

EBA ENGINEERING CONSULTANTS LTD.



SMALL PUBLIC WATER SYSTEM ASSESSMENT *Whitehorse Region*



"CREATING AND DELIVERING BETTER SOLUTIONS"



**Small Public Water System Assessment
Yukon Government Maintained Buildings**

WHITEHORSE REGION

EBA Project No. 1260002.001

March 2006

**Small Public Water System Assessment
Government of Yukon Maintained Buildings
WHITEHORSE REGION**

Submitted To:

Property Management Agency
Government of Yukon

Prepared by:

EBA CONSULTANTS LTD.
WHITEHORSE, YUKON TERRITORY

EBA Project No. 1260002

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1.0 INTRODUCTION

1.1 Scope of Work and Terms of Reference

The scope of work for this project was to conduct professional assessments of the wells, water systems and water sources for Government of Yukon maintained buildings in the “Whitehorse Region” as defined in the Request for Proposal (RFP) “Small Public Water Drinking Water System Assessment – Yukon Government Maintained Buildings – 2005”. The RFP, and the EBA project team’s proposal (EBA, February 2005) formed the Terms of Reference (TOR) for this study. In accordance with the TOR, the assessments were comprehensive and the reporting includes information, observations, comments, recommendations and plans/sketches for the water sources, infrastructure and distribution systems. The recommendations include Class D cost estimates to upgrade water systems to meet the new draft regulations - Draft Guidelines for Part III – Small Public Drinking Water Systems. Comparison of well construction with the Canadian Groundwater Association Guidelines for Water Well Construction, and comparison of water quality results with the Guidelines for Canadian Drinking Water Quality are included for each system. This report provides a summary of the assessment results and recommendations and costs for the Whitehorse Region.

1.2 Authorization

The project team consisting of EBA Engineering Consultants Ltd. (EBA), Dayton and Knight Ltd. (D&K) and Aqua Tech Service and Supply (ATSS) was authorized to complete the work program in accordance with the TOR. EBA, as the consulting team representative, signed a contract (GN04556521-40319) with the Property Management Agency (PMA) of the Government of Yukon (YTG) on March 8th 2005 to provide consulting services to conduct the Small Public Drinking Water Assessments as per the submitted proposal, fees and disbursements.

1.3 Public Drinking Water System Regulations and Guidelines

Since the tragedy of the Walkerton water supply contamination issue, jurisdictions across Canada have adopted the “Source to Tap, Multi-barrier” approach in assessing, planning and designing water supply systems. The Yukon has followed in step with the rest of

Canada in the development of several key guidelines for regulation. The following two draft drinking water guidelines for regulation to be enacted under the ***Public Health and Safety Act*** (Yukon), were released in April 2004:

- ***Public Drinking Water Systems Regulations***; and,
- ***Bulk Delivery of Drinking Water Regulations***.

As well, the Yukon Government has recently developed ***Draft Guidelines for Part III – Small Public Drinking Water Systems***, which were referenced during this study. We understand that these draft guidelines are still under review.

Each of these draft regulations specify requirements in the areas of source protection, training, permitting, engineering assessments, equipment, disinfection and treatment, operation and maintenance, sampling and analysis, record-keeping, and emergency planning. All remedial measures and feasibility assessments completed in this study are consistent with the requirements of Yukon legislation.

The ***Canadian Drinking Water Quality Guidelines*** (CDWQG) are referenced for the analysis of water quality data. These guidelines are amended periodically, and the most recent version (April 2004) was used for this study.

1.4 Methodology

The following sections describe the methodology used for completing the scope of work in accordance with the Terms of Reference.

1.4.1 Meeting #1: Project Kick-off

A project “Kick-Off” meeting was held on March 16th, 2005 following award of the contract to introduce the project team members and discuss the Terms of Reference. EBA representatives Ryan Martin and Matt Pye, ATSS representative Bert Albisser, and YTG representatives Tom Renwick and Nick Barnett attended the meeting. The civil/mechanical engineering representatives of the team (D&K) attended by teleconference. Project team introductions, access to background information (water quality results, well records), proposed mapping, schedule and billing was discussed.

