	-	-	8.4 ± 0.9	-	0.8 ± 0.6	0.8 ± 0.6	-	58730		
Bacteriological Analysis																
Total Coliforms		present/absent	-	present	-	-	absent	present	-	-	present	present	absent	-		
<i>E. Coli</i>		present/absent	-	absent	-	-	absent	absent	-	-	present	absent	-	absent		

Notes:

*<" indicates less than the laboratory detection limit

"-" indicates not analyzed / no guideline established

Comparison with Guidelines:

Bold Highlighted in red - Results exceed Guidelines for Canadian Drinking Water Quality (May 2008; only Takhini Hot Spring and Water Well)

Bold Highlighted in yellow - Results exceed CCME Protection of Aquatic Life Guidelines (surface water only)

¹ Stable isotope ratios are measured relative to the VSMOW (Vienna Standard Mean Ocean Water): $\delta^{18}\text{O} = ((^{18}\text{O}/^{16}\text{O})_{\text{sample}} / (^{18}\text{O}/^{16}\text{O})_{\text{reference}}) * 1000 \text{‰} \text{VSMOW}$; $\delta^2\text{H} = ((^2\text{H}/^1\text{H})_{\text{sample}} / (^2\text{H}/^1\text{H})_{\text{reference}}) * 1000 \text{‰} \text{VSMOW}$

² TU - Tritium Units (1TU = 0.11919 Becquerels/L per IAEA, 2000 Report; 1TU equals 1 ³H atom in 10¹⁸ ¹H atoms)

³ Value shown applies to Takhini Hot Spring sample; Guideline = 10⁶ [0.86log(hardness)]-3.2)

⁴ Value shown applies to hexavalent chromium; guideline for trivalent chromium: 0.0089 mg/L.

⁵ Copper guideline: 0.002 mg/L @ hardness of 0-120 mg/L; 0.003 mg/L @ hardness of 120-180 mg/L; 0.004 mg/L @ hardness of >180 mg/L.

⁶ Lead guideline: 0.001 mg/L @ hardness of 0-60 mg/L; 0.002 mg/L @ hardness of 60-120 mg/L; 0.004 mg/L @ hardness of 120-180 mg/L; 0.007 mg/L @ hardness of >180 mg/L.

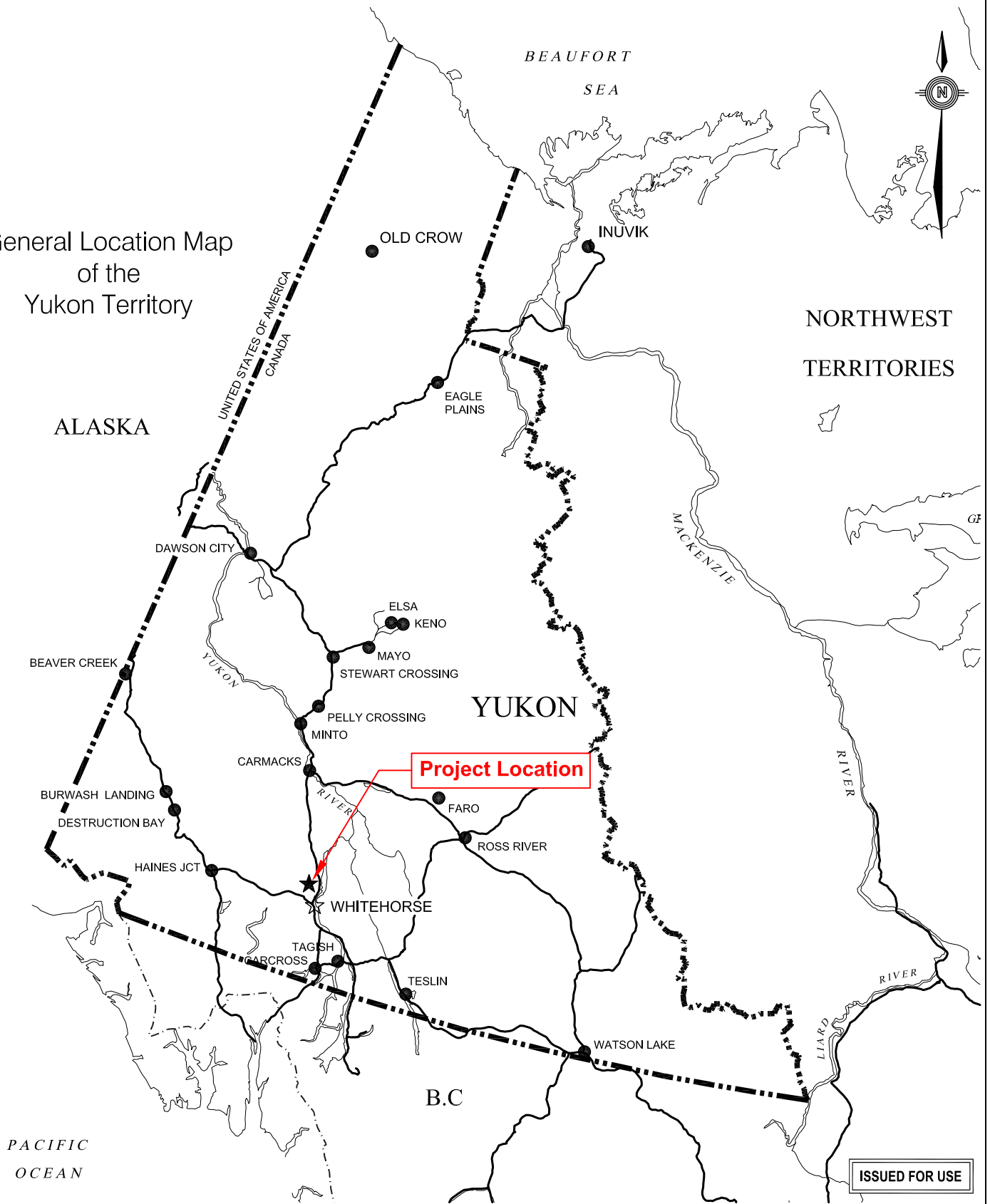
⁷ Nickel guideline: 0.025 mg/L @ hardness of 0-60 mg/L; 0.065 mg/L @ hardness of 60-120 mg/L; 0.110 mg/L @ hardness of 120-180 mg/L; 0.150 mg/L @ hardness of >180 mg/L.



FIGURES



General Location Map
of the
Yukon Territory



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CLIENT



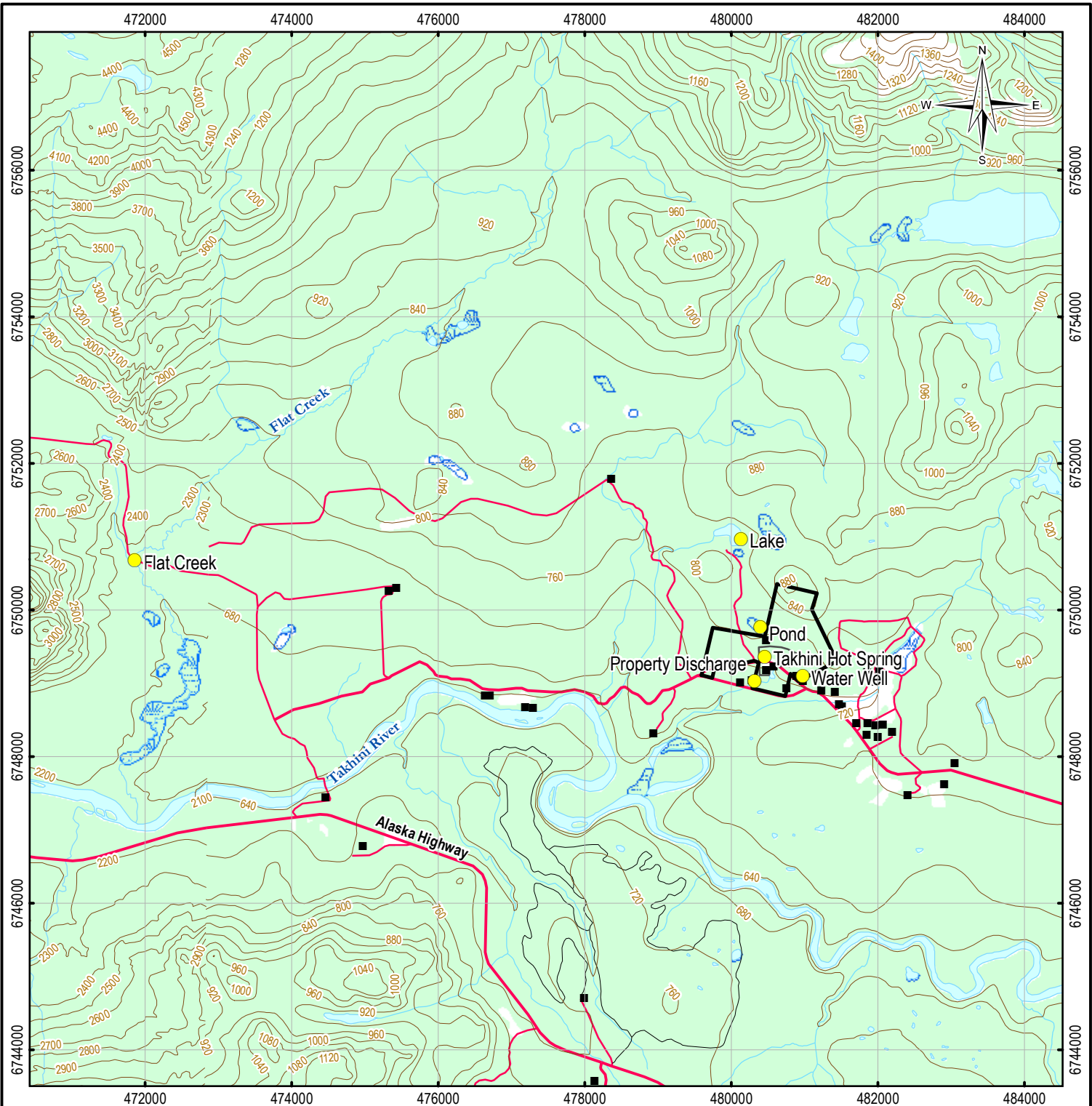
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**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

SITE LOCATION PLAN

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OFFICE EBA-WHSE	DATE June 19, 2009		

Figure 1



LEGEND

- Water Sample
- Watercourse
- Property Boundary
- Waterbody
- Building
- Wetland
- Contour (40m/100ft)
- Vegetation
- Limited Use Road
- Road
- Campground

NOTES

Base data source:
NTDB 1:50K (105D13, 105D14)

**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

**Overview of Study Area and
Water Sampling Locations**

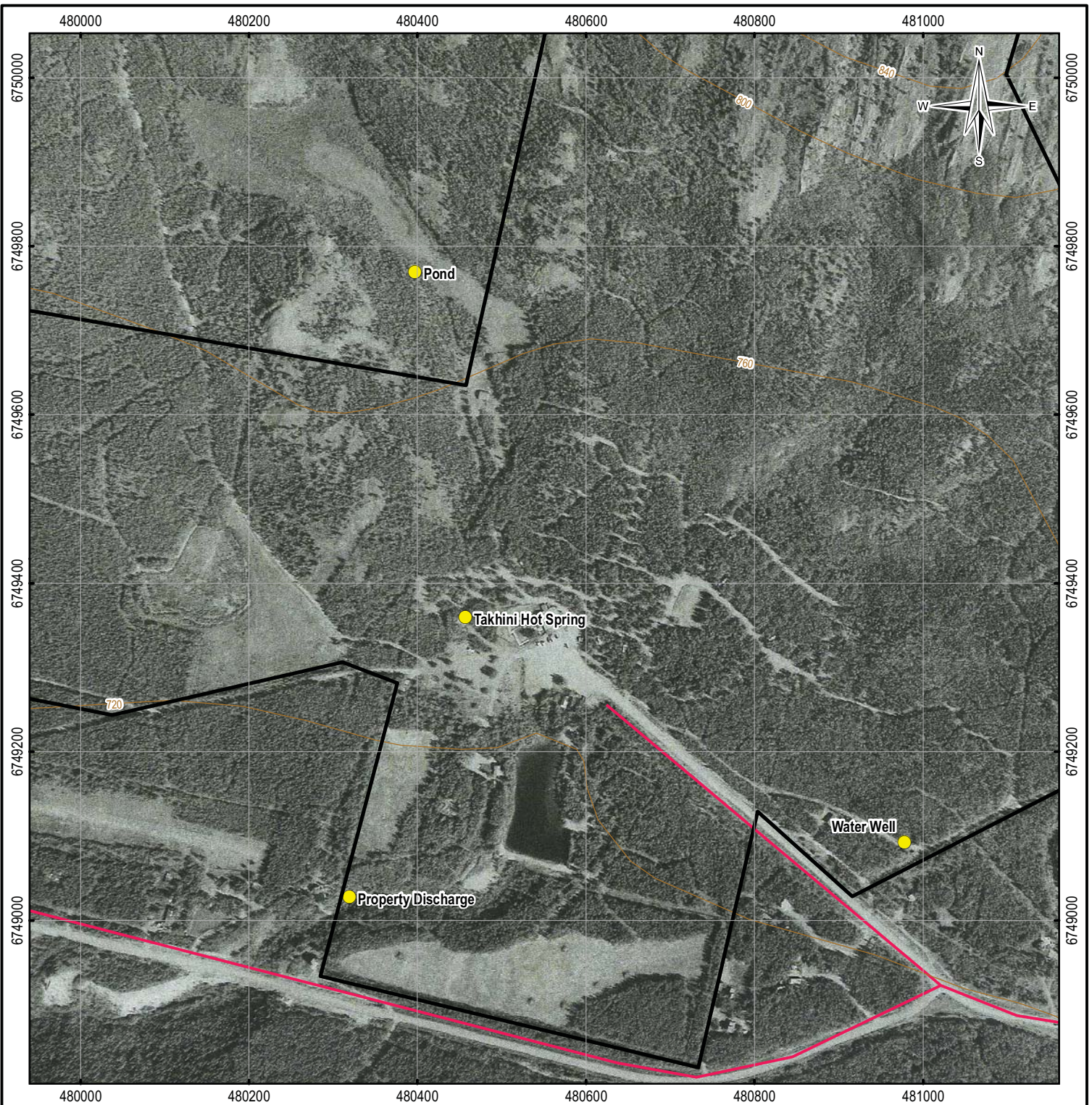
PROJECTION UTM Zone 8	DATUM NAD83		
Scale: 1:75,000			
FILE NO. W23101139_Figure02.mxd	DWN MEZ	CKD RM	REV 0
PROJECT NO. W23101139	OFFICE EBA-VANC	DATE June 30, 2009	



Figure 2

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c:\Vancouver\GIS\ENVIRONMENTAL\W231\W23101139_Takhini\Maps\W23101139_Figure03.mxd

LEGEND

- Water Sample
- Property Boundary
- Contour (40m)
- Road

NOTES

Base data source:
 Road and Contours: NTDB 1:50K (105D14)
 Air Photo: Geographic Air Survey Ltd (A28116-30)

**INTEGRATED GEOTHERMAL ASSESSMENT
 TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

Water Sample Locations

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:6,500	
<div style="display: flex; justify-content: space-between; width: 100%;"> 100 50 0 100 </div> <div style="text-align: center; margin-top: 5px;"> <p>Meters</p> </div>	



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FILE NO. W23101139_Figure03.mxd			
PROJECT NO. W23101139	DWN MEZ	CKD RM	REV 0
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Figure 3

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LEGEND

- Potential Thermal Infrared Anomalies
- Property Boundary
- Contour (40m)
- Road
- Watercourse
- Waterbody

NOTES

Base data source:
NTDB 1:50K

**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

**Takhini Hot Springs -
Thermal Infrared Survey**

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:10,000	

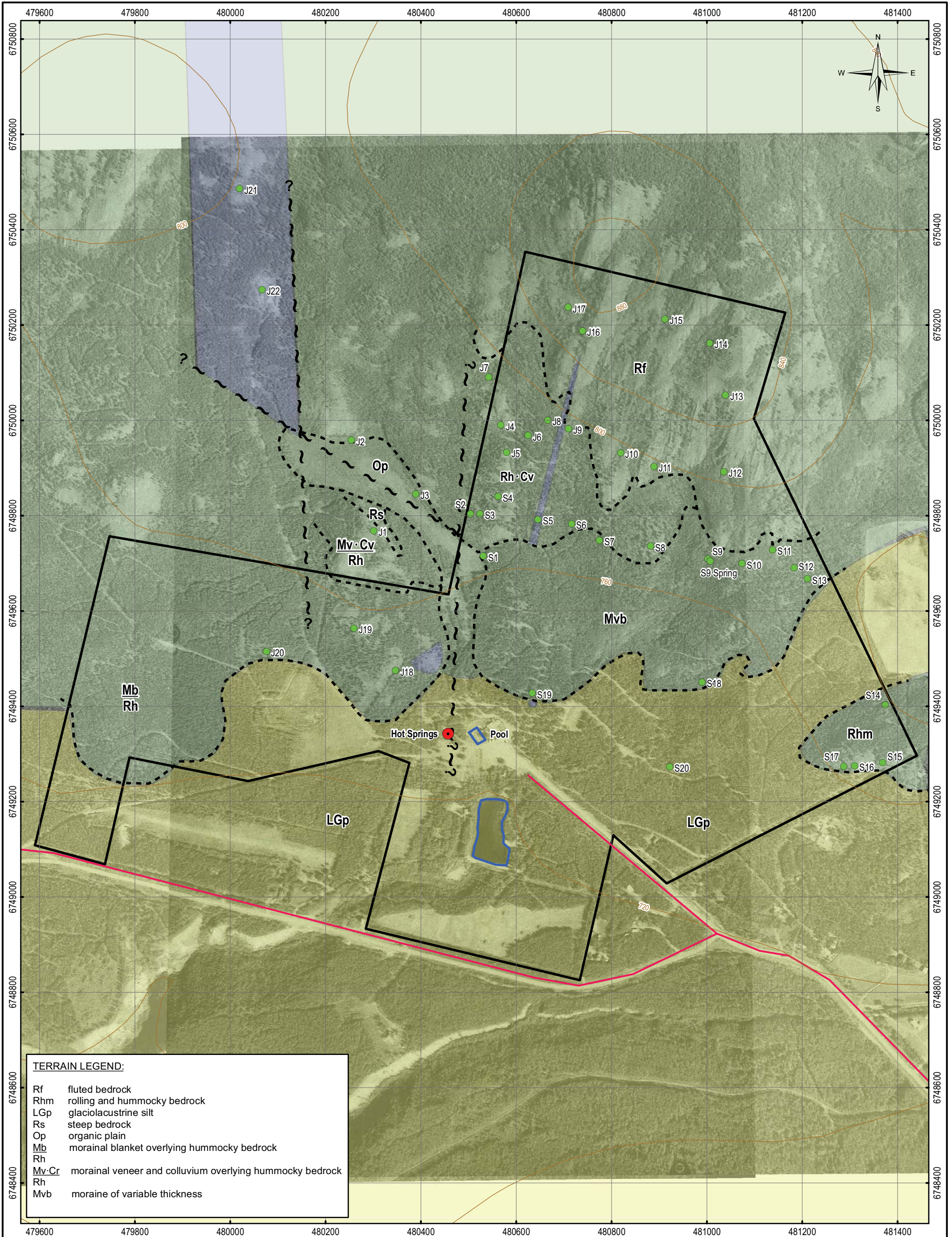
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PROJECT NO. W23101139.012	DWN MEZ	CKD GC	REV 0
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Figure 4



TERRAIN LEGEND:

Rf	fluted bedrock
Rhm	rolling and hummocky bedrock
LGp	glaciolacustrine silt
Rs	steep bedrock
Op	organic plain
Mb	morainal blanket overlying hummocky bedrock
Rh	morainal veneer and colluvium overlying hummocky bedrock
Mv-Cv	morainal veneer and colluvium overlying hummocky bedrock
Rh	morainal veneer and colluvium overlying hummocky bedrock
Mvb	moraine of variable thickness

LEGEND

●	Field Stations
●	Hot Springs
- - -	Terrain Boundary
~	Faults
—	Contour (40m)
—	Road
□	Pool
□	Property Boundary

Bedrock Geology

■	UTrAK2 - massive medium grey weathering
■	uTrAK3 - red weathering, red and green greywacke, pebble conglomerate, red shale partings, in places altered to quartzite
■	Quaternary Glaciolacustrine silt

NOTES
Base data source:
Contours from NTS 1:50,000

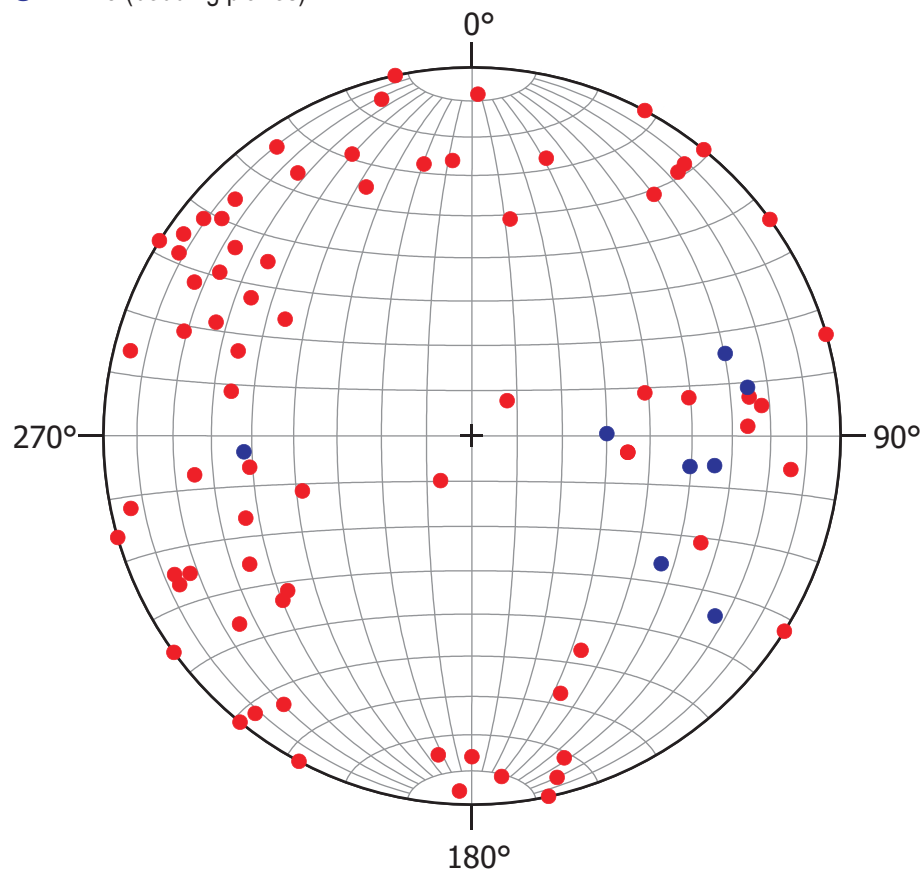
**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

