March 31, 2006

EBA File: 1260012
Via Email: tom.renwick@gov.yk.ca

Government of Yukon
Property Management Agency

Attention: Mr. Tom Renwick

Dear Mr. Renwick:

Subject: Results of Short Term Pumping and Water Quality Analysis
PMA Building #1950
km 1442 Alaska Highway, Yukon

1.0 INTRODUCTION

The Ibex Valley Fire Hall is currently serviced by an 11.8 m deep well (1950-A) located approximately 12 m away from the fire hall building as shown on Figure 1. Water quality data for the existing shallow well suggests that the well is being impacted by septic leachate and is potentially under the direct influence of surface water (EBA 2005). The well was deemed unfit for potable water supply, and a recommendation was made to drill a deep bedrock well with better water quality.

A replacement well (1950-B) was drilled under the supervision of EBA Engineering Consultants Ltd. (EBA) in November 2005. The results of this drilling program have been summarized in a letter report to PMA dated January 2006. The replacement well (1950-B) was virtually dry, and did not produce significant volumes of water during drilling. However, in the two days following drilling the static level rose to approximately 10 mbgl (m below ground). The log for the new well is included as Appendix A.

The following tasks were completed by EBA in February of 2005 to assist PMA in determining how to proceed with well yield enhancement:

- Coordinating and performing a short-term pumping interval to facilitate collection of water samples, and evaluation of well characteristics;
- Analyzing data collected during the pumping interval;
- Coordinating the laboratory analysis of water samples from the new well; and,
- Preparation of this letter report summarizing results of pumping and laboratory analysis and providing recommendations for proceeding with well enhancement.

The following sections summarize the results of the additional assessment and recommendations for well yield enhancement.

2.0 SHORT TERM PUMPING TEST AND PUMPING TEST ANALYSIS

A temporary submersible pump was installed in 1950-B on February 13, 2005. The well was pumped at an approximate rate of 0.05 L/s for 126 min. Due to the rapid drawdown observed in the pumping well, it was very difficult to maintain a constant pumping rate. The pumping test was terminated after 126 min when the water level was drawn down to the pump intake. The maximum drawdown observed in the pumping well was 22.3 m.

A Solinst Levelogger™ was installed in the pumping well at a depth of 17 m to facilitate collection of recovery data. A Barologger™ was also installed at an above ground location to allow for correction of the Levelogger data for fluctuations in barometric pressure.

Pumping and recovery water level data is plotted on a log scale and included as Figure 2. A Cooper-Jacob analysis was completed on the pumping and recovery data. The results of the analysis indicate that the transmissivity of the aquifer is on the order of 1 x 10^{-2} m^2/day (this is considered to be very low). Using an equivalent aquifer thickness of 55.5 m yields an equivalent hydraulic conductivity of 2 x 10^{-9} m/sec. As bedrock wells draw water from discrete fracture zones, this equivalent conductivity calculated is an approximation based on static water level and well depth. The actual hydraulic conductivity of the fracture zones is likely much higher. The equivalent conductivity provides a baseline for evaluating the effectiveness of any well yield enhancement.

Based on the very low effective transmissivity, an exact well yield rating cannot be provided at this time. The well yield is significantly less that 0.05 L/s (1 Igpm) and not sufficient to supply the potable water system.

3.0 SAMPLE COLLECTION AND WATER CHEMISTRY RESULTS

Sample Collection

Water samples were collected and retained continuously during pumping of 1950-B to facilitate field observations of sample clarity. Samples obtained near the beginning of the pumping interval were relatively clear and colourless. Samples obtained near the end of the pumping interval displayed an orangey colour indicative of elevated iron concentrations. To account for the variability in water quality, two samples were submitted for laboratory analysis. Samples collected in both the early and late portions of the pumping interval were analyzed. Although the well was not completely purged due to the extremely low yield, samples are considered to be reasonably representative of aquifer water quality.

Water samples were collected in laboratory supplied sample containers in accordance with laboratory sampling procedures. The samples were transported on ice to ALS Environmental in Vancouver, BC and analyzed for drinking water potability and dissolved metals. Laboratory reports and certificates are included as Appendix B.

Results

Water quality analyses results are summarized in Table 1; the following items are of note:

- Water from well 1950-B is a moderately hard calcium-bicarbonate type water.
- With the exception of turbidity, water quality analyses results for general potability indicate that the sample collected early in the pumping test meets Canadian Drinking Water Quality Guidelines (CDWQG) criteria for health based and aesthetic objectives. As this is a raw sample prior to any well development or extended pumping the elevated turbidity is not expected to reflect exact aquifer water quality.
- The Langlier Saturation Index of the water is zero (neutral), indicating no tendency to either scale or corrode.
- The late sample, as expected, displays turbidty, total iron and manganese concentrations above CDWQG. Elevated iron concentrations are likely due to interaction with stagnant water within the cased portion of the well.
- Laboratory results for water from 1950-B do not indicate any evidence of impacts from septic effluent.
- From an aesthetic perspective, water from 1950-B is of much better quality than water from 1950-A (lower hardness and TDS).

