

Government of Yukon- Property Management Agency

WELL COMPLETION REPORT
BURWASH LANDING AIRPORT TERMINAL BUILDING
PMA BUILDING #3201
DESTRUCTION BAY
YUKON

EBA FILE: 1260008

January 2006



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1.0 INTRODUCTION

EBA was retained by Government of Yukon (YTG) Property Management Agency (PMA) to coordinate the drilling, construction and testing of a new water supply well at the Burwash Landing Airport Terminal Building (ATB). The Burwash ATB (Building 3201) water system was formerly supplied by a 10.5 m deep well (3201-A) located in a below ground wooden enclosure adjacent to the building. An evaluation of the well and water supply system completed by EBA in 2005 entitled "Small Water System Assessments- Government of Yukon Maintained Buildings- Western Region" found several high risk deficiencies with the system including poor surface completion of the well, poor water quality and several potential contaminant sources within 30 m of the wellhead. EBA provided several different remedial options to mitigate risk associated with these deficiencies. The remedial option selected by PMA was drilling and commissioning of a new well to supply the system. Authorization to proceed with the work was granted on November 7, 2005.

1.1 SCOPE OF WORK

The following tasks were completed in accordance with EBA's proposal dated October 14, 2005:

- Development of specifications for drilling;
- Completion of a preliminary environmental screening for drilling;
- Arranging for qualified drilling and pumping test contractors;
- Co-ordinating and supervising drilling, well construction and pumping tests; and
- Preparation of this well completion report.

2.0 FIELD PROGRAM

2.1 WELL DRILLING, CONSTRUCTION AND TESTING

The well drilling and testing contract was awarded to Double D Drilling of Whitehorse, Yukon on November 7, 2005. Drilling of 3201-C commenced on November 22, 2005 and was completed on November 24, 2005. Testing took place between December 6 and 7, 2005.

3201-C was drilled using the dual rotary drilling method. Samples were retained continuously during drilling. A summary of soils encountered and observations made during drilling is included on the well log in Appendix A.

A water-bearing sand and gravel aquifer was encountered from 25.9 to 35.1 m below ground (m-bg). A screen was designed based on the grain size analysis of the material from this zone and installed between 33.7 and 34.9 m-bg. The screen was developed by lifting and surging with air for 8 hours. A summary of relevant well construction details is included on Table 1 on the following page.

TABLE 1: SUMMARY OF WELL INFORMATION AND CONSTRUCTION DETAILS	
REQUIRED DETAILS	DETAILS OR REPORT REFERENCE
Date of construction:	Well was drilled between November 22 th and 24 th , 2005.
Name and address of the owner of the well:	Government of Yukon- Department of Highways and Public Works- Property Management Agency Box 2703, Whitehorse, Yukon Y1A 2C6
Description of the property:	Burwash Landing Airport Terminal Building, km 1761 Alaska Highway, Burwash Landing, Yukon
UTM Co-ordinates(± 8 m):	UTM Zone 7 E 605247 N 6805596
Location of the well on the property:	See Figure 1.
Method of construction:	Drilled using the dual air rotary drilling method.
Description, depth and thickness of geologic materials encountered during construction:	See Well log 3201-C in Appendix A. Double D Drilling Log is also included in Appendix A.
Depth and diameter of the well:	The well construction details are provided on Well log in Appendix A. Total depth of well completion is 35.9 m-bg.
Type of casing materials and thickness:	Steel Casing – 0.250 inches (6.35 mm) thick.
Static water level:	Artesian well- flowing at approximately 3 IGPM.
Type, size, length and location of screen:	Stainless steel V-wire 6 (0.060”) slot Johnson screen. Total screen length is 1.2 m., set between 33.7 m and 34.9 m bg.
Location of major water-bearing zones:	Water bearing sand and gravel zone from 25.9 to 35.1 m bg.
Location, type and thickness of grout sealant placed around the well:	Bentonite seal was placed between annulus of conductor pipe and native sand and gravel. Seal is completed from grade to 6.0 m bg.

2.2 WELL AND AQUIFER TESTING

Well testing was completed on December 6 and 7, 2005 by Double D Drilling. A temporary submersible pump was installed in the well at a depth of 32.0 m–bg, flow was monitored during the pumping test with a totalizer located near the wellhead, and checked using a graduated barrel and stopwatch. Water from the pumping well was conveyed to a location 30.5 m away from the well and disposed of by infiltration.

A step rate test was first conducted to determine the optimal rate at which to perform the constant rate pumping test. The step rate test was initiated on December 6, 2005 at 10:00 AM. Three 60 min steps were completed at rates of 0.76, 1.52 and 2.65 L/s. The final step was extended for 24 hours as the constant rate test. A plot of drawdown and recovery is included as the upper portion of Figure 2. The lower portion of Figure 2 includes a plot of flow rate vs. specific capacity and drawdown observed at 60 min into each step. The water level in 3201-C and flow rate were monitored continuously during the constant rate pumping test. The pumping test concluded at 10:00 AM on December 7, 2005, and recovery was monitored for 8 hours. Data collected during the step test, constant rate test and recovery interval is included as Appendix B.

2.3 WATER QUALITY ANALYSIS

Water samples were collected from a sample port located at the wellhead at the end of the constant rate pumping test. Samples were collected in laboratory supplied sample containers in accordance with laboratory sampling procedures. Samples were shipped by air cargo to ALS Environmental in Vancouver, B.C. for detailed potability analysis including the following parameters: physical tests, dissolved anions, total metals, and total organic carbon. ALS is a member of the Canadian Association of Environmental Analytical Laboratories (CAEAL).

To expedite well hook-up, a preliminary water sample was analyzed immediately after well development. The sample was analyzed for dissolved metals and selected total metals. Analytical results are summarized in Table 4. Laboratory reports and certificates are included as Appendix C.

Upon well hook-up a sample was collected for bacteriological analysis by PMA. This sample was submitted to Yukon Environmental Health and Social Services (EHSS) on December 20, 2005. Results for this sample are included in Table 4. Laboratory reports and certificates are included in Appendix C.

3.0 RESULTS

3.1 PUMPING TEST

Step Test

A plot of observed drawdown in 3201-C during the step rate pumping test is included as the upper graph in Figure 2. The lower graph details specific capacity and drawdown observed at 60 min into each step. As the flow rate increased from 0.76 to 2.65 L/s, the specific capacity dropped from 0.92 to 0.60 L/s/m. As expected, drawdown vs. flow rate behaved in a relatively linear fashion.

Constant Rate Test

Drawdown observed in 3201-C during the constant rate pumping test is plotted on Figure 3. To facilitate pumping test analysis, the drawdown data has been plotted against elapsed time since the beginning of the constant rate pumping interval. Also included on Figure 3 is residual drawdown vs. residual time factor $(t/t^1)^1$ as observed during the recovery interval. The maximum drawdown observed during the constant rate pumping test was 12.686 m. No evidence of recharge, or positive boundaries was observed during the constant rate pumping test.

As indicated on a plot of drawdown vs. log time (Figure 3) the steepening of the drawdown curve likely indicates that the expanding zone of depression encountered negative boundaries (i.e. less permeable sediments) where a change in slope is observed.

¹ $t/t^1 = (\text{time since pump started}) / (\text{time since pump stopped})$

The plot of t/t' intercepts zero at residual drawdown at t/t' less than 1, indicating that the aquifer is of limited extent. The projected 100 day drawdown is approximately 38.25 m; which is significantly greater than the available drawdown of 33.7 m.

The observed and residual drawdown was analyzed using the Cooper-Jacob straight-line method, which assumes the following:

- The aquifer is infinite in aerial extent, and uniform in thickness.
- The aquifer is homogeneous and isotropic.
- The pumping well fully penetrates the aquifer thickness, and pumps at a constant rate.
- The piezometric surface was horizontal prior to pumping.
- Water is released instantaneously from storage with a decline in head.
- The well diameter is small such that well storage is negligible.
- Flow is laminar.

The results of the Cooper-Jacob analysis for the constant rate pumping test are included on Figure 3 and summarized in Table 2 below. The straight line approximation was applied separately for the early, mid and late pumping, and early and late recovery intervals. Summarized in Table 2 below are the transmissivity and conductivity values calculated from the constant rate pumping test data. Also included are the conductivity values calculated based on grain size analyses.

TABLE 2: AQUIFER TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY

CONDUCTIVITY BASED ON PUMPING TEST RESULTS			CONDUCTIVITY BASED ON GRAIN SIZE ANALYSIS	
INTERVAL	T TRANSMISSIVITY	K CONDUCTIVITY	SAMPLE DEPTH	K CONDUCTIVITY ²
EARLY PUMPING (T ₁ ,K ₁)	33 m ² /day	4.2 x 10 ⁻⁵ m/sec	34.1 m	1.04 x 10 ⁻² m/sec
MID PUMPING (T ₂ ,K ₂)	285 m ² /day	3.6 x 10 ⁻⁴ m/sec		
LATE PUMPING (T ₃ ,K ₃)	7 m ² /day	9.3 x 10 ⁻⁶ m/sec		
EARLY RECOVERY (T ₄ ,K ₄)	165 m ² /day	5.6 x 10 ⁻⁴ m/sec	35.1 m	1.75 x 10 ⁻³ m/sec
LATE RECOVERY (T ₅ ,K ₅)	25 m ² /day	8.6 x 10 ⁻⁵ m/sec		

² Based on the geometric mean of 10 approximation methods as shown on Figure A2 (Appendix A)

The aquifer conductivity interpreted from the grain size analyses is much higher than the conductivity interpreted from the pumping test results. This suggests that the material in the immediate vicinity of 3201-C is more conductive than the conductivity of the entire aquifer, which is consistent with the observation of negative boundary conditions during the pumping test. This may also suggest that samples obtained during drilling may not be representative of the aquifer material due to the loss of fines.

