10.0 BUILDING 5681: STEWART CROSSING GRADER STATION

10.1 Description of Existing Water Supply System

Building 5681, the Stewart Crossing Grader Station and Building 5682, the Stewart Crossing Living Complex, are serviced by a water supply system that sources water from a 177.4 m deep well. Water is delivered to each building from the pumphouse storage building by way of underground recirculating piping. The well is located adjacent to the pumphouse storage building (Building 5690) approximately 50 m east of the maintenance garage. A public fill station is also located at the pumphouse where residents of Stewart Crossing can obtain water. A site plan is provided as Figure 5681-A in Appendix A10. The coordinates of the wellhead, as measured by a handheld GPS device, were recorded as:

- UTM ZONE 8
- Northing: 7028437
- Easting: 416194

The pumphouse storage building houses water treatment and distribution equipment consisting of an inline filter, pressure tank, water softener and a proportional feed LMI chlorine injection system. The piping for the public water fill station leaves the main system after filtration and disinfection but before the water softener. Neither the chlorination nor the softening system was operating at the time of the water system assessment. A schematic detailing the water supply system is provided as Figure 5681-B in Appendix A10. Photos of the well and water system are also included at the back of this appendix.

Additionally, there is an abandoned dug well on site located in a pumphouse just outside from the southeast corner of the property and approximately 110 m south of the deep well. This well has not been properly decommissioned, and could pose a safety risk in its current condition. The dug well enclosure, although it has a ladder, is not locked, and could be easily accessed by children.

10.2 Description of Existing Wastewater Systems

Wastewater from the maintenance garage is discharged to a leach pit located east of the building approximately 33 m to the west of the deep well. The Living Complex

is served by a septic system with tank and in-ground disposal system on the east side of the building and is greater than 60 m from the well. Septic systems are shown on Figure 5681-A in Appendix A10.

10.3 Water Quality Results

10.3.1 Water Quality Results from Previous Sampling

Bacteriological

A total of 17 samples were collected from the Stewart Crossing Grader Station water system between October 2004 and June 2005 and were tested for total coliform and *E. Coli* by Yukon Environmental Health Services using the presence/absence test method. Samples were collected from the Grader Station as well as the Living Complex. Results are tabulated in Table 5681-1 in Appendix A10. Coliform bacteria and *E. coli* were reported as absent in each of the 17 samples for which results are provided.

Potability

YTG representatives collected water samples from this system on September 29, 2004 and June 8, 2005. A sample was also collected from the Living Complex on September 29, 2004. The samples were submitted to Northwest Labs in Surrey BC and ALS Environmental in Vancouver BC for potability analyses. The results of these analyses are summarized in Table 5681-2 in Appendix A10. EBA reviewed the analytical results for comparison with the Canadian Drinking Water Quality Guidelines (CDWQG) to observe general water quality, identify and recommend additional sampling and analytical and to identify potential indicators of contamination.

- At 10.3 NTU during the first sampling event and 17.7 NTU during the second sampling event, the turbidity in samples collected from the Grader Station were above the Canadian Drinking Water Quality Guideline – Maximum Acceptable Concentration (CDWQG MAC) of 1.0 NTU and aesthetic objective (AO) of 5.0 NTU. The sample collected from the Living Complex also marginally exceeded this MAC;
- Each of the samples collected have had arsenic concentrations below the existing CDWQG MAC of 0.025 mg/L but above the proposed MAC of 0.005 mg/L;

- At 0.6 mg/L during the first sampling event and 1.48 mg/L during the second sampling event, the total iron concentration was in exceedence of the CDWQG AO of 0.3 mg/L;
- At 0.136 mg/L during the first sampling event and 0.134 mg/L during the second sampling event, the total manganese concentration was in exceedence of the CDWQG AO of 0.05 mg/L;
- Colour was reported to be 27 CU, which was in exceedence of the CDWQG AO of 15 CU;
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed;
- The water quality results indicated that the groundwater is calcium bi-carbonate type water with a pH of approximately 8.1; and,
- The hardness (as $CaCO_3$) was approximately 170 mg/L and is considered hard. The high hardness indicates that the water softening system was not functioning when the water samples were taken.

10.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Stewart Crossing Grader Station water system that was identified to be included during the water system assessments is detailed below:

- Total and dissolved iron, manganese, and arsenic;
- Turbidity;
- Phosphate, silicate, and total vanadium to determine the potential for an arsenic removal treatment system;
- Total organic carbon (TOC);
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

Analytical results for these additional parameters can be used in treatment system design.

A water sample was obtained by EBA during the water system assessment on August 16 2005, and was submitted to ALS Environmental in Vancouver BC for analysis of additional parameters. These results are summarized in Table 3440-2 in Appendix A10 and the laboratory reports are included in Appendix B. Significant observations are detailed below:

- Turbidity at 8.02 NTU though lower than previous sampling events, was still above the CDWQG health based upper limit;

- Total and dissolved arsenic at 0.0108 and 0.00697 mg/L were above the proposed CDWQG MAC of 0.005 mg/L;
- Total iron at 0.923 mg/L was in exceedence of the CDWQ AO of 0.3 mg/L, however dissolved iron was below the laboratory detection limit (0.03 mg/L) indicating that the elevated total iron concentration was likely attributed to elevated turbidity;
- Total and dissolved manganese concentrations were in exceedence of CDWQG AO's at 0.14 and 0.135 mg/L respectively, indicating that elevated manganese concentrations were not related to elevated turbidity;
- Water quality results indicated no other exceedences of CDWQG MACs or AOs.

10.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surface water sources or septic waste. The chloride concentration was low and is within the normal background range for groundwater in the area. Nitrate and nitrite concentrations for this sample were also low and within the normal background range for this area. These water quality results indicate that the Stewart Crossing Grader Station water system was not under the influence of septic wastes or other anthropogenic sources of nutrients or anions at the time of sampling.