4.0 RECOMMENDATIONS FOR WELL YIELD ENHANCMENT

To enhance the yield of 1950-B, PMA could proceed with either hydrofracturing of the bedrock formation or with drilling the well deeper or with. Drilling 1950-B deeper would likely result in exposing new fracture zones and thus increasing the yield of the well. The inherent risk with drilling deeper is that poorer quality water may be encountered, and that productive fractures may not be encountered. Hydrofracturing of 1950-B involves the pressure injection of water into the bedrock well to increase the yield of exiting fractures. The section of the well being pressurized is isolated by installing packers above (and possibly below) the target zone. The increase in yield comes from the extension and opening of fractures when subjected to high pressures. Hydrofracturing can be very successful with low-yielding bedrock wells, and is considered the best option for increasing the yield of 1950-B.

Preliminary cost estimates for drilling and hydrofracturing are outlined below, assuming the work can be coordinated with other work in the area (no contractor mobilization/ de-mobilization charges). Combined costs (for both drilling and hydrofracturing) are also included in the event that one method is unsuccessful and PMA wishes to proceed with both drilling deeper and hydrofracturing of the well.

	OPTION 1	OPTION 2	OPTION 3
ITEM	HYDROFRACTURING ONLY	DRILLING ONLY	DRILLING AND HYDROFRACTURING
EBA Fees and Disbursements (Contractor Supervision and Reporting)	$ 3000	$ 3000	$ 3000
Contractor costs[1] (For drilling assume additional 30 m)	$ 3000	$4000	$ 7000
Pumping Test[2]	$7000	$7000	$7000
Laboratory Analytic Fees	$400	$400	$400
Total	**$13,400**	**$14,400**	**$17400**

If water quality results or well yield are deemed unacceptable, the well should be decommissioned in accordance with Canadian Groundwater Association (CGWA) guidelines and would cost approximately $1400.

[1] Based on typical rates charged by local contractors, actual amount may vary.
[2] Based on typical rates charged by local contractors, actual amount may vary.

5.0 CLOSURE

Conclusions and recommendations in this report are based upon the Hydrogeological Investigations as described in the previous sections. This report has been prepared for the use of the Government of Yukon Property Management Agency. It has been prepared in accordance with generally accepted hydrogeological practices. For further limitations regarding the use of the report, reference should be made to the EBA Environmental Report – General Conditions attached, which form a part of this report.

EBA trusts that this letter report satisfies your present requirements. Should you have any questions or comments please do not hesitate to contact the undersigned.

Respectfully submitted,

EBA Engineering Consultants Ltd.

Prepared by:

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(email: ksjohnston@eba.ca)

Reviewed by:

Ryan Martin, M.Sc.(Eng.), P.Eng.
Project Engineer, Hydrogeologist
(Direct Line: (867) 668-2071, ext. 31)
(email: rmartin@eba.ca)

REFERENCES

Canadian Groundwater Association. Guidelines for Water Well Construction. 1995.

EBA Engineering Consultants Ltd. July 2005. "Small Public Water Systems Assessment Yukon Government Maintained Buildings- Whitehorse Region Draft Report". Prepared for Government of Yukon Property Management Agency.

EBA Engineering Consultants Ltd. February 2006. "Ibex Valley Fire Hall Test Well Drilling PMA Building #1950 km 1442 Alaksa Highway, Yukon". Letter report to Government of Yukon Property Management Agency.

Driscoll, Fletcher G. 1986. Groundwater and Wells. Johnson Screens.

Federal–Provincial–Territorial Committee on Drinking Water of the Federal–Provincial–Territorial Committee on Health and the Environment, (April 2004), "Summary of Canadian Drinking Water Quality Guidelines".

Government of Yukon. December 22, 2005. Draft Guidelines for Part III – Small Public Drinking Water Systems

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.

