

13.0 BUILDINGS M0087 AND M0088: WATSON LAKE RCMP RESIDENCES

13.1 Description of Existing Water system

Buildings M0087 and M0088, the Watson Lake RCMP Residences located at 2 and 3 Adela Trail, are served by a water system supplied from a 13.0 m deep well. The wellhead is located in a concrete enclosure off from the basement of the M0088 residence. At the time of inspection the well was open and was not fitted with a proper cap on the well casing. The casing also appeared to be broken, and there was a disconnected length of casing that extended above grade above the existing casing. The well location, and other site details are provided as Figure M0088-A in Appendix A13. The coordinates of the wellhead using a hand held GPS device were:

- UTM ZONE 9
- Northing: 6657683
- Easting: 518271

The water system is equipped with a water softener, but not disinfection. A schematic detailing the water system is provided as Figure M0088-B in Appendix A13.

13.2 Description of Existing Wastewater Systems

A shared septic tank and effluent field that is used for these two residences as well as the M0086 RCMP Residence is located approximately 20 m northwest of the M0088 well. Figure M0088-A, provided in Appendix A13, shows the location of the septic system.

13.3 Water Quality Results

13.3.1 Results from Water Quality Analysis

Bacteriological

Two samples were collected from the M0087 Watson Lake RCMP Residence water system between May and June 2005, and one was collected from the M0088 RCMP Residence in June of 2005 and was tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table M0088-1 in Appendix A13. Coliform bacteria and *E. coli* were reported as absent in each of the three samples for which results were provided.

Potability

This site was only recently added as one of the YTG maintained facilities and as such baseline water quality was taken at approximately the same time as the water system assessments. A YTG consultant obtained samples for baseline water quality on June 22, 2005.

- All health-based and aesthetic objectives were met for the parameters analyzed; and,
- The softener appears to be functioning properly.

Some samples were taken during the water system assessments in order to determine parameters relative to the predesign of a potential treatment system, and are summarized below:

- UV absorbance, as well as tannins and lignin, to determine potential for UV treatment as a disinfection option for this water system; and,
- Total Organic Carbon to assist with treatment system selection.

Additionally, Measurements in the field for total dissolved solids, conductivity, pH, and temperature. Results of the baseline and additional analytical sampling are summarized in Table M0088-2 in Appendix 13 and the laboratory results are included in Appendix B.

13.3.2 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surface water sources or septic waste. Chloride concentrations were above the normal background ranges for groundwater in the area. Nitrate and nitrite concentrations for this sample were elevated above the background concentration for groundwater in the area. It is possible that the aquifer from which the groundwater is obtained for the M0087 and M0088 Watson Lake RCMP Residences well system is being impacted by surface water sources or septic wastes.

13.4 Conceptual Hydrogeology

No log was available for this well. Most wells in the area are completed at depths of less than 30 m within surficial morainic and colluvial deposits. These deposits are described as gravel, sand and silt, with occurrences of silty till sediments. This well is completed at 13.0 m depth with a static water level of 9.54 m below grade. This well is situated on the

north side of a groundwater flow divide near an area of groundwater discharge. The interpreted groundwater flow direction is likely northeasterly towards an unnamed lake.

13.5 Potential Contaminant Sources

Potential contaminant sources observed during the site investigation are provided in field notes in Appendix A13. Photos of potential contaminant sources are also provided at the end of this appendix.

A summary of potential contaminant sources within 30 m of the well is provided below:

- Septic field at 20 m;
- Fuel storage tank located in the basement of residence at 15 m (approx.).

13.5.1 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 property or neighbouring properties.

13.6 Identified Water System Deficiencies and Associated Risk

13.6.1 High and Medium Risk Deficiencies

- The well is located within 30 m of potential sources of contamination, including the community septic system;
- Poor surface completion of the well (located below grade in an enclosure off basement, well had no cap);
- The well is not equipped with a surface sanitary seal as required by the Canadian Groundwater Association's Well Construction Guidelines;
- At 13.0 m in depth, this well is considered a shallow well;
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it is a vulnerable type (unconfined aquifer), has a production zone less than 15 m below grade, and does not meet the requirements of the Guidelines for Water Well Construction; and,
- There is no disinfection system present.