Geology			
PROJECTION UTM Zone 8	DATUM NAD83		
Scale: 1:7,500 100 50 0 100 Meters			
FILE NO. W23101139_Figure11_Geology.mxd	PROJECT NO. W23101139	DWN MEZ	
OFFICE EBA-VANC	DATE June 30, 2009	REV 0	

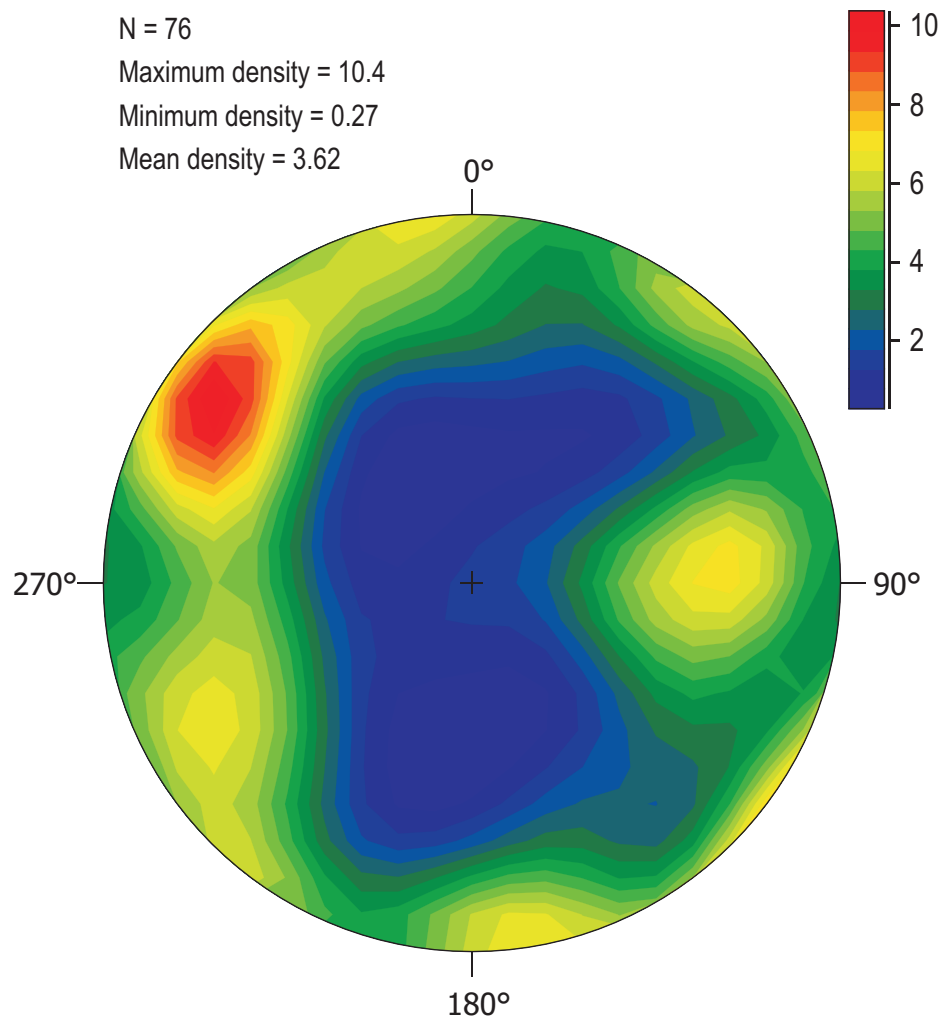
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Figure 11

- N total = 76
- n=68 (joints)
- n=8 (bedding planes)



N = 76
 Maximum density = 10.4
 Minimum density = 0.27
 Mean density = 3.62



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NOTES

Equal area projection, lower hemisphere

The dots in the left plot represent poles of joints (red) and bedding planes (blue) projected into the equatorial plane of a sphere. The density plot on the right shows clusters of poles with similar spatial orientation.

For example, the cluster of poles in the northwestern part of the stereographic projection (red area in the density plot on the right) corresponds to joints that dip steeply to a southeasterly direction. The majority of the blue dots on the left plot represent bedding planes that moderately dip toward the west.

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**INTEGRATED GEOTHERMAL ASSESSMENT
 TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

Stereographic Projection of Structural Data

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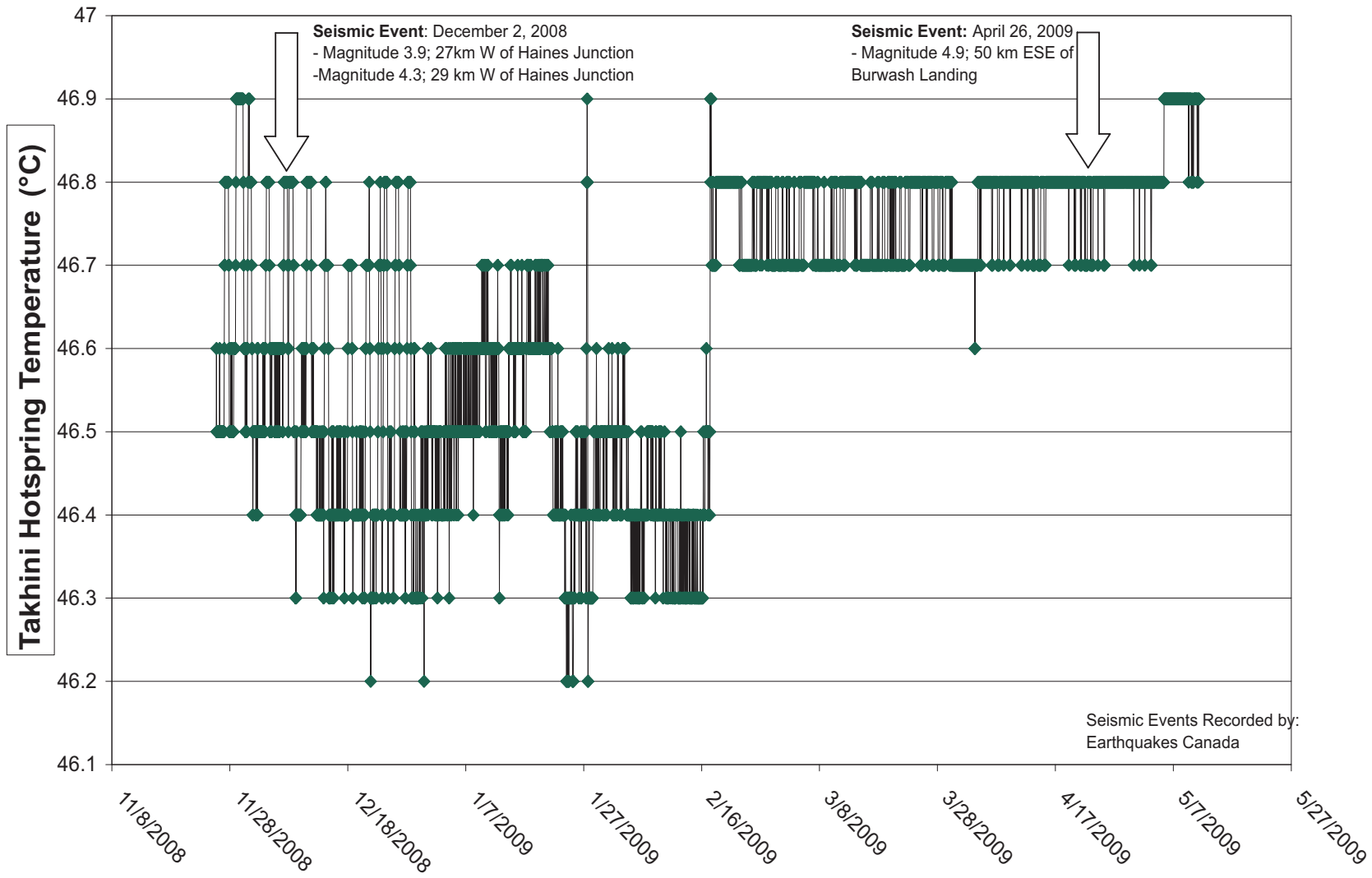


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 SK
 CKD
 JTD
 DATE
 June 2009

REV
 1

Figure 12



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**INTEGRATED GEOTHERMAL ASSESSMENT
 TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

**Hot Spring Temperature vs. Time Plot
 Showing Seismic Events**

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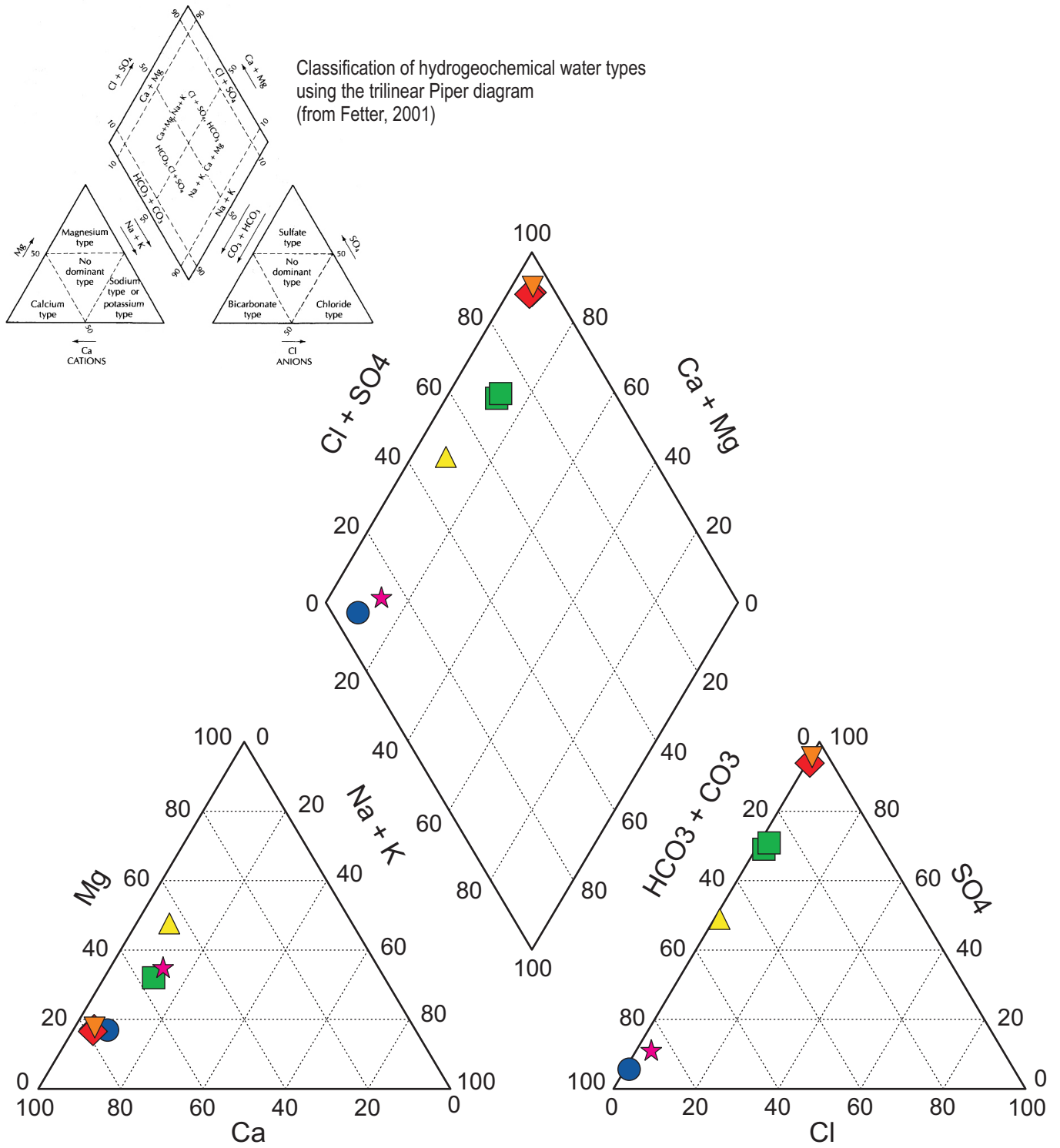


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DATE June 2009		

Figure 13

Classification of hydrogeochemical water types using the trilinear Piper diagram (from Fetter, 2001)



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LEGEND

- ◆ Takhini Hot Spring
- Cold Water Well
- Flat Creek
- ★ Pond
- ▲ Lake
- ▼ Property Discharge

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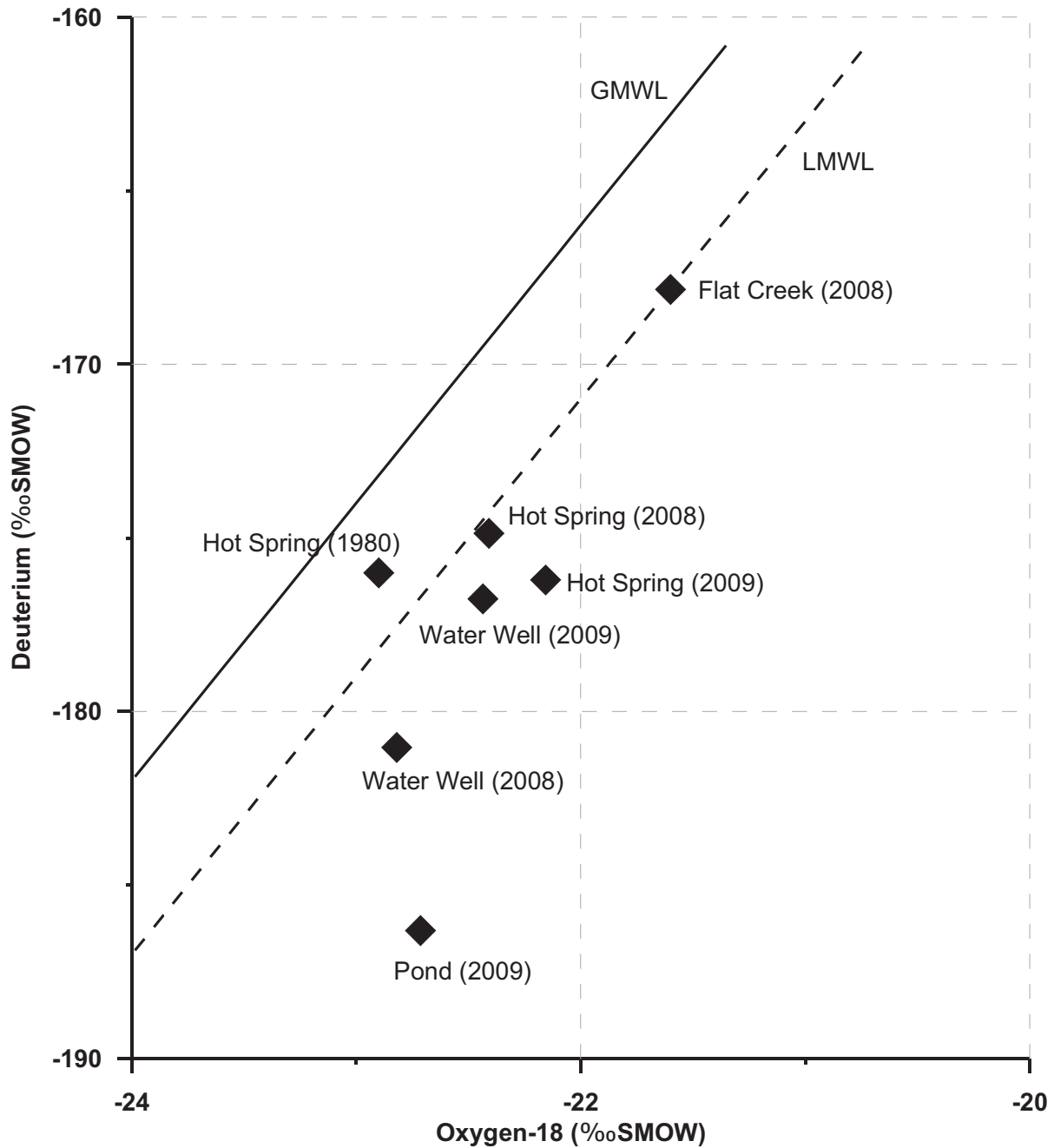


**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

Piper Diagram

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Figure 14



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NOTES

- 1) LMWL - Local (Whitehorse) Meteoric Water Line from Birks, Edwards, Gibson, Michel, Drimmie, and MacTavish, Canadian Network for Isotopes in Precipitation, University of Waterloo/ Meteorological Service of Canada 2003.
- 2) GMWL - Global Meteoric Water Line from Fetter (1994) citing Craig (1961).
- 3) Takhini Hot Springs 1980 Measurement from Everdingen (1981).
- 4) SMOW = Standard Mean Ocean Water

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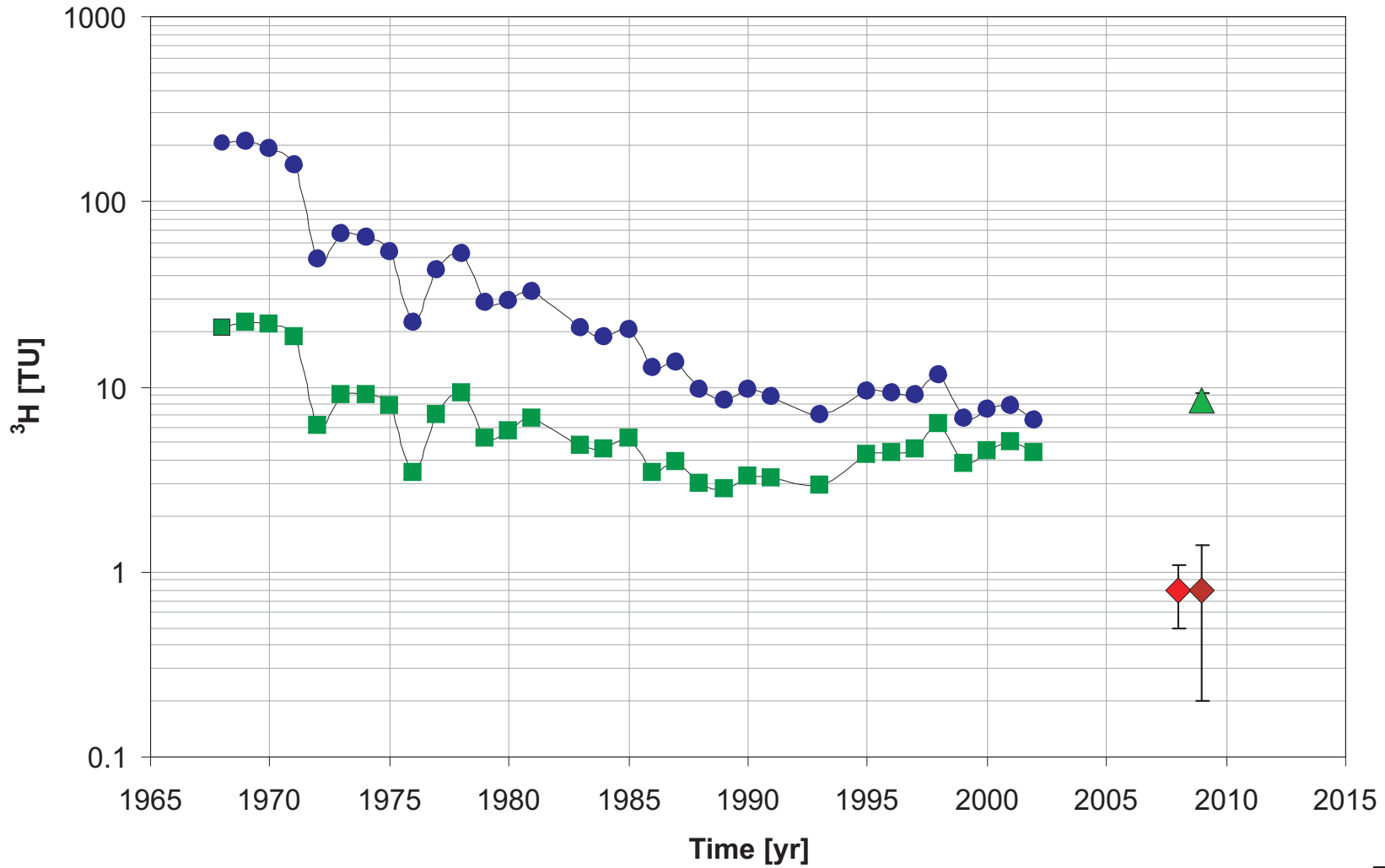


**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

**Plot of Stable Isotope Data
with Meteoric Water Line**

PROJECT NO. W23101139	DWN SK	CKD RMM	REV 1
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Figure 15



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LEGEND

- Atmospheric input function
- Atmospheric input function; decay-corrected for 2008
- ◆ Takhini Hot Spring (THS), 2008
- ◆ THS and “Cold” Water Well, 2009
- ▲ Pond, 2009

NOTES

Atmospheric tritium input function for Anchorage (from IAEA/WMO, 2006))