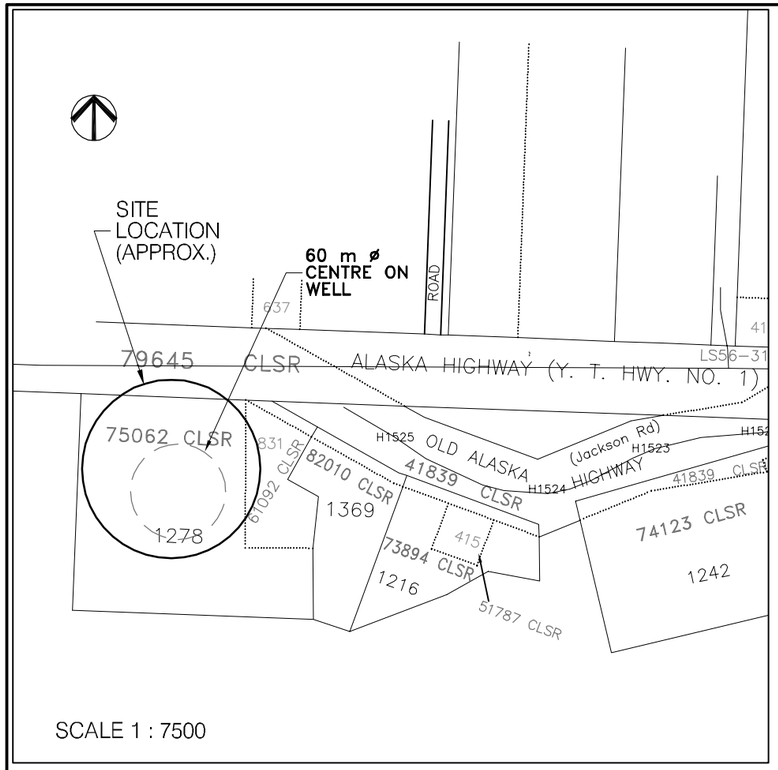
10.0 ALTERNATE REPORT FORMAT

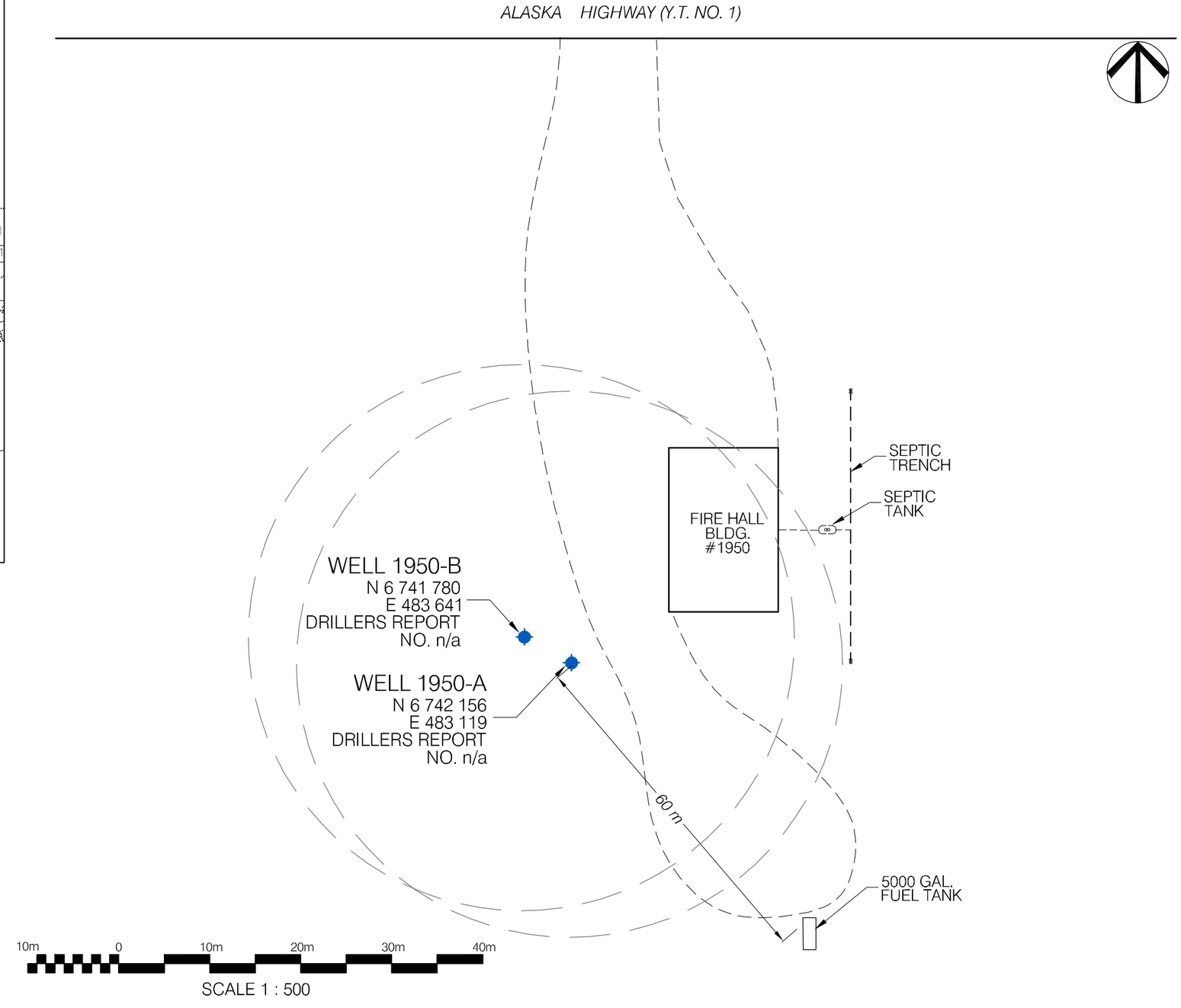
Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally 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.

FIGURES





NOTES:
1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.
2. LOCATION OF BUILDING ON PROPERTY IS APPROXIMATE ONLY.

30 m RADIUS FROM WATER WELL FOR CONSIDERATION OF PROXIMITY TO POTENTIAL CONTAMINANT SOURCES.

No.	DESCRIPTION	DATE	APPROVED
0	ISSUED FOR CLIENT REVIEW	DD/MM/YY	XXX

REVISION

EBA Engineering Consultants Ltd.