3.2 WATER QUALITY

Groundwater analytic results are presented in Table 4, and, laboratory results and certificates can be found in Appendix C. Water from this well is hard magnesium-bicarbonate type water. The following items are of note:

- Water from the 3201-C meets all current Canadian Drinking Water Quality Guidelines (CDWQG) for health based parameters;
- Total manganese at 0.149 mg/L is above the aesthetic objective (AO) of 0.05 mg/L, although not a health concern, manganese at this concentration may result in staining of fixtures.

4.0 WELL CAPACITY

To calculate the safe yield of a well, the 100-day specific capacity was multiplied by the safe available drawdown. The 100-Day specific capacity of the well (at a given pumping rate) is based on the projection of the constant rate drawdown to 100 days as shown on Figure 3. This conservatively assumes that 3201-C would be continuously pumped at the same rate for 100-days with no recharge to the aquifer. The safe available drawdown of the well is determined by applying a safety factor of 70% of the physical available drawdown after an allowance has been made for seasonal fluctuations in static water level. For a well completed in a confined aquifer (such as 3201-C), the water level should never be drawn below the bottom of the confining unit. In this case, the safe available drawdown accounts for this. The safe yield of a well is also limited by what the well screen is capable of delivering based on the maximum recommended screen entrance velocity. Table 3 on the following page details the safe yield calculations for 3201-C.

TABLE 3: SAFE YIELD CALCULATIONS			
WELL PARAMETER	VALUE	UNIT	KEY
Constant Rate Pumping Test Discharge Rate	2.7	L/s	a
Projected 100-Day Drawdown	38.25	m	b
100-Day Specific Capacity	0.07	L/s/m	c
Lowest Expected Seasonal Water Table (1.0 m fluctuation)	0.0	m	d
Depth to top of Screen Interval	33.7	m	e
Available Drawdown	33.7	m	f = e-d
Safety Factor	70	%	g
Safe Available Drawdown	23.6	m	h = f x g
Safe Yield Based on Constant Rate Pumping Test			
Safe Estimated Sustainable Yield	1.6	L/s	c x h
Safe Estimated Sustainable Yield	22	IGPM	
Check for Maximum Screen Entrance Velocity			
Recommended Maximum Screen Entrance Velocity	0.03	m/s	k
Intake Area (m ² / m of 0.040" Well Screen)	0.22	m ² /m	l
Maximum Yield per m screen	6.7	L/s	k x l
Maximum Yield for Screen Interval (1.2 m)	8.1	L/s	
Maximum Well Yield	107	IGPM	m
Check: Greater than Safe Estimated Sustainable Yield?	YES		

Based on specific capacity and available drawdown, the aquifer at 3201-C can be safely pumped at a rate of 1.6 L/s (22 IGPM).

5.0 WELL DECOMMISSIONING

The abandoned well (Figure 2) at the Burwash Airport Terminal Building was decommissioned on November 24, 2005 by backfilling with bentonite chips. Well decommissioning was completed by Double D Drilling.

6.0 WELL HOOK-UP

Aqua Tech Supplies and Services Ltd. (Aqua Tech) of Whitehorse, Yukon was retained by PMA to temporarily connect 3201-C to the Burwash Landing ATB water system. On December 13, 2006 Aqua Tech installed as 5SQ 10C 360 1 horsepower “Smart Pump” in 3201-C. The “Smart Pump” is designed such that the pump automatically shuts off if the well water level is drawn down to the pump intake. This ensures minimum pump submergence preventing damage to the well pump due to dry pumping conditions. The pump intake was positioned at 25.8 m and the pump was set at a flow rate of approximately 0.32 L/s (4 IGPM).

The well was connected to the water system using an above grade sanitary completion with a casing stick up of 0.65 m. It is understood by EBA that a permanent above grade sanitary completion will be installed in the spring of 2006.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the information presented in this well completion report:

- In December 2005, a new drinking water well (3201-C) was drilled at the Burwash Landing Airport Terminal Building. The well was drilled to a depth of 35.1 m below ground, and a screen was set from 33.7 to 34.7 m below ground within a confined sand aquifer. The well was constructed in accordance with Canadian Groundwater Association’s (CGWA) Water Well Construction Guidelines.
- Pumping test results indicate aquifer transmissivity ranging from 7 m²/day to 285 m²/day.
- The safe sustainable yield for 3201-C is 1.6 L/s (22 IGPM), which is sufficient to meet the demand for this facility.
- Water from 3201-C meets all CDWQG for health based parameters. The manganese concentration of 0.149 mg/L is above the aesthetic objective of 0.05 mg/L, and may result in staining of fixtures.
- To date, well construction and water quality results are in compliance with the Draft Guidelines for Part III – Small Public Drinking Water Systems.

Proper well operation and maintenance are fundamental to ensuring a reliable drinking water source. Recommendations pertinent to the operation of 3201-C are presented below:

- After extended periods of non-pumping the well should be allowed to discharge to waste until the water runs clear, pumping of small amounts of sand or discoloured water is normal after extended periods of non-pumping. The well should be connected to the system only once water clarity has ceased to improve.
- The pump should not be continuously turned off and on as this can severely decrease the lifetime of the pump, and promote sand build up within the casing thereby increasing the need for re-development of the well.

- In accordance with CGWA well construction guidelines the casing of the well should project at least 0.50 m above ground surface (it is currently 0.65 m above grade).
- The water level and specific capacity in a water supply well should be routinely monitored over time to facilitate evaluation of well performance.
- The well should be shock chlorinated (disinfected) bi-annually with a 200 mg/L sodium hypochlorite solution.
- It is understood by EBA that a permanent above grade sanitary completion will be installed in the spring. Well 3201-A should be decommissioned at this time in accordance with CGWA guidelines for well decommissioning.
- Any alterations to 3201-C should be in compliance with the Draft Guidelines for Part III – Small Public Drinking Water Systems, or the final document when in effect.

8.0 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 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.