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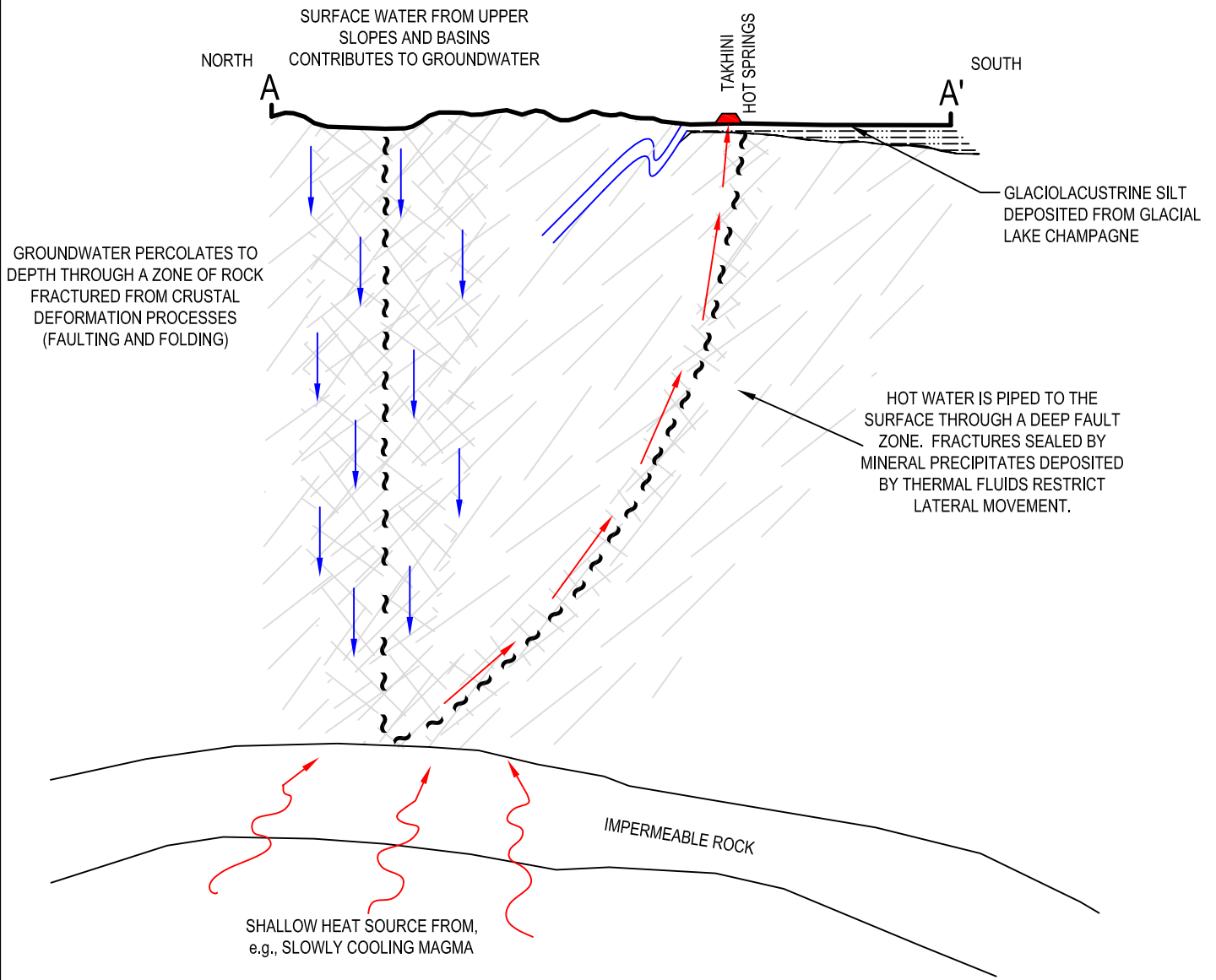


**INTEGRATED GEOTHERMAL ASSESSMENT
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

Atmospheric Tritium Input Function and Measured Tritium Concentrations

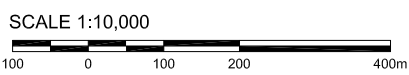
PROJECT NO. W23101139	DWN SK	CKD RMM	REV 1
OFFICE EBA-WHSE	DATE June 2009		

Figure 16



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CONCEPTUAL GEOLOGICAL AND HYDROGEOLOGICAL MODEL - TAKHINI HOT SPRINGS				
PROJECT NO. W23101139	DWN MEZ	CKD JD	REV 0	Figure 17
OFFICE VANC	DATE June 30, 2009			



APPENDIX A

APPENDIX A INTERIM REPORTS



TECHNICAL MEMO

CREATING AND DELIVERING BETTER SOLUTIONS

www.eba.ca

TO: Mr. Garry Umbrich, Director
Takhini Hot Springs Ltd.

DATE: January 26, 2009

C:

MEMO NO: 1

FROM: Scott Schillereff

FILE: W23101139.004

SUBJECT: **Interim Report - Water Sampling and Review of Satellite Imagery**

1.0 INTRODUCTION

EBA is currently conducting a geochemical and thermal assessment of the Takhini Hot Springs Limited (THS) property, including field water sampling and analysis at chemical laboratories, deploying a data logger for temperature monitoring at the hot spring, review of existing satellite imagery and geological and hydrogeological information on the THS property, a low level IR survey, and a geological and water monitoring ground reconnaissance.

This interim report presents a factual summary of the work that has been completed to date. The work completed to date includes Task 2 (water sampling, chemical and isotope analyses, and deployment of temperature data logger) and Task 3 (review of existing remote sensing satellite imagery).

2.0 PROGRESS REPORT FOR TASK 2

Task 2 included water sampling of the THS, the drinking water supply well, and a background surface water sample from Flat Creek west of the THS property, chemical, bacteriological, and isotope analyses of the samples, and the deployment of a dedicated data logger (temperature and pressure) in the THS cistern. The following sections describe the Task 2 work completed to date.

2.1 WATER SAMPLING

EBA collected three water samples from the Takhini Hot Spring, the water supply well, and from Flat Creek on November 25, 2008. Field measurements of alkalinity and ferrous iron were conducted by EBA at the same sampling locations on December 4, 2008.

The THS sample was collected from the cistern at a depth of about 0.5-1 m below the water level using a bailer. Temperature profiles measured at different points within the cistern confirmed that the temperature distribution in the cistern is fairly homogeneous and the sampling location can therefore be considered representative of the spring source.

The sample from the drinking water supply well was taken using the existing submersible well pump and piping after purging the well for about 5 min. The sample was collected from a sampling port at the well head, and prior to any water treatment.

W23101139.004_THS_Interim Report_IFU.doc

The Flat Creek sample represents the background quality of surface water discharging from upstream of the THS property. The grab sample was taken upstream of the bridge on the Takhini River Road crossing Flat Creek. At the time of sampling, Flat Creek was covered by ice with a thickness of about 20-30 cm. A hole was chopped in the ice to obtain a water sample.

All samples that required filtering were filtered in the field immediately following the sample collection. For the analysis of diluted silicon, a field-filtered sample was diluted with distilled water at a ratio of 1:10 (1 part filtered sample and 9 parts distilled water). Samples were collected in laboratory supplied sample bottles and following the sampling instructions provided by the laboratories. The samples were stored in a cooler and samples for chemical and isotope analyses were sent with a chain of custody log and on ice by air mail to the laboratories on November 26, 2008. The samples for bacteriological analysis were submitted to Environmental Health Services in Whitehorse, Yukon on November 26, 2008. Physical and chemical parameters were analyzed by CanTest, Burnaby, B.C. The analyses of stable environmental isotopes, ^{18}O , ^2H (deuterium) and ^3H (tritium), were conducted by the University of Waterloo – Environmental Isotope Laboratory.

In addition to the field parameters measured during sample collection on November 25, 2008, EBA conducted field measurements of alkalinity and ferrous iron at the same sampling locations on December 4, 2008. Alkalinity and ferrous iron concentrations are sensitive to changes in redox conditions and pH and therefore, field measurements are necessary to achieve reasonable accuracy of these parameters.

The results of the chemical, bacteriological, and isotope analyses are summarized in Table 1. A detailed interpretation of the results, including hydrochemical characterization, thermochemical assessment, and comparison against applicable water quality guidelines, will be presented in the final report. The evaluation of these data in the final report will be used to infer deeper temperatures the water was exposed to along its subsurface flow path. An indication of significantly hotter conditions at depth would support the concept of planning for a deep exploratory drilling program. Results will be tabulated and plotted on a trilinear diagram, and environmental isotopes plotted in relation to a meteoric water line. These technical plotting techniques will be used to help determine the origin and subsurface circulation of the water. Other chemical constituents will be used to estimate the higher temperatures that the water has been exposed to at depth (geothermometry).

The results will also be tabulated and compared against commonly used environmental water quality guidelines to determine if there are any deleterious substances in the water, or concentrations above guideline values for the water. It will be useful for the Takhini Hot Spring owners to know if the water contains any chemicals of concern from a regulatory perspective.

Finally, the water chemistry will be assessed to show if there are constituents which might be considered beneficial and therapeutic (e.g., mineral salts). This would be useful for the owner's group when promoting and marketing the hot spring resort.

2.2 DEPLOYMENT OF TEMPERATURE DATA LOGGER

EBA deployed a dedicated temperature and pressure data logger (Solinst Levelogger) in the THS cistern to continuously monitor temperature and water elevation. The data logger was installed at a depth of about 0.9 m below the water level. The temperature and water elevation is being recorded in hourly intervals, starting on November 25, 2008 at 15:00. Long-term temperature data will be valuable to document seasonal variations and responses to substantial precipitation events or seismic disturbances. Although the outflow from the cistern is controlled by the invert elevation of the discharge pipe, there may also be some slight fluctuations of the water level that would provide qualitative information regarding the response to precipitation or seismic events. The temperature and water level information will add rigor to the understanding of the spring behaviour, and be of great interest to future guests.

3.0 PROGRESS REPORT FOR TASK 3

Task 3 includes the review of existing remote sensing satellite imagery. The following activities were completed under this Task:

EBA identified potential sources of thermal satellite imagery. The following criteria were applied:

- Temporal: Late September/early October and first two weeks May – with typically cold temperatures and minimal snow cover; early morning (prior to sunrise if possible) and evening (after sunset) to avoid too much solar interference.
- Spatial: 60°52'45.23"N & 135°21'31.52"W – centered on the THS property.
- Satellites to search: LANDSAT 7 and ASTER. LANDSAT scenes cover 185 km x 185 km, a larger area than ASTER, 120 km x 150 km.

EBA searched the following websites for existing satellite images:

- Canada Center for Remote Sensing
 - http://ccrs.nrcan.gc.ca/index_e.php
- USGS
 - <http://edcns17.cr.usgs.gov/EarthExplorer/>
 - <http://glovis.usgs.gov/>
 - <http://edcwww.cr.usgs.gov/>
- NASA
 - <https://zulu.ssc.nasa.gov/mrsid/>
- Geomatics
 - http://www.iunctus.com/?gclid=CKCinuyh8JYCFRs-awod7R4_rQ
- Global Land Cover Facility
 - <http://glcf.umiacs.umd.edu/data/landsat/>

Our search for existing satellite imagery as outlined above did not indicate existing thermal satellite imagery for the THS site. A future option is to request that suitable imagery be acquired through a satellite tasking request. This option could be further pursued following discussion with THS.

TABLE 1: RESULTS OF CHEMICAL, BACTERIOLOGICAL AND ISOTOPE ANALYSES

Analyte		Units	Sample Name	Takhini Hot Spring	Water Well	Flat Creek
			CanTest ID	811270391	811270422	811270431
			Sample Date	25-11-2008	25-11-2008	25-11-2008
			Sample Location	Cistern	Water Well	Creek
			Easting (UTM, Nad83)	08 480457	08 480978	08 471856
			Northing (UTM, Nad83)	6749360	6749093	6750678
			Matrix	Geothermal Groundwater	Groundwater	Surface water
Detection Limit	Results	Results	Results			
Ion Balance		%		-1.5	0.3	1.5
Water type				Ca-SO ₄	Ca-Mg-SO ₄ -HCO ₃	Ca-HCO ₃
Field Parameters						
Temperature	T	°C		46.2	5.0	0.0
pH		pH units		6.70	7.75	8.19
Dissolved O ₂	DO	mg/L		0.5	0.6	13.6
Electrical Conductivity	EC	µS/cm at 25°C		2289	1015	128
Total Dissolved Solids	TDS	ppm		1145	503	63
Ferrous Iron	Fe ²⁺	mg/L		0.9	1.1	0
p-Alkalinity		mg/L CaCO ₃		0	0	0
m-Alkalinity		mg/L CaCO ₃		140	220	100
Physical Parameters						
pH		pH units	-	7.55	7.93	7.98
Electrical Conductivity	EC	µS/cm at 25°C	1	3400	1110	150
True Color		CU	5	<5	<5	<5
Turbidity		NTU	0.1	5.1	3.0	0.6
Hardness		mg/L CaCO ₃	1	1770	588	73
Dissolved Major Ions						
Calcium	Ca	mg/L	0.05	580	151	23.9
Magnesium	Mg		0.05	78.2	50.9	3.26
Sodium	Na		0.05	36.5	36.3	2.72
Potassium	K		0.1	8.7	1.0	0.7
Silicon	Si		0.25	19.8	8.0	5.4
Diluted Silicon (1:10)	Si		0.25	2	0.8	0.5
Chloride	Cl		0.2	1.5	8.7	<0.20
Fuoride	F		0.05	3.62	<0.25	0.10
Nitrate - N	NO ₃		0.05	<0.05	<0.25	<0.05
Sulfate	SO ₄		0.5	1740	440	4.56
Ortho Phosphorus	P		0.02	<0.02	<0.02	<0.02
Hydroxide Alkalinity	OH		0.5	<0.5	<0.5	<0.5
Carbonate Alkalinity	CO ₃		0.5	<0.5	<0.5	<0.5
Bicarbonate Alkalinity	HCO ₃		0.5	127	236	88.9
Total Alkalinity	CaCO ₃		0.5	104	193	72.8
Dissolved Gases						
Hydrogen Sulfide	H ₂ S	mg/L	0.01	<0.01	-	-
Free Carbon Dioxide	CO ₂		2	16.7	-	-
Metals - Dissolved						
Aluminum	Al	mg/L	0.005	0.013	0.008	<0.005
Antimony	Sb		0.001	0.002	<0.001	<0.001
Arsenic	As		0.001	0.008	<0.001	<0.001
Barium	Ba		0.001	0.016	0.020	0.018
Beryllium	Be		0.001	<0.001	<0.001	<0.001
Bismuth	Bi		0.001	<0.001	<0.001	<0.001
Boron	B		0.05	0.05	<0.05	<0.05
Cadmium	Cd		0.0002	<0.0002	<0.0002	<0.0002
Chromium	Cr		0.001	<0.001	<0.001	<0.001
Cobalt	Co		0.001	<0.001	<0.001	<0.001
Copper	Cu		0.001	0.001	<0.001	<0.001
Gold	Au		5E-11	<5E-11	-	-
Iron	Fe		0.05	0.53	0.62	0.06
Lead	Pb		0.001	<0.001	<0.001	<0.001
Lithium	Li		0.001	0.027	0.011	0.001
Manganese	Mn		0.001	0.017	0.029	0.023
Mercury	Hg		0.00002	<0.00002	<0.00002	<0.00002
Molybdenum	Mo		0.0005	0.0049	0.0017	0.0008
Nickel	Ni		0.001	<0.001	<0.001	<0.001
Phosphorus	P		0.15	<0.15	<0.15	<0.15
Selenium	Se		0.001	0.001	<0.001	<0.001
Silver	Ag		0.00025	<0.00025	<0.00025	<0.00025
Strontium	Sr		0.001	14.0	4.05	0.15
Tellurium	Te		0.001	<0.001	<0.001	<0.001
Thallium	Tl		0.0001	<0.0001	<0.0001	<0.0001
Thorium	Th		0.0005	<0.0005	<0.0005	<0.0005
Tin	Sn		0.001	<0.001	<0.001	<0.001
Titanium	Ti		0.001	<0.001	<0.001	<0.001
Uranium	U		0.0005	<0.0005	0.006	0.0007
Vanadium	V		0.001	<0.001	<0.001	<0.001
Zinc	Zn	0.005	<0.005	0.410	<0.005	
Zirconium	Zr	0.01	<0.01	<0.01	<0.01	
Environmental Isotopes						
Oxygen-18 ¹	δ ¹⁸ O	‰		-22.41	-22.82	-21.6
Deuterium ¹	δ ² H			-174.86	-181.025	-167.84
Tritium	³ H		TU ²		0.8 ± 0.3	-
Bacteriological Analysis						
Total Coliforms		present/absent		present	absent	present
<i>E. Coli</i>				absent	absent	absent

Notes:

"<" indicates less than the laboratory detection limit

"-" indicates not analyzed

p-alkalinity = phenolphthalein alkalinity (carbonate); m-alkalinity = methyl orange (bicarbonate) alkalinity. Total alkalinity = p- plus m-alkalinity

¹ Stable isotope ratios are measured relative to the VSMOW (Vienna Standard Mean Ocean Water):

δ¹⁸O = ((¹⁸O/¹⁶O)_{sample}/¹⁸O/¹⁶O_{reference})*1000‰VSMOW; δ²H = ((²H/¹H)_{sample}/²H/¹H_{reference})*1000‰VSMOW

² TU - Tritium Units (1TU = 0.11919 Becquerels/L per IAEA, 2000 Report; 1TU equals 1 ³H atom in 10¹⁸ ¹H atoms)

TECHNICAL MEMO

CREATING AND DELIVERING BETTER SOLUTIONS

www.eba.ca

TO: Garry Umbrich
Takhini Hot Springs Limited

DATE: February 16, 2009

C:

MEMO NO: 009 - 1

FROM: Scott Schillereff

FILE: W23101139.009

SUBJECT: **Preliminary Results – Takhini Hot Spring Geothermometry Calculations and Water Age**

Further to your request, EBA has carried out a preliminary assessment of geothermometry calculations using the water chemistry reported for the Takhini Hot Spring sample. This assessment was carried out ahead of our original project schedule at your request. In addition, we provide comments on the relative age of the water that is discharging at the spring. We (EBA) based these results on the water chemistry reported in our Interim Report (technical memo) to you, dated January 26, 2009. The geothermometry calculations were carried out by Katherine Johnston, P.Eng. of EBA. These results were checked and water age assessment made by Scott Schillereff, Ph.D., P.Geo. of EBA, with additional review by Andrew Chiasson, Ph.D., P.E. (associate of EBA).

Geothermometry Results

We applied a range of geothermometer formulas to the hot spring water sample chemistry. Based on our current knowledge of the geologic setting of the spring, we consider that silica-based geothermometer formulas give the most reasonable results to indicate the hottest temperature that the hot spring water has been exposed to during its subsurface flow path.

The Takhini Hot Spring water sample had a diluted silicon concentration of 2.0 mg/L. Multiplying by 10 to account for the dilution, and a factor of 2.14 to convert to equivalent silica concentration, gives a SiO₂ (silica) concentration at the spring of 42.8 mg/L. This value was used in the silica-based formulas. A total of four separate silica-based geothermometer formulas produced very consistent calculated temperatures of 95 to 96°C (203 to 205°F) which we interpret, based on current information, to represent the hottest temperature that the spring water was exposed to during its subsurface flow path. It is important to note that the depth and location of these temperature conditions are not currently known for the spring. In addition, these results are preliminary and may be revised in the context of the full geochemical assessment which will follow for this project after the full field program is complete.

Water Age

The hydrogen isotope tritium (³H) had a concentration of 0.8 (+/- 0.3) TU (tritium units) for the Takhini Hot Spring sample. Tritium can be used to date the relative age when water precipitated from the atmosphere and originally recharged groundwater, which then migrated along a subsurface flow path and now discharges at the spring. Prior to atmospheric nuclear weapons testing, starting in 1953, natural concentrations of tritium in water precipitating from the earth's atmosphere were

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low (less than 5-10 TU); after 1953, they were much higher (up to hundreds or thousands of TU). Thus, the tritium concentration in groundwater can indicate whether it recharged before or after 1953. The tritium result for the Takhini Hot Spring sample is less than 5-10 TU which we interpret to mean that the groundwater now discharging from the spring recharged prior to 1953. The precise age of the spring water is not yet known.



APPENDIX B

APPENDIX B SPECTRUM INFRARED LTD. REPORT AND DATA



Takhini Hot Springs Infrared Survey

May 07, 2009

Spectrum Infrared Ltd.

Grant J Eliuk, Infrared Thermographer Level 2, #409

Spectrum Infrared Ltd. was contracted to conduct a helicopter thermal infrared (TIR) survey of the Takhini Hot Springs area, Yukon. The objective of the survey was to identify any existing potential thermal anomalies that may be associated with hot geothermal sources on the property. The survey was conducted May 7, 2009. Figure 1 shows the location of the project area several of the potential thermal anomalies identified.

METHODS AND RESULTS

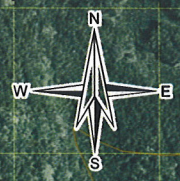
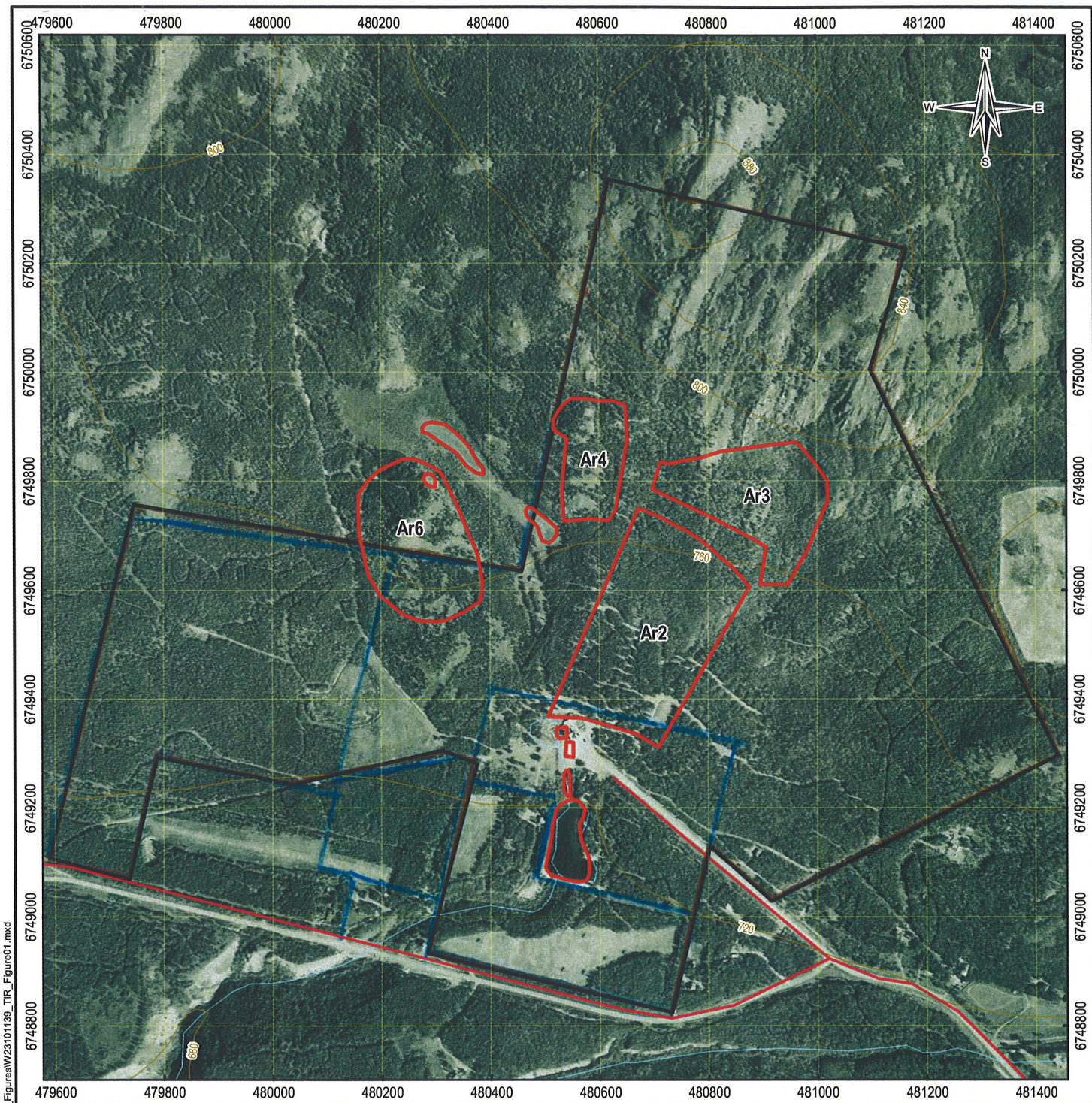
A safety briefing was completed prior to the helicopter survey flight. The pilot was also instructed how to position the aircraft to allow data acquisition while in flight. Lift off occurred at approximately 05:00 on May 7, 2009. Ferry time to Takhini Hot Springs was approximately 10 minutes. The area was surveyed along various flight lines and aspects; total flying time was approximately one hour.