10.4 Conceptual Hydrogeology

The log for this well indicates that the well is completed at a depth of 177.4 m within a confined gravel aquifer. Drilling encountered mostly silt from ground surface to 100.6 m with interbedded fine and coarse-grained material to a depth of 177.4 m. The presence of a thick sequence of fine-grained material overlying the aquifer provides significant protection from surficial sources of contamination.

10.5 Potential Contaminant Sources

Details and photographs of potential contaminant sources observed during the site investigation are compiled in Appendix A10.

Potential contaminant sources within 30 m of the wellhead include:

- Various drums containing paint, toulene, and other unknown chemicals within 15 m of the well;
- Creosote treated timbers at 15 m; and
- Various industrial activities occurring around the well.

In addition, a tar storage tank is located 45 m away from the wellhead. There is an underground fuel storage tank (UST) located approximately 40 m from the well. The closest portion of a septic system to the wellhead is a septic leach pit located 33 m away.

10.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environmental Programs Branch and Environment Canada Environmental Protection Branch did not identify any recorded spill events or contaminated sites issues for this site or neighbouring sites.

10.6 Identified Water System Deficiencies and Associated Risk

10.6.1 High and Medium Risk Deficiencies

High and medium risk deficiencies observed during this study include:

- Poor surface completion of the well. Due to insulation surrounding the wellhead it was not possible to determine the exact stick up of the well casing, however it is unlikely that the casing extends the required 500 mm above grade, and as such, could potentially be subjected to flooding and is in contravention of the regulation;
- The well is located within 30 m of potential contaminant sources including various chemical storage drums, creosote timbers, and industrial activities;
- Turbidity has been in exceedence of the both the CDWQG MAC and AO;
- The chlorine disinfection system was not in operation at the time of water system assessment;
- There is no backflow prevention between the system and on the public fill station; and,
- The pumphouse door is normally left unlocked which could pose a security issue.

10.6.2 Low Risk Deficiencies

- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Guidelines for Water Well

Construction), however as mentioned previously, there is likely a tight bond between the casing and the soil formation based on the well record and drilling method;

- The arsenic concentration, although not in exceedence of the current CDWQG MAC, is above the proposed MAC of 0.005 mg/L;
- The total iron concentration has been in exceedence of the CDWQG AO;
- The manganese concentration has been in exceedence of the CDWQG AO;
- The colour has previously been reported above the CDWQG AO; and,
- The public water fill comes off of the water system prior to the softening system, and the softening system was not operating at the time of water system assessment.

The Niels Jacobsen report titled "Community Water Systems in the Yukon – Stewart Crossing" (February, 2003) also noted that there are features that are normally found in a pumphouse for a community water supply system that are lacking in this one which relate to construction materials, floor type, plumbing and security. When the water system requires treatment upgrades to remove arsenic to below the proposed MAC, more space will be required than currently available and it would be worthwhile to consider constructing a new building that is complete with a concrete floor and more suitable plumbing to house the water system equipment.

10.7 Mitigative Options for Deficiencies

Mitigative options were developed to address the deficiencies identified in the previous section. Deficiencies are categorized by recommended level of priority (with Priority 1 being most critical).

10.7.1 Priority 1

The following recommendations are provided in order to mitigate deficiencies that are of immediate concern for the Stewart Crossing Grader Station. Priority 1 remedial recommendations include:

- Standard wellhead including installation of a pitless unit and near surface sanitary seal should be completed. With a near surface sanitary seal, this well would considered to be non-GUDI.
- A chlorine tap should be installed on the wellhead and the well and water system should be super-chlorinated.

- Primary disinfection treatment consisting of a duplex commercial filtration system to filter to 1 micron (absolute) should be considered and the proportional feed chlorination system should upgraded to ensure disinfection of the water supplied to this building. It is recommended that a digital dosing proportional feed chlorination system (or equivalent) be installed to replace the existing LMI system, as it would be more reliable and require less maintenance. The LMI system could be maintained as a back-up chlorination system (a back-up chlorination system was recommended by Niels Jacobsen in February 2003). The digital dosing type of chlorine injection system has recently been installed in most other community wells in the Yukon and would lend itself to better preparedness for equipment maintenance and replacement as well as operator training. These are conceptual design recommendations based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.
- All chemical storage and creosoted timber piles should be relocated to at least 30 m from the wellhead. Activities within 30 m of the wellhead should be regulated to ensure that hazardous chemicals are not handled or stored in proximity to the wellhead.
- Backflow prevention should be installed to ensure that water can not flow from the public access point back to the water system.

10.7.2 Priority 2

The softener system should be reconditioned and brought back into operation. Once the softener system is brought back into operation, arsenic concentrations should be monitored to determine whether future arsenic removal treatment will be required (see Priority 3).

All other high and medium risk deficiencies would be mitigated through completion of Priority 1 upgrades.

10.7.3 Priority 3

Although standard softener systems are not designed for arsenic removal, they do often effect some arsenic removal. The arsenic concentrations should be monitored following reconditioning of the softener system. In the event that arsenic concentrations are still above the proposed MAC, an arsenic removal treatment system would be required. A new building to house all treatment equipment should be considered at this time.

10.8 Cost Estimates for Mitigative Options

Engineering costs for mitigative options are estimated to be 20% of construction costs, and would include inspection and completion reporting. The costs for materials and labour (not including engineering) are provided in the sections below. An additional contingency allowance of 20% is suggested for budgetary purposes.