DESIGNED BY:	R. MARTIN
DRAWN BY:	J. BUYCK
DATE:	JUNE 2005
SCALE:	AS SHOWN
PROJECT No.:	1260002.001
ACAD FILENAME:	001-WHITEHORSE REGION

CLIENT: Yukon
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

IBEX FIRE HALL
BUILDING 1950
SITE LOCATION DIAGRAM
WELL ID: 1950

REVISION ISSUE: 0

DRAWING No.: FIGURE 1

TABLES

TABLE 1: SUMMARY OF LABORATORY CHEMISTRY RESULTS

		1950-A Ibex Valley Fire Hall- Old Well	1950-A Ibex Valley Fire Hall- Old Well	1950-B Ibex Valley Fire Hall- Early	1950-B Ibex Valley Fire Hall- Late	Canadian Drinking Water Quality Guidelines		
	ALS Report			X2039	X2039			
	Date	05-Oct-04	05-Oct-05	13-Feb-06	13-Feb-06	Lower Limit	Upper Limit	
						AO	MAC	AO
Physical Tests								
Colour	CU	5	<5.0	<5.0	-			
Conductivity (Lab)	uS/cm	512	847	313	-			
Total Dissolved Solids (Lab)	mg/L	304	579	172	-			
Hardness (CaCO3)	mg/L	265	392	112	112			
pH (field)	pH units	7.8	8.21	-		6.5		8.5
pH (lab)	pH units			8.09	-			
Turbidity	NTU	0.5	**4.92**	**11.3**	**158**	5	1	
Dissolved Anions								
Alkalinity-Total CaCO3	mg/L	190	230	141	-			
Chloride	mg/L	52	1.67	15.3	-			250
Fluoride	mg/L	0.23	1.05	0.220	-		1.5	
Sulphate	mg/L	23	109	15.6	-			500
Nutrients								
Nitrate Nitrogen	mg/L	1.5	<0.10	0.20	-		10	
Nitrite Nitrogen	mg/L	<0.05	<0.10	<0.10	-		3.2	
Ammonia Nitrogen	mg/L	-	0.075					
Total Metals								
Aluminum	mg/L	<0.02	<0.020	0.163	0.621			
Antimony	mg/L	0.0008	<0.0010	<0.0025	<0.0025		0.006	
Arsenic	mg/L	0.0037	0.00384	0.00199	0.00231		0.025	
Barium	mg/L	0.0928	0.13	<0.10	<0.10		1	
Boron	mg/L	<0.02	<0.20	<0.50	<0.50		5	
Cadmium	mg/L	<0.0002	<0.00040	<0.0010	<0.0010		0.005	
Calcium	mg/L	74.2	115	35.5	38.7			
Chromium	mg/L	0.0014	<0.0040	<0.010	<0.010		0.05	
Copper	mg/L	0.344	0.295	<0.0050	0.0059			1
Iron	mg/L	0.064	**0.852**	0.124	**11.7**			0.3
Lead	mg/L	0.0013	0.0041	<0.0050	<0.0050		0.01	
Magnesium	mg/L	17.7	25.4	4.34	4.79			
Manganese	mg/L	0.006	0.0382	0.021	**0.609**			0.05
Mercury	mg/L	<0.0002	<0.00020	<0.00020	<0.00020		0.001	
Potassium	mg/L	1.6	1.75	0.980	1.44			
Selenium	mg/L	0.0006	<0.0020	<0.0050	<0.0050		0.01	
Sodium	mg/L	13	27.7	23.9	29.4			200
Uranium	mg/L	0.0058	0.00869	0.004	0.00283		0.02	
Zinc	mg/L	0.04	<0.10	<0.25	<0.25			5
Dissolved Metals								
Aluminum	mg/L	-	-	<0.050	<0.050			
Antimony	mg/L	-	-	<0.0025	<0.0025		0.006	
Arsenic	mg/L	-	-	0.00156	<0.00050		0.025	
Barium	mg/L	-	-	<0.10	<0.10		1	
Boron	mg/L	-	-	<0.50	<0.50		5	
Cadmium	mg/L	-	-	<0.0010	<0.0010		0.005	
Calcium	mg/L	-	-	37.4	37.4			
Chromium	mg/L	-	-	<0.010	<0.010		0.05	
Copper	mg/L	-	-	<0.0050	<0.0050			1
Iron	mg/L	-	-	<0.030	<0.030			0.3
Lead	mg/L	-	-	<0.0050	<0.0050		0.01	
Magnesium	mg/L	-	-	4.52	4.67			
Manganese	mg/L	-	-	<0.010	**0.136**			0.05
Mercury	mg/L	-	-	<0.00020	<0.00020		0.001	
Potassium	mg/L	-	-	0.95	1.27			
Selenium	mg/L	-	-	<0.0050	<0.0050		0.01	
Sodium	mg/L	-	-	23.4	30.5			200
Uranium	mg/L	-	-	0.00414	0.0026		0.02	
Zinc	mg/L	-	-	<0.25	<0.25			5

Notes:
1) CDWQG criteria are taken from the "Canadian Drinking Water Quality Guidelines, April 2004."
2) MAC refers to the Maximum Acceptable Concentration according to the CDWQG criteria.
3) AO refers to the Aesthetic Objective according to the CDWQG criteria.
4) "-" indicates not analyzed.
5) **Bold** indicates parameter above CDWQG AO.
6) **Bold and highlighted** indicates parameter above CDWQG MAC.