A P660 SC Flir Infrared Scanner was used to image the ground surface. Initial survey altitude was approximately 5,500 feet ASL (above sea level), descending to approximately 3,500 ft ASL. An emissivity (measure of energy radiated from the earth's surface) setting of 0.95 was used. Relative humidity was recorded at 45%, with an ambient temperature of 0° C. The thermal data images were recorded on a Sony 505 digital camera DVD.

Following the flight, the raw footage recorded on the DVD was reviewed at EBA's Whitehorse office to insure complete data recording and quality. Areas identified as potential thermal anomalies or areas of interest were identified and recorded on aerial photographs of the area for post processing analysis. Post-processing included adjusting the level and span, or thermal focus to enhance the interpretation of potential thermal anomalies.

Five (5) potential thermal anomalies were identified from the TIR helicopter survey data and labelled "Ar". The following figures and discussion highlight the potential thermal anomalies observed and describe the results of the post-processing analysis.

Figure 2 is a thermogram showing three areas of potential thermal activity, or thermal anomalies, identified from the TIR survey, labelled Ar2-Ar4, respectively. The polygon Ar1 represents the approximate property boundary from an oblique angle. Figure 3 is an aerial photograph of the overall area and is provided to reference the reader to the location of the thermogram in Figure 2. The crosshairs identify several points where temperatures were calculated using the temperature at Sp2 as a reference point. The values reported at the crosshairs give the temperature difference (rise) from Sp2. Sp1 is located at the discharge pond for the hot springs and may be used as a reference point as well. The temperature values calculated at the crosshairs in the thermogram for each of the anomalies (other than Sp2) are known as 'quantitative infrared'. Ar2, Ar3, Ar4, and Ar5, Ar6 (Figure 4) show the general patterns of potential thermal activity in this area, which is known as 'qualitative infrared'.



Q:\Vancouver\GIS\ENVIRONMENTAL\W23101139_TIR_Figures\W23101139_TIR_Figure01.mxd

- LEGEND**
- Potential Thermal Infrared Anomalies
 - Property Boundary
 - Contour (40m)
 - Road
 - Watercourse
 - Waterbody

NOTES
Base data source:
NTDB 1:50K

DRAFT

**GEOTHERMAL ASSESSMENT PROGRAM
TAKHINI HOT SPRINGS, WHITEHORSE, YUKON**

**Takhini Hot Springs -
Thermal Infrared Survey**

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:10,000	



FILE NO. W23101139_TIR_Figure01.mxd			
PROJECT NO. W23101139	DWN MEZ	CKD GC	REV 0
OFFICE EBA-VANC	DATE June 18, 2009		

Figure 1

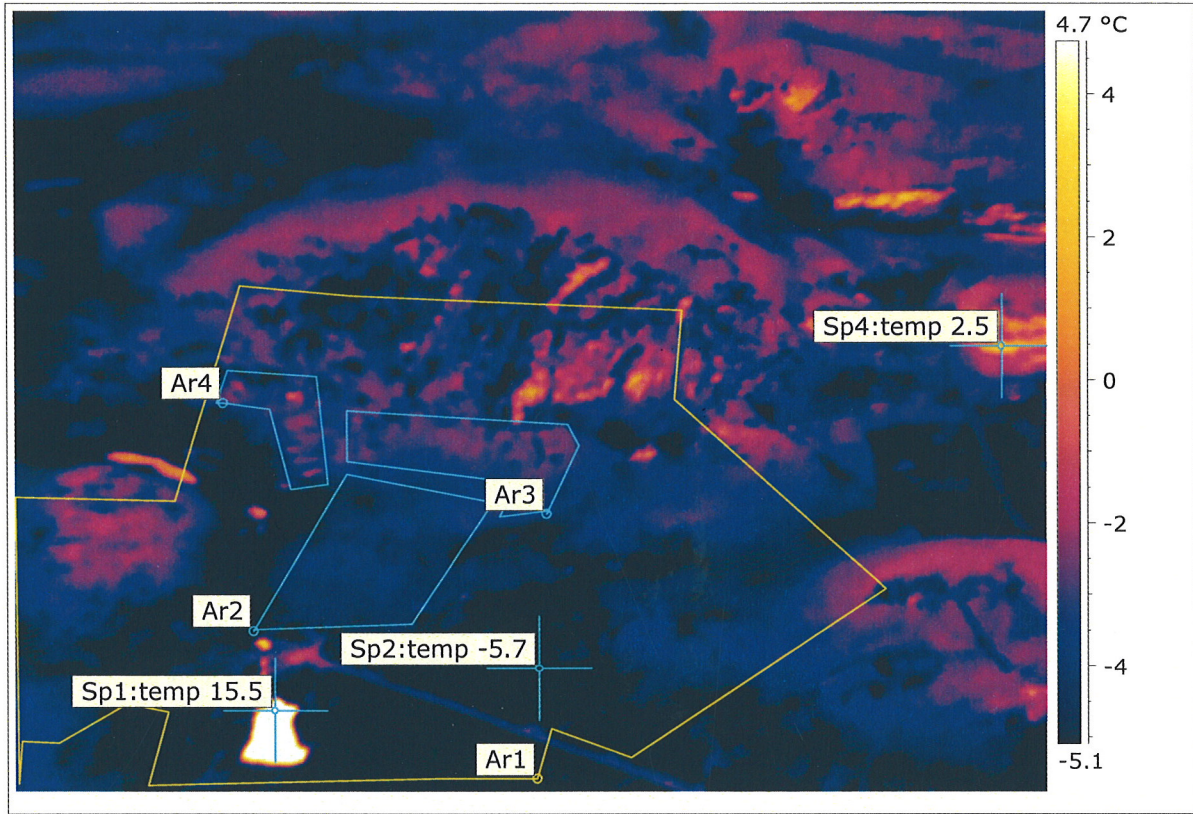


Figure 2. Thermogram of the Takhini Hot Springs area. View is from approximately 5,500 ft ASL, looking southeast to northwest.

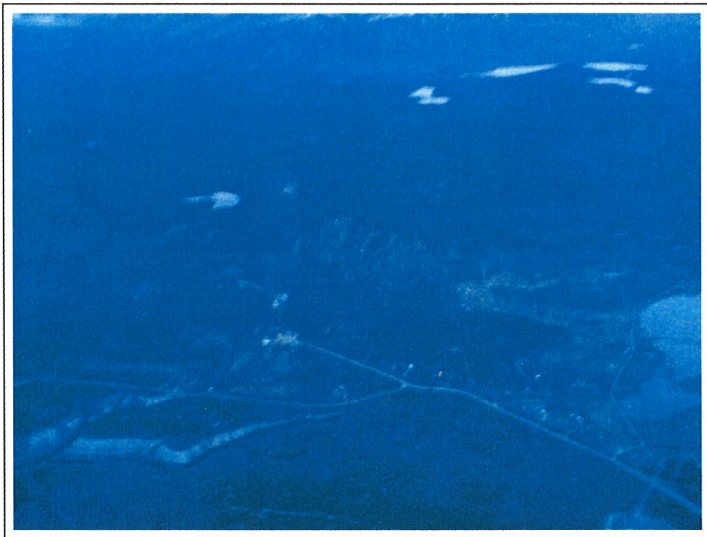


Figure 3. Aerial photograph of the project area looking southeast to northwest. Thermogram in Figure 2 is of the area in the center of the photo.

Figures 4 and 5 display a thermogram and aerial photo, respectively, for the project site from northeast to southwest. In Figure 4, Sp2 is a reference point for the hot springs discharge pond, and Sp3 references ambient earth temperatures. Sp1 is the temperature of the lake to the northeast of the hot springs. Area Ar6 has been identified as a potential area of thermal activity, with elevated temperatures between the start point of the Ar6 polygon and the end point at Sp1. Ar5 shows a thermal pattern that may be associated with the hot springs.

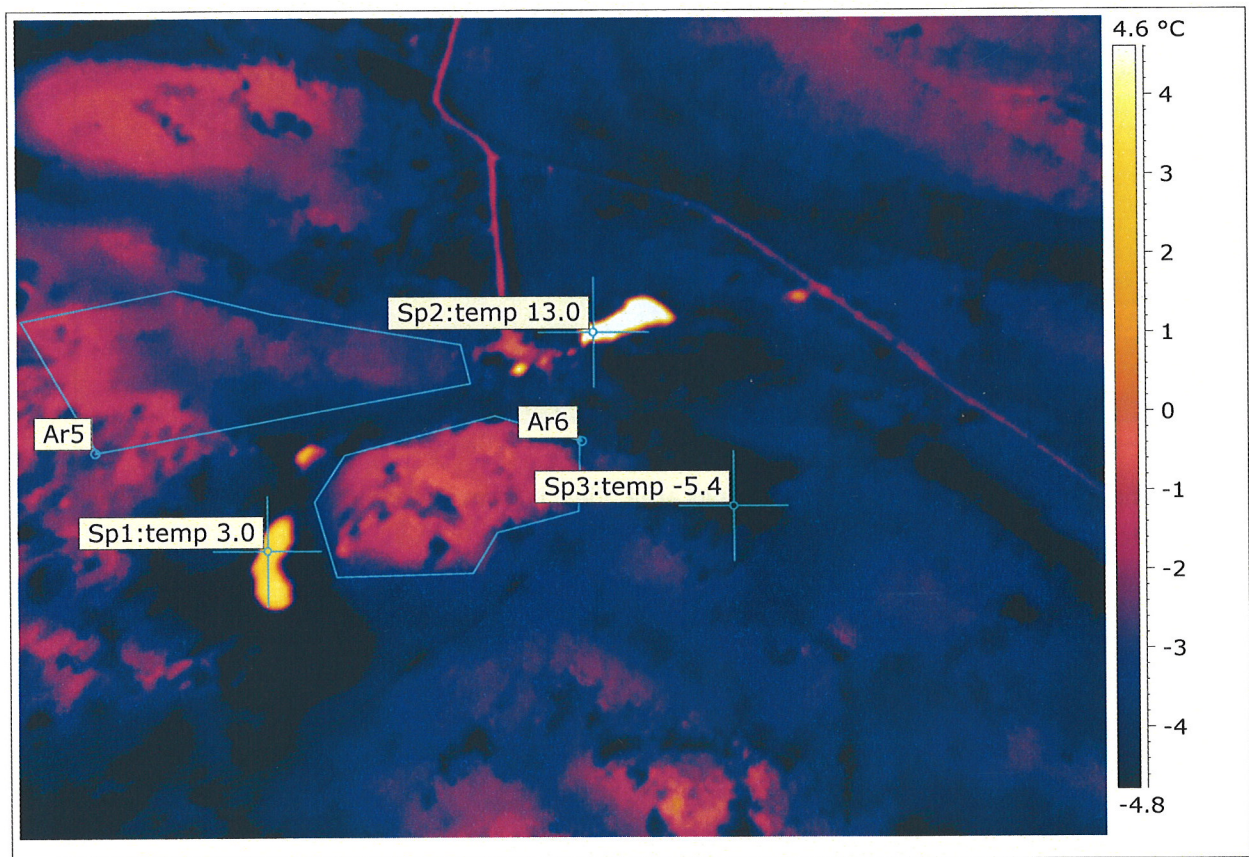


Figure 4. Thermogram of the Takhini Hot Springs area from approximately 3,500 ft ASL looking north to south.

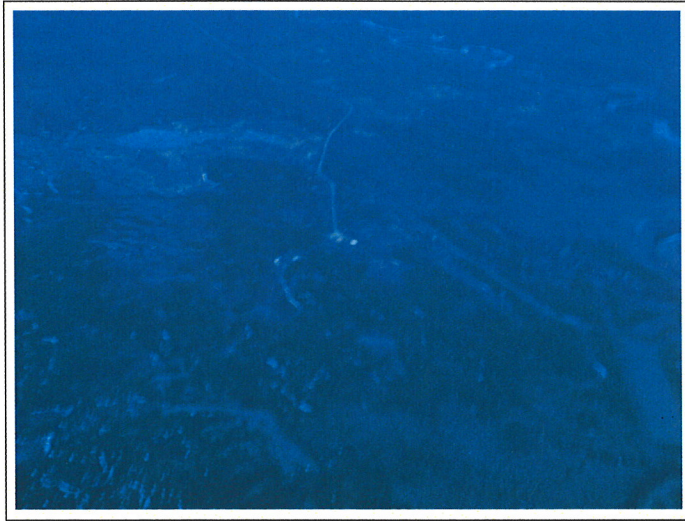


Figure 5. Aerial photograph of the project area looking north to south. Thermogram in Figure 4 is of the area in the center of the photo.

Figure 6 below is a thermogram revealing additional detail from a lower altitude of the potential thermal anomaly shown in Figure 4 and labelled Ar6, and an additional point of interest.

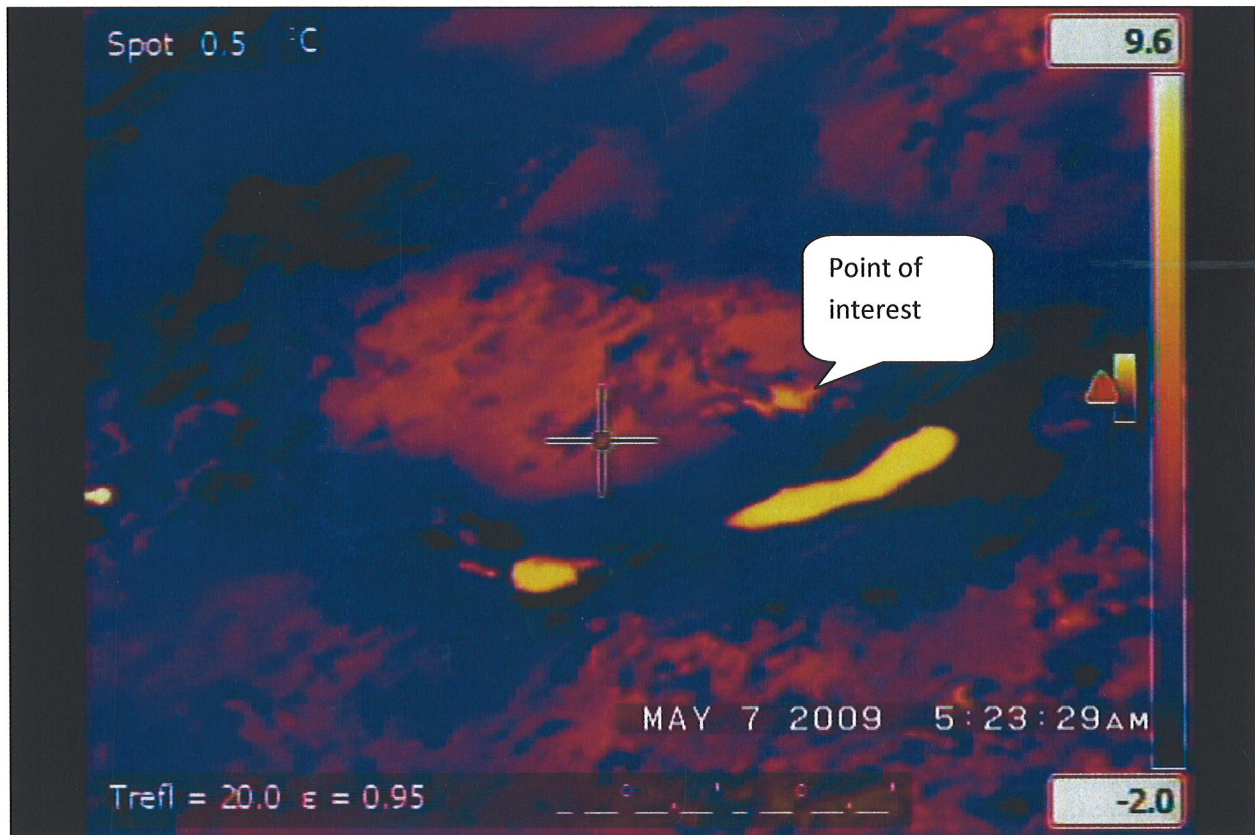


Figure 6. Thermogram.

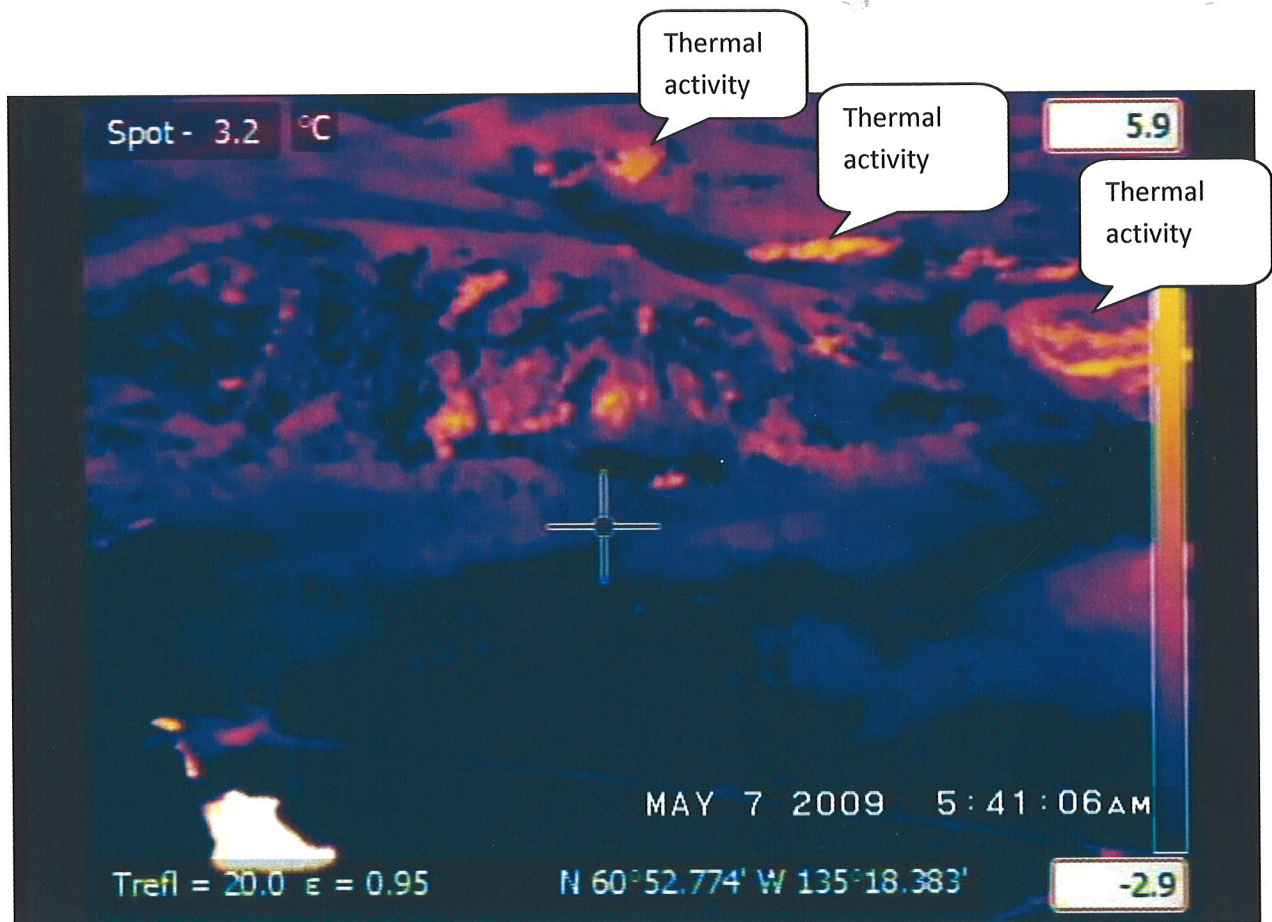


Figure 7. Thermogram.

The thermogram shown in Figure 7 above reveals several “points of interest”, some of which have been labelled. (Please note the labelled points are off the property.) The lighter areas in this thermogram reveal heightened potential thermal activity in areas associated with rock outcrops, which may be the result of solar gain, or heating of the earth’s surface during the day and releasing that stored thermal energy at cooler times. There is also the possibility that this thermal signature could be associated with geothermal activity. Further study will be required to determine the source of the anomalies.

It is also important to note the thermal patterns seen at the crosshair and along the base of the mountain. This thermal pattern may be associated with faulting.

A DVD is being provided with this report which contains a digital recording of the airborne TIR survey.

CONCLUSIONS

Based on the results of the May 7, 2009 helicopter TIR survey of the Takhini Hot Springs area and subsequent post processing of the data collected, the following conclusions are presented:

- ❖ Five (5) potential thermal anomalies were identified in the project area.