13.6.2 Low Risk Deficiencies

- There is a fuel storage tank located inside the basement of the residence. This is not a high-risk deficiency because the resident would likely notice fuel leak or spill before well contamination could occur; and,

13.7 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).

Considering that this well and other wells in the RCMP complex show indications of potential impact from anthropogenic sources, it is proposed that a community water distribution system be installed to serve the entire RCMP complex with water supplied from the existing detachment well.

13.7.1 Priority 1

The following recommendations are provided in order to mitigate deficiencies that are of immediate concern for the M0087 and M0088 Watson Lake RCMP Residences:

- The well should be superchlorinated and a cap should be installed on the well casing; and,
- A NSF-55 certified UV system with pre-filter should be installed at the point of entry to the building. Pre-treatment may be required.

13.7.2 Priority 2

- A centralized treatment system should be installed in the basement of the RCMP detachment. This treatment system could consist of either a chlorine disinfection system with suitable retention or a UV disinfection (NSF/ANSI 55 certified) system. This is a conceptual design recommendation based on the information available, and is intended to be used for planning and budgeting purposes. Engineering input will be required for final system specifications or design.
- The wellhead construction of the existing detachment well should be improved, including extending the well to at least 500 mm above grade and installing a commercial pitless unit. A surface sanitary seal (grout or bentonite) to at least 3 m

below grade should be retrofitted around the well and then the ground be graded to promote surface drainage away from the wellhead;

- Additional assessment, including pumping tests, should be completed to determine the detachment wells yield and construction details, and,
- A low-flow/low pressure water distribution line should be installed to service each building. Service lines should be run to M0086, to one of M0087 or M0088 and existing piping can be used to connect to the other, to one of M0126 or M0127 and existing piping can be used to connect to the other, and existing piping between the detachment and the RCMP gym can be used to serve the gym.

13.7.3 Priority 3

- Decommission well in accordance with regulation.

13.8 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.