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TABLES

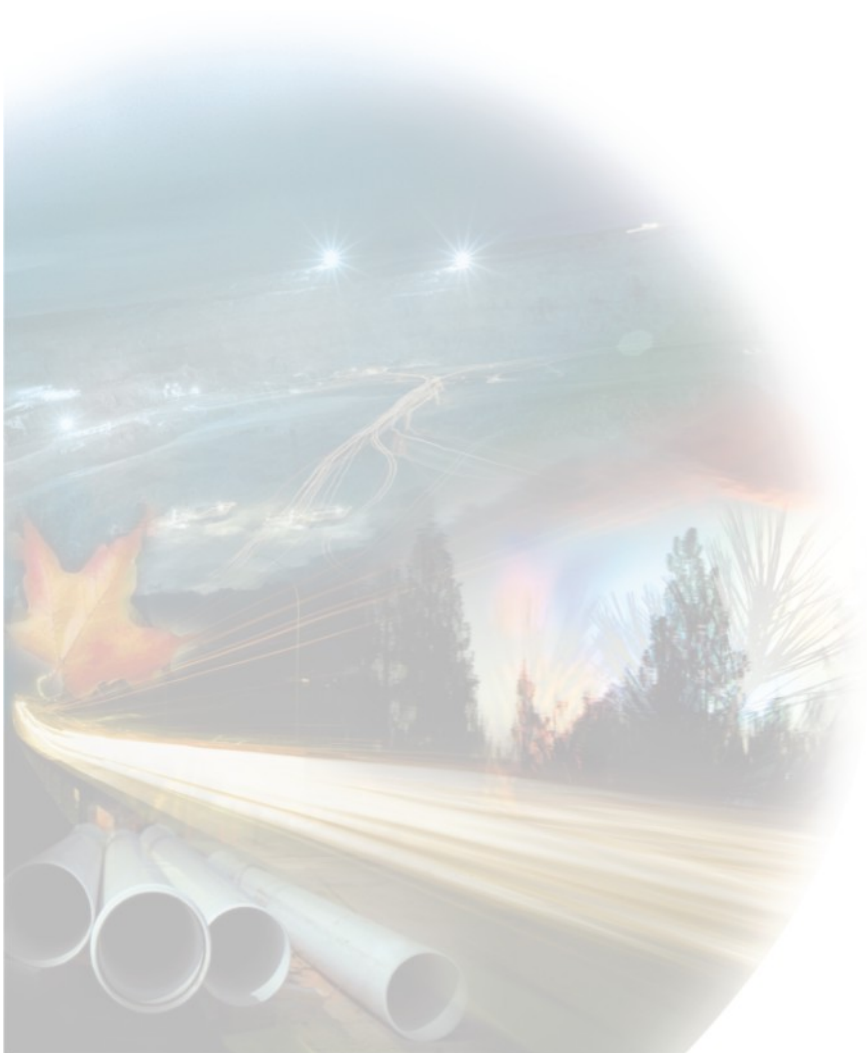


TABLE 4
SUMMARY OF LABORATORY CHEMISTRY RESULTS

	ALS Report	3201-C	3201-C	3201-C	Canadian Drinking Water Quality		
		Burwash Airport Post Development	Burwash Airport End of Pumping Test	Burwash Airport Post Well Hook-Up	Guidelines		
		W8265	W8652	N/A	Lower Limit	Upper Limit	
Date	17-Nov-05	7-Dec-05	20-Dec-05	AO	MAC	AO	
Physical Tests							
Colour	CU	-	6.1	-			
Conductivity (Field)	uS/cm	489	-	-			
Conductivity (Lab)	uS/cm	-	436	-			
Total Dissolved Solids (Field)	mg/L	246	-	-			
Total Dissolved Solids (Lab)	mg/L	-	261	-			
Hardness (CaCO ₃)	mg/L	186	179	-			
pH (field)	pH units	8.4	-	-	6.5		8.5
pH (lab)	pH units	-	8.21	-			
Turbidity	NTU	-	0.83	-			
UV Absorbance		-	0.0380	-			
Dissolved Anions							
Alkalinity-Total CaCO ₃	mg/L	-	235	-			
Chloride	mg/L	-	1.15	-			250
Fluoride	mg/L	-	0.313	-		1.5	
Sulphate	mg/L	-	34.6	-			500
Nutrients							
Nitrate Nitrogen N	mg/L	-	<0.10	-		10	
Nitrite Nitrogen N	mg/L	-	<0.10	-		3.2	
Total Metals							
Aluminum	mg/L	-	<0.020	-			
Antimony	mg/L	-	<0.0010	-		0.006	
Arsenic	mg/L	0.00340	0.00357	-		0.025	
Barium	mg/L	-	<0.040	-		1	
Boron	mg/L	-	0.35	-		5	
Cadmium	mg/L	-	<0.00040	-		0.005	
Calcium	mg/L	-	26.3	-			
Chromium	mg/L	-	<0.0040	-		0.05	
Copper	mg/L	-	<0.0020	-			1
Iron	mg/L	0.106	<0.030	-			0.3
Lead	mg/L	-	<0.0020	-		0.01	
Magnesium	mg/L	-	27.5	-			
Manganese	mg/L	0.163	0.149	-			0.05
Mercury	mg/L	-	<0.00020	-		0.001	
Potassium	mg/L	-	4.86	-			
Selenium	mg/L	-	<0.0020	-		0.01	
Sodium	mg/L	-	26.5	-			200
Uranium	mg/L	-	0.00078	-		0.02	
Zinc	mg/L	-	<0.10	-			5
Dissolved Metals							
Aluminum	mg/L	<0.10	-	-			
Antimony	mg/L	<0.0050	-	-		0.006	
Arsenic	mg/L	0.00320	-	-		0.025	
Barium	mg/L	<0.20	-	-		1	
Boron	mg/L	<1.0	-	-		5	
Cadmium	mg/L	<0.0020	-	-		0.005	
Calcium	mg/L	28.6	-	-			
Chromium	mg/L	<0.020	-	-		0.05	
Copper	mg/L	<0.010	-	-			1
Iron	mg/L	<0.030	-	-			0.3
Lead	mg/L	<0.010	-	-		0.01	
Magnesium	mg/L	27.80	-	-			
Manganese	mg/L	0.158	-	-			0.05
Mercury	mg/L	<0.00020	-	-		0.001	
Potassium	mg/L	5.50	-	-			
Selenium	mg/L	<0.010	-	-		0.01	
Sodium	mg/L	27.6	-	-			200
Uranium	mg/L	<0.0010	-	-		0.02	
Zinc	mg/L	<0.50	-	-			5
Organic Parameters							
Total Organic Carbon	mg/L	-	1.99	-			
Bacteriological							
E. coli	present/absent	-	-	NP ⁶		0	
Total Coliforms	present/absent	-	-	NP		0	

Notes:

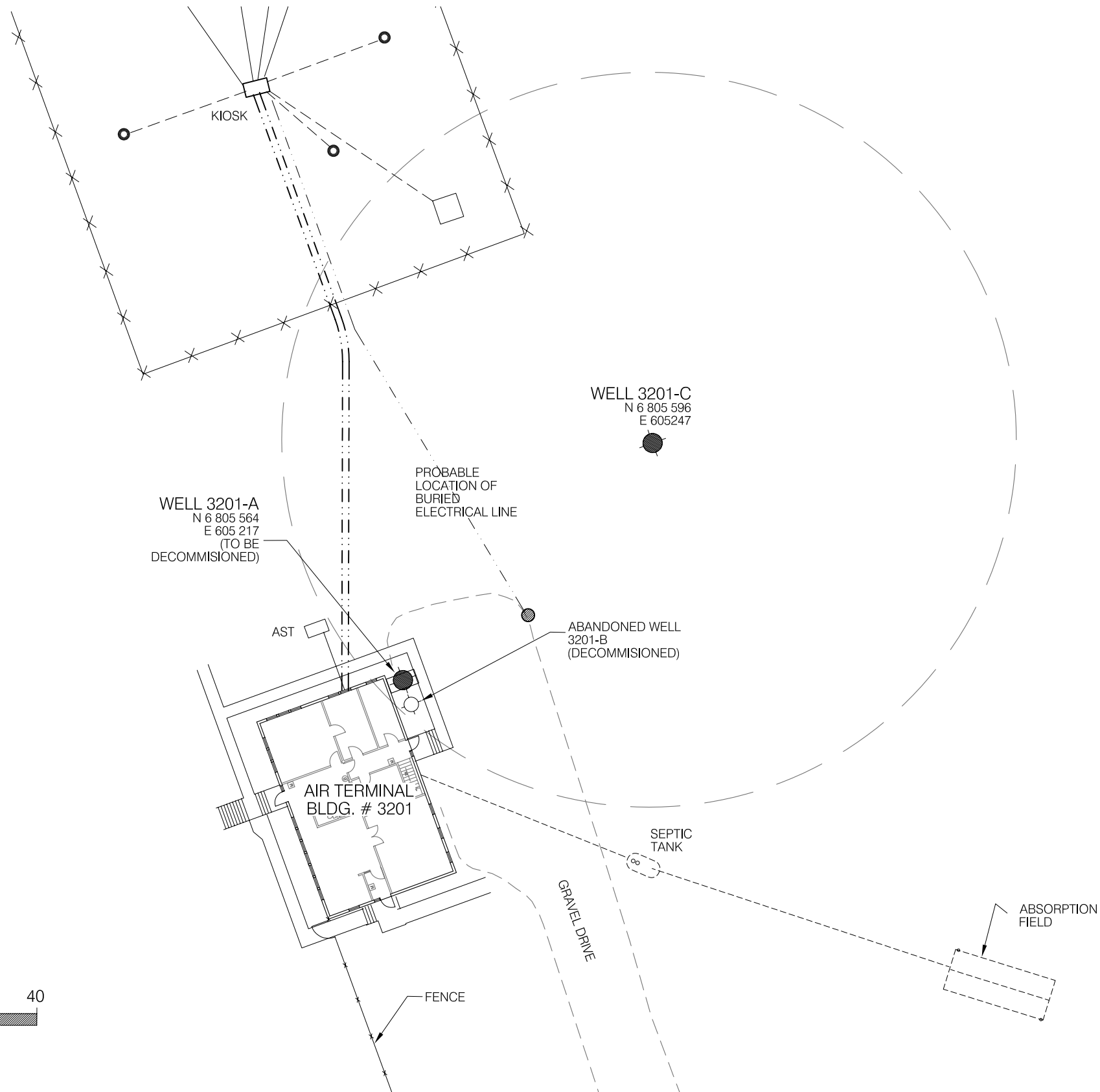
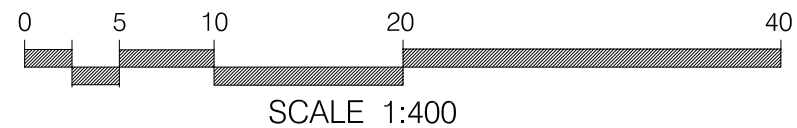
- 1) CDWQG criteria are taken from the "Canadian Drinking Water Quality Guidelines, April 2004."
- 2) MAC refers to the Maximum Acceptable Concentration according to the CDWQG criteria.
- 3) AO refers to the Aesthetic Objective according to the CDWQG criteria.
- 4) "-" indicates not analyzed.
- 5) **Bold**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





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.

30 m RADIUS FROM WATER WELL FOR CONSIDERATION OF PROXIMITY TO POTENTIAL CONTAMINANT SOURCES.
 BUILDING STRUCTURES RELATIVE TO PROPERTY LINES ARE APPROXIMATE ONLY.

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: AUG. 2005
 SCALE: AS SHOWN
 PROJECT No.: 1260002.003
 ACAD FILENAME: 003-WESTERN REGION

CLIENT:

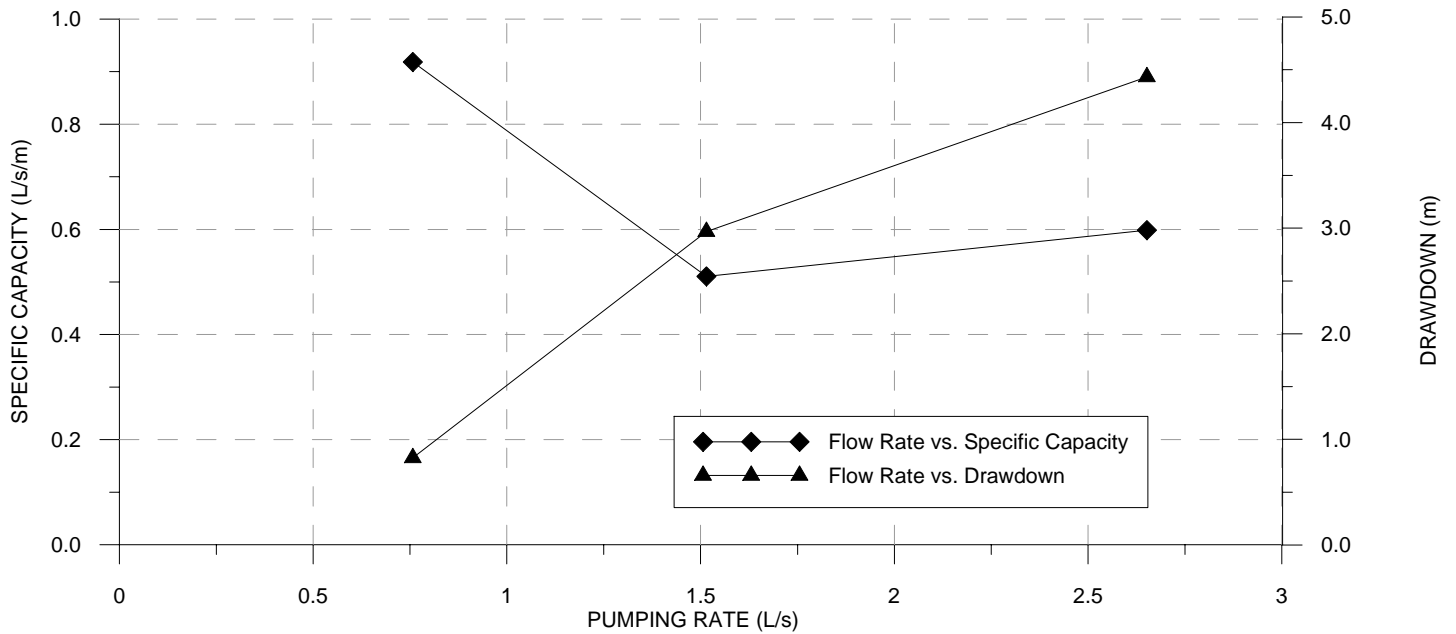
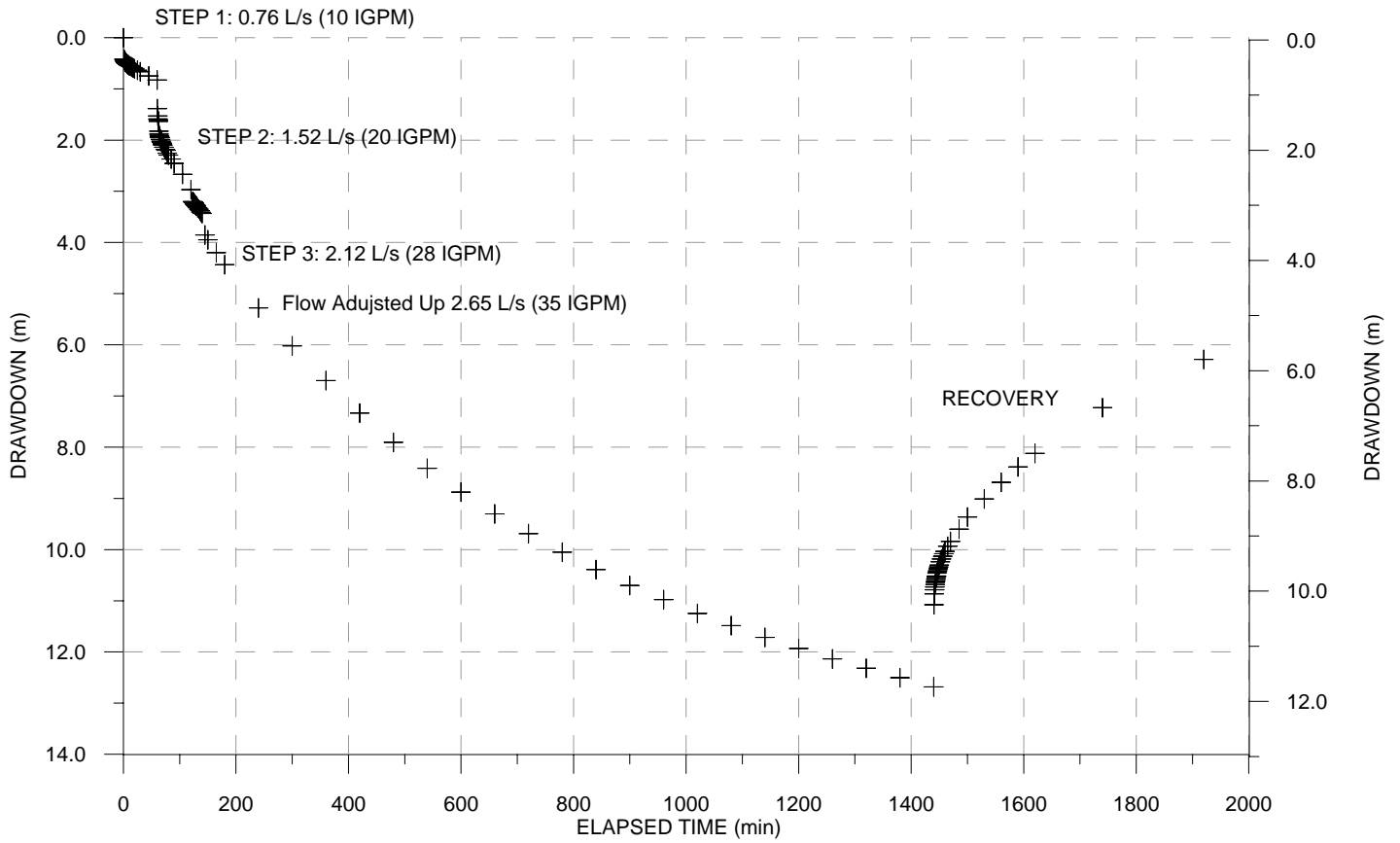
Yukon
 Highways and Public Works
 Property Management Branch

WELL COMPLETION REPORT

**GOVERNMENT OF YUKON
 HIGHWAYS & PUBLIC WORKS**

**BURWASH LANDING AIRPORT
 BUILDING # 3201
 SITE LOCATION DIAGRAM
 WELL ID: 3201-C**

REVISION	ISSUE
0	0
FIGURE No. FIGURE 1	



EBA Engineering Consultants Ltd.

PROJECT WELL COMPLETION REPORT
BURWASH LANDING AIRPORT TERMINAL BUILDING

CLIENT



TITLE

STEP TEST AND SPECIFIC CAPACITY

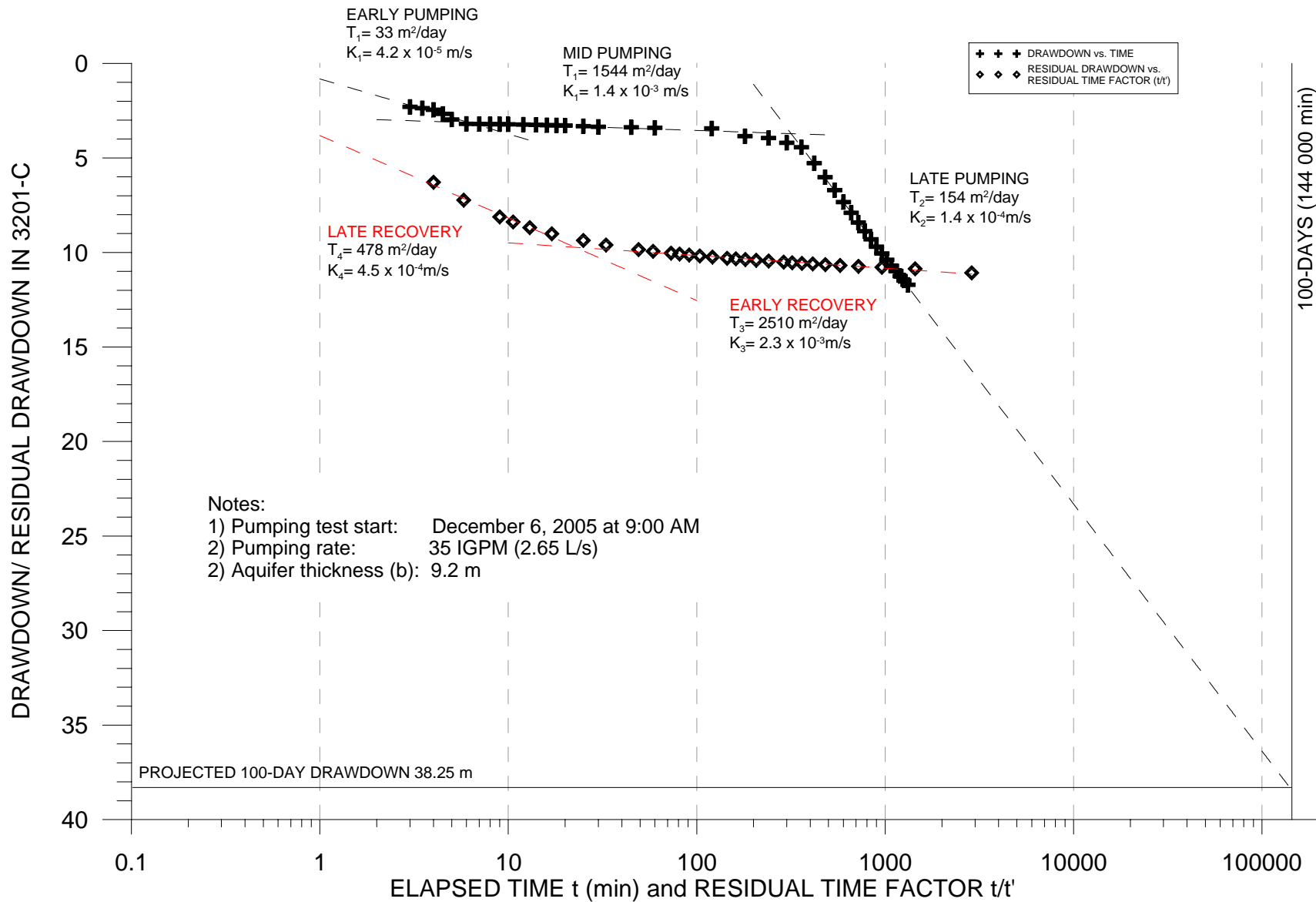
DATE OCTOBER 2005

DWN. KSJ

CHKD.