10.8.1 Priority 1

The estimated costs for the recommended Priority 1 upgrades are detailed below:

- It would cost approximately **$5,000** for materials and labour to complete the recommended pitless unit wellhead upgrade and well and water system superchlorination.
- Commercial stainless steel duplex filtration canisters and filters (to 1 micron (absolute) would cost approximately **$2,500** installed.
- Upgrades to a new digital dosing chlorine feed system with suction lines and reservoir would be approximately **$2,100** installed.
- A suitable backflow prevention device could be supplied and installed for approximately **$400.**

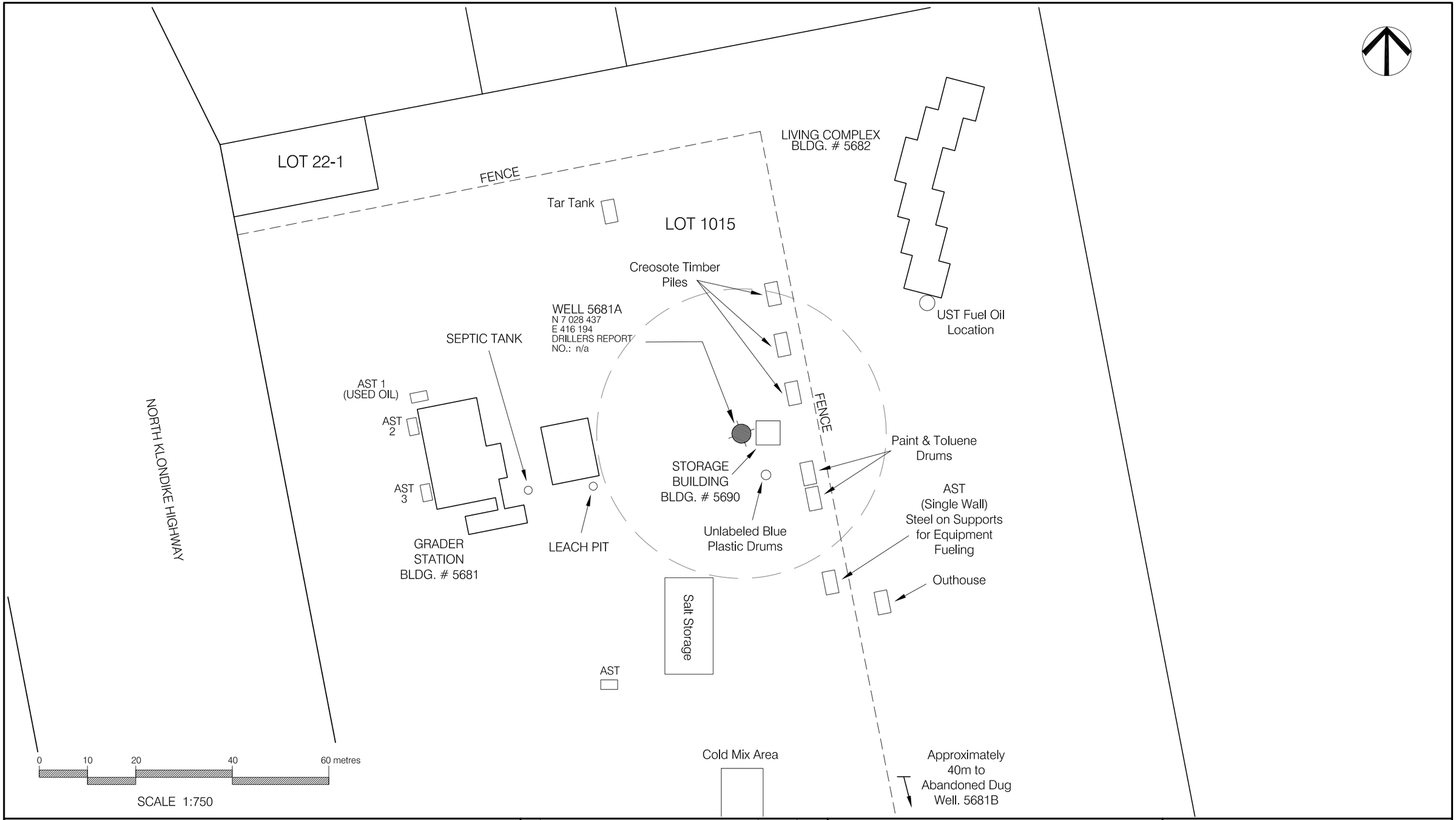
Therefore, it would cost approximately **$10,000** to complete the recommended Priority 1 upgrades for this system.

10.8.2 Priority 2

Reconditioning and the softener system would cost approximately **$500.**

10.8.3 Priority 3

An arsenic removal treatment system would cost in the order of **$4,000**, while a new building to house the treatment systems with a concrete floor and appropriate construction would cost in the order of **$20,000**.



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.

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

REVISION

EBA Engineering Consultants Ltd.

DESIGNED BY:	R. MARTIN
DRAWN BY:	J. BUYCK
DATE:	SEPT. 2005
SCALE:	AS SHOWN
PROJECT No.:	1260002.004
ACAD FILENAME:	004-NORTHERN REGION

CLIENT:

Yukon
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
NORTHERN REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

STEWART X-ING GRADER STATION
BUILDING # 5681
SITE LOCATION DIAGRAM
WELL ID: 5681

REVISION ISSUE
0

FIGURE No.
FIGURE 5681-A

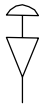
LEGEND


PUMP


PRESSURE GAUGE


GATE VALVE


CHECK VALVE

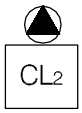

SOLENOID

#2 COMPONENT ID. No.
(SEE TABLE ON FOLLOWING PAGE)

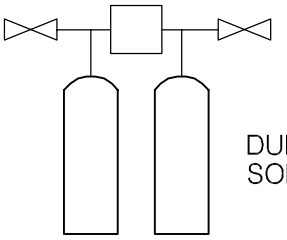
FLOW METER

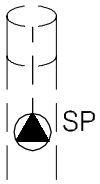
WATER FILTER
(CARTRIDGE TYPE)