If you have any questions regarding the information presented in this report, please do not hesitate to contact me. Thank you for choosing Spectrum Infrared Ltd. This report was documented by a Certified Level 2 Infrared Thermographer, license # 409.

Spectrum Infrared Ltd. assumes no liability directly or indirectly as a result of this report.

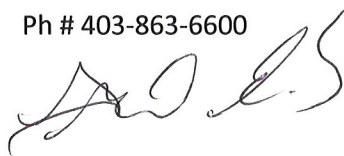
Sincerely,

Grant J Eliuk

Spectrum Infrared Ltd.

Grant@sirltd.com

Ph # 403-863-6600

A handwritten signature in black ink, appearing to read 'Grant J Eliuk', written in a cursive style.



APPENDIX C

APPENDIX C LABORATORY CERTIFICATES



Analysis Report



REPORT ON: Analysis of Water Samples

REPORTED TO: EBA Engineering Consultants
Calcite Business Centre
Unit 6
151 Industrial Road
Whitehorse, YT
Y1A 2V3

Att'n: Ryan Martin/Stephan Klump

CHAIN OF CUSTODY: 2137268
PROJECT NAME: Takhini Hot Springs
PROJECT NUMBER: W23101139

NUMBER OF SAMPLES: 7

REPORT DATE: December 16, 2008

DATE SUBMITTED: November 27, 2008

GROUP NUMBER: 91127134

SAMPLE TYPE: Water

NOTE: Results contained in this report refer only to the testing of samples as submitted. Other information is available on request.

TEST METHODS:

Anions in Water by Ion Chromatography - was determined based on Method 4110 in Standard Methods (21st Edition) and EPA Method 300.0 (Revision 2.1).

Alkalinity in Water - was performed based on Method 2320 in Standard Methods (21st Edition).

Alkalinity in Water - was performed based on Method 2320 in Standard Methods (21st Edition).

Colour (True) in Water - was determined based on Method 2120 in Standard Methods (21st Edition) and Method X321 in the BC Laboratory Manual (2005 Edition).

Conductivity in Water - was performed based on Method 2510 in Standard Methods (21st Edition) and Method X322 in the BC Laboratory Manual (2005 Edition).

Hardness in Water - was calculated based on Method 2340 B in Standard Methods for the Examination of Water and Wastewater (21st Edition).

Orthophosphate (Total Reactive Phosphate) in Water - was performed based on Method 4500-P in Standard Methods (21st Edition) and Method X157 in the BC Laboratory Manual (2005).

(Continued)

CANTEST LTD.

Anna Becalska, PhD
Coordinator, Trace Metals

Page 1 of 17

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



pH in Water - was determined based on Method 4500-H in Standard Methods (21st Edition) and Method X330 in the BC Laboratory Manual (2005).

Turbidity in Water - was performed based on Method 2130 in Standard Methods (21st Edition) and Method X164 in the BC Laboratory Manual (2005 Edition).

Conventional Parameters - analyses were performed using procedures based on those described in the most current editions of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials", (2005 edition) Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" (21st Edition), published by the American Public Health Association.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 245.7, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Field Filtered Metals in Water - Samples were filtered in the field (e.g. at the time of sampling) and quantitatively determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP) and/or Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Sulfur Compounds - analysis was performed using procedures based on EPA Method 918 using gas chromatographic separation and flame photometric detection.

COMMENTS:

Sample 811270391 was analyzed for Gold and the result was <0.05 ng/mL. (nanograms per millilitre) The sample was analyzed by conventional ICP-MS directly, at a dilution of x1. The element was fully quantified against a certified standard using single point calibration. Sample analysis and operation of the ICP-MS was done according to in-house SOPs. Total Metals digest was performed on raw sample submitted to water lab. GJS

TEST RESULTS:

(See following pages)

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	Takhini Hot Spring	Water Well	Flat Creek		
DATE SAMPLED:	Nov 25/08	Nov 25/08	Nov 25/08		
CANTEST ID:	811270391	811270422	811270431	DETECTION LIMIT	UNITS
pH, Laboratory	7.55	7.93	7.98	-	pH units
Conductivity	3400	1110	150	1	µS/cm
True Color	<	<	<	5	CU
Turbidity	5.1	3.0	0.55	0.1	NTU
Hardness CaCO3	1770	588	73	1	mg/L
Free Carbon Dioxide	16.7	-	-	2	mg/L
Total Alkalinity CaCO3	104	193	72.8	0.5	mg/L
Bicarbonate Alkalinity HCO3	127	236	88.9	0.5	mg/L
Carbonate Alkalinity CO3	<	<	<	0.5	mg/L
Hydroxide Alkalinity OH	<	<	<	0.5	mg/L
Dissolved Fluoride F	3.62	< 0.25	0.10	0.05	mg/L
Dissolved Chloride Cl	1.50	8.70	<	0.2	mg/L
Dissolved Nitrate N	<	< 0.25	<	0.05	mg/L
Dissolved Sulphate SO4	1740	440	4.56	0.5	mg/L
Ortho Phosphorus P	<	<	<	0.02	mg/L as P

µS/cm = microsiemens per centimeter

NTU = nephelometric turbidity units

mg/L as P = milligrams per liter as P

< = Less than detection limit

CU = color units

mg/L = milligrams per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		Takhini Hot Spring	Takhini Hot Spring	Water Well	Water Well		
SAMPLE PREPARATION:		TOTAL	DISSOLVED	TOTAL	DISSOLVED		
DATE SAMPLED:		Nov 25/08	Nov 25/08	Nov 25/08	Nov 25/08	DETECTION LIMIT	UNITS
CANTEST ID:		811270391	811270391	811270422	811270422		
Aluminum	Al	-	0.013	-	0.008	0.005	mg/L
Antimony	Sb	-	0.002	-	<	0.001	mg/L
Arsenic	As	-	0.008	-	<	0.001	mg/L
Barium	Ba	-	0.016	-	0.02	0.001	mg/L
Beryllium	Be	-	<	-	<	0.001	mg/L
Bismuth	Bi	-	<	-	<	0.001	mg/L
Boron	B	-	0.05	-	<	0.05	mg/L
Cadmium	Cd	-	<	-	<	0.0002	mg/L
Calcium	Ca	582	580	173	151	0.05	mg/L
Chromium	Cr	-	<	-	<	0.001	mg/L
Cobalt	Co	-	<	-	<	0.001	mg/L
Copper	Cu	-	0.001	-	<	0.001	mg/L
Iron	Fe	-	0.53	-	0.62	0.05	mg/L
Lead	Pb	-	<	-	<	0.001	mg/L
Lithium	Li	-	0.027	-	0.011	0.001	mg/L
Magnesium	Mg	9.94	78.2	63.1	50.9	0.05	mg/L
Manganese	Mn	-	0.017	-	0.029	0.001	mg/L
Mercury	Hg	-	<	-	<	0.02	µg/L
Molybdenum	Mo	-	0.0049	-	0.0017	0.0005	mg/L
Nickel	Ni	-	<	-	<	0.001	mg/L
Phosphorus	P	-	<	-	<	0.15	mg/L
Potassium	K	5.4	8.7	0.9	1	0.1	mg/L
Selenium	Se	-	0.001	-	<	0.001	mg/L
Silicon	Si	19.8	19.3	8	8	0.25	mg/L
Silver	Ag	-	<	-	<	0.00025	mg/L
Sodium	Na	34.9	36.5	45.2	36.3	0.05	mg/L
Strontium	Sr	-	14	-	4.05	0.001	mg/L
Tellurium	Te	-	<	-	<	0.001	mg/L
Thallium	Tl	-	<	-	<	0.0001	mg/L
Thorium	Th	-	<	-	<	0.0005	mg/L
Tin	Sn	-	<	-	<	0.001	mg/L

(Continued on next page)

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	Takhini Hot Spring	Takhini Hot Spring	Water Well	Water Well			
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	DISSOLVED			
DATE SAMPLED:	Nov 25/08	Nov 25/08	Nov 25/08	Nov 25/08	DETECTION LIMIT	UNITS	
CANTEST ID:	811270391	811270391	811270422	811270422			
Titanium	Ti	-	<	-	<	0.001	mg/L
Uranium	U	-	<	-	0.006	0.0005	mg/L
Vanadium	V	-	<	-	<	0.001	mg/L
Zinc	Zn	-	<	-	0.41	0.005	mg/L
Zirconium	Zr	-	<	-	<	0.01	mg/L

mg/L = milligrams per liter
 < = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	Flat Creek	Flat Creek	Takhini Hot Spring-Diluted	Water Well-Diluted			
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	TOTAL			
DATE SAMPLED:	Nov 25/08	Nov 25/08	Nov 25/08	Nov 25/08	DETECTION LIMIT	UNITS	
CANTEST ID:	811270431	811270431	812100204	812100206			
Aluminum	Al	-	<	-	-	0.005	mg/L
Antimony	Sb	-	<	-	-	0.001	mg/L
Arsenic	As	-	<	-	-	0.001	mg/L
Barium	Ba	-	0.018	-	-	0.001	mg/L
Beryllium	Be	-	<	-	-	0.001	mg/L
Bismuth	Bi	-	<	-	-	0.001	mg/L
Boron	B	-	<	-	-	0.05	mg/L
Cadmium	Cd	-	<	-	-	0.0002	mg/L
Calcium	Ca	28.2	23.9	-	-	0.05	mg/L
Chromium	Cr	-	<	-	-	0.001	mg/L
Cobalt	Co	-	<	-	-	0.001	mg/L
Copper	Cu	-	<	-	-	0.001	mg/L
Iron	Fe	-	0.06	-	-	0.05	mg/L
Lead	Pb	-	<	-	-	0.001	mg/L
Lithium	Li	-	0.001	-	-	0.001	mg/L
Magnesium	Mg	3.88	3.26	-	-	0.05	mg/L
Manganese	Mn	-	0.023	-	-	0.001	mg/L
Mercury	Hg	-	<	-	-	0.02	µg/L
Molybdenum	Mo	-	0.0008	-	-	0.0005	mg/L
Nickel	Ni	-	<	-	-	0.001	mg/L
Phosphorus	P	-	<	-	-	0.15	mg/L
Potassium	K	0.5	0.7	-	-	0.1	mg/L
Selenium	Se	-	<	-	-	0.001	mg/L
Silicon	Si	5.4	5.5	2	0.8	0.25	mg/L
Silver	Ag	-	<	-	-	0.00025	mg/L
Sodium	Na	3.0	2.72	-	-	0.05	mg/L
Strontium	Sr	-	0.15	-	-	0.001	mg/L
Tellurium	Te	-	<	-	-	0.001	mg/L
Thallium	Tl	-	<	-	-	0.0001	mg/L
Thorium	Th	-	<	-	-	0.0005	mg/L
Tin	Sn	-	<	-	-	0.001	mg/L

(Continued on next page)

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	Flat Creek	Flat Creek	Takhini Hot Spring-Diluted	Water Well-Diluted		
SAMPLE PREPARATION:	TOTAL	DISSOLVED	TOTAL	TOTAL		
DATE SAMPLED:	Nov 25/08	Nov 25/08	Nov 25/08	Nov 25/08	DETECTION LIMIT	UNITS
CANTEST ID:	811270431	811270431	812100204	812100206		
Titanium Ti	-	<	-	-	0.001	mg/L
Uranium U	-	0.0007	-	-	0.0005	mg/L
Vanadium V	-	<	-	-	0.001	mg/L
Zinc Zn	-	<	-	-	0.005	mg/L
Zirconium Zr	-	<	-	-	0.01	mg/L

mg/L = milligrams per liter
 < = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	Flat Creek-Diluted		
SAMPLE PREPARATION:	TOTAL		
DATE SAMPLED:	Nov 25/08		
CANTEST ID:	812100207	DETECTION LIMIT	UNITS
Silicon	Si	0.5	0.25 mg/L

mg/L = milligrams per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Analysis of Sulfur Components in Liquid

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Hydrogen Sulfide
Takhini Hot Spring	Nov 25/08	811270420	<
DETECTION LIMIT UNITS			10 µg/L

µg/L = micrograms per liter
< = Less than detection limit

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control for Conventional Parameters in Water

Parameter		QC Type	QC Result	Units	Lower Limit	Upper Limit
pH, Laboratory		pH Calibration Verification	100.3	% Recovery	98	102
		Duplicate	0.0	R.P.D.	0	3
		Duplicate	1.0	R.P.D.	0	3
Conductivity		Conductivity Calibration Ver.	100.7	% Recovery	96	104
		Blank	NC	uS/cm	0	1
		Duplicate	PASS	R.P.D.	0	5
True Color		Blank	< 5	CU	0	5
		Calibration Verification	87.5	% Recovery	75	105
Turbidity		Blank	< 0.1	NTU	0	0.1
		Duplicate	3.4	R.P.D.	0	15
Total Alkalinity	CaCO3	Blank	0.7	mg/L	0	4
		Alkalinity Calibration Ver.	94.0	% Recovery	85	115
Dissolved Fluoride	F	Dionex Certified Standard	99.0	% Recovery	90	110
		Duplicate	0.0	R.P.D.	0	10
		Duplicate	PASS	R.P.D.	0	10
Dissolved Chloride	Cl	Dionex Certified Standard	96.6	% Recovery	90	110
		Duplicate	0.0	R.P.D.	0	12
		Duplicate	1.9	R.P.D.	0	12
		Duplicate	PASS	R.P.D.	0	12
Dissolved Nitrate	N	Dionex Certified Standard	97.8	% Recovery	90	110
Dissolved Sulphate	SO4	Dionex Certified Standard	94.7	% Recovery	90	110
		Duplicate	0.1	R.P.D.	0	10
		Duplicate	0.2	R.P.D.	0	10
		Duplicate	1.5	R.P.D.	0	10
Ortho Phosphorus	P	Blank	< 0.02	mg/L as P	0	0.05
		Spike	101.0	% Recovery	90	114
		Calibration Verification	101.0	% Recovery	92	108

(Continued on next page)

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control for Conventional Parameters in Water

Parameter	QC Type	QC Result	Units	Lower Limit	Upper Limit
Ortho Phosphorus P	Duplicate	0.0	R.P.D.	0	16

uS/cm = microsiemens per centimeter

NTU = nephelometric turbidity units

mg/L as P = milligrams per liter as P

< = Less than detection limit

R.P.D. = Relative Percent Difference

PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.

NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

CU = color units

mg/L = milligrams per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control for Dissolved Metals Analysis in Water (QC# 116822)

Parameter	Duplicate (R.P.D.) 811270422	Duplicate Limits	Duplicate (R.P.D.) 811270463	Duplicate Limits	Duplicate (R.P.D.) 812010206	Duplicate Limits
Mercury Hg	NC	20	NC	20	NC	20

ug/L = micrograms per liter

R.P.D. = Relative Percent Difference

NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control for Dissolved Metals Analysis in Water (QC# 116822)

Parameter	Spike (% Recovery) 811270422	Spike Limits	Spike (% Recovery) 811270463	Spike Limits	Spike (% Recovery) 812010206	Spike Limits
Mercury Hg	100	68 - 130	105	68 - 130	98	68 - 130

ug/L = micrograms per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control for Total Metals Analysis in Water (QC# 116705)

Parameter	Potassium/Silicon Spike Vista (% Recovery)	Potassium/Silicon Spike Vista Limits	Total Blank (mg/L)	Total Blank Limits
Calcium Ca	-	-	< 0.05	0.05
Magnesium Mg	-	-	< 0.05	0.05
Potassium K	116	80 - 120	-	-
Sodium Na	-	-	< 0.1	0.2

mg/L = milligrams per liter

REPORTED TO: EBA Engineering Consultants

REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control Frequency Summary

Total Metals Preparation (Batch# 116705)

QC Type	No. Samples
ICPMS Spike	1
ICP Spike Vista ICAP	1
Potassium/Silicon Spike Vista	1
ICPMS Lab Fortified Blank	1
Total Blank	2
Duplicate	4

Water Lab Ion Chromatography (Batch# 116707)

QC Type	No. Samples
Blank	2
Duplicate	3

Auto-Titrator Analysis (Batch# 116722)

QC Type	No. Samples
Blank	1
Duplicate	3

Colour Analysis (Batch# 116759)

QC Type	No. Samples
Blank	1
Duplicate	1

Turbidity Analysis (Batch# 116760)

QC Type	No. Samples
Blank	1
Duplicate	2

(Continued on next page)

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REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control Frequency Summary

Mercury Water Bromination Prep (Batch# 116822)

QC Type	No. Samples
Duplicate	3
Spike	3

Total Metals Preparation (Batch# 117199)

QC Type	No. Samples
ICPMS Spike	1
ICP Spike Vista ICAP	1
ICPMS Lab Fortified Blank	1
Total Blank	2
Duplicate	4

Total Metals Preparation (Batch# 116705)

QC Type	No. Samples
Batch Size	44

Water Lab Ion Chromatography (Batch# 116707)

QC Type	No. Samples
Batch Size	33

Auto-Titrator Analysis (Batch# 116722)

QC Type	No. Samples
Batch Size	35

(Continued on next page)

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REPORT DATE: December 16, 2008

GROUP NUMBER: 91127134



Batch Quality Control Frequency Summary

Colour Analysis (Batch# 116759)

QC Type	No. Samples
Batch Size	7

Turbidity Analysis (Batch# 116760)

QC Type	No. Samples
Batch Size	18

Mercury Water Bromination Prep (Batch# 116822)

QC Type	No. Samples
Batch Size	31

Total Metals Preparation (Batch# 117199)

QC Type	No. Samples
Batch Size	45

Bacteriological Analyses

Yukon Health and Social Services – Environmental and Health Services



Health and Social Services
Santé et des Affaires sociales
Environmental Health Services
Service d'hygiène du milieu

EBA Engineering
BACTERIOLOGICAL ANALYSIS OF DRINKING WATER
ANALYSE BACTÉRIOLOGIQUE DE L'EAU POTABLE

DEC 04 2008

#2 Hospital Road, Whitehorse, Yukon Y1A 3H8
phone : (867) 667-8391 fax : (867) 667-8322
Toll free: 1-800-661-0408 ext.8391

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Tél : (867) 667-8391 Téléc. : (867) 667-8322
Toll free: 1-800-661-0408, poste 8391

RECEIVED

Contact Information • Coordonnées de la personne-ressource

Contact Person Stephen Klump Phone 867 668 3068
Personne-ressource Stephen Klump Téléphone 867 668 3068
Mailing address EBA Engineering, Calcite Business Fax 867 668 4549
Adresse postale EBA Engineering, Calcite Business Télécopieur 867 668 4549
Centre, Unit 6, 151 Industrial Road, Whitehorse Postal code Y1A 2V3
Code postal Y1A 2V3
First Nation, Municipal or Business Name _____
Nom de la première nation, de la municipalité ou de l'entreprise _____
Agent _____ Fax _____
Agent _____ Télécopieur _____

Sampling Location • Lieu de la prise d'échantillon

Municipal Address Takhini Hot Springs Subdivision _____
Adresse municipale Takhini Hot Springs Lotissement _____
Legal Description Lot _____ Quad _____ Plan no. _____
Désignation officielle Terrain _____ Quadrilatère _____ Plan n° _____
Other Information (e.g., Location, Business / Building Name) _____
Autres renseignements (par ex. : emplacement, nom de l'entreprise, nom de l'édifice) _____

Sample Collection / Échantillonnage

Sample Collected By Stephen Klump Date 08/11/25 Time 1:00 am/pm (pm)
Échantillon prélevé par Stephen Klump Date 08/11/25 Heure 1:00 (pm)
YY/MM/DD • AA/MM/JJ
Sampling Site (e.g., kitchen tap) cistern
Point d'échantillonnage (par ex. : robinet de cuisine) cistern
Is this a Resample from a Previous Test? Yes No Previous Sample Number _____
Est-ce un deuxième échantillon d'un test antérieur? Oui Non Numéro de l'échantillon précédent _____

Sample Supply / Source d'approvisionnement

Public Supply Bulk Water Distributor Business Private Residence
Municipal - par canalisation Municipal - par camion Privé - entreprise Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well Driven Well Drilled Well Depth of Well _____
Puits creusé Puits tubulaire Puits foré à la sondeuse Profondeur du puits _____
 Water Holding Tank Other (explain) cistern
Eau livrée Autre (précisez) _____

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? Yes No Free Available Chlorine _____ p.p.m.
L'eau contient-elle du chlore? Oui Non Chlore libre disponible _____ mg/L
Other Treatment Systems (e.g., UV, softener, filter) _____
Autre dispositif de traitement (par ex. : désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau) _____

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample Date 08/11/26 Time 10:50 am/pm _____ By [Signature]
Réception de l'échantillon Date 08/11/26 Heure 10:50 (pm) Par [Signature]
YY/MM/DD • AA/MM/JJ
Condition of Sample Satisfactory Unsatisfactory (explain) _____
État de l'échantillon Satisfaisant Non satisfaisant (précisez) _____
Incubation Date 08/11/26 Time 4:50 am/pm _____ By [Signature] Incubator 2
Incubation Date 08/11/26 Heure 4:50 (pm) Par [Signature] Incubation 2
YY/MM/DD • AA/MM/JJ
Analysis Completed Date 08/11/27 Time 4:50 am/pm _____ By [Signature]
Analyse terminée Date 08/11/27 Heure 4:50 (pm) Par [Signature]
YY/MM/DD • AA/MM/JJ

Results (See Reverse Side for Interpretation)
Résultats (Voir au verso l'interprétation des résultats)

<p>Total Coliforms/Coliformes totaux</p> <p><input checked="" type="checkbox"/> Present / Présence <input type="checkbox"/> Absent / Absence</p>	<p>E. coli/E. coli</p> <p><input type="checkbox"/> Present / Présence <input checked="" type="checkbox"/> Absent / Absence</p>
---	---

Comments / Commentaires

Results Satisfactory for Bacteriological Quality
Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample
Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions

RAW WATER - NO ACTION REQ'D
[Signature]



Health and Social Services
Santé et des Affaires sociales
Environmental Health Services
Service d'hygiène du milieu

BACTERIOLOGICAL ANALYSIS OF DRINKING WATER
ANALYSE BACTÉRIOLOGIQUE DE L'EAU POTABLE
CONSULTANTS LTD.
WHITEHORSE

#2 Hospital Road, Whitehorse, Yukon Y1A 3H8
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DEC 07 2006