13.8.1 Priority 1

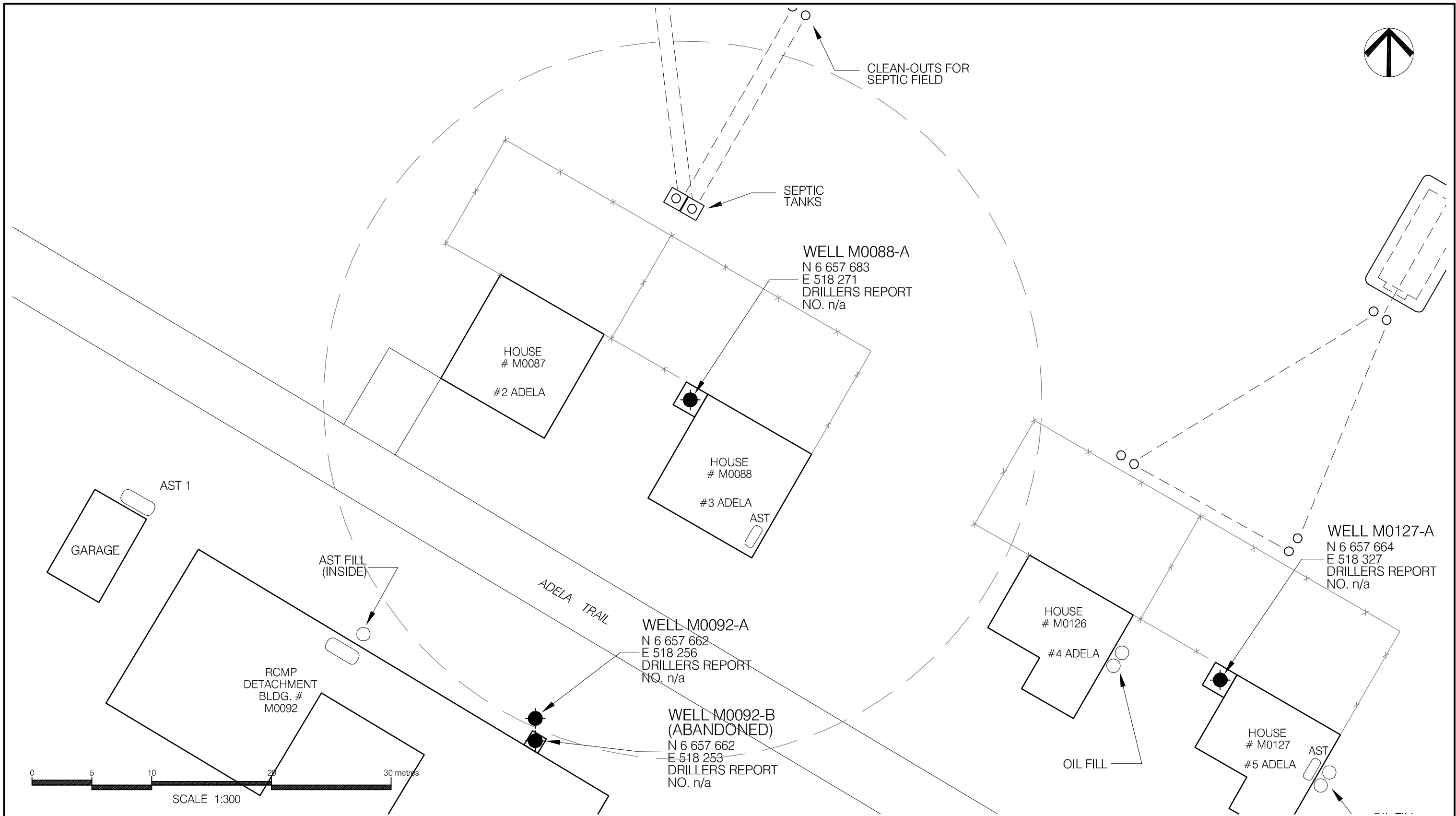
- The cost associated with superchlorinating the water system (including the well) and installing a well cap, and then installing a point of entry UV disinfection system with pre-filter would cost in the order of **\$2,500** for all materials and labour.

13.8.2 Priority 2

- The estimated total cost to install the distribution system would be in the order of **\$25,000**, including all materials and labour. Since the distribution system would serve five residences the cost to these systems would be approximately **\$10,000**.

13.8.3 Priority 3


- It would cost in the order of **\$1,000** to properly decommission the well.



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	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: JULY 2005
SCALE: AS SHOWN
PROJECT No.: 1260002.002
ACAD FILENAME: 002-EASTERN REGION

CLIENT:


Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
EASTERN REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

WATSON LAKE RCMP HOUSE
BUILDING # M0088
SITE LOCATION DIAGRAM
WELL ID: M0088-A

REVISION ISSUE
0

FIGURE No.
M0088-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)

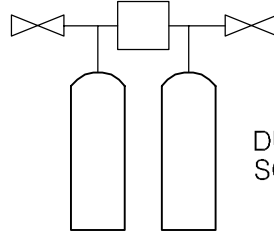


PRESSURE TANK

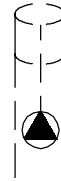


CL₂

CHLORINE RESERVOIR AND
INJECTION PUMP

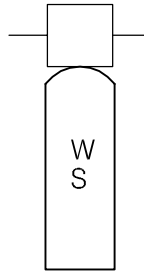


DUPLEX WATER
SOFTENER



SP

WELL WITH
SUBMERSIBLE PUMP



ACTIVATED
CARBON

Z:\0201\Drawings\1260002 - Water Assessment YTG\002 - Eastern Region\1260002\003 Eastern Schematic_LEGEND.dwg, 4/11/2006 10:31:08 AM, Adobe PDF, jbuyck



EBA Engineering Consultants Ltd.

PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT
EASTERN REGION

CLIENT



TITLE SCHEMATIC SYSTEM
LEGEND

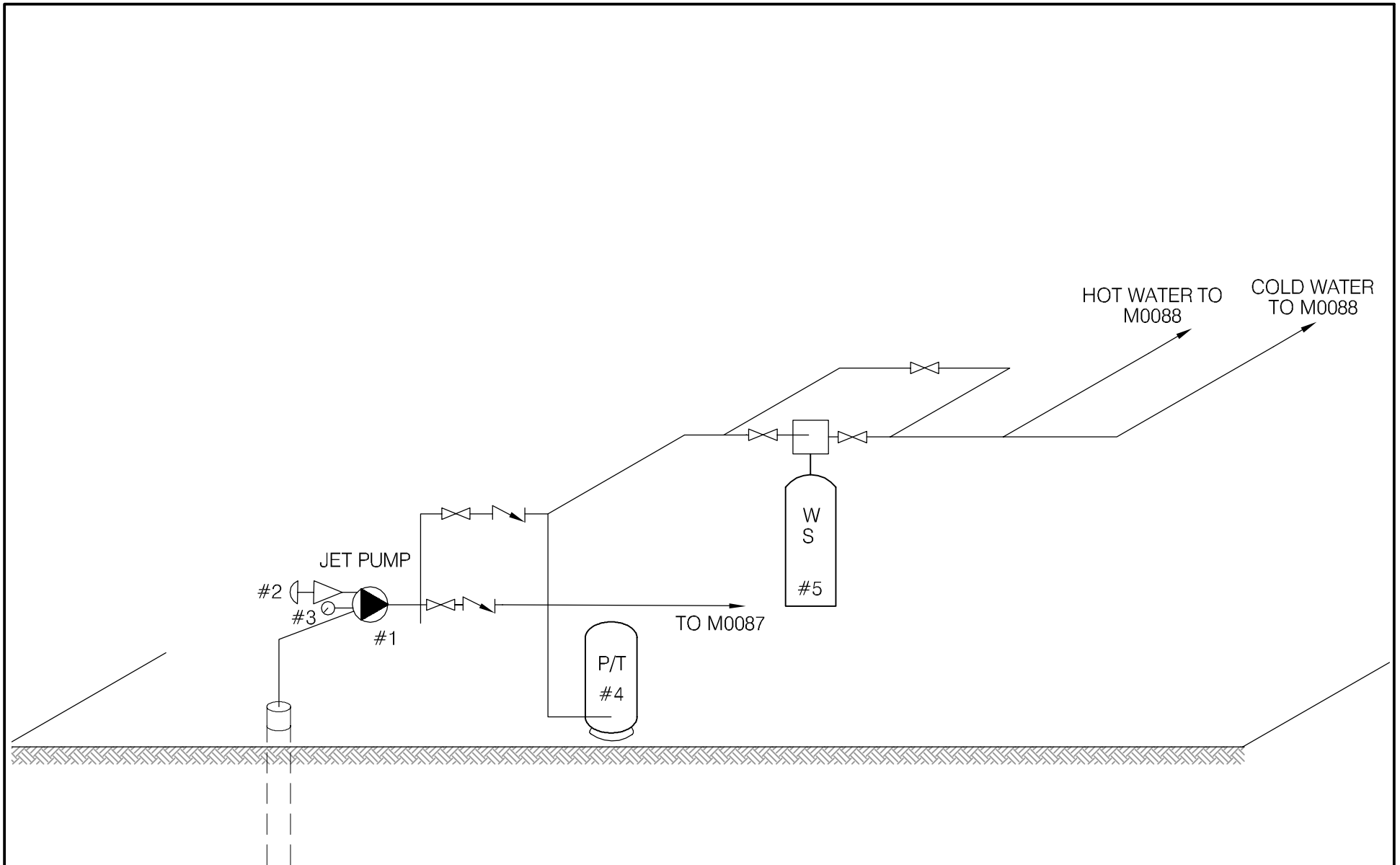
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