PRESSURE TANK

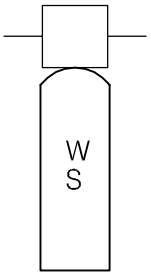


CHLORINE RESERVOIR AND
INJECTION PUMP


DUPLEX WATER
SOFTENER

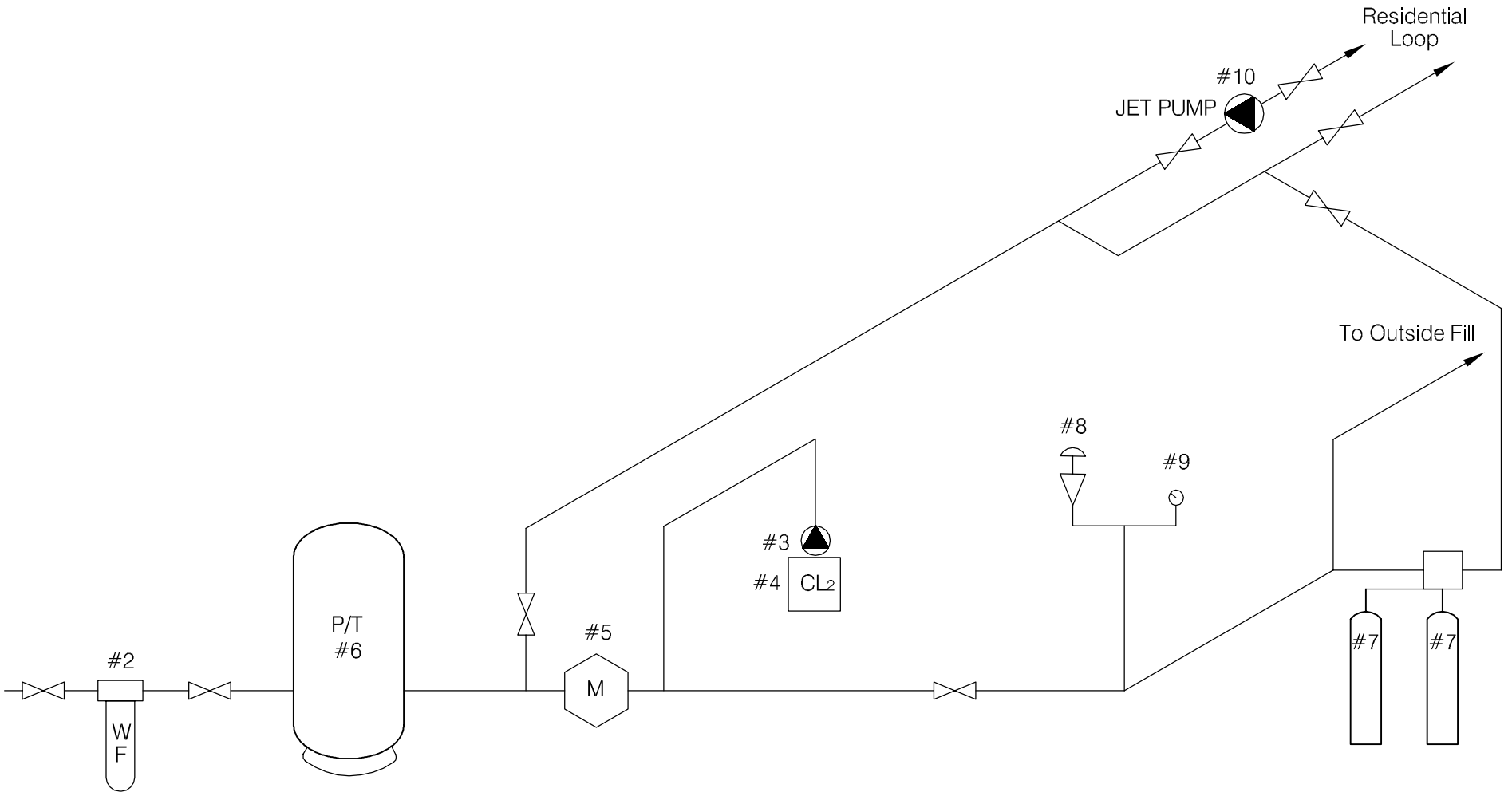


WELL WITH
SUBMERSIBLE PUMP



ACTIVATED
CARBON

EBA Engineering Consultants Ltd.			PROJECT	SMALL PUBLIC WATER SYSTEMS ASSESSMENT WESTERN REGION	
CLIENT Yukon Highways and Public Works Property Management Branch			TITLE	SCHEMATIC SYSTEM LEGEND	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	FILE NO. 1260002		DRWG. LEGEND



SCHEMATIC PRODUCED BY BERT ALBISSER OF AQUA TECH SUPPLIES AND SERVICES LTD.

EBA Engineering Consultants Ltd.			PROJECT	SMALL PUBLIC WATER SYSTEMS ASSESSMENT NORTHERN REGION	
CLIENT Yukon Highways and Public Works Property Management Branch			TITLE	WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 5681 GRADER STATION - STEWART CROSSING, YT.	
DATE SEPT. 2005	DWN. JSB	CHKD. RMM	FILE NO. 1260002.004		DWG.: FIGURE 5681-B

Z:\0201Drawings\1260002 Water Assessment YTG\004 - Northern Region\stewart\1260002004 Grader Station_5681B Schematic.dwg, 4/5/2006 3:16:43 PM, Adobe PDF, jbuyck

Northern Region – Stewart Crossing Grader Station
Building # 5681

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	SUB PUMP	?				5HP - 4"
2	INLINE FILTER	AMEREK	10" BB			1½" x 10"
3	CHLORINE PUMP	LMI	A751-39251		20020712896	
4	CHLORINE TANK	LHI	20 I. GALLON			
5	FLOW METER	LMI	RFP-010			
6	PRESSURE TANK	WELL X TROL	WX-360			
7	SOFTENER	AQUA-TECH	SOZ65606	DUPLEX	184243	9000-1460 DUPLEX
8	PRESSURE SWITCH	SQUARE D	FSG-2			
9	PRESSURE GAUGE	MARSH	0-100			2½" - ¼ NPT
10	CIRC PUMP	ARMSTRONG	?			

