

TECHNICAL MEMO

CREATING AND DELIVERING BETTER SOLUTIONS

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TO: Mr. Brian Ritchie, Program Manager,
Government of Yukon
Community Development Division,
Community Services

DATE: July 19, 2007

C:

MEMO NO: 1

FROM: Ryan Martin, P.Eng.
Katherine Johnston, EIT

FILE: 1260009

SUBJECT: **Executive Summary and Figure 8 from EBA Report - Whitehorse Copper Subdivision Hydrogeological Assessment for Water Supply – Draft, July 2007**

An adapted executive summary, Figure 8, and closure and limitations from the EBA report titled “Whitehorse Copper Subdivision Hydrogeological Assessment for Water Supply – July 2007” are provided in this memo for your use in the lottery process and to use as a technical backgrounder for this study.

Executive Summary

EBA Engineering Consultants Ltd. (EBA) was retained to co-ordinate and supervise a test well drilling program for the new Whitehorse Copper Subdivision. The Whitehorse Copper Subdivision is comprised of 110 country residential and 25 service industrial lots. Its located to the west of the McRae industrial area and to the south east of the Mt. Sima Road. The lots will not be serviced by municipal water or sewer, and it will be the responsibility of the individual property owners to provide such services.

The purpose of this project was to provide potential lot purchasers with a qualitative assessment of the water supply potential of the subdivision area and to address the potential impact to downgradient water users resulting from the establishment of water supply wells and inground sewage disposal fields in the area.

Five test wells were drilled and tested throughout the subdivision footprint. Based on the results of well drilling and testing and laboratory analysis, two distinct bedrock units are interpreted to exist within the subdivision footprint- the Miles Canyon Basalt and the Whitehorse Batholith Granodiorite. The extent of these units has been estimated based on bedrock geology mapping for the area (see Attached Figure 8), and the results of the test well drilling program. Bedrock contacts are not considered to be exact.

Areas underlain by the Miles Canyon Basalt have a high potential for the establishment of successful domestic water supply wells as water quantity and quality is consistent regionally. Three test wells; TW06-01, TW06-03 and TW06-04 encountered the Miles Canyon Basalt. TW06-01 and TW06-04 were completed in the basalt and have safe sustainable yields of 0.2 and 0.8 L/s (3.3 and 18.9

USgpm) respectively. The water from both wells meets Canadian Drinking Water Quality Guidelines (CDWQG) for health based parameters, iron and manganese may exceed the aesthetic objectives at some locations.

Areas underlain by the Whitehorse Batholith Granodiorite have a lower potential for the establishment of successful water supply wells, as both water quantity and quality are variable throughout the region. Two of the test wells TW06-02 and TW06-05 are completed within this unit. Each well was drilled to a depth of 61.0 meters below ground (mbgl). The safe sustainable yield of TW06-02 is 0.04 L/s (0.7 USgpm), and the safe sustainable yield of TW06-05 is 0.5 L/s (7.7 USgpm). The large difference in the well yield is attributed to the productive fracture zone which was encountered in TW06-05 near the bottom of the hole (a productive fracture zone was not encountered in TW06-02). Water quality results for these two wells display total uranium above the CDWQG Maximum Acceptable Concentration (MAC) of 0.02 mg/L. The uranium is interpreted to be naturally occurring. Water from these wells should not be consumed or used for cooking without prior treatment for uranium removal. Water treatment options for uranium removal include the installation of a point of use Reverse Osmosis (RO), or anion exchange systems. This would allow home owners to use the treated water for drinking and cooking, and the untreated well water for other household activities such as bathing and irrigation. Selection of the appropriate system should be done by a qualified professional on a case by case basis. There is insufficient information available at present to define the extent of groundwater with elevated uranium. Although both wells that were drilled in the Granodiorite formation for this study had water sample results with elevated uranium concentrations, there may be areas or depths of completion within the Granodiorite in this development that would produce water with uranium below the CDWQG. There are known wells completed in Wolf Creek area that are reportedly completed in the Granodiorite with acceptable water quality.