APPENDIX A

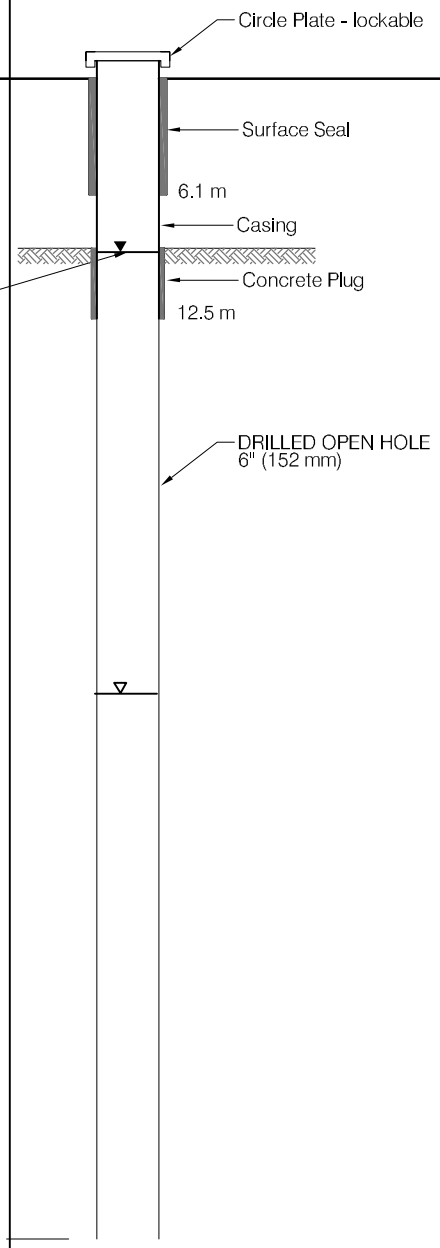
WELL LOG AND DRILLERS REPORT

HYDROGEOLOGIC LOG

BOREHOLE NO. 1950-B

PURPOSE OF HOLE: Water Supply Well
DRILLING METHOD: Dual Air Rotary
START DRILLING: December 9, 2005
SCREEN INSTALLED: N/A
CONTRACTOR: Double "D" Drilling

GROUND ELEV. (m-geod): N/A
TOP OF CASING (m-geod): N/A
CASING STICK UP (m): 1.40 m
DEPTH TO STATIC (m): 9.0 m below grd.
DEPTH TO SCREEN TOP (m): N/A
UTM Coordinates from GPS: Zone 7, 6741780 N, 483641 E

Lithology Depth (m)	Comments	Well Installation Summary
0m SAND - some gravel, silty, brown, dry to moist 5m 8.8 m 10m BEDROCK - fine grained, red/brown 15m 20m 25m 30m 35m 40m - Possible fracture @ 43.3 m-bg. 45m 55m 60m - Possible fracture @ 63.1 m-bg. 65m Color changes to grey at 65.0 m 65.5 m END OF HOLE 70m	Static Water Level = 9.0 mbgl (February 13, 2006)	

EBA Engineering Consultants Ltd.

PROJECT: IBEX VALLEY FIRE HALL
WHITEHORSE, YUKON

CLIENT: Yukon Highways and Public Works Property Management Branch

TITLE: WELL LOG 1950-B

DATE	DWN.	CHKD.	FILE NO.	DRWG.
JAN. 2006	JSB	KSJ	1260008	FIGURE A1

Z:\0201Drawings\S.Klondike-Haines Junction Hwy\1260008 Ibex Valley Fire Hall Water Well\1260008 Figure 1 Well 1950_B.dwg, 4/11/2006 8:43:19 AM, Adobe PDF, jbuyck

BRITISH COLUMBIA — BC Environment — Water Management Branch, Groundwater Section

WATER WELL RECORD

Date 05 12 11 (YR MO DY)

BCGS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address ____

Legal Description & Address ____

Descriptive Location IBEX VALLEY FIRE HALL

1. TYPE OF WORK: 1 ☑ New Well 2 ☐ Reconditioned 3 ☐ Deepened 4 ☐ Abandoned

2. WORK METHOD: 1 ☐ Cable tool 2 ☐ Bored 3 ☐ Jetted 4 ☑ Rotary a ☐ mud b ☐ air c ☐ reverse ☐ Other ____

3. WATER WELL USE: 1 ☐ Domestic 2 ☐ Municipal 3 ☐ Irrigation 4 ☐ Comm. & Ind. ☐ Other ____

4. DRILLING ADDITIVES NONE

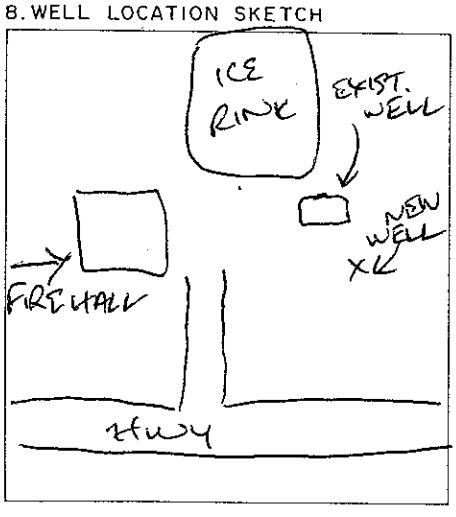
5. MEASUREMENTS from 1 ☐ ground level 2 ☐ top of casing; casing height above ground level 4 ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	29	OVERBURDEN	
29	215	BEDROCK	
		* POSSIBLE FRACTURES @ 142, 207 FT	
		* 10" SURFACE STEEL 0 - 20FT	
		@ bottom grey to red @ bottom fracture	