TABLE 5681/5682- 1: SUMMARY OF BACTERIOLOGICAL RESULTS

Building #	Building Name	Number of Sampling Events	Time Period over which Sampling was Done	Any Positive Total Coliform Results? (yes or no)	Fraction of Positive Total Coliform Results vs. Total Sampling Events	Any positive E.Coli results? (yes or no)	Most Recent Sampling Event Available for EBA Review	Is Most Recent Result Positive?
5681	Stewart Crossing Grader Station	9	Oct-04 to Jun-05	no	0/9	no	9-Jun-05	no
5682	Stewart Crossing Living Complex	8	Oct-04 to Jun-05	no	0/8	no	9-Jun-05	no

Table 5681/5682 - 2: Water Quality Results

SOURCE:	Building 5681 - Stewart Crossing Grader Station			Building 5682 - Stewart Crossing Living Complex	GCDWQ Criteria		
Location/ Resident	Stewart Crossing			Stewart Crossing			
Address							
Treatment	Softener (not in use), filtration			Softener (not in use), filtration			
Disinfection	Chlorination (not in use)			Chlorination (not in use)			
Source of Water	On-site well			On-site well			
Purpose of Sampling	Base Line	Base Line	Additional Sampling	Base Line			
Sample Location			Complex Residence				
Date Sampled	29-Sep-04	8-Jun-05	16-Aug-05	29-Sep-04	**Lower**	**Upper Limit**	
Physical Tests *(ALS)*					**AO**	**MAC**	**AO**
Colour (CU)	**27**	<5.0		7			15
Conductivity (uS/cm)		344					
Total Dissolved Solids	180	180		181			500
Hardness CaCO3	169	171		168	AO >200 = poor, > 500 unacceptable[A]		
pH	8.07	8.22		8.07	6.5		8.5
Turbidity (NTU)	**10.3**	**17.7**	**8.02**	**1.4**		1	5
UV Absorbance							
% UV Transmittance							
Dissolved Anions *(ALS)*							
Alkalinity-Total CaCO3	161	160		163			
Chloride Cl	0.8	<0.50		0.6			250
Fluoride F	0.15	0.173		0.15		1.5	
Silicate SiO4			10.2				
Sulphate SO4	17.7	18.5		17.8			500
Nitrate Nitrogen N	<0.1	<0.10		<0.1		10	
Nitrite Nitrogen N	<0.05	<0.10		<0.05		1	
Ammonia Nitrogen N							
Total Phosphate PO4			0.0285				
Total Metals *(ALS)*							
Aluminum T-Al	<0.005	<0.010		<0.005		0.1	
Antimony T-Sb	<0.0002	<0.00050		<0.0002		0.006	
Arsenic T-As	*0.0094*	*0.0117*	*0.0108*	*0.0074*		0.025	
Barium T-Ba	0.08	0.077		0.072		1	
Boron T-B	0.005	<0.10		0.004		5	
Cadmium T-Cd	<0.00001	<0.00020		<0.00001		0.005	
Calcium T-Ca		53.5					
Chromium T-Cr	0.001	<0.0020		0.001		0.05	
Copper T-Cu	<0.001	0.0057		0.002		1	
Iron T-Fe	**0.6**	**1.48**	**0.923**	0.28			0.3
Lead T-Pb	<0.0001	<0.0010		0.0002		0.01	
Magnesium T-Mg		9.11					
Manganese T-Mn	**0.136**	**0.134**	**0.14**	**0.136**			0.05
Mercury T-Hg		<0.00020				0.001	
Potassium T-K		1.38					
Selenium T-Se		<0.0010				0.01	
Sodium T-Na	3	3.4		3			200
Uranium T-U	<0.0005	<0.00010		<0.0005		0.02	
Vanadium T-V			<0.030				
Zinc T-Zn	0.221	0.43		0.226			5
Dissolved Metals							
Arsenic D-As			0.00697			0.025	
Iron D-Fe			<0.030				0.3
Manganese D-Mn			**0.135**				0.05
Organic Parameters							
Tannin and Lignin							
Total Organic Carbon C			1.44				
Field Chemistry (EBA)							
pH			8.38		6.5		8.5
TDS (ppm)			165				500
EC (uS/cm)			326				
Temperature (°C)			15.5				
Free Available Chlorine			0.01				

Notes:

A. Guidelines indicated for hardness are not CDWQG, rather they are general aesthetic guidelines - exceedences are indicated in yellow highlighting.

Italics and underline indicates exceedence of proposed MAC (ie. arsenic)

Bold with Yellow highlighting indicates exceedence of CDWQG Aesthetic Objective (AO)

Bold Underline with Yellow highlighting indicates exceedence of CDWQG MAC

Results are expressed as milligrams per litre except for pH and Colour (CU) Conductivity (umhos/cm), Temperature (°C) and Turbidity (NTU)

< = Less than the detection limit indicated.

AO = Aesthetic Objective

MAC = Maximum Acceptable Concentration (Health Based)

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin, Luke Lebel Date Aug 16, 2005

WELL ID #	Owner	Location Description
5681	YTG	Stewart Crossing Grader Station

1. Well Location and Potential Contaminant Sources

a. General location of well: (Community, Subdivision, etc.)
Stewart Crossing

b. Specific location: (Road or street, Building number, name of owner and/, legal description,
In wellhouse on grader station compound

c. GPS location: N 7028437 E 416194 elv 468m ±6m

d Is there electric power? ☒ Yes ☐ No

e Is there outside water access? ☒ Yes ☐ No
Publicly Accessable

f. Does the well system have:

☐ 15 or more service connections to a piped distribution system ? If so how many_____
Maintenance garage and Living Complex
☐ 5 or more delivery sites on a trucked distribution system? If so how many_____

g. Nearest building, specify Pumphouse

h. Distance from well to building 1.65m

i. If there is an effluent disposal field, is its location known? ☒ Yes ☐ No

j. Distance from well to nearest point of known field: leach pit @ 33 m

k. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral

l. Is there any part of a sewage disposal system(s)or other potential sources of pollution that may pose a health and safety risk within 30 m? ☐ Yes ☒ No
No. Tank @ ~45m; outhouse @ ~40m

m. Is the well located within 300 m from a sewage lagoon or pit? ☐ Yes ☒ No unlikely

n. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No unlikely

o. Is the infrastructure protecting the wellhead, pumphouse, storage tank and/or water treatment plant designed and secured to prevent:

Unauthorized access by humans? ☐ Yes ☒ No Unlocked enclosure
Entrance by animals? ☐ Yes ☒ No Access possible

p. Is well site subject to flooding? ☐ Yes ☒ No

q. Is the well site well drained? ☒ Yes ☐ No

r. Is there a buried fuel tank on the property? ☒ Yes ☐ No

If yes, is it ☒ in use ☐ abandoned

Is the location known? ☒ Yes ☐ No
Distance from the well to known buried tank ~40 m

s. Are there any other known contaminant sources on the property?