Productive overburden deposits are expected to exist intermittently throughout the subdivision area. TW06-03 was completed in sand and gravel overburden overlying the Miles Canyon Basalt with a safe sustainable yield of 0.8 L/s (12 USgpm). Where present in sufficient thickness, overburden aquifers are expected to supply adequate water quantity and quality for the establishment of domestic water supply wells.

Potential impacts to downgradient groundwater quantity have been assessed based on the expected groundwater recharge and demand over the subdivision area. Based on the conservative assumptions that every homeowner establishes a water supply well, and that no well water is returned to the ground through septic fields, recharge over the total recharge area (72 000 m³/year), exceeds the total groundwater demand (44 845 m³/year).

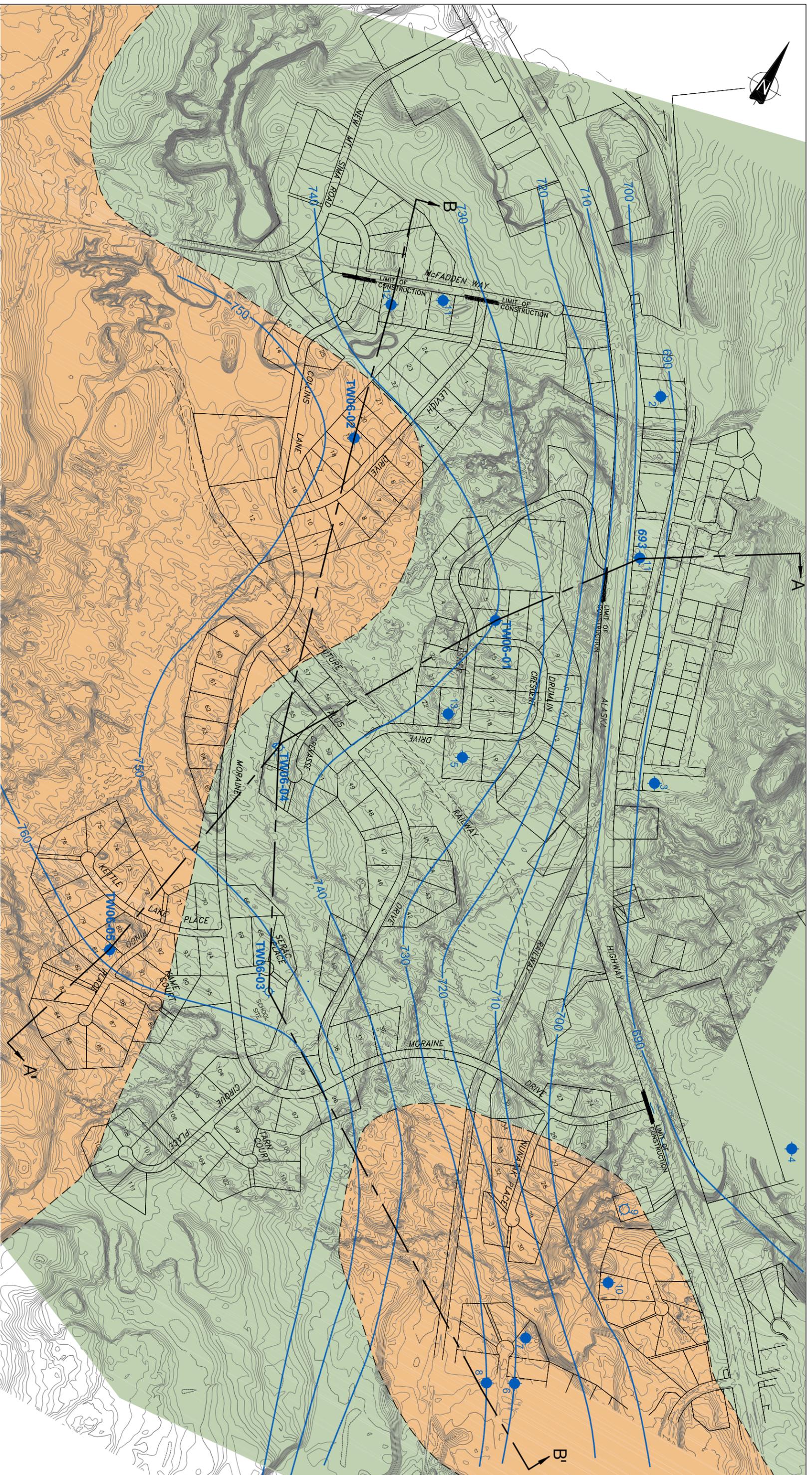
Downgradient impacts to water quality are expected to be negligible as long as in-ground sewage disposal fields are designed and operated properly. The feasibility of establishing in-ground sewage disposal should be evaluated on a lot by lot basis, and wells must be properly constructed (in accordance with Canadian Groundwater Association Guidelines) to help ensure protection of the underlying aquifers in the area. Continued monitoring of the groundwater level and groundwater