Contact Information / Informations de la personne-ressource

Contact Person / Personne-ressource: Stephen Klump Phone / Téléphone: 668 3068
Mailing address / Adresse postale: EBA Engineering, Calcite business Centre, Unit 6, 151 Industrial Road, Whitehorse Fax / Télécopieur: 668 4349
Postal code / Code postal: Y1A 2V3
First Nation, Municipal or Business Name / Nom de la première nation, de la municipalité ou de l'entreprise: _____
Agent / Agent: _____ Fax / Télécopieur: _____

Sampling Location / Lieu de la prise d'échantillon

Municipal Address / Adresse municipale: Talchini Hot Springs Subdivision / Lotissement: _____
Legal Description / Désignation officielle Terrain: _____ Quad / Quadrilatère: _____ Plan no. / Plan n°: _____
Other Information (e.g., Location, Business / Building Name) / Autres renseignements (par ex. : emplacement, nom de l'entreprise, nom de l'édifice): _____

Sample Collection / Échantillonnage

Sample Collected By / Échantillon prélevé par: Stephen Klump Date / Date: 08/11/25 Time / Heure: 3:00 am pm
Sampling Site (e.g., kitchen tap) / Point d'échantillonnage (par ex. : robinet de cuisine): well tap
Is this a Resample from a Previous Test? / Est-ce un deuxième échantillon d'un test antérieur? Yes / Oui No / Non Previous Sample Number / Numéro de l'échantillon précédent: _____

Sample Supply / Source d'approvisionnement

Public Supply / Municipal - par canalisation Bulk Water Distributor / Municipal - par camion Business / Privé - entreprise Private Residence / Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well / Puits creusé Driven Well / Puits tubulaire Drilled Well / Puits foré à la sondeuse Depth of Well / Profondeur du puits: _____
 Water Holding Tank / Eau livrée Other (explain) / Autre (précisez): _____

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? / L'eau contient-elle du chlore? Yes / Oui No / Non Free Available Chlorine / Chlore libre disponible: _____ p.p.m. / mg/L
Other Treatment Systems (e.g., UV, softener, filter) / Autre dispositif de traitement (par ex. : désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau): _____

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample / Réception de l'échantillon Date / Date: 08/11/26 Time / Heure: 10:30 am pm By / Par: M
Condition of Sample / État de l'échantillon Satisfactory / Satisfaisant Unsatisfactory (explain) / Non satisfaisant (précisez): _____
Incubation / Incubation Date / Date: 08/11/26 Time / Heure: 4:50 am pm By / Par: J Incubator / Incubation: 2
Analysis Completed / Analyse terminée Date / Date: 08/11/27 Time / Heure: 4:50 am pm By / Par: J

Results (See Reverse Side for Interpretation) / Résultats (Voir au verso l'interprétation des résultats)

Total Coliforms/Coliformes totaux	E. coli/E. coli
<input type="checkbox"/> Present / Présence <input checked="" type="checkbox"/> Absent / Absence	<input type="checkbox"/> Present / Présence <input checked="" type="checkbox"/> Absent / Absence

Comments / Commentaires

Results Satisfactory for Bacteriological Quality / Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample / Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions



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Mailing address / Adresse postale: EBA Engineering, Calcutt Business Centre, Unit 6, 151 Industrial Road, Whitehorse Fax / Télécopieur: 668-4349
Postal code / Code postal: Y1A 2V3
First Nation, Municipal or Business Name / Nom de la première nation, de la municipalité ou de l'entreprise: _____
Agent / Agent: _____ Fax / Télécopieur: _____

Sampling Location • Lieu de la prise d'échantillon

Municipal Address / Adresse municipale: Flat Creek Subdivision / Lotissement: _____
Legal Description / Désignation officielle Terrain: _____ Lot / Parcelle: _____ Quad / Quadrilatère: _____ Plan no. / Plan n°: _____
Other Information (e.g., Location, Business / Building Name) / Autres renseignements (par ex. : emplacement, nom de l'entreprise, nom de l'édifice): _____

Sample Collection / Échantillonnage

Sample Collected By / Échantillon prélevé par: Stephan Klump Date / Date: 08/11/25 Time / Heure: 5:00 am
Sampling Site (e.g., kitchen tap) / Point d'échantillonnage (par ex. : robinet de cuisine): _____
Is this a Resample from a Previous Test? / Est-ce un deuxième échantillon d'un test antérieur? Yes / Oui No / Non Previous Sample Number / Numéro de l'échantillon précédent: _____

Sample Supply / Source d'approvisionnement

Public Supply / Municipal - par canalisation Bulk Water Distributor / Municipal - par camion Business / Privé - entreprise Private Residence / Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well / Puits creusé Driven Well / Puits tubulaire Drilled Well / Puits foré à la sondeuse Depth of Well / Profondeur du puits: _____
 Water Holding Tank / Eau livrée Other (explain) / Autre (précisez): creek (special project)

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? / L'eau contient-elle du chlore? Yes / Oui No / Non Free Available Chlorine / Chlore libre disponible: _____ p.p.m. / mg/L
Other Treatment Systems (e.g., UV, softener, filter) / Autre dispositif de traitement (par ex. : désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau): _____

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample / Réception de l'échantillon: Date / Date: 08/11/26 Time / Heure: 10:50 am By / Par: [Signature]
Condition of Sample / État de l'échantillon: Satisfactory / Satisfaisant Unsatisfactory (explain) / Non satisfaisant (précisez): _____
Incubation / Incubation: Date / Date: 08/11/26 Time / Heure: 4:50 pm By / Par: [Signature] Incubator / Incubation: 2
Analysis Completed / Analyse terminée: Date / Date: 08/11/27 Time / Heure: 4:50 pm By / Par: [Signature]

Results (See Reverse Side for Interpretation) / Résultats (Voir au verso l'interprétation des résultats)

<p>Total Coliforms/Coliformes totaux</p> <p><input checked="" type="checkbox"/> Present / Présence <input type="checkbox"/> Absent / Absence</p>	<p>E. coli/E. coli</p> <p><input type="checkbox"/> Present / Présence <input checked="" type="checkbox"/> Absent / Absence</p>
---	---

Comments / Commentaires

Results Satisfactory for Bacteriological Quality / Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample / Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions / Enquête et prise de mesures correctives appropriées
RAW WATER - NO ACTION
REQUIERED - I



Health and Social Services
Santé et des Affaires sociales
Environmental Health Services
Service d'hygiène du milieu

BACTERIOLOGICAL ANALYSIS OF DRINKING WATER
ANALYSE BACTÉRIOLOGIQUE DE L'EAU POTABLE

#2 Hospital Road, Whitehorse, Yukon Y1A 3H8
phone : (867) 667-8391 fax : (867) 667-8322
Toll free: 1-800-661-0408 ext.8391

EBA Engineering
Consultants Ltd.
WHITEHORSE
2, chemin Hospital, Whitehorse (Yukon) Y1A 3H8
Tél. : (867) 667-8391 Téléc. : (867) 667-8322
Sans frais au Yukon 1-800-661-0408, poste 8391

Contact Information • Coordonnées de la personne

Contact Person **Stephen Klump / EBA** RECEIVED
Personne-ressource
Mailing address **151 Industrial Road** Telephone **667-2071 x250**
Adresse postale **Whitehorse** Fax **668-4349**
Postal code **Y1A 2V3** Télécopieur

First Nation, Municipal or Business Name
Nom de la première nation, de la municipalité ou de l'entreprise
Agent Fax
Agent Télécopieur

Sampling Location • Lieu de la prise d'échantillon

Municipal Address **Takhini Hot Springs** Subdivision
Adresse municipale Lotissement
Legal Description Lot Quad Plan no.
Designation officielle Terrain Quadrilatère Plan n°
Other Information (e.g., Location, Business / Building Name)
Autres renseignements (par ex. : emplacement, nom de l'entreprise, nom de l'édifice)

Sample Collection / Échantillonnage

Sample Collected By **S. Klump** Date **09/05/12** Time **4** am
Échantillon prélevé par Date Heure (pm)
Sampling Site (e.g., kitchen tap) **well head** YYYMM/DD • AAMM/JJ
Point d'échantillonnage (par ex. : robinet de cuisine)
Is this a Resample from a Previous Test? Yes No Previous Sample Number
Est-ce un deuxième échantillon d'un test antérieur? Oui Non Numéro de l'échantillon précédent

Sample Supply / Source d'approvisionnement

Public Supply Bulk Water Distributor Business Private Residence
Municipal - par canalisation Municipal - par camion Privé - entreprise Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well Driven Well Drilled Well Depth of Well
Puits creusé Puits tubulaire Puits foré à la sonde Profondeur du puits
 Water Holding Tank Other (explain)
Eau livrée Autre (précisez)

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? Yes No Free Available Chlorine p.p.m.
L'eau contient-elle du chlore? Oui Non Chlore libre disponible mg/L
Other Treatment Systems (e.g., UV, softener, filter)
Autre dispositif de traitement (par ex. : désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau)

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample Date **09/05/13** Time **1000** am By **BT**
Réception de l'échantillon Date Heure pm Par
Condition of Sample Satisfactory Unsatisfactory (explain)
État de l'échantillon Satisfaisant Non satisfaisant (précisez)
Incubation Date **09/05/13** Time **1120** pm By **J** Incubator **2**
Incubation Date Heure pm Par Incubation
Analysis Completed Date **09/05/14** Time **1120** pm By **J**
Analyse terminée Date Heure pm Par

Results (See Reverse Side for Interpretation)
Résultats (Voir au verso l'interprétation des résultats)

Total Coliforms/Coliformes totaux		E. coli/E. coli	
<input type="checkbox"/> Present / Présence	<input checked="" type="checkbox"/> Absent / Absence	<input type="checkbox"/> Present / Présence	<input checked="" type="checkbox"/> Absent / Absence

Comments / Commentaires

Results Satisfactory for Bacteriological Quality
Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample
Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions
Faire enquête et appliquer les mesures correctives nécessaires
 Boil Water Before Consumption
Faire bouillir l'eau avant de la consommer



Health and Social Services
Santé et des Affaires sociales
Environmental Health Services
Service d'hygiène du milieu

BACTERIOLOGICAL ANALYSIS OF DRINKING WATER
ANALYSE BACTÉRIOLOGIQUE DE L'EAU POTABLE

#4

Engineering
EBA
WHITEHORSE

MAY 21 2009

#2 Hospital Road, Whitehorse, Yukon Y1A 3H8
phone : (867) 667-8391 fax : (867) 667-8322
Toll free: 1-800-661-0408 ext.8391

2, chemin Hospital, Whitehorse (Yukon) Y1A 3H8
Tél. : (867) 667-8391 Téléc. : (867) 667-8322
Sans frais au Yukon 1-800-661-0408 ext. 8391

RECEIVED

Contact Information • Coordonnées de la personne-ressource

Contact Person Stephan Klump / EBA Phone 668-2071 x250
Personne-ressource
Mailing address 151 Industrial Road Fax 668-4349
Adresse postale Whitehorse Postal code Y1A 2V3

First Nation, Municipal or Business Name
Nom de la première nation, de la municipalité ou de l'entreprise
Agent
Agent

Sampling Location • Lieu de la prise d'échantillon

Municipal Address Talmine Hot Spring Subdivision
Adresse municipale Lotissement
Legal Description Lot Quad Plan no.
Désignation officielle Terrain Quadrilatère Plan n°
Other Information (e.g., Location, Business / Building Name)
Autres renseignements (par ex. : emplacement, nom de l'entreprise, nom de l'édifice)

Sample Collection / Échantillonnage

Sample Collected By Stephan Klump Date 09/05/12 Time 2 am
Échantillon prélevé par Date Heure
Sampling Site (e.g., kitchen tap) Cistern
Point d'échantillonnage (par ex. : robinet de cuisine)
Is this a Resample from a Previous Test? Yes No Previous Sample Number
Est-ce un deuxième échantillon d'un test antérieur? Oui Non Numéro de l'échantillon précédent

Sample Supply / Source d'approvisionnement

Public Supply Bulk Water Distributor Business Private Residence
Municipal - par canalisation Municipal - par camion Privé - entreprise Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well Driven Well Drilled Well Depth of Well
Puits creusé Puits tubulaire Puits foré à la sondeuse Profondeur du puits
 Water Holding Tank Other (explain) Spring / no drinking water!
Eau livrée Autre (précisez)

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? Yes No Free Available Chlorine p.p.m.
L'eau contient-elle du chlore? Oui Non Chlore libre disponible mg/L
Other Treatment Systems (e.g., UV, softener, filter)
Autre dispositif de traitement (par ex. : désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau)

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample Date 09/05/13 Time 1000 am By BT
Réception de l'échantillon Date Heure pm Par
Condition of Sample Satisfactory Unsatisfactory (explain)
État de l'échantillon Satisfaisant Non satisfaisant (précisez)
Incubation Date 09/05/13 Time 205 am By 2 incubator
Incubation Date Heure pm Par Incubation
Analysis Completed Date Time am By
Analyse terminée Date Heure pm Par

Results (See Reverse Side for Interpretation)
Résultats (Voir au verso l'interprétation des résultats)

Total Coliforms/Coliformes totaux <input checked="" type="checkbox"/> Present / Présence <u>5</u> <input type="checkbox"/> Absent / Absence	E. coli/E. coli <input type="checkbox"/> Present / Présence <u>0</u> <input checked="" type="checkbox"/> Absent / Absence
--	--

Comments / Commentaires

Results Satisfactory for Bacteriological Quality
Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample
Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions
Faire enquête et appliquer les mesures correctives nécessaires
 Boil Water Before Consumption
Traiter l'eau avant de la consommer

ENUMERATION REQ'D
made a note
method deviation
By 2
Par



Health and Social Services
Santé et des Affaires sociales
Environmental Health Services
Service d'hygiène du milieu

BACTERIOLOGICAL ANALYSIS OF DRINKING WATER
ANALYSE BACTÉRIOLOGIQUE DE L'EAU POTABLE

#2 Hospital Road, Whitehorse, Yukon Y1A 3H8
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Tél. : (867) 667-8391 Téléc. : (867) 667-8322
Sans frais au Yukon 1-800-661-0408, poste 8391

#C3151
WHITEHORSE

Contact Information • Coordonnées de la personne-ressource

Contact Person / Personne-ressource: Stephan Klump / EBA Phone / Téléphone: 667-2071 x250
Mailing address / Adresse postale: 151 Industrial Road Fax / Télécopieur: 668-55554349
Whitehorse Y1A 2V3 Postal code / Code postal: _____
First Nation, Municipal or Business Name / Nom de la première nation, de la municipalité ou de l'entreprise: _____
Agent / Agent: _____ Fax / Télécopieur: _____

Sampling Location • Lieu de la prise d'échantillon

Municipal Address / Adresse municipale: Takhini Hot Springs Subdivision / Lotissement: _____
Legal Description / Désignation officielle Terrain: _____ Lot / Parcelle: _____ Quad / Quadrilatère: _____ Plan no. / Plan n°: _____
Other Information (e.g., Location, Business / Building Name) / Autres renseignements (par ex.: emplacement, nom de l'entreprise, nom de l'édifice): _____

Sample Collection / Échantillonnage

Sample Collected By / Échantillon prélevé par: Stephan Klump Date / Date: 09/05/12 Time / Heure: 12 am / pm
Sampling Site (e.g., kitchen tap) / Point d'échantillonnage (par ex.: robinet de cuisine): Property discharge
Is this a Resample from a Previous Test? / Est-ce un deuxième échantillon d'un test antérieur? Yes / Oui No / Non Previous Sample Number / Numéro de l'échantillon précédent: _____

Sample Supply / Source d'approvisionnement

Public Supply / Municipal - par canalisation Bulk Water Distributor / Municipal - par camion Business / Privé - entreprise Private Residence / Privé - résidence

Sample Source / Provenance de l'échantillon

Dug Well / Puits creusés Driven Well / Puits tubulaire Drilled Well / Puits foré à la sondeuse Depth of Well / Profondeur du puits: _____
 Water Holding Tank / Eau livrée Other (explain) / Autre (précisez): Creek, no drinking water!

Water Treatment / Traitement de l'eau

Is the Water Chlorinated? / L'eau contient-elle du chlore? Yes / Oui No / Non Free Available Chlorine / Chlore libre disponible: _____ p.p.m. / mg/L
Other Treatment Systems (e.g., UV, softener, filter) / Autre dispositif de traitement (par ex.: désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau): _____

For Laboratory Use Only / À l'usage du laboratoire seulement

Receipt of Sample / Réception de l'échantillon: Date / Date: 09/05/13 Time / Heure: 1000 am / pm By / Par: BT
Condition of Sample / État de l'échantillon: Satisfactory / Satisfaisant Unsatisfactory (explain) / Non satisfaisant (précisez): _____
Incubation / Incubation: Date / Date: 09/05/13 Time / Heure: 205 am / pm By / Par: 2 Incubator / Incubation: 20
Analysis Completed / Analyse terminée: Date / Date: _____ Time / Heure: _____ am / pm By / Par: _____

Results (See Reverse Side for Interpretation)

Résultats (Voir au verso l'interprétation des résultats)

Total Coliforms / Coliformes totaux <input checked="" type="checkbox"/> Present / Présence <input type="checkbox"/> Absent / Absence	E. coli / E. coli <u>4</u> <input checked="" type="checkbox"/> Present / Présence <input type="checkbox"/> Absent / Absence
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Comments / Commentaires

Results Satisfactory for Bacteriological Quality / Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample / Rééchantillonnage immédiat
 Investigate and Take Appropriate Corrective Actions / Faire enquête et appliquer les mesures correctives nécessaires
 Boil Water Before Consumption / Traiter l'eau avant de la consommer

ENUMERATION RES'D
method deviation
By / Par: BT

Bill To: EBA Engineering Consulting Lt	Project:	Lot ID: 682877
Report To: EBA Engineering Consulting Lt	ID: W23101139	Approval Status: Approved
Calcite Business Centre	Name: Takhini Hot Springs	Invoice Frequency: by Lot
Unit 6, 151 Industrial Road	Location:	COD Status:
Whitehorse, YT, Canada	LSD:	Control Number:
Y1A 2V3	P.O.:	Date Received: May 15, 2009
Attn: Stephan Klump	Acct code:	Date Reported: May 26, 2009
Sampled By: Ryan Martin		Report Number: 1220742
Company: EBA		

Contact & Affiliation	Address	Delivery Commitments
Stephan Klump EBA Engineering - Edmonton	Unit 6, 151 Industrial Road, Calcite Business Whitehorse, Yukon Territory Y1A 2V3 Phone: (867) 668-2071 Fax: (867) 668-4349 Email: sklump@eba.ca	On [Lot Verification] send (COA) by Email - Single Report On [Report Approval] send (COC, Test Report) by Email - Merge Reports On [Report Approval] send (Test Report) by Email - Single Report On [Lot Approval and Final Test Report Approval] send (COC, Test Report, Invoice) by Post

Notes To Clients:

- Holding time for Ortho-Phosphorus analysis had expired upon receipt for samples 1-5.
- Dissolved Si is included in the TW33F.

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Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Sample Disposal Date: August 24, 2009

All samples will be stored until this date unless other instructions are received. Please indicate other requirements below and return this form to the address or fax number on the bottom of this page.

Extend Sample Storage Until _____ (MM/DD/YY)

The following charges apply to extended sample storage:

Storage for 1 to 5 samples per month	\$ 10.00
Storage for 6 to 20 samples per month	\$ 15.00
Storage for 21 to 50 samples per month	\$ 30.00
Storage for 51 to 200 samples per month	\$ 60.00
Storage for more than 200 samples per month	\$ 110.00

Return Sample, collect, to the address below via:

Greyhound

Loomis

Purolator

Other (specify) _____

Name _____

Company _____

Address _____

Phone _____

Fax _____

Signature _____

Analytical Report

Bill To: EBA Engineering Consulting Lt	Project:	Lot ID: 682877
Report To: EBA Engineering Consulting Lt	ID: W23101139	Control Number:
Calcite Business Centre	Name: Takhini Hot Springs	Date Received: May 15, 2009
Unit 6, 151 Industrial Road	Location:	Date Reported: May 26, 2009
Whitehorse, YT, Canada	LSD:	Report Number: 1220742
Y1A 2V3	P.O.:	
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

	Reference Number	682877-1	682877-2	682877-3		
	Sample Date	May 12, 2009	May 12, 2009	May 12, 2009		
	Sample Time	NA	NA	NA		
	Sample Location					
	Sample Description	THS #1 / Pond	THS #3 / Outflow	THS #4 / Spring		
	Matrix	Water	Water	Water		
Analyte	Units	Results	Results	Results	Nominal Detection Limit	
Inorganic Nonmetallic Parameters						
Orthophosphate-P	Total Reactive	mg/L	0.263	<0.002	<0.002	0.002
Metals Dissolved						
Silicon	Dissolved	mg/L	8.16	14.2	21.3	0.05
Sulfur	Dissolved	mg/L	3.6	546	547	0.3
Mercury	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	0.0001
Aluminum	Dissolved	mg/L	0.007	<0.05	<0.05	0.005
Antimony	Dissolved	mg/L	<0.0002	<0.002	<0.002	0.0002
Arsenic	Dissolved	mg/L	0.0004	0.004	0.009	0.0002
Barium	Dissolved	mg/L	0.010	0.02	0.02	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.001	<0.001	0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.005	<0.005	0.0005
Boron	Dissolved	mg/L	0.027	0.05	0.03	0.002
Cadmium	Dissolved	mg/L	0.00004	<0.0001	<0.0001	0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.005	<0.005	0.0005
Cobalt	Dissolved	mg/L	<0.0001	<0.001	<0.001	0.0001
Copper	Dissolved	mg/L	0.004	<0.01	<0.01	0.001
Lead	Dissolved	mg/L	0.0002	<0.001	0.001	0.0001
Lithium	Dissolved	mg/L	0.001	0.04	0.04	0.001
Molybdenum	Dissolved	mg/L	0.002	<0.01	<0.01	0.001
Nickel	Dissolved	mg/L	0.0006	<0.005	<0.005	0.0005
Selenium	Dissolved	mg/L	<0.0002	<0.002	<0.002	0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00010	<0.0001	0.00001
Strontium	Dissolved	mg/L	0.323	13.0	13.3	0.001
Thallium	Dissolved	mg/L	<0.00005	<0.0005	<0.0005	0.00005
Tin	Dissolved	mg/L	<0.001	<0.01	<0.01	0.001
Titanium	Dissolved	mg/L	0.0007	0.020	0.021	0.0005
Uranium	Dissolved	mg/L	0.0006	<0.005	<0.005	0.0005
Vanadium	Dissolved	mg/L	0.0003	<0.001	<0.001	0.0001
Zinc	Dissolved	mg/L	0.007	0.02	0.01	0.001
Subsample	Field Filtered		Field Filtered	Field Filtered	Field Filtered	
Metals Total						
Mercury	Total	ug/L	0.01	<0.01	0.02	0.01
Aluminum	Total	mg/L	0.141	0.023	0.005	0.005
Antimony	Total	mg/L	0.0003	0.0015	0.0020	0.0002
Arsenic	Total	mg/L	0.0003	0.0044	0.0083	0.0002
Barium	Total	mg/L	0.012	0.020	0.015	0.001
Beryllium	Total	mg/L	<0.00004	<0.00004	0.00014	0.00004