☒ Yes ☐ No Describe Industrial activities around the well

If yes, specify the source: ☐ dump ☐ sewage lagoon ☐ cemetery ☐ other

Potential Source 1: Unknown Drums contents; Distance from well to Potential Source 1: ~40 m
Potential Source 2: Paint + Toulene Drums; Distance from well to Potential Source 2: ~15 m
Potential Source 3: Tar tank; Distance from well to Potential Source 3: ~45m
Potential Source 4: Salt storage; Distance from well to Potential Source 4: ~35m
creosote timbers @ ~15m

t. Are there other wells on this property? ☒ Yes ☐ No

How many? 1 ☐ in use ☒ abandoned ☐ require proper sealing
dug well @ ~100m

2. Well and Wellhead information:

a. When was well installed? Year 1994 Month April

b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____

c. Is there a drillers log for the well: ☒ Yes ☐ No

d. Is there a surface seal to 6 m ☐ Yes ☒ No ☐ unknown ☐ unlikely

e. Surface casing: ☒ Yes Diameter 30 cm ☐ No

f. Well casing: Diameter 30 cm to 12.8 m / 20 cm to 150 m / 15cm to 176 m Material: ☒ steel ☐ plastic ☐ concrete

g. Depth of well: 177.4 m ☐ measured (if possible) ☒ reported ☒ from log

h. Static water level below ground: Unknown

☐ measured (if possible) ☐ reported ☐ from log ☐ flowing

i. (If granular) Is the well completed: ☐ open end casing ☒ with a well screen

☐ with slotted pipe ☐ unknown other _____

j. (If bedrock) Does the well have a liner? ☐ yes ☐ No ☐ steel ☐ plastic

k. If there is a well screen: length 1.8 m slot size(s) 80 slot and 50 slot
Location of screen: from 176.0 m to 177.4 m from log reported

l. Is there a sump below the screen? ☐ Yes ☒ No

m. Is the well head: ☐ in pumphouse ☐ in pit ☐ pitless adaptor ☐ in a building

☒ in a wooden enclosure other, describe adjacent to pumphouse

n. If the well head is located in a wooden enclosure,

i. Is the well head below grade? describe in detail No

ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☐ Yes ☒ No

iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No

iv. Any evidence of rodents? Specify No

v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition likely, but not able to observe due to insulation

3. Water Supplying This Well:

a. By definition is the water from a surface water source or under the direct influence of surface water?

☒ Yes ☐ No ☐ farther investigation required.

If yes is there treatment or disinfection ☒ Yes ☐ No

Explain (filtration, disinfection etc...) Filtration, softening, chlorination

---

4. Aquifer Supplying This Well:

a. The aquifer is: ☐ bedrock ☒ granular sediment ☐ unknown

b. Does water level and/or well capacity show seasonal fluctuation? ☐ Yes ☒ No unlikely

5. Pump Installation:

a. Is the well equipped with a pump? ☒ yes ☐ No

b. Type of pump: ☐ hand ☒ electric submersible ☐ jet

☐ shallow well centrifugal ☐ other, _____

c. Description: Manufacturer _____ Model _____

horsepower _____ capacity _____ voltage _____

d. Date installed: _____ By: _____

e. For submersible pump, depth of setting below surface _____

f. Drop pipe for submersible pump: ☐ steel ☐ plastic unknown

g. Pump delivers water to: ☒ pressure tank ☐ elevated tank ☐ other

h. Are there automatic pump controls: ☒ Yes ☐ No

i. Is there provision for taking water samples before water reaches storage? ☐ Yes ☒ No

j. Is there a water meter on the system? ☐ Yes ☒ No

k. Is the pump and piping protected from freezing? ☒ Yes ☐ No

If yes, describe: Insulation and heat trace

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations:

PART B: EBA Site Inspection

Inspector: BERT ALBASSER Date AUG. 16/05

WELL ID #	Owner	Location Description
5681	YTG	STEWART CROSSING, YT

6. Water Treatment

a. Is well water treated? ☑ Yes ☐ No; Type of treatment:

☑ chlorination ☑ iron and or manganese removal ☐ other _____

b. Is water entering plumbing or piped distribution system treated with chlorine or another treatment that is as effective as chlorine used to achieve disinfection throughout the system?

☑ Yes ☐ No If so how CHLORINATOR (LIQUID)

c. If treated with chlorine, is the free residual chlorine concentration less than 0.2 mg/L

☐ Yes ☑ No _____ reading.

Tested at _____ (location)

d. Is testing for chlorine residual concentration done at the tap (eg. Kitchen faucet) or from representative points in a piped distribution system, including a point from tap at the end line

☐ Yes ☑ No If yes how often? _____

e. If the drinking water is being transported by water delivery truck does it have a minimum chlorine free residual of 0.4 mg/L at the time of fill. ☐ Yes ☑ No

7. Water Quality (observations):

a. Does the water stain plumbing? ☐ yes ☑ No ☐ slight ☐ severe

Type of stain: ☐ brown ☐ red ☐ black

b. Does the water contain sediment? ☐ Yes ☑ No ☐ occasional ☐ constant

c. Is there an unpleasant odour? ☐ Yes ☑ No ☐ H_2S ☐ Other _____

d. Is there an unpleasant taste? ☐ Yes ☑ No ☐ brackish ☐ Other _____

e. Is there a history of bad bacterial analyses? ☐ Yes ☑ No

f. Is there a chemical analysis? ? ☐ Yes ☐ No ☐ adequate ☐ incomplete

g. Is there analysis of trihalomethanes (THMs) where the water source is a surface water supply or a well under the direct influence of surface water? ☐ Yes ☑ No

h. Is the drinking water tested daily with an accurate reading chlorine test kit capable of reading in the range 0 to 3.5 mg/L of free chlorine residual in increments of 0.1mg/L? ☐ Yes ☑ No ☐ unknown

i. If yes is the test performed in accordance with manufactures directions? ☐ Yes ☑ No ☐ unknown

j. Is a record of the date, time,name of person performing the test and results of the drinking water sample kept? ☐ Yes ☑ No