FILE NO. 1260008

DRWG. FIGURE 2



		PROJECT	WELL COMPLETION REPORT BURWASH LANDING AIRPORT TERMINAL BUILDING
CLIENT		TITLE	PUMPING TEST ANALYSIS- 3201-C
DATE	JANUARY 2006 DWN. KSJ	FILE NO.	1260008
	CHKD.	DRWG.	FIGURE 3



APPENDIX A

WELL LOG AND GRAIN SIZE ANALYSIS



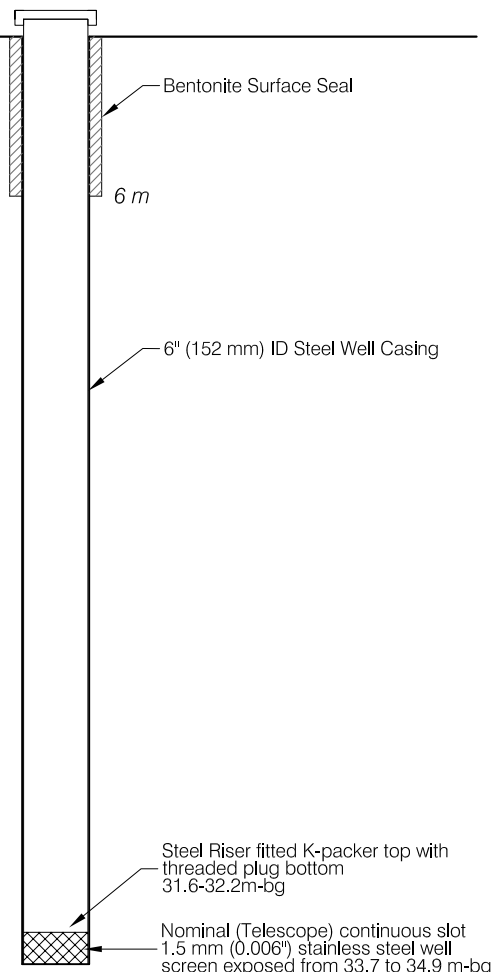
HYDROGEOLOGIC LOG


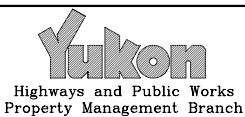
BOREHOLE NO.

3201-C

PURPOSE OF HOLE: Water Supply Well
 DRILLING METHOD: Dual Air Rotary
 START DRILLING: November 24, 2004
 SCREEN INSTALLED: November 28, 2004
 CONTRACTOR: Midnight Sun Drilling Co. Ltd.

CASING STICK UP (m): 0.65 m above grd.
 DEPTH TO STATIC (m): 26.0 m below grd.
 DEPTH TO SCREEN TOP (m): 32.2 m

Lithology	Comments	Well Installation Summary
<p>Depth (m)</p> <p>0m</p> <p>SILT & SAND - trace of clay, fine to med. grained sand, dry, light brown</p> <p>5m</p> <p>9.1 m</p> <p>10m GRAVEL - sandy, some silt, becomes finer with depth, moist, grey/brown</p> <p>10.7 m</p> <p>SILT & SAND (TILL) - trace of gravel, compact, moist, grey</p> <p>15m</p> <p>21.4 m</p> <p>25m</p> <p>25.9 m</p> <p>SAND & GRAVEL - trace of silt, angular to sub-angular gravel becoming coarser with depth, wet, grey</p> <p>30m</p> <p>35m</p> <p>35.1 m</p> <p>END OF BOREHOLE</p> <p>40m</p>	<p>Artesian well - flowing at 3 IGPM</p>	 <p>The diagram shows a vertical well casing starting 0.65 m above ground level. A Bentonite Surface Seal is located 6 m below ground level. The casing is 6" (152 mm) ID Steel Well Casing. At the bottom, there is a Steel Riser fitted with a K-packer top and a threaded plug bottom, extending from 31.6 m to 32.2 m below ground level. A Nominal (Telescope) continuous slot 1.5 mm (0.006") stainless steel well screen is exposed from 33.7 m to 34.9 m below ground level.</p>

 <p>EBA Engineering Consultants Ltd.</p>	<p>PROJECT: WELL COMPLETION REPORT AIRPORT TERMINAL BUILDING BURWASH LANDING, YUKON</p>
<p>CLIENT:</p>  <p>Yukon Highways and Public Works Property Management Branch</p>	<p>TITLE: WELL LOG 3201-C</p>
<p>DATE: JAN. 2006 DWN. JSB CHKD. KSJ</p>	<p>FILE NO. 1260008 DRWG. FIGURE A1</p>



BCGS MAP, WELL No., ELEV, Date 19, Well Type, Location Accuracy: 61° 22.08' N, 139° 02.00' W

Owners Name & Address, Legal Description & Address

Descriptive Location BURWASH LANDING AIRPORT, BURWASH YT

1. TYPE OF WORK, 2. WORK METHOD, 3. WATER WELL USE, 4. DRILLING ADDITIVES, 5. MEASUREMENTS, 9. CASING Materials

6. WELL LOG DESCRIPTION table with columns FROM ft, TO ft, SWL ft, and log description entries like COARSE GRAVEL + SAND, W/B SAND + GRAVEL, etc.

Table for Hole Diameter, Diameter, Thickness, Weight with units

Pitless unit, 10. SCREEN Type, Material

Shoe(s), Open hole, from to ft Diameter, Grout

10. SCREEN: Type, Material, Set from to ft below ground level

RISER, SCREEN & BLANKS table with columns Length, Diam. ID, Slot Size, units

Fittings, top K PACKER, bottom THREADED PLUG

11. DEVELOPED BY: 1 Barging, 2 Jetting, 3 Air, 4 Bailing, 5 Pumping

12. TEST: Pump, Bail, Air, Rate, Temp, SWL before test, Water Level after test

Table for DRAWDOWN in ft and RECOVERY in ft with columns mins, WL

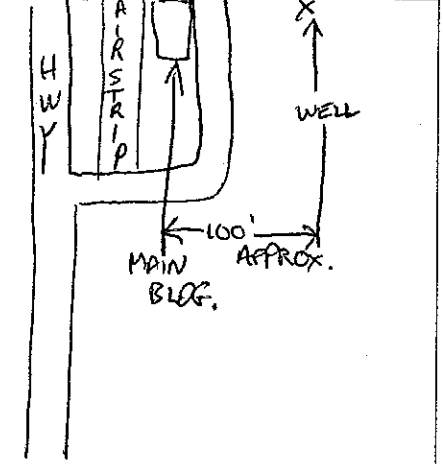
13. RECOMMENDED PUMP TYPE, SETTING, PUMPING RATE

14. WATER TYPE: 1 Fresh, 2 Salty, 3 Clear, 4 Cloudy, colour, smell, gas

15. WATER ANALYSIS: 1 Hardness, 2 Iron, 3 Chloride, 4 pH, Field Date

7. CONSULTANT, Address

8. WELL LOCATION SKETCH



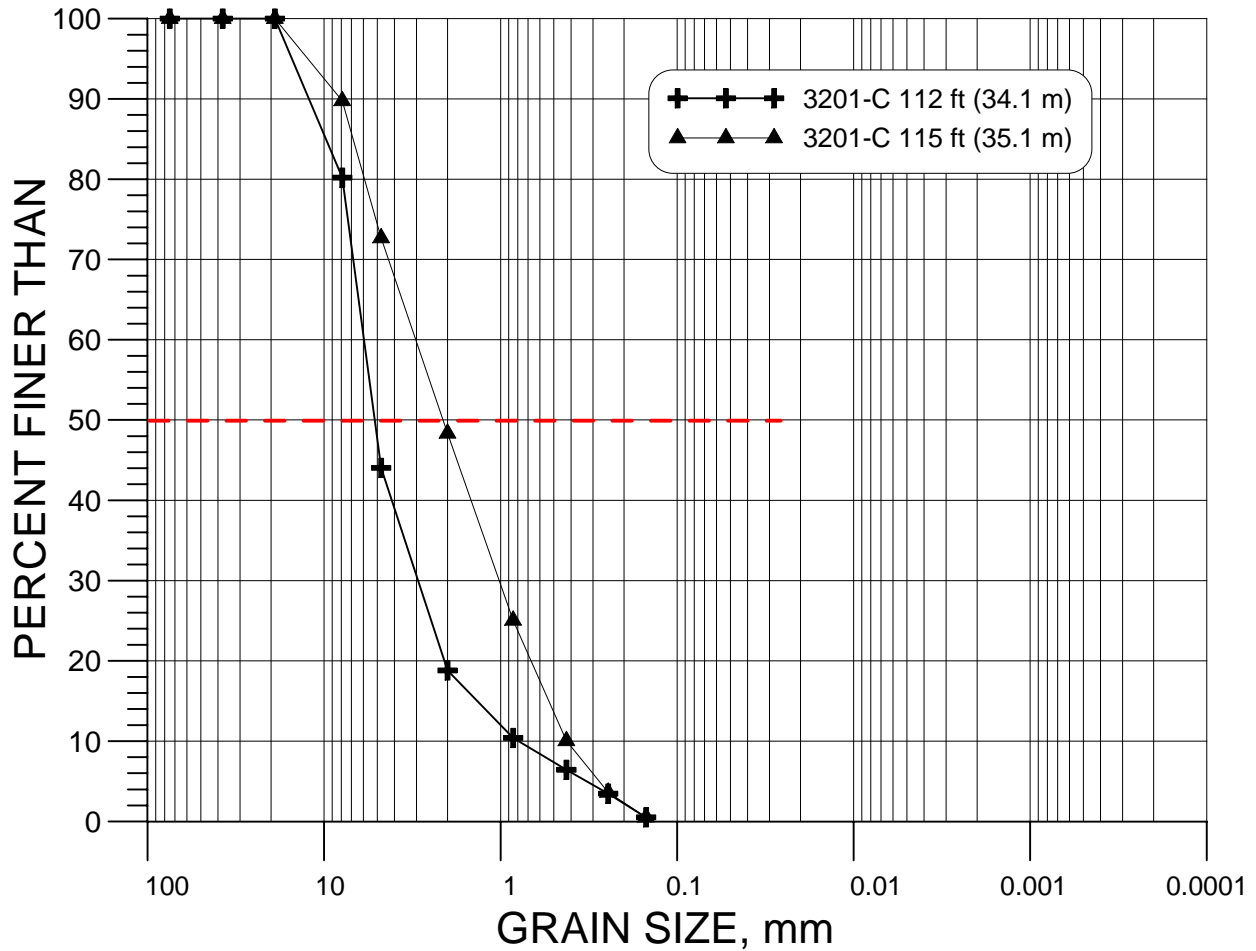
SITE ID No, Lab Date

16. FINAL WELL COMPLETION DATA: Well Depth, Well Yield, Static Water Level, Back filled, Well Head Completion

17. DRILLER: STANVICK, Signature, FIRST NAME

18. CONTRACTOR: Double D Drilling Co., Address, Member, BCGWA

UNIFIED SOIL CLASSIFICATION SYSTEM 1992



HYDRAULIC CONDUCTIVITY (K) ESTIMATES

	34.1 m (112 ft)	35.1 m (115 ft)
HAZEN	9.21E-03 m/sec	1.57E-03 m/sec
TERZAGHI	4.13E-03 m/sec	6.57E-04 m/sec
SAUERBREI	8.61E-03 m/sec	8.84E-04 m/sec
KOZENY	1.67E-02 m/sec	5.16E-03 m/sec
ZAMARINU	2.00E-02 m/sec	4.25E-03 m/sec
SLICHTER	2.44E-03 m/sec	3.94E-04 m/sec
BEYER	8.60E-03 m/sec	1.54E-03 m/sec
KRUGER	2.28E-02 m/sec	4.25E-03 m/sec
ZUNKER	1.28E-02 m/sec	3.34E-03 m/sec
USBR	2.22E-02 m/sec	1.59E-03 m/sec
MINIMUM	2.44E-03 m/sec	3.94E-04 m/sec
GEOMETRIC MEAN	1.04E-02 m/sec	1.75E-03 m/sec
MAXIMUM	2.28E-02 m/sec	2.36E-03 m/sec

EBA Engineering Consultants Ltd.