Analytical Report

Bill To: EBA Engineering Consulting Lt Report To: EBA Engineering Consulting Lt Calcite Business Centre Unit 6, 151 Industrial Road Whitehorse, YT, Canada Y1A 2V3 Attn: Stephan Klump Sampled By: Ryan Martin Company: EBA	Project: W23101139 ID: W23101139 Name: Takhini Hot Springs Location: LSD: P.O.: Acct code:	Lot ID: 682877 Control Number: Date Received: May 15, 2009 Date Reported: May 26, 2009 Report Number: 1220742
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	Reference Number	682877-1	682877-2	682877-3	
	Sample Date	May 12, 2009	May 12, 2009	May 12, 2009	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	THS #1 / Pond	THS #3 / Outflow	THS #4 / Spring	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Metals Total - Continued					
Bismuth	Total	mg/L	<0.0001	<0.0001	0.0001
Boron	Total	mg/L	0.026	0.037	0.004
Cadmium	Total	mg/L	0.00005	<0.00001	0.00001
Calcium	Total	mg/L	27.8	526	0.05
Chromium	Total	mg/L	0.0009	<0.0004	0.0004
Cobalt	Total	mg/L	0.00016	0.00033	0.00029
Copper	Total	mg/L	0.009	<0.001	0.001
Iron	Total	mg/L	0.18	0.08	0.01
Lead	Total	mg/L	0.0005	<0.0001	0.0001
Lithium	Total	mg/L	<0.001	0.031	0.001
Magnesium	Total	mg/L	10.2	77.2	0.05
Manganese	Total	mg/L	0.0152	0.0298	0.0001
Molybdenum	Total	mg/L	0.00160	0.00376	0.00484
Nickel	Total	mg/L	0.001	0.004	0.001
Phosphorus	Total	mg/L	0.433	<0.01	0.01
Potassium	Total	mg/L	9.9	8.9	0.1
Selenium	Total	mg/L	<0.0006	<0.0006	0.0006
Silicon	Total	mg/L	7.91	12.5	0.05
Silver	Total	mg/L	<0.00001	<0.00001	0.00001
Sodium	Total	mg/L	0.89	37.2	0.02
Strontium	Total	mg/L	0.372	12.8	0.001
Sulfur	Total	mg/L	3.7	525	0.1
Tellurium	Total	mg/L	<0.0001	<0.0001	0.0001
Thallium	Total	mg/L	<0.00001	0.00004	0.00010
Thorium	Total	mg/L	<0.0001	0.0004	0.0001
Tin	Total	mg/L	0.0002	<0.0001	0.0001
Titanium	Total	mg/L	0.0080	0.0030	0.0028
Uranium	Total	mg/L	0.0009	0.0005	<0.0004
Vanadium	Total	mg/L	0.00034	0.00035	0.0001
Zinc	Total	mg/L	0.012	0.004	0.005
Zirconium	Total	mg/L	0.0003	0.0006	0.0002
Physical and Aggregate Properties					
Colour	True	Colour units	160	9	20
Routine Water					
pH	@ 25 °C	pH	7.16	7.76	7.24
pH			7.72	7.75	7.57
Temperature of observed		°C	22.2	22.5	22.0

Analytical Report

Bill To: EBA Engineering Consulting Lt	Project:	
Report To: EBA Engineering Consulting Lt	ID: W23101139	Lot ID: 682877
Calcite Business Centre	Name: Takhini Hot Springs	Control Number:
Unit 6, 151 Industrial Road	Location:	Date Received: May 15, 2009
Whitehorse, YT, Canada	LSD:	Date Reported: May 26, 2009
Y1A 2V3	P.O.:	Report Number: 1220742
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

Reference Number	682877-1	682877-2	682877-3
Sample Date	May 12, 2009	May 12, 2009	May 12, 2009
Sample Time	NA	NA	NA
Sample Location			
Sample Description	THS #1 / Pond	THS #3 / Outflow	THS #4 / Spring
Matrix	Water	Water	Water

Analyte	Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continued					
pH					
Electrical Conductivity	µS/cm at 25 C	196	2510	2580	1
Calcium	Dissolved mg/L	23.0	610	630	0.2
Magnesium	Dissolved mg/L	9.2	83	81	0.2
Sodium	Dissolved mg/L	0.9	37	36	0.4
Potassium	Dissolved mg/L	9.0	8	9	0.4
Iron	Dissolved mg/L	0.03	<0.1	0.53	0.01
Manganese	Dissolved mg/L	0.006	<0.05	<0.05	0.005
Chloride	Dissolved mg/L	2.6	2.0	1.3	0.4
Fluoride	mg/L	<0.05	2.8	3.0	0.05
Nitrate - N	mg/L	<0.01	<0.05	<0.05	0.01
Nitrite - N	mg/L	0.007	<0.02	<0.02	0.005
Nitrate and Nitrite - N	mg/L	<0.01	<0.07	<0.07	0.01
Sulfate (SO ₄)	Dissolved mg/L	11	1640	1640	0.9
Hydroxide	mg/L	<5	<5	<5	5
Carbonate	mg/L	<6	<6	<6	6
Bicarbonate	mg/L	113	96	134	5
P-Alkalinity	as CaCO ₃ mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO ₃ mg/L	93	79	110	5
Total Dissolved Solids	Calculated mg/L	110	2420	2460	1
Hardness	Dissolved as CaCO ₃ mg/L	95	1860	1910	
Ionic Balance	Dissolved %	101	110	110	

Analytical Report

Bill To: EBA Engineering Consulting Lt
 Report To: EBA Engineering Consulting Lt
 Calcite Business Centre
 Unit 6, 151 Industrial Road
 Whitehorse, YT, Canada
 Y1A 2V3
 Attn: Stephan Klump
 Sampled By: Ryan Martin
 Company: EBA

Project:
 ID: W23101139
 Name: Takhini Hot Springs
 Location:
 LSD:
 P.O.:
 Acct code:

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Reference Number	682877-4	682877-5
Sample Date	May 12, 2009	May 12, 2009
Sample Time	NA	NA
Sample Location		
Sample Description	THS #5 / Water Well	THS #6 / Lake
Matrix	Water	Water

Analyte	Units	Results	Results	Results	Nominal Detection Limit
Inorganic Nonmetallic Parameters					
Orthophosphate-P	Total Reactive	mg/L	<0.002	0.003	0.002
Metals Dissolved					
Silicon	Dissolved	mg/L	8.06	7.00	0.05
Sulfur	Dissolved	mg/L	159	44.1	0.3
Mercury	Dissolved	mg/L	<0.0001	<0.0001	0.0001
Aluminum	Dissolved	mg/L	<0.005	<0.005	0.005
Antimony	Dissolved	mg/L	<0.0002	<0.0002	0.0002
Arsenic	Dissolved	mg/L	0.0007	0.0008	0.0002
Barium	Dissolved	mg/L	0.023	0.015	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001	0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.0005	0.0005
Boron	Dissolved	mg/L	0.036	0.020	0.002
Cadmium	Dissolved	mg/L	<0.00001	<0.00001	0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.0005	0.0005
Cobalt	Dissolved	mg/L	<0.0001	0.0001	0.0001
Copper	Dissolved	mg/L	0.001	0.002	0.001
Lead	Dissolved	mg/L	0.0002	0.0001	0.0001
Lithium	Dissolved	mg/L	0.017	0.004	0.001
Molybdenum	Dissolved	mg/L	0.002	0.001	0.001
Nickel	Dissolved	mg/L	<0.0005	<0.0005	0.0005
Selenium	Dissolved	mg/L	<0.0002	<0.0002	0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001	0.00001
Strontium	Dissolved	mg/L	4.40	0.620	0.001
Thallium	Dissolved	mg/L	<0.00005	<0.00005	0.00005
Tin	Dissolved	mg/L	<0.001	<0.001	0.001
Titanium	Dissolved	mg/L	0.0055	0.0021	0.0005
Uranium	Dissolved	mg/L	0.0059	0.0043	0.0005
Vanadium	Dissolved	mg/L	0.0002	0.0003	0.0001
Zinc	Dissolved	mg/L	0.285	0.008	0.001
Subsample	Field Filtered		Field Filtered	Field Filtered	
Metals Total					
Mercury	Total	ug/L	0.03	<0.01	0.01
Aluminum	Total	mg/L	0.006	0.019	0.005
Antimony	Total	mg/L	<0.0002	<0.0002	0.0002
Arsenic	Total	mg/L	0.0006	0.001	0.0002
Barium	Total	mg/L	0.022	0.015	0.001
Beryllium	Total	mg/L	<0.00004	<0.00004	0.00004

Analytical Report

Bill To: EBA Engineering Consulting Lt	Project:	
Report To: EBA Engineering Consulting Lt	ID: W23101139	Lot ID: 682877
Calcite Business Centre	Name: Takhini Hot Springs	Control Number:
Unit 6, 151 Industrial Road	Location:	Date Received: May 15, 2009
Whitehorse, YT, Canada	LSD:	Date Reported: May 26, 2009
Y1A 2V3	P.O.:	Report Number: 1220742
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

Reference Number	682877-4	682877-5
Sample Date	May 12, 2009	May 12, 2009
Sample Time	NA	NA
Sample Location		
Sample Description	THS #5 / Water Well	THS #6 / Lake
Matrix	Water	Water

Analyte	Units	Results	Results	Results	Nominal Detection Limit
Metals Total - Continued					
Bismuth	Total	mg/L	<0.0001	<0.0001	0.0001
Boron	Total	mg/L	0.038	0.018	0.004
Cadmium	Total	mg/L	<0.00001	0.00003	0.00001
Calcium	Total	mg/L	146	54.4	0.05
Chromium	Total	mg/L	<0.0004	<0.0004	0.0004
Cobalt	Total	mg/L	0.00010	0.00013	0.00002
Copper	Total	mg/L	<0.001	0.001	0.001
Iron	Total	mg/L	1.00	0.33	0.01
Lead	Total	mg/L	0.0003	0.0002	0.0001
Lithium	Total	mg/L	0.013	0.003	0.001
Magnesium	Total	mg/L	48.5	33.4	0.05
Manganese	Total	mg/L	0.0360	0.0493	0.0001
Molybdenum	Total	mg/L	0.00150	0.00126	0.00002
Nickel	Total	mg/L	0.001	<0.001	0.001
Phosphorus	Total	mg/L	<0.01	0.046	0.01
Potassium	Total	mg/L	1	3.6	0.1
Selenium	Total	mg/L	<0.0006	<0.0006	0.0006
Silicon	Total	mg/L	6.48	6.30	0.05
Silver	Total	mg/L	<0.00001	<0.00001	0.00001
Sodium	Total	mg/L	33.0	8.15	0.02
Strontium	Total	mg/L	5.03	0.703	0.001
Sulfur	Total	mg/L	131	40.5	0.1
Tellurium	Total	mg/L	<0.0001	<0.0001	0.0001
Thallium	Total	mg/L	<0.00001	<0.00001	0.00001
Thorium	Total	mg/L	<0.0001	<0.0001	0.0001
Tin	Total	mg/L	<0.0001	<0.0001	0.0001
Titanium	Total	mg/L	0.0012	0.0017	0.0001
Uranium	Total	mg/L	0.0061	0.0049	0.0004
Vanadium	Total	mg/L	0.00005	0.00015	0.00004
Zinc	Total	mg/L	0.299	0.009	0.001
Zirconium	Total	mg/L	<0.0001	<0.0001	0.0001

Physical and Aggregate Properties

Colour	True	Colour units	<5	91	5
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Routine Water


pH	@ 25 °C	pH	7.60	7.77
pH			7.97	7.99
Temperature of observed		°C	21.2	20.8

Analytical Report

Bill To: EBA Engineering Consulting Lt	Project:	Lot ID: 682877
Report To: EBA Engineering Consulting Lt	ID: W23101139	Control Number:
Calcite Business Centre	Name: Takhini Hot Springs	Date Received: May 15, 2009
Unit 6, 151 Industrial Road	Location:	Date Reported: May 26, 2009
Whitehorse, YT, Canada	LSD:	Report Number: 1220742
Y1A 2V3	P.O.:	
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

Reference Number	682877-4	682877-5
Sample Date	May 12, 2009	May 12, 2009
Sample Time	NA	NA
Sample Location		
Sample Description	THS #5 / Water Well	THS #6 / Lake
Matrix	Water	Water

Analyte	Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continued					
pH					
Electrical Conductivity	µS/cm at 25 C	1150	491		1
Calcium	Dissolved mg/L	156	50.3		0.2
Magnesium	Dissolved mg/L	53.7	32.4		0.2
Sodium	Dissolved mg/L	38.2	8.1		0.4
Potassium	Dissolved mg/L	0.8	3.3		0.4
Iron	Dissolved mg/L	1.14	0.10		0.01
Manganese	Dissolved mg/L	0.033	0.028		0.005
Chloride	Dissolved mg/L	10.2	2.0		0.4
Fluoride	mg/L	0.13	0.07		0.05
Nitrate - N	mg/L	<0.01	0.01		0.01
Nitrite - N	mg/L	0.011	<0.005		0.005
Nitrate and Nitrite - N	mg/L	0.01	0.01		0.01
Sulfate (SO4)	Dissolved mg/L	477	132		0.9
Hydroxide	mg/L	<5	<5		5
Carbonate	mg/L	<6	<6		6
Bicarbonate	mg/L	236	171		5
P-Alkalinity	as CaCO3 mg/L	<5	<5		5
T-Alkalinity	as CaCO3 mg/L	193	140		5
Total Dissolved Solids	Calculated mg/L	852	313		1
Hardness	Dissolved as CaCO3 mg/L	612	259		
Ionic Balance	Dissolved %	99	100		

Approved by: 
 Carol Nam, Dipl. T.
 Quality Officer

Quality Control

Bill To: EBA Engineering Consulting Lt Report To: EBA Engineering Consulting Lt Calcite Business Centre Unit 6, 151 Industrial Road Whitehorse, YT, Canada Y1A 2V3 Attn: Stephan Klump Sampled By: Ryan Martin Company: EBA	Project: ID: W23101139 Name: Takhini Hot Springs Location: LSD: P.O.: Acct code:	Lot ID: 682877 Control Number: Date Received: May 15, 2009 Date Reported: May 26, 2009 Report Number: 1220742
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Inorganic Nonmetallic Parameters

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC	
Orthophosphate-P	mg/L	<0.002	-0.010	0.010	yes	
Date Acquired: May 19, 2009						
Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC	
Orthophosphate-P	mg/L	95.40	90	110	yes	
Date Acquired: May 19, 2009						
Orthophosphate-P	mg/L	89.00	90	110	yes	
Date Acquired: May 19, 2009						
Certified Reference Material	Units	Measured	Target	Lower Limit	Upper Limit	Passed QC
Orthophosphate-P	mg/L	2.49	2.509	2.210	2.810	yes
Date Acquired: May 19, 2009						
Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Orthophosphate-P	mg/L	0.263	0.272	20	0.050	yes
Date Acquired: May 19, 2009						

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	<0.05	-0.04	0.05	yes
Sulfur	mg/L	<0.3	-0.3	0.3	yes
Mercury	mg/L	<0.0001	-0.0598	0.0602	yes
Aluminum	ug/L	<5	-5	5	yes
Antimony	ug/L	<0.2	-0.2	0.2	yes
Arsenic	ug/L	<0.2	-0.2	0.2	yes
Barium	ug/L	<1	-1	1	yes
Beryllium	ug/L	<0.1	-0.0	0.1	yes
Bismuth	ug/L	<0.5	-1.5	1.5	yes
Boron	ug/L	<2	-2	2	yes
Cadmium	ug/L	<0.01	-0.01	0.01	yes
Chromium	ug/L	<0.5	-0.3	0.3	yes
Cobalt	ug/L	<0.1	-0.1	0.1	yes
Copper	ug/L	<1	-1	1	yes
Lead	ug/L	<0.1	-0.1	0.1	yes
Lithium	ug/L	<1	-1	1	yes
Molybdenum	ug/L	<1	-1	1	yes
Nickel	ug/L	<0.5	-0.5	0.5	yes
Selenium	ug/L	<0.2	-0.2	0.2	yes
Silver	ug/L	0.02	-0.10	0.10	yes
Strontium	ug/L	<1	-1	1	yes
Thallium	ug/L	<0.05	-0.05	0.05	yes

Quality Control

Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Metals Dissolved - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Tin	ug/L	<1	-1	1	yes
Titanium	ug/L	<0.5	-0.5	0.5	yes
Uranium	ug/L	<0.5	-0.5	0.5	yes
Vanadium	ug/L	<0.1	-0.1	0.1	yes
Zinc	ug/L	<1	-0	2	yes

Date Acquired: May 20, 2009

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Silicon	mg/L	1.13	1.13	10	0.01	yes
Sulfur	mg/L	174	174	10	0.1	yes
Mercury	mg/L	<0.0001	<0.0001	10	0.0003	yes
Aluminum	ug/L	<50	<50	10	11	yes
Antimony	ug/L	<2	<2	10	0.4	yes
Arsenic	ug/L	4	4	10	0.4	yes
Barium	ug/L	670	640	10	2	yes
Beryllium	ug/L	<1	<1	10	0.2	yes
Bismuth	ug/L	<5	<5	10	1.1	yes
Boron	ug/L	50	50	10	4	yes
Cadmium	ug/L	0.2	0.2	10	0.02	yes
Chromium	ug/L	<5	<5	10	1.1	yes
Cobalt	ug/L	1	<1	10	0.2	yes
Copper	ug/L	10	<10	10	2	yes
Lead	ug/L	<1	<1	10	0.2	yes
Lithium	ug/L	40	40	10	2	yes
Molybdenum	ug/L	<10	<10	10	2	yes
Nickel	ug/L	<5	5	10	1.1	yes
Selenium	ug/L	<2	<2	10	0.4	yes
Silver	ug/L	<0.10	<0.10	10	0.22	yes
Strontium	ug/L	2010	2000	10	2	yes
Thallium	ug/L	<0.5	<0.5	10	0.11	yes
Tin	ug/L	<10	<10	10	2	yes
Titanium	ug/L	20	19	10	1.1	yes
Uranium	ug/L	7	8	10	1.1	yes
Vanadium	ug/L	<1	<1	10	0.2	yes
Zinc	ug/L	20	20	10	2	yes

Date Acquired: May 20, 2009

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Mercury	mg/L	0.0007	0.0007	0.0009	yes
Mercury	mg/L	0.0029	0.0025	0.0034	yes

Date Acquired: May 21, 2009

Date Acquired: May 21, 2009

Quality Control

Bill To: EBA Engineering Consulting Lt	Project:	
Report To: EBA Engineering Consulting Lt	ID: W23101139	Lot ID: 682877
Calcite Business Centre	Name: Takhini Hot Springs	Control Number:
Unit 6, 151 Industrial Road	Location:	Date Received: May 15, 2009
Whitehorse, YT, Canada	LSD:	Date Reported: May 26, 2009
Y1A 2V3	P.O.:	Report Number: 1220742
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Mercury	mg/L	0.0008	0.0007	0.0009	yes
Aluminum	ug/L	975	851	1091	yes
Antimony	ug/L	39.7	38.6	44.2	yes
Arsenic	ug/L	39.4	37.1	43.7	yes
Barium	ug/L	192	184	214	yes
Beryllium	ug/L	19.6	17.2	22.6	yes
Bismuth	ug/L	99.9	90.6	111.0	yes
Boron	ug/L	379	348	444	yes
Cadmium	ug/L	2.14	1.75	2.35	yes
Chromium	ug/L	95.2	92.1	107.1	yes
Cobalt	ug/L	20.2	17.4	23.4	yes
Copper	ug/L	191	165	225	yes
Lead	ug/L	20.8	17.2	23.2	yes
Lithium	ug/L	181	169	229	yes
Molybdenum	ug/L	188	171	231	yes
Nickel	ug/L	97.7	83.7	113.7	yes
Selenium	ug/L	37.7	34.0	46.0	yes
Silver	ug/L	19.8	17.80	23.80	yes
Strontium	ug/L	192	166	226	yes
Thallium	ug/L	10.7	8.77	11.77	yes
Tin	ug/L	179	176	206	yes
Titanium	ug/L	97.1	85.1	115.1	yes
Uranium	ug/L	96.8	83.4	113.4	yes
Vanadium	ug/L	17.0	16.3	22.3	yes
Zinc	ug/L	196	182	218	yes
Date Acquired: May 20, 2009					
Aluminum	ug/L	51	45	58	yes
Antimony	ug/L	2.1	1.9	2.3	yes
Arsenic	ug/L	2.0	1.7	2.3	yes
Barium	ug/L	10	1	19	yes
Beryllium	ug/L	0.9	0.8	1.1	yes
Bismuth	ug/L	5.4	4.5	5.7	yes
Boron	ug/L	19	17	23	yes
Cadmium	ug/L	0.1	0.08	0.12	yes
Chromium	ug/L	4.9	4.4	5.6	yes
Cobalt	ug/L	1.0	0.9	1.2	yes
Copper	ug/L	10	9	12	yes
Lead	ug/L	1.1	0.9	1.2	yes
Lithium	ug/L	9	9	12	yes
Molybdenum	ug/L	10	9	12	yes
Nickel	ug/L	5.0	4.2	5.7	yes
Selenium	ug/L	1.8	1.7	2.3	yes