TANK AND PIPING DETAILS

Tank Room

Is there a water tank? Yes No Details: PRESSURE TANK

Where is it located?
Comments: _____

Is the room in which the water tank is located heated to maintain an optimum temperature of 4°C for stored water?
YES NO
Comments: MAIN HOUSE

Are there windows in the add-on that may allow direct sunlight onto the water holding tank? YES NO
Comments: _____

Are there other heat sources near the tank? YES NO
Comments: _____

Is there waterproof flooring with a sealed base to contain spills? YES NO
Comments: _____

Overall Tank

What are the tank size and dimensions?

WX - 366

What material is the tank constructed of? STEEL & BUTYL BLANKET

Is tank and associated piping constructed of safe materials (i.e. CSA approved and material that does not affect the taste of the water)? (YES) NO

Comments: _____

Tank Inlet, Outlet and Lid

Is there adequate access on the tank for cleaning (i.e. min 15" access lid)? YES NO

Does the lid have a tight seal and is it watertight when closed? YES NO

Does the tank have an overflow or high level whistle? YES NO

Is the water tank drain accessible? YES NO

WATER TANK AND WATER QUALITY CONDITION

Are there signs of staining or biofouling? YES NO
Comments: _____

Is there any sediment or scum in bottom of tank? YES NO
Comments: _____

Is there any odour associated with the water or tank? YES NO

Have there been any bacteriological analyses conducted previously? YES NO

Does the tank appear that it has been cleaned recently? YES NO

Are the tanks easily assessed for the purpose of cleaning and disinfection? YES NO

8. Conclusions

a. Comments on overall installation:

INSTALLATION IS ACCEPTABLE WITH THE EXCEPTION OF THE SOFTNER DRAIN. THERE IS NO PROPER DRAIN AS IT DRAINS ON THE GROUND OUTSIDE THE WELL HOUSE. THE CHLORINATOR IS UNPLUGGED. IT IS NOT IN SERVICE AT THIS TIME.

b. Recommendations:

INSTALL PROPER DRAIN FACILITY FOR TREATMENT SYSTEM.
RETURN SOFTNER TO SERVICE AND TRAIN PERSONNEL TO OPERATE THE SYSTEM AND INSTITUTE CHLORINE RESIDUAL TESTING AT SCHEDULED INTERVALS. DAILY RESIDUAL TESTING IS RECOMMENDED.

Field Report

13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1

PHONE (403) 633-3070
TELEX 036-8496

Started. Mar. 8 .....19.8

Completed.. Mar. 10 .....19.8

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Cone Transport.	W / W	Stewart
		X ing
	94-1A-3	Living Complex

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOURS
			MOVE 12" casing				
			Loading	Mar. 8	9:00	5:00	8
			Load	Mar. 9	8:00	8:30	0.5
			Travel to stwart	"	8:30	2:30	6
			move on set up	"	2:00	5:30	2.5
0	20	Gr.	sand cobs.	"	5:30	7:00	1.5
20	40	Gr.	sand cobs	Mar. 10	8:00	11:30	3.5
			Remove casing hammer	"	11:30	12:30	1

Rcrd. of Casing & Pipe Size	Type	Size	Type
12"			
Feet	Inch	Feet	Inch
42			

Remarks:

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Field Report

MIDNIGHT SUN DRILLING CO. LTD. WHITEHORSE Y.T.
13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1
PHONE (403) 633-3070
TELEX 036-8496

Started. May. 8 ..... 19 9.

Completed. Apr. 1 ..... 19 9.

(2)

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Com. Transportation	41 / 10	Stewart Xing
	94-1A-3	

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOURS
			MOVE 8" casing				
			set 40' of 8" casing	Mar. 10	12:30	8:00	7.5
40	47	Gr.	sand cobs				
47	100	silt	.....				
100	175	silt	Broke casing unable to close bit	Mar. 11	8:00	8:00	12
			set up wait to 11:00 for Pullers Pulling casing to slow	Mar. 12	8:00	4:00	8
			travel to whse for Eqpt & 6" casing	"	4:00	9:00	5
			Loading	"	9:00	11:00	2
			.....				
			Travel to start	Mar. 13	1:00	7:00	6
			Pulling 175' casing	"	8:00	6:00	10

Rcrd. of Casing & Pipe Size	Type	Size	Type
Feet	Inch	Feet	Inch

Remarks:

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Willow Printers

Field Report

13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1

PHONE (403) 633-3070
TELEX 036-8496

Started. Mar. 8 ..... 19 9

Completed. Mar. 1 ..... 19 9

(3)

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Comm. Transport.	W / W	Stewart Xing
	94-1A-3	

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOUR
			MOVE 8" casing				
			waiting for drive shoe	Mar. 14	8:00	4:30	8
			mount casing hammer				
			set 40' casing	"	4:30	8:00	3.
			Redrill to 175'	Mar. 15	8:00	8:00	12.
175	290	silt	Plugged bit	Mar. 16	8:00	8:00	12.
			unable to keep bit	Mar. 17	8:00	6:00	10
			from plugging				
			Fix discharge hose				
			off casing hammer.				
			Fix casing hammer				
			cable.				

Rcrd. of Casing & Pipe Size	Type	Size	Type
Feet	Inch	Feet	Inch

Remarks:

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Willow Printers

Field Report

MIDNIGHT SUN DRILLING CO. LTD. WHITEHORSE Y.T.
13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1
PHONE (403) 633-3070
TELEX 036-8496

Started Mar. 8 19 9?
Completed Apr. 1 19 9?