7. CONSULTANT ____

Address ____

8. WELL LOCATION SKETCH



9. CASING Materials: 1 ☑ Steel 2 ☐ Galvanized 3 ☐ Wood 4 ☐ Plastic 5 ☐ Concrete ☐ Other ____

							units
Hole Diameter	6 5/8						ins
Diameter	6						ins
from	0						ft
to	41						ft
Thickness	.250						ins
Weight							lb/ft

Pitless unit ____ ft 1 ☐ above 2 ☐ below ground level

1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded | 1 ☐ New 2 ☐ Used

Perforations: ____

Shoe(s): BARBER DRIVE SHOE

Open hole, from 41 to 215 ft Diameter 6 ins

Grout: ____

10. SCREEN: 1 ☐ Nominal (Telescope) 2 ☐ Pipe Size

Type 1 ☐ Continuous Slot 2 ☐ Perforated 3 ☐ Louvre ☐ Other ____

Material 1 ☐ Stainless Steel 2 ☐ Plastic ☐ Other ____

Set from ____ to ____ ft below ground level

RISER, SCREEN & BLANKS							units
Length							ft
Diam. I D							ins
Slot Size							ins
from							ft
to							ft

Fittings, top ____ bottom ____

Gravel Pack ____

11. DEVELOPED BY: 1 ☐ Surging 2 ☐ Jetting 3 ☐ Air 4 ☐ Bailing 5 ☐ Pumping ☐ Other ____

12. TEST 1 ☐ Pump 2 ☐ Bail 3 ☐ Air Date ____ (YR MO DY)

Rate ____ USgpm Temp ____ °C SWL before test ____ ft

Water Level ____ ft after test of ____ hrs

☐ DRAWDOWN in ft				☐ RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING ft	RECOMMENDED PUMPING RATE USgpm

14. WATER TYPE: 1 ☐ fresh 2 ☐ salty 3 ☐ clear 4 ☐ cloudy

colour ____ smell ____ ; gas 1 ☐ yes 2 ☐ no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date ____ (YR MO DY)

SITE I D No ____

16. FINAL WELL COMPLETION DATA

Well Depth 215 ft Well Yield ____ US gpm

Static Water Level ____ ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled ____

Well Head Completion LOCKABLE HINGED LID

17. DRILLER (PLEASE PRINT) SURNAME STANWICK FIRST NAME DOUG

Signature ____

18. CONTRACTOR, Address DOUBLE D DRILLING LTD. BOX 766 TERRACE B.C. V8G 4R1 250 635 7877

Member, B C G W A ☑ yes ☐ no ; Doug Stanwick

APPENDIX B

PUMPING TEST DATA

APPENDIX B PUMPING TEST DATA

WELL NAME:	TW05-01	PUMP INTAKE DEPTH (m):	32.00
STATIC WATER LEVEL (m):	10.790	SCREEN INTERVAL:	N/A
DATUM:	Top of Casing	SLOT SIZE ("):	N/A
DATUM STICK-UP(m):	1.400	AVAILABLE DRAWDOWN(m):	21.21
WELL DIAMETER (mm):	152 mm (6")	SCREEN DIAMETER (mm):	6" Nominal

DATE	TIME	ELAPSED TIME (min)	DEPTH TO WATER (m)	DRAWDOWN (m)	FLOW RATE (IGPM)	FLOW RATE (L/s)	SPECIFIC CAPACITY (L/s/m)	pH	EC	TEMP	COMMENTS
13-Feb-06	10:25:00	0	10.404	0.000		-	-				Water clear.
13-Feb-05	10:25:30	0.5	10.442	0.038		-	-				
13-Feb-05	10:27:00	2	10.449	0.045		-	-				
13-Feb-05	10:28:30	3.5	10.710	0.306	0.7	0.05	0.16				
13-Feb-05	10:29:30	4.5	10.881	0.477		-	-				
13-Feb-05	10:32:00	7	11.272	0.868		-	-				
13-Feb-05	10:33:00	8	11.405	1.001		-	-				
13-Feb-05	10:34:30	9.5	11.616	1.212	0.5	0.04	0.03				
13-Feb-05	10:35:00	10	11.692	1.288		-	-				
13-Feb-05	10:37:00	12	11.952	1.548		-	-				
13-Feb-05	10:39:00	14	12.192	1.788		-	-				
13-Feb-05	10:41:00	16	12.389	1.985	0.3	0.03	0.01				Adjust Flow Up
13-Feb-05	10:43:00	18	12.658	2.254		-	-				
13-Feb-05	10:45:00	20	13.005	2.601	0.7	0.05	0.02				
13-Feb-05	10:50:00	25	13.797	3.393		-	-				
13-Feb-05	10:55:00	30	14.424	4.020		-	-				
13-Feb-05	11:05:00	40	15.935	5.531	0.4	0.03	0.01				Adjust Flow Up
13-Feb-05	11:15:00	50	16.777	6.373	0.4	0.03	0.00				Adjust Flow Up
13-Feb-05	11:25:00	60	18.077	7.673	0.7	0.06	0.01				
13-Feb-05	11:40:00	75	20.293	9.889	0.7	0.05	0.01				
13-Feb-05	11:55:00	90	23.474	13.070	0.8	0.06	0.00				
13-Feb-05	12:10:00	105	26.294	15.890	0.7	0.05	0.00				Water turing orangey.
13-Feb-05	12:25:00	120	28.105	17.701	0.6	0.04	0.00				Adjust Flow Up.
13-Feb-05	12:27:00	122	30.020	19.616		-	-				
13-Feb-05	12:29:00	124	31.930	21.526		-	-				
13-Feb-05	12:31:00	126	32.775	22.371		-	-				Stop Pumping.