quality of the Wolf Creek long term monitoring well is recommended to help ensure water level and quality objectives are maintained in the area.

Closure and Limitations

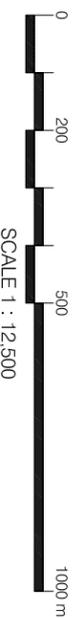
Information included in this memo is based upon the Hydrogeological Investigations as described in the full version of this report. The geologic information obtained from this investigation was limited to five test wells throughout a relatively large area. Extrapolation of these results to the area surrounding each well should be made carefully, as the nature of the earth's structure and characteristics throughout the site is highly variable.

This memo has been prepared for the use of Yukon Government – Community Services Department. It has been prepared in accordance with generally accepted hydrogeological practices. For further limitations regarding the use of this memo, reference should be made to the EBA Environmental Report – General Conditions, which are provided with this memo.



- LEGEND:**
- **2** BEDROCK WELL AND IDENTIFIER
 - **739** GROUNDWATER ELEVATION (SEE TABLE 1 FOR DETAILS)
 - **2** BEDROCK WELL AND IDENTIFIER (SEE TABLE 1 FOR DETAILS)
 - **2** OVERBURDEN WELL AND IDENTIFIER (SEE TABLE 1 FOR DETAILS)
 - BEDROCK CONTACT (INFERRED)
 - PRIMARY BEDROCK UNIT IS
 - PRIMARY BEDROCK UNIT IS
 - WHITEHORSE BATHOLITH (GRANODIORITE)

- NOTES:**
1. ALL LOCATIONS ARE APPROXIMATE.
 2. DRAWING ADAPTED FROM BASE PLAN PROVIDED BY QUEST ENGINEERING GROUP.
 3. BEDROCK GEOLOGY ADAPTED FROM GARTNER LEE 2002.
 4. DRAWING HAS BEEN PRODUCED IN COLOR, ANY REPRODUCTIONS MAY NOT BE REPRESENTATIVE OF ORIGINAL.



CLIENT



EBA Engineering Consultants Ltd.



**WHITEHORSE COPPER SUBDIVISION
HYDROGEOLOGICAL ASSESSMENT FOR WATER SUPPLY**

**SITE PLAN WITH WELL LOCATIONS AND
BEDROCK GEOLOGY**

PROJECT NO.	DWN	QCD	REV
1260009	JSB	KSJ	0
OFFICE	DATE		
EBA-WHSE	June 26, 2007		

Figure 8



ENVIRONMENTAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA’s client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA’s client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA’s investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

2.1 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

3.0 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA’s liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

1. With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;
2. With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.

4.0 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

6.0 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

7.0 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

8.0 NOTIFICATION OF AUTHORITIES

The client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

9.0 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

10.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.