 EBA Engineering Consultants Ltd.		PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT EASTERN REGION	
CLIENT 		TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: M0088 WATSON LAKE RCMP RESIDENCE	
DATE	JULY 2005	DWN.	JSB
CHKD.	FMM	FILE NO.	1260002.002
		DWG.:	FIGURE M0088-B

TABLE M0088- 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?
M0087	R.C.M.P. Housing	2	May -05 to Jun-05	no	0/2	no	23-Jun-05	no
M0088	R.C.M.P. Housing	1	23-Jun-05	no	0/1	no	23-Jun-05	no



Table M0088-2: Water Quality Results

Location/ Resident	Watson Lake		GCDWQ Criteria		
Address	2 and 3 Adela Trail				
Treatment	Water Softener				
Disinfection	No				
Source of Water	On-Site Well				
Purpose of Sampling	Baseline	Additional Sampling			
Sample Location	M0087	M0088			
Date Sampled	22-Jun-05	22-Jun-05	Lower Limit	Upper Limit	
Physical Tests (ALS)			AO	MAC	AO
Colour (CU)	<5.0				15
Conductivity (uS/cm)	581				
Total Dissolved Solids	362				500
Hardness CaCO3	<0.66		AO >200 = poor, > 500 unacceptable ^A		
pH	7.93		6.5		8.5
Turbidity (NTU)	0.25			1	5
UV Absorbance		0.0240			
Dissolved Anions (ALS)					
Alkalinity-Total CaCO3	288				
Chloride Cl	23.1				250
Fluoride F	0.024			1.5	
Sulphate SO4	8.18				
Nitrate Nitrogen N	1.57			10	
Nitrite Nitrogen N	<0.10			1	
Total Metals (ALS)					
Aluminum T-Al	<0.010				
Antimony T-Sb	<0.00050			0.006	
Arsenic T-As	0.00066			0.025	
Barium T-Ba	<0.020			1	
Boron T-B	<0.10			5	
Cadmium T-Cd	<0.00020			0.005	
Calcium T-Ca	0.22				
Chromium T-Cr	<0.0020			0.05	
Copper T-Cu	0.0095			1	
Iron T-Fe	<0.030				0.3
Lead T-Pb	<0.0010			0.01	
Magnesium T-Mg	<0.10				
Manganese T-Mn	0.0101				0.05
Mercury T-Hg	<0.00020			0.001	
Potassium T-K	0.48				
Selenium T-Se	<0.0010			0.01	
Sodium T-Na	143				200
Uranium T-U	0.00030			0.02	
Zinc T-Zn	<0.050				5
Organic Parameters					
Tannin and Lignin		<0.10			
Total Organic Carbon C		1.86			
Field Chemistry (EBA)					
pH		7.94	6.5		8.5
TDS (ppm)		363			500
EC (uS/cm)		729			
Temperature (°C)		7.4			

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)



**Table M0088-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification			GPS Coordinates		
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
M0088	R.C.M.P. Housing	Watson Lake	6657683	518271	700

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeability Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150		No	13.0	Unknown	Jet pump		9.54 m below grade

Potential Contaminant Sources					
Distance from well to nearest point of septic field (m)	Distance from well to nearest building (m)	Distance to surface water body (m)	AST present on property?	Distance from well to AST (m)	Other potential sources of contamination observed on property, and distance to well
M0086, M0087, M0088 septic field	Located inside basement	Greater than 60 m	Basement AST's	15 m	UST at 55 m
M0092 septic field at 45 m			AST 1	45 m	4 other wells on property at approximately 60 m, 25 m, 25m (abandoned), and 60 m
M0126 and M00127 septic at 55 m			AST 2	45 m	

Well Construction Details					
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading	Comments
1.45 below grade	No		Unlikely	Ground above wellhead enclosure is relatively flat.	Well services both M0087 and M0088 RCMP residences



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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Mardin
Luke Lebel