(4)

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Comm + Transport	W/W	Stewart Xing
	94-1A-3	

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOURS
			MOVE 8" casing				
			Pull back to 100' 3 times	Mar. 18	8:00	11:00	15
			blew oring on Rapid				
			feed bank when using				
			casing hammer				
			wench.				
			change over to clutch	Mar. 19	8:00	8:00	12
			bank, Not working				
			change spools				
			Plugged bit trip out				
			Bit plugged trip hole	Mar. 20	8:00	12:00	16
			Redrill from 180' Built seal				
			for top of casing hammer				
290	305	silt	Put tent on				
			Blew hose off Fitting to				
			Injection pump Trouble				
			with supply Pump Getting				
			water Picking up rocks Blow seal				

Rcrd. of Casing & Pipe Size	Type	Size	Type
Feet	Inch	Feet	Inch

Remarks:

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Field Report

MIDNIGHT SUN DRILLING CO. LTD. WHITEHORSE Y.T.

13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1

PHONE (403) 633-3070
TELEX 036-8496

Started. Mar. 8 ..... 19 92

Completed. Apr. 1 ..... 19 92

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Com. & Transport	W/W2	Stewart Xing
	94-1A.3	

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOURS
			MOVE 8" casing Tripod hole Redrill from 220' Axelery, compressor dumped oil from receiver tank cleaned Fuel filters	Mar. 21	8:00	11:00	
305	315	silt					
			Taking broken Peace odd casing hammer	"	11:00	12:00	1
			Taking Broken Peace odd casing hammer	Mar. 22	12:00	4:00	4
315	365	silt	2hrs Fixing short 6" discharge hose on casing hammer.	Mar. 23	8:00	11:00	15
365	385	silt	blowing oring in Rapit Feed control Rank. Plugged bit Tripped hole Hole heaving	Mar. 24	8:00	10:30	14.5

Rcrd. of Casing & Pipe Size	Type	Size	Type
Feet	Inch	Feet	Inch

Remarks:

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Willow Printers

Field Report

13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1

PHONE (403) 633-3070
TELEX 036-8496

Started Mar. 8 19.?

Completed Apr. 1 19.?

(6)

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Comet Transp.	W/WE	Stewart Xing
	84-1B-3	

FORMATION LOG FROM	TO	FORMATION	DESCRIPTION OF WORK	TIME DATE	FROM	TO	HOURS
			MOVE 8" casing				
385	445	silt	changed 6" discharge hose	mar25	8:00	8:30	12.5
445	475	silt		mar26	8:00	12:00	16
475	490	silt	Gr. Sand. changed 6" short hose				

Rcrd. of Casing & Pipe Size	Type	Size	Type
8"			
Feet	Inch	Feet	Inch
491			

Remarks:

Static Level	Total Rig Time hrs.
Ground Level	Total Standby hrs.
Top Of Casing	Drilling Mud sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Field Report

13 MacDONALD ROAD
WHITEHORSE, YUKON
Y1A 4L1

PHONE (403) 633-3070
TELEX 036-8496

Started Mar. 8 19 94

Completed Apr. 1 19 94

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Comsteam	W/W	Stewart
		x ing
	94-1A-3	

FORMATION LOG FROM	TO	FORMATION
490	520	silt
520	567	silt
567	574	silt
574	579	silt
579	582	silt

DESCRIPTION OF WORK	DATE	TIME FROM	TO	HOURS
MOVE 6" casing				
Trip out	Mar. 27	8:00	5:00	9
set 120' of 6" casing	"	5:00	8:00	3
set 270' of 6" casing	Mar. 28	8:00	12:30	16.5
	Mar. 29	8:00	9:00	13
Gr.	Mar. 30	8:00	9:30	13.5
Gr.	~~Mar. 31~~			
Sand Pea Gr.				
Gr.				
Trip out	Mar. 31	8:00	11:00	3
check hole set screens	"	11:00	5:00	6
Develop	"	5:00	12:00	7
Nite shift 12:00-8:00 Dev.				
Trip out clean up	Apr. 1	8:00	2:00	6
Load				
Travel to Whse with drill	"	2:00	7:30	5.5

Rcrd. of Casing & Pipe

Size	Type	Size	Type
6			
Feet	**Inch**	**Feet**	**Inch**
57.6			

Remarks: 100 G.P.M.
screen bottom 582' G.L.
1 - 80 slot
1 - 50 slot
1 - 2' riser + ~~Reed~~ R-Packer
5/8 bit pin
Totle Length 10' 6"

Static Level		Total Rig Time	hrs.
Ground Level		Total Standby	hrs.
Top Of Casing		Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN..... CLIENT.....

TITLE..... TITLE.....

Photo 001: Abandoned well enclosure.

Photo 002: Wellhead of abandoned well.

Photo 003: Looking down abandoned dug well.

Photo 005: 5681 Stewart Crossing grader station facing west.

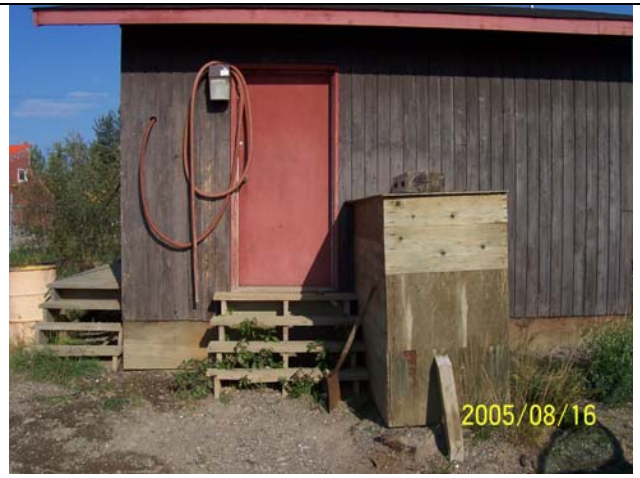


Photo 009: 5690 Existing deep well enclosure and well house storage building.

Photo 174: 5690 water system that serves 5681 & 5682. (pressure tank, filter, pump controls, LMI proportion feed chlorination system).

Photo 008: 5682 Living Complex.

Photo 012: Paint and toluene drum storage.