Notes:
1) Depth to water measured below top of casing.

APPENDIX C

LABORATORY REPORTS AND CERTIFICATES

ALS Environmental

CERTIFICATE OF ANALYSIS

Date:	February 21, 2006
ALS File No.	X2039
Report On:	IBEX Valley 1260012 Water Analysis
Report To:	**EBA Engineering Consultants Ltd.** Calcite Business Centre Unit 6 - 151 Industrial Road Whitehorse, YT Y1A 2V3
Attention:	**Ms. Katherine Johnston**
Received:	February 14, 2006

ALS ENVIRONMENTAL
per:

Sime Buric, B.Sc. - Client Services
Natasha Markovic-Mirovic, B.Sc. - Project Chemist

ALS CANADA LTD.
1988 Triumph Street, Vancouver, BC Canada V5L 1K5
Phone: 604-253-4188 Fax: 604-253-6700 Website: www.alsenviro.com

REMARKS

For some of the submitted water samples, the measured concentration of specific dissolved parameters is greater than the corresponding total parameters concentration. The explanation for these findings is one or a combination of the following:

- laboratory method variability;
- field sampling method variability;
- bias introduced during general handling, storage, transportation and/or analysis of the sample;
- field sample grab bias - where separate grab samples are processed to produce total and dissolved samples;
- field sample split bias - where total and dissolved parameters samples are produced from the same grab sample.

For further clarification on any of the above information, please contact your ALS representative.

File No. X2039

RESULTS OF ANALYSIS - Water

Sample ID			Early	Late
ALS ID			*1*	*2*
Physical Tests				
Colour	(CU)		<5.0	-
Conductivity	(uS/cm)		313	-
Total Dissolved Solids			172	-
Hardness	CaCO3		112	112
pH			8.09	-
Turbidity	(NTU)		11.3	158
Dissolved Anions				
Alkalinity-Total		CaCO3	141	-
Chloride	Cl		15.3	-
Fluoride	F		0.220	-
Sulphate	SO4		15.6	-
Nutrients				
Nitrate Nitrogen		N	0.20	-
Nitrite Nitrogen		N	<0.10	-
Total Metals				
Aluminum	T-Al		0.163	0.621
Antimony	T-Sb		<0.0025	<0.0025
Arsenic	T-As		0.00199	0.00231
Barium	T-Ba		<0.10	<0.10
Boron	T-B		<0.50	<0.50
Cadmium	T-Cd		<0.0010	<0.0010
Calcium	T-Ca		35.5	38.7
Chromium	T-Cr		<0.010	<0.010
Copper	T-Cu		<0.0050	0.0059
Iron	T-Fe		0.124	11.7
Lead	T-Pb		<0.0050	<0.0050
Magnesium	T-Mg		4.34	4.79
Manganese	T-Mn		0.021	0.609
Mercury	T-Hg		<0.00020	<0.00020
Potassium	T-K		0.98	1.44
Selenium	T-Se		<0.0050	<0.0050
Sodium	T-Na		23.9	29.4
Uranium	T-U		0.00389	0.00283
Zinc	T-Zn		<0.25	<0.25

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).
< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH, Conductivity (umhos/cm), Turbidity (NTU), and Colour (CU).
Results are expressed as milligrams per litre except where noted.

File No. X2039

RESULTS OF ANALYSIS - Water

Sample ID		Early	Late
ALS ID		*1*	*2*
Dissolved Metals			
Aluminum	D-Al	<0.050	<0.050
Antimony	D-Sb	<0.0025	<0.0025
Arsenic	D-As	0.00156	<0.00050
Barium	D-Ba	<0.10	<0.10
Boron	D-B	<0.50	<0.50
Cadmium	D-Cd	<0.0010	<0.0010
Calcium	D-Ca	37.4	37.4
Chromium	D-Cr	<0.010	<0.010
Copper	D-Cu	<0.0050	<0.0050
Iron	D-Fe	<0.030	<0.030
Lead	D-Pb	<0.0050	<0.0050
Magnesium	D-Mg	4.52	4.67
Manganese	D-Mn	<0.010	0.136
Mercury	D-Hg	<0.00020	<0.00020
Potassium	D-K	0.95	1.27
Selenium	D-Se	<0.0050	<0.0050
Sodium	D-Na	23.4	30.5
Uranium	D-U	0.00414	0.00260
Zinc	D-Zn	<0.25	<0.25

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).
< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH, Conductivity (umhos/cm), Turbidity (NTU), and Colour (CU).
Results are expressed as milligrams per litre except where noted.

File No. X2039

Appendix 1 - REGULATORY CRITERIA

Health Canada

Summary of Guidelines for Canadian Drinking Water Quality, April 2003. Please see the guidelines for further details.
All limits are Maximum Acceptable Concentration (MAC) unless otherwise indicated. Limits are expressed as mg/L except for pH, Turbidity, Colour and Bacteriolgical Tests.