PROJECT WELL COMPLETION REPORT- BURWASH LANDING AIRPORT TERMINAL BUILDING

CLIENT



TITLE

3201-C GRAINSIZE ANALYSIS

DATE

DWN.

CHKD.

FILE NO. 1260008

DRWG. A1

SAMPLE NO. 112 ft
 LOCATION Burwash Landing Airport
 BORING NO. 3201-C
 DEPTH 112 ft (34.1 m)

DATE 23-Nov-05
 TECHNICIAN KSJ
 JOB NO. 1260008

	SIEVE NO.		OPENING SIZE (mm)	TARE + SAMPLE (g)	SAMPLE (g)	WEIGHT RETAINED (%)	WEIGHT PASSING (%)
	TYLER	U.S. EQUIV					
COBBLES		3.0"	75.0	0.00	0.00	0.0	100.0
GRAVEL	MESH	1.5"	37.5	0.00	0.00	0.0	100.0
	.742	3/4"	19.0	0.00	0.00	0.0	100.0
	0.313	5/16"	7.9	200.00	200.00	19.8	80.2
	4	4	4.75	365.00	365.00	36.1	44.1
S A N D	9	10	2.00	255.00	255.00	25.2	18.8
	20	20	.850	85.00	85.00	8.4	10.4
	35	40	.425	40.00	40.00	4.0	6.4
	60	60	.246	30.00	30.00	3.0	3.5
	100	100	.150	30.00	30.00	3.0	0.5
FINES	PAN		< .075	5.00	5.00	0.5	0.0
TOTAL					1010.00	100.0	

TARE (g): 0

TOTAL GRAVEL (g) : 565.00

TOTAL SAMPLE (g) : 1010.00

% GRAVEL : 55.94

TOTAL SAND (g) : 440.00

TOTAL SAMPLE (g) : 1010.00

% SAND : 43.56

TOTAL FINES (g) : 5.00

TOTAL SAMPLE (g) : 1010.00

% FINES : 0.50

HYDROMETER (Y/N) : NO

SAMPLE DESCRIPTION : Brown/grey medium-coarse SAND, trace gravel.

SAMPLE NO. 115 ft
LOCATION Burwash Landing Airport
BORING NO. 3201-C
JOB NO. 1260008

DATE 23-Nov-05
TECHNICIAN KSJ
DEPTH 35.1 m (115 ft)

	SIEVE NO.		OPENING SIZE (mm)	TARE + SAMPLE (g)	SAMPLE (g)	WEIGHT RETAINED (%)	WEIGHT PASSING (%)
	TYLER	U.S. EQUIV					
COBBLES		3.0"	75.0	0.00	0.00	0.0	100.0
GRAVEL	MESH	1.5"	37.5	0.00	0.00	0.0	100.0
	.742	3/4"	19.0	0.00	0.00	0.0	100.0
	0.313	5/16"	7.9	99.00	99.00	10.2	89.8
	4	4	4.75	165.00	165.00	17.1	72.7
S A N D	9	10	2.00	235.00	235.00	24.3	48.3
	20	20	.850	225.00	225.00	23.3	25.1
	35	40	.425	145.00	145.00	15.0	10.0
	60	60	.246	62.00	62.00	6.4	3.6
	100	100	.150	30.00	30.00	3.1	0.5
FINES	PAN		< .075	5.00	5.00	0.5	0.0
TOTAL					966.00	100.0	

TARE (g): 0

TOTAL GRAVEL (g) : 264.00

TOTAL SAMPLE (g) : 966.00

% GRAVEL : 27.33

TOTAL SAND (g) : 697.00

TOTAL SAMPLE (g) : 966.00

% SAND : 72.15

TOTAL FINES (g) : 5.00

TOTAL SAMPLE (g) : 971.00

% FINES : 0.51

HYDROMETER (Y/N) : NO

SAMPLE DESCRIPTION : Brown/grey medium-coarse SAND, trace gravel.



APPENDIX B

PUMPING TEST DATA



APPENDIX B1 PUMPING TEST DATA

WELL NAME: 3201-C	PUMP INTAKE DEPTH (m): 32.00
STATIC WATER LEVEL (m): <u>Flowing</u>	SCREEN INTERVAL: 33.7 - 35.9 m-bgl
DATUM: <u>Top of Casing</u>	SLOT SIZE ("): 0.060 (40 Slot)
DATUM STICK-UP(m): 1.000	AVAILABLE DRAWDOWN(m): 32.00
WELL DIAMETER (mm): 152 mm (6")	SCREEN DIAMETER (mm): 6" Nominal

DATE	TIME	ELAPSED TIME (min)	DEPTH TO WATER (m)	DRAWDOWN (m)	TOTALIZER (ft ³)	FLOW RATE (IGPM)	FLOW RATE (L/s)	SPECIFIC CAPACITY (L/s/m)	COMMENTS
6-Dec-05	10:00:00	0	0.000	0.000	8970	-	-	-	STEP 1
6-Dec-05	10:01:00	1	0.415	0.415	-	10	0.76	1.83	
6-Dec-05	10:01:30	1.5	0.430	0.430					
6-Dec-05	10:02:00	2	0.443	0.443					
6-Dec-05	10:02:30	2.5	0.455	0.455					
6-Dec-05	10:03:00	3	0.463	0.463	-	10	0.76	1.64	
6-Dec-05	10:03:30	3.5	0.475	0.475					
6-Dec-05	10:04:00	4	0.480	0.480	-	10	0.76	1.58	
6-Dec-05	10:04:30	4.5	0.490	0.490					
6-Dec-05	10:05:00	5	0.495	0.495	-	10	0.76	1.53	
6-Dec-05	10:06:00	6	0.505	0.505	-	10	0.76	1.50	
6-Dec-05	10:07:00	7	0.515	0.515	-	10	0.76	1.47	
6-Dec-05	10:08:00	8	0.525	0.525	-	10	0.76	1.44	
6-Dec-05	10:09:00	9	0.533	0.533	-	10	0.76	1.42	
6-Dec-05	10:10:00	10	0.542	0.542	-	10	0.76	1.40	
6-Dec-05	10:12:00	12	0.554	0.554	-	10	0.76	1.37	
6-Dec-05	10:14:00	14	0.567	0.567	-	10	0.76	1.34	
6-Dec-05	10:16:00	16	0.581	0.581	-	10	0.76	1.30	
6-Dec-05	10:18:00	18	0.595	0.595	-	10	0.76	1.27	
6-Dec-05	10:20:00	20	0.607	0.607	-	10	0.76	1.25	
6-Dec-05	10:25:00	25	0.635	0.635	-	10	0.76	1.19	
6-Dec-05	10:30:00	30	0.665	0.665	-	10	0.76	1.14	
6-Dec-05	10:45:00	45	0.746	0.746	190	10	0.76	1.02	
6-Dec-05	11:00:00	60	0.825	0.825	-	10	0.76	0.92	
6-Dec-05	11:00:30	60.5	1.385	1.385	-	-	-	-	START STEP 2
6-Dec-05	11:01:00	61	1.530	1.530	-	-	-	-	
6-Dec-05	11:01:30	61.5	1.587	1.587	-	-	-	-	
6-Dec-05	11:02:00	62	1.615	1.615	-	-	-	-	
6-Dec-05	11:02:30	62.5	1.634	1.634	-	20	1.52	0.93	
6-Dec-05	11:03:00	63	1.825	1.825	-	20	1.52	0.83	
6-Dec-05	11:03:30	63.5	1.885	1.885	-	20	1.52	0.80	
6-Dec-05	11:04:00	64	1.914	1.914	-	20	1.52	0.79	
6-Dec-05	11:04:30	64.5	1.937	1.937	-	20	1.52	0.78	
6-Dec-05	11:05:00	65	1.954	1.954	-	20	1.52	0.78	
6-Dec-05	11:06:00	66	1.988	1.988	-	20	1.52	0.76	
6-Dec-05	11:07:00	67	2.018	2.018	-	20	1.52	0.75	
6-Dec-05	11:08:00	68	2.045	2.045	-	20	1.52	0.74	
6-Dec-05	11:09:00	69	2.071	2.071	-	20	1.52	0.73	
6-Dec-05	11:10:00	70	2.097	2.097	-	20	1.52	0.72	
6-Dec-05	11:12:00	72	2.140	2.140	-	20	1.52	0.71	
6-Dec-05	11:14:00	74	2.181	2.181	-	20	1.52	0.69	
6-Dec-05	11:16:00	76	2.200	2.200	-	20	1.52	0.69	
6-Dec-05	11:18:00	78	2.258	2.258	-	20	1.52	0.67	