Quality Control

Bill To: EBA Engineering Consulting Lt Report To: EBA Engineering Consulting Lt Calcite Business Centre Unit 6, 151 Industrial Road Whitehorse, YT, Canada Y1A 2V3 Attn: Stephan Klump Sampled By: Ryan Martin Company: EBA	Project: ID: W23101139 Name: Takhini Hot Springs Location: LSD: P.O.: Acct code:	Lot ID: 682877 Control Number: Date Received: May 15, 2009 Date Reported: May 26, 2009 Report Number: 1220742
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Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silver	ug/L	0.96	0.87	1.17	yes
Strontium	ug/L	11	9	12	yes
Thallium	ug/L	0.54	0.47	0.56	yes
Tin	ug/L	10	8	11	yes
Titanium	ug/L	5.0	4.3	5.8	yes
Uranium	ug/L	5.4	4.4	5.9	yes
Vanadium	ug/L	1.0	0.9	1.2	yes
Zinc	ug/L	10	9	12	yes
Date Acquired: May 20, 2009					
Silicon	mg/L	9.98	9.01	10.99	yes
Sulfur	mg/L	49.8	45.0	55.0	yes
Date Acquired: May 20, 2009					
Silicon	mg/L	0.20	0.18	0.22	yes
Sulfur	mg/L	1	0.9	1.1	yes
Date Acquired: May 20, 2009					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	<0.05	-0.06	0.06	yes
Iron	mg/L	<0.01	-0.06	0.06	yes
Magnesium	mg/L	<0.05	-0.06	0.06	yes
Manganese	mg/L	<0.005	-0.0060	0.0060	yes
Phosphorus	mg/L	<0.01	-0.060	0.060	yes
Potassium	mg/L	<0.1	-0.15	0.15	yes
Silicon	mg/L	0.12	-0.03	0.03	yes
Sodium	mg/L	<0.02	-0.06	0.06	yes
Date Acquired: May 19, 2009					
Calcium	mg/L	<0.05	-0.06	0.06	yes
Iron	mg/L	<0.01	-0.06	0.06	yes
Magnesium	mg/L	<0.05	-0.06	0.06	yes
Manganese	mg/L	<0.005	-0.0150	0.0150	yes
Phosphorus	mg/L	<0.01	-0.060	0.060	yes
Potassium	mg/L	<0.1	-0.15	0.15	yes
Silicon	mg/L	0.12	-0.06	0.06	yes
Sodium	mg/L	<0.02	-0.06	0.06	yes
Date Acquired: May 19, 2009					
Mercury	ug/L	<0.01	-20.010	20.010	yes
Date Acquired: May 19, 2009					

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
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Quality Control

Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Metals Total - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Mercury	ng/L	94.40	85	115	yes
Date Acquired: May 19, 2009					
Calcium	mg/L	111.39	90	110	yes
Iron	mg/L	101.70	90	110	yes
Magnesium	mg/L	104.57	90	110	yes
Manganese	mg/L	101.70	90	110	yes
Phosphorus	mg/L	89.88	90	110	yes
Potassium	mg/L	102.60	90	110	yes
Silicon	mg/L	285.30	90	110	yes
Sodium	mg/L	106.90	90	110	yes

Date Acquired: May 19, 2009

Certified Reference Material	Units	Measured	Target	Lower Limit	Upper Limit	Passed QC
Mercury	ug/L	0.10	0.110	0.081	0.139	yes
Date Acquired: May 19, 2009						
Aluminum	mg/L	0.597	0.601	0.513	0.689	yes
Antimony	mg/L	0.154	0.1500	0.1116	0.1884	yes
Arsenic	mg/L	0.132	0.1310	0.1067	0.1553	yes
Barium	mg/L	0.50	0.401	0.365	0.437	yes
Beryllium	mg/L	0.151	0.15100	0.13210	0.16990	yes
Boron	mg/L	0.34	0.175	0.140	0.209	yes
Cadmium	mg/L	0.115	0.11600	0.09920	0.13280	yes
Calcium	mg/L	54.8		46.23	54.21	yes
Chromium	mg/L	0.131	0.1350	0.1119	0.1581	yes
Cobalt	mg/L	0.153	0.16100	0.14090	0.18110	yes
Copper	mg/L	0.12	0.114	0.105	0.123	yes
Iron	mg/L	0.62		0.56	0.72	yes
Lead	mg/L	0.327	0.3050	0.2603	0.3497	yes
Magnesium	mg/L	30.8		26.50	33.70	yes
Manganese	mg/L	0.734	0.7530	0.6846	0.8214	yes
Molybdenum	mg/L	0.116	0.12000	0.09960	0.14040	yes
Nickel	mg/L	0.42	0.441	0.396	0.486	yes
Potassium	mg/L	25		21.30	28.50	yes
Selenium	mg/L	0.219	0.2200	0.1870	0.2530	yes
Silver	mg/L	0.0225	0.03000	0.02550	0.03450	yes
Sodium	mg/L	10.0		8.02	11.98	yes
Strontium	mg/L	0.10	0.100	0.085	0.115	yes
Thallium	mg/L	0.136	0.13100	0.10640	0.15560	yes
Vanadium	mg/L	1.49	1.50000	1.32780	1.67220	yes
Zinc	mg/L	0.33	0.260	0.230	0.290	yes

Date Acquired: May 19, 2009

Quality Control

Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Metals Total - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Mercury	ug/L	0.02	0.02	30	0.050	yes
Date Acquired: May 19, 2009						

Physical and Aggregate Properties

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Colour	Colour units	<5	5	10		yes
Date Acquired: May 20, 2009						

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Colour	Colour units	27	20	30	yes
Date Acquired: May 20, 2009					

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	<0.2	-0.1	0.2	yes
Magnesium	mg/L	<0.2	-0.1	0.1	yes
Sodium	mg/L	<0.4	-0.4	0.4	yes
Potassium	mg/L	<0.4	-0.4	0.4	yes
Iron	mg/L	<0.01	-0.01	0.01	yes
Manganese	mg/L	<0.005	-0.003	0.005	yes
Chloride	mg/L	<0.4	-0.4	0.4	yes
Fluoride	mg/L	<0.05	-0.05	0.05	yes
Nitrate - N	mg/L	<0.01	-0.01	0.01	yes
Nitrite - N	mg/L	<0.005	-0.005	0.005	yes
Date Acquired: May 20, 2009					

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
pH	pH	99.75	97	103	yes
Date Acquired: May 26, 2009					

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		6.77	6.83	10	0.10	yes
Electrical Conductivity	dS/m at 25 C	0.075	0.075	10	0.002	yes
Calcium	mg/L	164	163	10	0.6	yes
Magnesium	mg/L	28.3	28.2	10	0.7	yes
Sodium	mg/L	19.0	19.1	10	1.2	yes
Potassium	mg/L	7.7	7.7	10	1.2	yes
Iron	mg/L	0.03	0.03	10	0.05	yes
Manganese	mg/L	1.50	1.50	10	0.010	yes
Chloride	mg/L	2.0	2.1	10	0.5	yes
Fluoride	mg/L	<0.05	<0.05	10	0.05	yes

Quality Control

Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Routine Water - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Nitrate - N	mg/L	1.36	1.37	10	0.01	yes
Nitrite - N	mg/L	0.025	0.024	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10		yes
Bicarbonate	mg/L	40	40	10		yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	33	33	10	5	yes
Date Acquired: May 20, 2009						
pH	pH	6.82	6.80	0	0.10	yes
Date Acquired: May 26, 2009						

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	1990	1900.0	2230.0	yes
Date Acquired: May 21, 2009					
pH		9.14	9.07	9.27	yes
Electrical Conductivity	dS/m at 25 C	2.78	2.620	2.860	yes
Calcium	mg/L	239	225.1	274.9	yes
Magnesium	mg/L	96.8	88.0	108.0	yes
Sodium	mg/L	239	225.1	274.9	yes
Potassium	mg/L	241	225.1	274.9	yes
Iron	mg/L	9.48	9.01	10.99	yes
Manganese	mg/L	2.33	2.251	2.749	yes
Chloride	mg/L	80.8	76.1	85.1	yes
Fluoride	mg/L	9.82	9.31	10.81	yes
Nitrate - N	mg/L	9.97	9.60	10.58	yes
Nitrite - N	mg/L	9.93	9.510	10.530	yes
Nitrate and Nitrite - N	mg/L	19.9	18.09	22.11	yes
P-Alkalinity	mg/L	483	419	551	yes
T-Alkalinity	mg/L	1030	900	1100	yes
Date Acquired: May 20, 2009					
pH		6.89	6.77	6.97	yes
Electrical Conductivity	dS/m at 25 C	0.078	0.070	0.082	yes
Calcium	mg/L	5.2	4.6	5.5	yes
Magnesium	mg/L	2.0	1.8	2.2	yes
Sodium	mg/L	5.0	4.5	5.5	yes
Potassium	mg/L	5.0	4.6	5.6	yes
Iron	mg/L	0.21	0.02	0.38	yes
Manganese	mg/L	0.051	0.045	0.055	yes
Chloride	mg/L	14.1	13.6	16.6	yes
Fluoride	mg/L	0.48	0.45	0.57	yes
Nitrate - N	mg/L	0.50	0.46	0.55	yes

Quality Control

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 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrite - N	mg/L	0.492	0.452	0.548	yes
Nitrate and Nitrite - N	mg/L	0.99	0.79	1.19	yes
P-Alkalinity	mg/L	43	22	82	yes
T-Alkalinity	mg/L	128	112	138	yes

Date Acquired: May 20, 2009

Trace Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	<5	-7	7	yes
Antimony	µg/L	<0.2	-0.4	0.2	yes
Arsenic	µg/L	<0.2	-0.5	0.5	yes
Barium	µg/L	<1	-0.1	0.2	yes
Beryllium	µg/L	<0.04	-0.10	0.10	yes
Boron	µg/L	<5	-6	5	yes
Cadmium	µg/L	<0.01	-0.03	0.03	yes
Chromium	µg/L	<0.4	-0.1	0.2	yes
Cobalt	µg/L	<0.02	-0.06600	0.06600	yes
Copper	µg/L	<1	-0.830	0.790	yes
Lead	µg/L	<0.1	-0.100	0.140	yes
Lithium	µg/L	<1	-0	0	yes
Manganese	µg/L	<0.1	-0.9	0.9	yes
Molybdenum	µg/L	<0.02	-0.31	0.29	yes
Nickel	µg/L	<1	-1	1	yes
Selenium	µg/L	<0.6	-1.7	1.3	yes
Silver	µg/L	<0.01	-0.07	0.05	yes
Strontium	µg/L	<1	-0.3	0.3	yes
Tellurium	µg/L	<0.1	-0.7	0.7	yes
Thallium	µg/L	<0.01	-0.03	0.03	yes
Thorium	µg/L	<0.1	-1.50	1.50	yes
Tin	µg/L	<0.1	-3.0	3.0	yes
Titanium	µg/L	<0.1	-0.2	0.2	yes
Uranium	µg/L	<0.4	-0.0	0.0	yes
Vanadium	µg/L	<0.03	-0.30	0.30	yes
Zinc	µg/L	<1	-2	4	yes
Zirconium	µg/L	<0.1	-0.0	0.0	yes

Date Acquired: May 19, 2009

Aluminum	µg/L	<5	-4	8	yes
Antimony	µg/L	<0.2	-0.6	0.4	yes
Arsenic	µg/L	<0.2	-0.6	0.6	yes
Barium	µg/L	<1	-0.1	0.1	yes
Beryllium	µg/L	<0.04	-0.09	0.09	yes

Quality Control

Bill To: EBA Engineering Consulting Lt Report To: EBA Engineering Consulting Lt Calcite Business Centre Unit 6, 151 Industrial Road Whitehorse, YT, Canada Y1A 2V3 Attn: Stephan Klump Sampled By: Ryan Martin Company: EBA	Project: ID: W23101139 Name: Takhini Hot Springs Location: LSD: P.O.: Acct code:	Lot ID: 682877 Control Number: Date Received: May 15, 2009 Date Reported: May 26, 2009 Report Number: 1220742
---	---	--

Trace Metals Total - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Boron	µg/L	<5	-12	11	yes
Cadmium	µg/L	<0.01	-0.08	0.08	yes
Chromium	µg/L	<0.4	-0.1	0.2	yes
Cobalt	µg/L	<0.02	-0.07500	0.08700	yes
Copper	µg/L	<1	-1.930	1.430	yes
Lead	µg/L	<0.1	-0.150	0.210	yes
Lithium	µg/L	<1	-0	0	yes
Manganese	µg/L	<0.1	-1.0	1.1	yes
Molybdenum	µg/L	<0.02	-1.67	1.81	yes
Nickel	µg/L	<1	-1	1	yes
Selenium	µg/L	<0.6	-2.5	1.5	yes
Silver	µg/L	<0.01	-0.13	0.07	yes
Strontium	µg/L	<1	-0.2	0.2	yes
Tellurium	µg/L	<0.1	-0.2	0.2	yes
Thallium	µg/L	<0.01	-0.32	0.34	yes
Thorium	µg/L	<0.1	-1.75	0.95	yes
Tin	µg/L	<0.1	-0.5	0.4	yes
Titanium	µg/L	<0.1	-0.2	0.3	yes
Uranium	µg/L	<0.4	-0.1	0.1	yes
Vanadium	µg/L	<0.03	-0.30	0.30	yes
Zinc	µg/L	2	-4	6	yes
Zirconium	µg/L	<0.1	-0.1	0.1	yes

Date Acquired: May 19, 2009

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	103.54	90	110	yes
Antimony	µg/L	95.40	90	110	yes
Arsenic	µg/L	104.32	90	110	yes
Barium	µg/L	101.88	90	110	yes
Beryllium	µg/L	107.76	90	110	yes
Boron	µg/L	104.48	90	110	yes
Cadmium	µg/L	104.44	90	110	yes
Chromium	µg/L	99.78	90	110	yes
Cobalt	µg/L	98.28	90	110	yes
Copper	µg/L	105.00	90	110	yes
Lead	µg/L	109.84	90	110	yes
Manganese	µg/L	100.80	90	110	yes
Molybdenum	µg/L	100.16	90	110	yes
Nickel	µg/L	98.70	90	110	yes
Selenium	µg/L	107.80	90	110	yes
Silver	µg/L	124.24	90	110	yes
Strontium	µg/L	104.58	90	110	yes
Thallium	µg/L	107.80	90	110	yes

Quality Control

Bill To: EBA Engineering Consulting Lt Project:
 Report To: EBA Engineering Consulting Lt ID: W23101139
 Calcite Business Centre Name: Takhini Hot Springs
 Unit 6, 151 Industrial Road Location:
 Whitehorse, YT, Canada LSD:
 Y1A 2V3 P.O.:
 Attn: Stephan Klump Acct code:
 Sampled By: Ryan Martin
 Company: EBA

Lot ID: **682877**
 Control Number:
 Date Received: May 15, 2009
 Date Reported: May 26, 2009
 Report Number: 1220742

Trace Metals Total - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Tin	µg/L	10.00	70	106	yes
Vanadium	µg/L	99.10	90	110	yes
Zinc	µg/L	105.32	90	110	yes

Date Acquired: May 19, 2009

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	µg/L	666	593	15	100	yes
Antimony	µg/L	2.2	2.1	15	2.0	yes
Arsenic	µg/L	14.5	14.1	15	2.0	yes
Barium	µg/L	41	38	15	10.0	yes
Beryllium	µg/L	<0.04	<0.04	15	0.40	yes
Boron	µg/L	26	26	15	40	yes
Cadmium	µg/L	0.24	0.27	15	0.10	yes
Chromium	µg/L	1.6	2.1	15	6.0	yes
Cobalt	µg/L	1.41	1.40	15	0.20000	yes
Copper	µg/L	9	2	15	5.000	yes
Lead	µg/L	3.5	3.0	15	1.000	yes
Lithium	µg/L	2	2	15	10	yes
Manganese	µg/L	642	648	15	1.0	yes
Molybdenum	µg/L	1.60	1.64	15	0.20	yes
Nickel	µg/L	2	2	15	10	yes
Selenium	µg/L	<0.6	<0.6	15	5.0	yes
Silver	µg/L	<0.01	<0.01	15	0.10	yes
Strontium	µg/L	372	377	15	10.0	yes
Tellurium	µg/L	<0.1	<0.1	20	0.5	yes
Thallium	µg/L	0.01	0.01	15	0.10	yes
Thorium	µg/L	<0.1	0.3	15	1.00	yes
Tin	µg/L	0.2	<0.1	15	1.0	yes
Titanium	µg/L	8.0	7.7	15	1.0	yes
Uranium	µg/L	0.9	0.9	15	1.0	yes
Vanadium	µg/L	2.30	2.15	15	0.40	yes
Zinc	µg/L	81	80	15	10	yes
Zirconium	µg/L	0.3	0.6	15	1.0	yes

Date Acquired: May 19, 2009

Methodology and Notes

Bill To: EBA Engineering Consulting Lt	Project:	Lot ID: 682877
Report To: EBA Engineering Consulting Lt	ID: W23101139	Control Number:
Calcite Business Centre	Name: Takhini Hot Springs	Date Received: May 15, 2009
Unit 6, 151 Industrial Road	Location:	Date Reported: May 26, 2009
Whitehorse, YT, Canada	LSD:	Report Number: 1220742
Y1A 2V3	P.O.:	
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510	20-May-09	BTG Edmonton
Alkalinity, pH, and EC in water	APHA	* Electrometric Method, 4500-H+ B	20-May-09	BTG Edmonton
Alkalinity, pH, and EC in water	APHA	* Titration Method, 2320 B	20-May-09	BTG Edmonton
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	20-May-09	BTG Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	20-May-09	BTG Edmonton
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	21-May-09	BTG Edmonton
Colour (True) in water	APHA	* Visual Comparison Method, 2120 B	20-May-09	BTG Surrey
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	21-May-09	BTG Edmonton
Mercury Low Level (Total) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	19-May-09	BTG Surrey
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	20-May-09	BTG Edmonton
Metals SemiTrace (Total) in Water	US EPA	* Metals & Trace Elements by ICP-AES, 6010B	19-May-09	BTG Surrey
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	20-May-09	BTG Edmonton
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	20-May-09	BTG Edmonton
pH in water (Surrey)	APHA	* Electrometric Method, 4500-H+ B	26-May-09	BTG Surrey
Phosphorus - total reactive P (orthophosphate) (low level)	APHA	Ascorbic Acid Reduction Method, 4500 -P E	19-May-09	BTG Surrey
Trace Metals (Total) in Water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	19-May-09	BTG Surrey
Trace Metals (Total) in Water	US EPA	* Metals & Trace Elements by ICP-AES, 6010B	19-May-09	BTG Surrey

* Bodycote method(s) based on reference method

References

APHA	Standard Methods for the Examination of Water and Wastewater
EPA	Environmental Protection Agency Test Methods - US
US EPA	US Environmental Protection Agency Test Methods

Comments:

Methodology and Notes

Bill To: EBA Engineering Consulting Lt	Project:	Lot ID: 682877
Report To: EBA Engineering Consulting Lt	ID: W23101139	Control Number:
Calcite Business Centre	Name: Takhini Hot Springs	Date Received: May 15, 2009
Unit 6, 151 Industrial Road	Location:	Date Reported: May 26, 2009
Whitehorse, YT, Canada	LSD:	Report Number: 1220742
Y1A 2V3	P.O.:	
Attn: Stephan Klump	Acct code:	
Sampled By: Ryan Martin		
Company: EBA		

-
- Holding time for Ortho-Phosphorus analysis had expired upon receipt for samples 1-5.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis
See reverse for your nearest Bodycote location and proper sampling protocol

Billing Address:		Copy of Report To:		Copy of invoice:	
Company: EBA Engineering Consulting Ltd.	QA/QC Report <input checked="" type="checkbox"/>	Company: EBA Engineering Consulting Ltd.	Mail invoice to this address for approval <input type="checkbox"/>		
Address: Unit 6, 151 Industrial Rd Whitehorse, YT Y1A 2V3		Address: Unit 6, 151 Industrial Rd Whitehorse, YT Y1A 2V3			
Attention: Stephan Klump	Report Result:	Attention: Ryan Martin	Report Result:		
Phone: 867-668-3068	Fax <input type="checkbox"/>	Phone: 867-668-3068	Fax <input type="checkbox"/>		
Fax: 867-668-4349	Mail <input checked="" type="checkbox"/>	Fax: 867-668-4349	Mail <input type="checkbox"/>		
Cell:	Courier <input type="checkbox"/>	Cell:	Courier <input type="checkbox"/>		
e-mail: sklump@eba.ca	e-mail <input checked="" type="checkbox"/>	e-mail: rmartin@eba.ca	e-mail <input checked="" type="checkbox"/>		
	e-Service <input type="checkbox"/>		e-Service <input type="checkbox"/>		

Information to be included on Report and Invoice Project ID: W23101139 Project Name: Takhini Hot Springs Project Location: Legal Location: PO#: Proj. Acct. Code: Agreement ID: <u>87038</u>	RUSH Please contact the laboratory to confirm rush dates and times before submitting samples.	Sample Custody (Please Print) Sampled by: Ryan Martin Company EBA Signature _____ I authorize Bodycote to proceed with the work indicated on this form: Date: <u>13-May</u> Initial: <u>SK</u> Received by: _____ Sample Temp: <u>MAY 13 2009</u> Waybill #: _____ Date _____ Company <u>CityCore</u> Time <u>3:45pm</u>
	Upon filling out this section, client accepts that surcharges will be attached to this analysis	
	RUSH required on: <input type="checkbox"/> All Analysis <input type="checkbox"/> or <input type="checkbox"/> As indicated	
	Signature: _____ Bodycote Authorization: _____	

Special Instructions / Comments All "Dissolved Metals" samples are field-filtered and preserved. Please indicate which regulations you are required to meet:	FOR LAB USE ONLY Condition of containers/coolers upon arrival at lab	Check here if Bodycote is required to report results directly to a regulatory body (Please include contact information) <input type="checkbox"/> Check here if you are testing POTABLE WATER for HUMAN CONSUMPTION <input type="checkbox"/>
---	--	--

	Sample Identification	Location	Depth			Date/Time Sampled	Matrix	Sampling Method	↓	Enter tests above (✓ relevant samples below)											
			IN	CM	M					THS3F	OP04	TH22	HG	LE	COLO	6	7	8	9		
1	THS #1	Pond				12-May-09	Surface Water	Grab	4	✓	✓	✓	✓	✓	✓						
2	THS #3	Outflow				12-May-09	Surface Water	Grab	4	✓	✓	✓	✓	✓	✓						
3	THS #4	Spring				12-May-09	Ground water	Grab	5	✓	✓	✓	✓	✓	✓	✓					
4	THS #5	Water well				12-May-09	Ground water	Pump	4	✓	✓	✓	✓	✓	✓						
5	THS #6	Lake				12-May-09	Surface Water	Grab	5/1	✓	✓	✓	✓	✓	✓						
6																					
7																					
8																					
9																					
10																					
11																					
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