			Lower Limit	Upper Limit		Notes
Physical Tests						
Colour	(CU)		-	15	CU	1
Total Dissolved Solids			-	500	mg/L	1
pH			6.5	8.5		1
Turbidity	(NTU)		-	5	NTU	1, 2
Dissolved Anions						
Chloride	Cl		-	250	mg/L	1
Fluoride	F		-	1.5	mg/L	
Sulphate	SO4		-	500	mg/L	1, 3
Nutrients						
Nitrate Nitrogen		N	-	10	mg/L	
Nitrite Nitrogen		N	-	1	mg/L	
Total Metals						
Antimony	T-Sb		-	0.006	mg/L	4, 5
Arsenic	T-As		-	0.025	mg/L	4
Barium	T-Ba		-	1	mg/L	
Boron	T-B		-	5	mg/L	4
Cadmium	T-Cd		-	0.005	mg/L	
Chromium	T-Cr		-	0.05	mg/L	
Copper	T-Cu		-	1	mg/L	1, 6
Iron	T-Fe		-	0.3	mg/L	1
Lead	T-Pb		-	0.01	mg/L	6, 5
Manganese	T-Mn		-	0.05	mg/L	1
Mercury	T-Hg		-	0.001	mg/L	
Selenium	T-Se		-	0.01	mg/L	
Sodium	T-Na		-	200	mg/L	1
Uranium	T-U		-	0.02	mg/L	4
Zinc	T-Zn		-	5	mg/L	1, 6

1 Aesthetic Objective (AO) (taste, odour, appearance, etc.)
2 1 NTU maximum allowed for water entering distribution systems.
3 There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.
4 Interim Maximum Acceptable Concentration (IMAC)
5 First drawn water may be high, flush system before sampling.
6 At point of consumption.

Appendix 1 - REGULATORY CRITERIA

Health Canada

Summary of Guidelines for Canadian Drinking Water Quality, April 2003. Please see the guidelines for further details.
All limits are Maximum Acceptable Concentration (MAC) unless otherwise indicated. Limits are expressed as mg/L except for pH, Turbidity, Colour and Bacteriolgical Tests.

		Lower Limit	Upper Limit		Notes
Dissolved Metals					
Antimony	D-Sb	-	0.006	mg/L	1, 2
Arsenic	D-As	-	0.025	mg/L	1
Barium	D-Ba	-	1	mg/L	
Boron	D-B	-	5	mg/L	1
Cadmium	D-Cd	-	0.005	mg/L	
Chromium	D-Cr	-	0.05	mg/L	
Copper	D-Cu	-	1	mg/L	3, 4
Iron	D-Fe	-	0.3	mg/L	3
Lead	D-Pb	-	0.01	mg/L	4, 2
Manganese	D-Mn	-	0.05	mg/L	3
Mercury	D-Hg	-	0.001	mg/L	
Selenium	D-Se	-	0.01	mg/L	
Sodium	D-Na	-	200	mg/L	3
Uranium	D-U	-	0.02	mg/L	1
Zinc	D-Zn	-	5	mg/L	3, 4

1 Interim Maximum Acceptable Concentration (IMAC)
2 First drawn water may be high, flush system before sampling.
3 Aesthetic Objective (AO) (taste, odour, appearance, etc.)
4 At point of consumption.

Appendix 2 - METHODOLOGY

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Colour in Water

This analysis is carried out using procedures adapted from APHA Method 2120 "Color". Colour (true colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. The analysis is carried out without pH adjustment.

Recommended Holding Time:
Sample: 2 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:
Sample: 7 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:
Sample: 2 hours
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Turbidity of Water

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

Recommended Holding Time:
Sample: 2 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:
Sample: 14 days
Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:
Sample: 6 months
Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Mercury in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

Recommended Holding Time:
Sample: 28 days
Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Results contained within this certificate relate only to the samples as submitted.

End of Report

01699

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CHAIN OF CUSTODY FORM

PAGE _____ OF _____

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TELEPHONE: 8676682071 FAX: 8676684349 CONTACT: K Johnston
PROJECT NAME & NO.: IBEX VALLEY 1260012 SAMPLER: K. Johnston
QUOTE NO.: _____ PO NO.: _____ ALS CONTACT: NMM
REPORT FORMAT: ☐ HARDCOPY ☒ EMAIL - ADDRESS: ksjohnston
☐ FAX ☐ EXCEL ☐ PDF ☐ OTHER: _____

ANALYSIS REQUESTED:

FOR LAB USE ONLY	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED YYYY-MM-DD	TIME	MATRIX	FULL DW PACKAGE	TOTAL METALS	DISSOLVED METALS	TURBIDITY									NOTES (sample specific comments, due dates, etc.)
X2039	EARLY				X		X										
	LATE					X	X	X									

TURN AROUND REQUIRED: ☐ ROUTINE ☐ RUSH - SPECIFY DATE: _____ (surcharge may apply)

SEND INVOICE TO: ☐ SAME AS REPORT **INVOICE FORMAT:** ☐ HARDCOPY ☐ PDF ☐ FAX
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	TIME		TIME
RELINQUISHED BY:	DATE	RECEIVED BY: GNR	DATE 07a/02/14
	TIME		TIME 14:15

FOR LAB USE ONLY

COOLER SEAL INTACT?	SAMPLE TEMPERATURE: 3 °C	COOLING METHOD?
☐ YES ☐ NO ☐ N/A	FROZEN? ☐ YES ☐ NO	☑ ICEPACKS ☐ ICE ☐ NONE

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