APPENDIX B1 PUMPING TEST DATA

WELL NAME: 3201-C	PUMP INTAKE DEPTH (m): 32.00
STATIC WATER LEVEL (m): Flowing	SCREEN INTERVAL: 33.7 - 35.9 m-bgl
DATUM: Top of Casing	SLOT SIZE ("): 0.060 (40 Slot)
DATUM STICK-UP(m): 1.000	AVAILABLE DRAWDOWN(m): 32.00
WELL DIAMETER (mm): 152 mm (6")	SCREEN DIAMETER (mm): 6" Nominal

6-Dec-05	11:20:00	80	2.293	2.293	-	20	1.52	0.66	
6-Dec-05	11:25:00	85	2.371	2.371	-	20	1.52	0.64	
6-Dec-05	11:30:00	90	2.454	2.454	-	20	1.52	0.62	
6-Dec-05	11:45:00	105	2.667	2.667	-	20	1.52	0.57	
6-Dec-05	12:00:00	120	2.967	2.967	-	20	1.52	0.51	
6-Dec-05	12:03:00	123	3.200	3.200	-	28	2.12	0.66	START STEP 3
6-Dec-05	12:03:30	123.5	3.206	3.206	-	28	2.12	0.66	
6-Dec-05	12:04:00	124	3.210	3.210	-	28	2.12	0.66	
6-Dec-05	12:04:30	124.5	3.215	3.215	-	28	2.12	0.66	
6-Dec-05	12:05:00	125	3.222	3.222	-	28	2.12	0.66	
6-Dec-05	12:06:00	126	3.237	3.237	-	28	2.12	0.66	
6-Dec-05	12:07:00	127	3.253	3.253	-	28	2.12	0.65	
6-Dec-05	12:08:00	128	3.266	3.266	-	28	2.12	0.65	
6-Dec-05	12:09:00	129	3.277	3.277	-	28	2.12	0.65	
6-Dec-05	12:10:00	130	3.292	3.292	-	28	2.12	0.64	
6-Dec-05	12:12:00	132	3.322	3.322	-	28	2.12	0.64	
6-Dec-05	12:14:00	134	3.350	3.350	-	28	2.12	0.63	
6-Dec-05	12:16:00	136	3.380	3.380	-	28	2.12	0.63	
6-Dec-05	12:18:00	138	3.407	3.407	-	28	2.12	0.62	
6-Dec-05	12:20:00	140	3.435	3.435	-	28	2.12	0.62	
6-Dec-05	12:25:00	145	3.851	3.851	-	35	2.65	0.69	
6-Dec-05	12:30:00	150	3.947	3.947	-	35	2.65	0.67	CONTINUE STEP 3
6-Dec-05	12:45:00	165	4.201	4.201	-	35	2.65	0.63	FOR CONSTANT RATE TEST
6-Dec-05	13:00:00	180	4.433	4.433	864	35	2.65	0.60	
6-Dec-05	14:00:00	240	5.278	5.278	-	35	2.65	0.50	
6-Dec-05	15:00:00	300	6.021	6.021	-	35	2.65	0.44	
6-Dec-05	16:00:00	360	6.699	6.699	-	35	2.65	0.40	
6-Dec-05	17:00:00	420	7.333	7.333	-	35	2.65	0.36	
6-Dec-05	18:00:00	480	7.904	7.904	-	35	2.65	0.34	
6-Dec-05	19:00:00	540	8.412	8.412	-	35	2.65	0.32	
6-Dec-05	20:00:00	600	8.875	8.875	-	35	2.65	0.30	
6-Dec-05	21:00:00	660	9.300	9.300	-	35	2.65	0.29	
6-Dec-05	22:00:00	720	9.689	9.689	-	35	2.65	0.27	
6-Dec-05	23:00:00	780	10.050	10.050	-	35	2.65	0.26	
7-Dec-05	0:00:00	840	10.390	10.390	-	35	2.65	0.26	
7-Dec-05	1:00:00	900	10.701	10.701	-	35	2.65	0.25	
7-Dec-05	2:00:00	960	10.978	10.978	-	35	2.65	0.24	
7-Dec-05	3:00:00	1020	11.248	11.248	-	35	2.65	0.24	
7-Dec-05	4:00:00	1080	11.485	11.485	-	35	2.65	0.23	
7-Dec-05	5:00:00	1140	11.715	11.715	-	35	2.65	0.23	
7-Dec-05	6:00:00	1200	11.932	11.932	-	35	2.65	0.22	
7-Dec-05	7:00:00	1260	12.135	12.135	-	35	2.65	0.22	
7-Dec-05	8:00:00	1320	12.319	12.319	-	35	2.65	0.22	
7-Dec-05	9:00:00	1380	12.505	12.505	-	35	2.65	0.21	
7-Dec-05	10:00:00	1440	12.686	12.686	8944	35	2.65	0.21	

APPENDIX B1 PUMPING TEST DATA

WELL NAME: 3201-C	PUMP INTAKE DEPTH (m): 32.00
STATIC WATER LEVEL (m): Flowing	SCREEN INTERVAL: 33.7 - 35.9 m-bgl
DATUM: Top of Casing	SLOT SIZE ("): 0.060 (40 Slot)
DATUM STICK-UP(m): 1.000	AVAILABLE DRAWDOWN(m): 32.00
WELL DIAMETER (mm): 152 mm (6")	SCREEN DIAMETER (mm): 6" Nominal

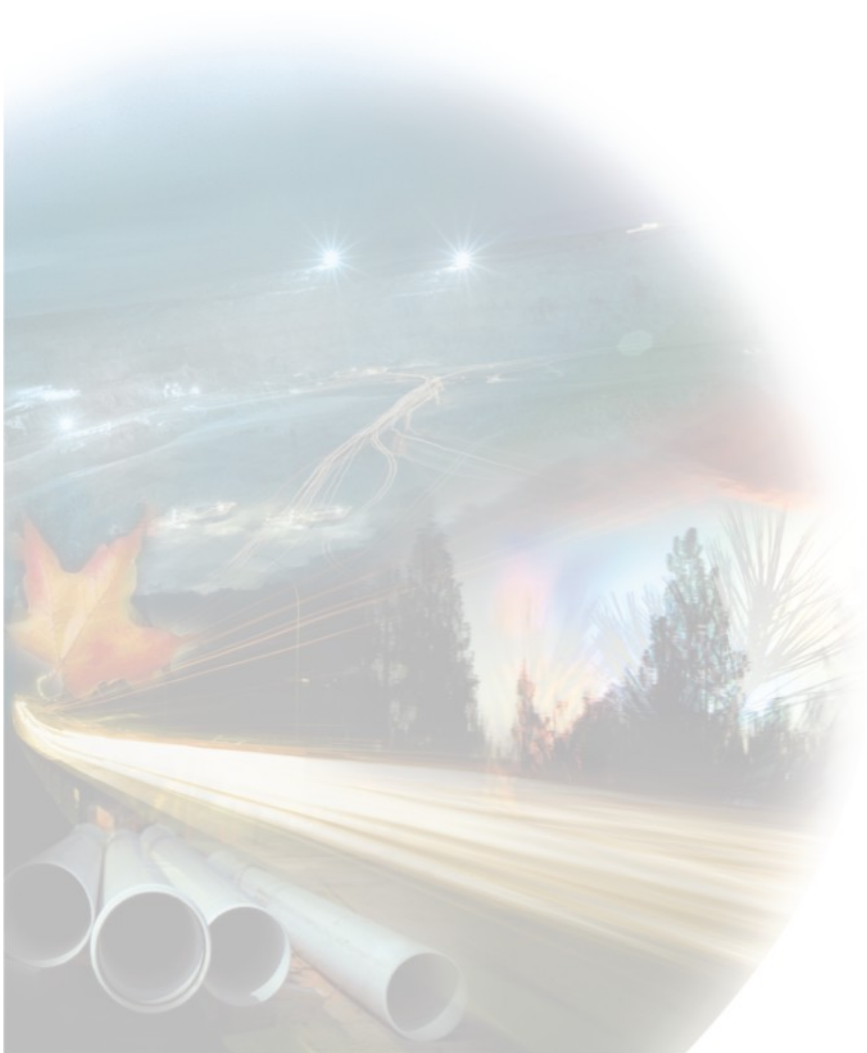
7-Dec-05	10:00:30	1440.5	11.080	11.080	-	0	0.00	-	START RECOVERY
7-Dec-05	10:01:00	1441	10.865	10.865	-	0	0.00	-	
7-Dec-05	10:01:30	1441.5	10.785	10.785	-	0	0.00	-	
7-Dec-05	10:02:00	1442	10.730	10.730	-	0	0.00	-	
7-Dec-05	10:02:30	1442.5	10.685	10.685	-	0	0.00	-	
7-Dec-05	10:03:00	1443	10.641	10.641	-	0	0.00	-	
7-Dec-05	10:03:30	1443.5	10.605	10.605	-	0	0.00	-	
7-Dec-05	10:04:00	1444	10.570	10.570	-	0	0.00	-	
7-Dec-05	10:04:30	1444.5	10.542	10.542	-	0	0.00	-	
7-Dec-05	10:05:00	1445	10.513	10.513	-	0	0.00	-	
7-Dec-05	10:06:00	1446	10.452	10.452	-	0	0.00	-	
7-Dec-05	10:07:00	1447	10.415	10.415	-	0	0.00	-	
7-Dec-05	10:08:00	1448	10.377	10.377	-	0	0.00	-	
7-Dec-05	10:09:00	1449	10.338	10.338	-	0	0.00	-	
7-Dec-05	10:10:00	1450	10.303	10.303	-	0	0.00	-	
7-Dec-05	10:12:00	1452	10.240	10.240	-	0	0.00	-	
7-Dec-05	10:14:00	1454	10.183	10.183	-	0	0.00	-	
7-Dec-05	10:16:00	1456	10.131	10.131	-	0	0.00	-	
7-Dec-05	10:18:00	1458	10.084	10.084	-	0	0.00	-	
7-Dec-05	10:20:00	1460	10.035	10.035	-	0	0.00	-	
7-Dec-05	10:25:00	1465	9.934	9.934	-	0	0.00	-	
7-Dec-05	10:30:00	1470	9.842	9.842	-	0	0.00	-	
7-Dec-05	10:45:00	1485	9.601	9.601	-	0	0.00	-	
7-Dec-05	11:00:00	1500	9.365	9.365	-	0	0.00	-	
7-Dec-05	11:30:00	1530	9.013	9.013	-	0	0.00	-	
7-Dec-05	12:00:00	1560	8.686	8.686	-	0	0.00	-	
7-Dec-05	12:30:00	1590	8.385	8.385	-	0	0.00	-	
7-Dec-05	13:00:00	1620	8.120	8.120	-	0	0.00	-	
7-Dec-05	15:00:00	1740	7.228	7.228	-	0	0.00	-	
7-Dec-05	18:00:00	1920	6.286	6.286	-	0	0.00	-	