Date June 22, 2005

WELL ID #	Owner	Location Description
M0088	RCMP	RCMP Residence

1. Well Location and Potential Contaminant Sources

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

Watson Lake

b. Specific location: (Road or street, Building number, name of owner and/, legal description,

3 Adela Trail

c. GPS location: N 6657683 E 519271 elev 700 ± 11

d. Is there electric power? Yes No

e. Is there outside water access? Yes No

f. Does the well system have:

15 or more service connections to a piped distribution system? If so how many _____

#'s 2 and 3 Adela Trail

5 or more delivery sites on a trucked distribution system? If so how many _____

g. Nearest building, specify Located inside residence

h. Distance from well to building _____

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

j. Distance from well to nearest point of known field: ~20m

k. Well location relative to field: upslope downslope lateral

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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

All RCMP complex septic systems @ 20m, ~45m, and ~55m

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

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

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

Entrance by animals? Yes No

Access possible → open casing

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 ~55m

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

Yes No Describe ASTS in basement @ ~15m

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

Potential Source 1: AST 1; Distance from well to Potential Source 1: ~45m

Potential Source 2: AST 2; Distance from well to Potential Source 2: ~45m

Potential Source 3: _____; Distance from well to Potential Source 3: _____

Potential Source 4: _____; Distance from well to Potential Source 4: _____

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

How many? 4 in use (3) abandoned (1) require proper sealing

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2. Well and Wellhead information:

- a. When was well installed? Year _____ Month _____
- 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 _____ No
- f. Well casing: Diameter 15cm Material: steel plastic concrete
- g. Depth of well: 13.1 m below upper casing measured (if possible) reported from log
- h. Static water level below ground: 9.64 m below upper casing
 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 unknown
- j. (If bedrock) Does the well have a liner? yes No steel plastic
- k. If there is a well screen: length unknown slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? Yes No unknown
- m. Is the well head: in pumphouse in pit pitless adaptor in a building enclosure off of residence basement - concrete
 in a wooden enclosure other, describe _____
- n. If the well head is located in a wooden enclosure,

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- i. Is the well head below grade? describe in detail ~ 1.45 m below grade
- 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, but access is possible
- v. Does the well casing have a proper seal cap? Yes No

If no, describe condition No cap, casing is broken

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 Yes No

Explain (filtration, disinfection etc...) softener

4. Aquifer Supplying This Well:

- a. The aquifer is: bedrock granular sediment unknown

is likely

- 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 _____

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d. Date installed: _____ By: _____

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

f. Drop pipe for submersible pump: steel plastic

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: Inside heated building

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: BERT ALBISSEL

Date JUNE 22 / 05

WELL ID #	Owner	Location Description
<u>M0088</u>	ITS. <u>RCMP</u>	<u>RCMP WATSON LAKE</u>

6. Water Treatment

- a. Is well water treated? Yes No; Type of treatment: WATER SOFTNER
- 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 _____
- 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 H₂S Other _____

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- 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:

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: _____

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: _____

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Overall Tank

What are the tank size and dimensions?

What material is the tank constructed of? _____

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

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8. Conclusions

a. Comments on overall installation:

JET PUMP INSTALLATION IS UNSAFE.
THERE IS NO SANITARY SEAL ON WELL HEAD.
THE WELL IS WIDE OPEN TO CONTAMINATION
OF ALL SORTS.
THE INSTALLATION BEYOND THE JET PUMP
IS GOOD.

b. Recommendations:

AS THERE IS NO POSSIBILITY OF
PERFORMING ANY WELL MAINTENANCE,
A NEW WELL SHOULD BE DRILLED FOR
THE COMPLEX. PROPER TREATMENT
MUST BE PROVIDED. THIS WELL COULD
POSSIBLY SERVE THE WHOLE COMPLEX.



Photo 0033: M0088 Wellhead in concrete enclosure off from basement of residence



Photo 0037: M0088 Well casing extended above grade – not connected to casing below



Photo 0032: M0088 Jet pump and pressure tank



Photo 0034: M0088 Water softener (left), and pressure tank (behind)