APPENDIX C

LABORATORY REPORTS AND CERTIFICATES



ALS Environmental

EBA Engineering
Consultants Ltd.
WHITEHORSE

DEC 19 2005



RECEIVED

CERTIFICATE OF ANALYSIS

Date: December 6, 2005

ALS File No. W8265

Report On: 1260008 Burwash Landing
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: December 1, 2005

ALS ENVIRONMENTAL

per:

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

RESULTS OF ANALYSIS - Water

Sample ID 1260008-
Burwash
Airport
ALS ID 1

Physical Tests

Hardness CaCO₃ 186

Total Metals

Arsenic T-As 0.0034
Iron T-Fe 0.106
Manganese T-Mn 0.163

Dissolved Metals

Aluminum D-Al <0.10
Antimony D-Sb <0.0050
Arsenic D-As 0.0032
Barium D-Ba <0.20
Boron D-B <1.0

Cadmium D-Cd <0.0020
Calcium D-Ca 28.6
Chromium D-Cr <0.020
Copper D-Cu <0.010
Iron D-Fe <0.030

Lead D-Pb <0.010
Magnesium D-Mg 27.8
Manganese D-Mn 0.158
Mercury D-Hg <0.00020
Potassium D-K 5.5

Selenium D-Se <0.010
Sodium D-Na 27.6
Uranium D-U <0.0010
Zinc D-Zn <0.50

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.



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 Bacteriological Tests.

		Lower Limit	Upper Limit	Notes
Total Metals				
Arsenic	T-As	-	0.025 mg/L	1
Iron	T-Fe	-	0.3 mg/L	2
Manganese	T-Mn	-	0.05 mg/L	2
Dissolved Metals				
Antimony	D-Sb	-	0.006 mg/L	1, 3
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	2, 4
Iron	D-Fe	-	0.3 mg/L	2
Lead	D-Pb	-	0.01 mg/L	4, 3
Manganese	D-Mn	-	0.05 mg/L	2
Mercury	D-Hg	-	0.001 mg/L	
Selenium	D-Se	-	0.01 mg/L	
Sodium	D-Na	-	200 mg/L	2
Uranium	D-U	-	0.02 mg/L	1
Zinc	D-Zn	-	5 mg/L	2, 4

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

Appendix 2 - METHODOLOGY



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

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.

This Certificate Of Analysis shall only be reproduced in full, except with the written approval of ALS Environmental.

End of Report



CERTIFICATE OF ANALYSIS

Date: December 21, 2005

ALS File No. W8652

Report On: 1260008 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: December 9, 2005

ALS ENVIRONMENTAL

per:

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

File No. W8652

REMARKS



Please note that the certain Metals detection limits have been increased for some of the samples due to the matrix interferences encountered during the analysis.

RESULTS OF ANALYSIS - Water

Sample ID	Burwash Airport	D.Bay Grades Stn.
Sample Date	05-12-07	05-12-03
Sample Time	11:00	17:00
ALS ID	1	2

Physical Tests

Colour	(CU)	<5.0	6.1
Conductivity	(uS/cm)	436	781
Total Dissolved Solids		261	548
Hardness	CaCO3	179	384
pH		8.21	8.18
Turbidity	(NTU)	0.83	0.85
UV Absorbance		0.0380	0.0800

Dissolved Anions

Alkalinity-Total		CaCO3	235	265
Chloride	Cl		1.15	0.62
Fluoride	F		0.313	0.280
Sulphate	SO4		34.6	213

Nutrients

Nitrate Nitrogen		N	<0.10	<0.10
Nitrite Nitrogen		N	<0.10	<0.10

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 OF ANALYSIS - Water

Sample ID	Burwash Airport	D.Bay Grades Stn.
Sample Date	05-12-07	05-12-03
Sample Time	11:00	17:00
ALS ID	1	2

Total Metals

Aluminum	T-Al	<0.020	<0.020
Antimony	T-Sb	<0.0010	<0.0010
Arsenic	T-As	0.00357	0.0111
Barium	T-Ba	<0.040	0.061
Boron	T-B	0.35	1.31
Cadmium	T-Cd	<0.00040	<0.00040
Calcium	T-Ca	26.3	57.3
Chromium	T-Cr	<0.0040	<0.0040
Copper	T-Cu	<0.0020	<0.0020
Iron	T-Fe	<0.030	0.173
Lead	T-Pb	<0.0020	<0.0020
Magnesium	T-Mg	27.5	58.5
Manganese	T-Mn	0.149	0.0677
Mercury	T-Hg	<0.00020	<0.00020
Potassium	T-K	4.86	4.88
Selenium	T-Se	<0.0020	<0.0020
Sodium	T-Na	26.5	26.9
Uranium	T-U	0.00078	0.00098
Zinc	T-Zn	<0.10	<0.10

Organic Parameters

Total Organic Carbon	C	1.99	5.68
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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.



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 Bacteriological 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	SO ₄	-	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 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.

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Appendix 2 - METHODOLOGY - Continued



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

UV Absorbance/% Transmittance

This analysis is carried out using procedures adapted from APHA Method 5910B "Ultraviolet Absorption Method" and Method 415.3 "Determination of Total Organic Carbon and Specific UV Absorbance at 254nm in Source Water and Drinking Water", published by the United States Environmental Protection Agency (EPA). The sample is filtered through a 0.45um filter and measured for absorbance in a quartz cell at 254nm and reported as absorbance per cm (i.e. cm⁻¹). The analysis is carried out without pH adjustment. Alternatively, results can be reported as % Transmittance (over one cm) where the absorbance result is converted to % Transmittance by the following calculation: %T = 100(10 to the power of -A).

Recommended Holding Time:
Sample: 2 days
Reference: APHA and EPA

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

File No. W8652

Appendix 2 - METHODOLOGY - Continued



Reference: EPA

Laboratory Location: ALS Environmental, Vancouver

Carbon in Water

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". All fractions of carbon are determined by the combustion-infrared method. Total carbon includes organic carbon (covalently bonded in organic molecules) and inorganic carbon (carbonate, bicarbonate and dissolved carbon dioxide). Total organic carbon is the calculated difference between the total carbon and the inorganic carbon determination. Dissolved carbon fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

Recommended Holding Time:

Sample: 28 days

Reference: APHA

Laboratory Location: ALS Environmental, Vancouver

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

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End of Report



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

Health and Social Services
 Services de santé et de services sociaux
 Environmental Health Services
 Services de santé d'hygiène du milieu

Hospital Road, Whitehorse, Yukon Y1A 3H8
 Tel: (867) 667-8391 fax: (867) 667-8322
 Sans frais au Yukon 1-800-661-0408, poste 8391

1 Person
 Name-ressource: Nick Barnett Phone: _____
 Telephone: _____
 Address: BNA Fax: _____
 Postal code: _____
 Postal code: _____
 Institution, Municipal or Business Name: _____
 Name of the first nation, of the municipality or of the enterprise: _____
 Fax: _____
 Telephone: _____

Local Address: Burwash Airport Subdivision: _____
 Description: _____ Lot: _____ Quad: _____
 Official designation: _____ Terrain: _____ Quadrant: _____ Plan no.: _____
 Plan n°: _____
 Information (e.g., Location, Business / Building Name): _____
 Renseignements (par ex.: emplacement, nom de l'entreprise, nom de l'édifice): _____

Collected By: Tom Renwick Date: 05/12/20 Time: 1045 am
 Collected by: _____ Date: _____ Time: _____
 Site (e.g., kitchen tap): Kitchen Tap
 Sampling location (par ex.: robinet de cuisine): _____
 Resample from a Previous Test? Yes No Previous Sample Number: _____
 Rééchantillonner d'un test antérieur? Oui Non Numéro de l'échantillon précédent: _____

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

Drug 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): _____
 Eau livrée Autre (précisez): _____

Water Chlorinated? Yes No Free Available Chlorine: _____ p.p.m.
 L'eau est-elle chlorée? Oui Non Chlore libre disponible: _____ mg/L

Treatment Systems (e.g., UV, softener, filter): _____
 Systèmes de traitement (par ex.: désinfection aux rayons ultraviolets, adoucisseur d'eau, filtre d'eau): _____

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

Sample Date: 05/12/20 Time: 120 am By: 9
 Date de l'échantillon: _____ Heure: _____ Par: _____

Sample Status: Satisfactory Unsatisfactory (explain): _____
 État de l'échantillon: Satisfaisant Non satisfaisant (précisez): _____

Incubation Date: 05/12/20 Time: 423 am By: 1 incubator
 Date d'incubation: _____ Heure: _____ Par: _____ Incubation: _____

Completed Date: 05/12/20 Time: 423 am By: 3
 Date terminée: _____ Heure: _____ Par: _____

Total Coliforms/Coliformes totaux
 Present / Présence: Absent / Absence
E. coli/E. coli
 Present / Présence: Absent / Absence:

Results Satisfactory for Bacteriological Quality
 Résultats satisfaisants à l'égard de la qualité bactériologique
 Immediately Resample / Rééchantillonner immédiatement
 Investigate and Take Appropriate Corrective Actions
 Enquête et appliquer les mesures correctives nécessaires
 Do Not Drink Water Before Consumption / Ne pas boire l'eau avant de la consommer
 ENTERED
 By: _____
 Pat: _____