1.4.2 Information Collection and Review

The assessment began with the compilation and review of all relevant information including previous reports, site plans, air photos, well logs, pump testing results and water quality data.

An evaluation of all existing water quality information available from a previous study (Collection of Water Samples for Bacteriological Testing, Chemical and Physical Parameter Testing – Various Locations, Yukon – YTG Contract 2004) was undertaken prior to the field program. The purpose of this review was to identify wells that may be impacted by various potential sources of contamination in order to determine the additional water quality parameters necessary to evaluate treatment/disinfection options. The available water quality information was assessed for compliance with the Guidelines for Canadian Drinking Water Quality criteria. EBA prepared a letter dated April 7th, 2005 for YTG Property Management Agency titled Recommendations for Additional Analytical – Small Public Drinking Water System Assessments – Government of Yukon Maintained Buildings – 2005. The letter provided recommendations and estimated costs for additional sampling, field chemistry and laboratory analyses.

1.4.3 Meeting #2: Pre-Assessment

Following the collection and review of available information pertaining to the subject water systems, a meeting was held in Whitehorse with YTG, EBA and ATSS representatives on May 5, 2005. Each of the regional managers attended.

The findings of the analytical review were discussed, with particular attention given to the recommendations for additional water quality sampling. Laboratory and courier cost estimates for the additional analyses were presented at the meeting, along with contact information for personnel involved in the project.

Specific aspects of the field program were discussed including site access and the standardized reporting format for each system. Also, the sequence of regions to be evaluated was determined based on priority of expected high-risk deficiency upgrades and level of risk. It was decided that the first region to be assessed would be the Whitehorse Region, followed by the Eastern Region, Western Region and the Northern Region.

1.4.4 Assessment Team

For system assessment, a project field team consisting of an EBA hydrogeologist (Ryan Martin, P.Eng.), an EBA Field Technician (Luke Lebel) and one senior Aqua Tech personnel (Bert Albisser) was utilized. The primary responsibility of EBA personnel during the field assessments was the evaluation of well construction and location. All potential sources of contamination within 150 m of subject wells with specific attention to the 30 m surrounding the well were identified during the system assessments.

The primary responsibility of Aqua Tech personnel (Bert Albisser) during the field assessments was the accurate documentation of the distribution and treatment/disinfection systems, including general condition and maintenance requirements. Aqua Tech personnel provided a preliminary evaluation of the system to EBA and D&K and assisted with detailed evaluation and development of recommendations.

D&K personnel provided technical advice by correspondence, as needed during the water system assessments, and were not required to visit the sites.

1.4.5 Wellhead Inspections and Water Supply Source Evaluations

For each of the subject wells, the field investigation began with a site reconnaissance to assess general site conditions, topography, surface drainage patterns and exposed sediments. The major focus of the reconnaissance was identification of potential sources of contamination that may not have been previously identified through research prior to the field assessment. Separation distances were measured to all potential sources of contamination within 150 m of the well, including septic fields, sewage lagoons, cemeteries, landfills, buildings, roads, fuel storage tanks and other sources of potential contamination. This information is presented in the individual sections for each water system on digital, scaled site plans developed for the subject sites. Groundwater flow directions are inferred where possible within the report based on topography and proximity to surface water bodies, as well as previous work.

Following the site reconnaissance, a detailed inspection of the water supply system was undertaken. Where possible, the following information was obtained for each well:

- Wellhead construction, enclosure, piping, cleanliness and the buildings served;
- GPS coordinates at each wellhead;

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- GPS coordinates for septic fields or other potential contaminant sources within 150 m of each wellhead;
 - Digital photographs of wellheads and any potential contaminant sources;
 - Surface completion details relevant to the security and operation of the well;
 - Assessment of all well enclosures;
 - Completion of wellhead check lists for each well incorporating the following items:
 - o Compliance with the ***Canadian Groundwater Association Guidelines for Water Well Construction***, including existence of casing seals (if possible) and height of casing above ground surface;
 - o Casing type and diameter;
 - o Type and condition of well cap;
 - o Potential for ponding of surface drainage at wellhead;
 - o Qualitative description of water quality concerns if possible (e.g. staining, odours);
 - o Description of system deficiencies and digital photographs illustrating deficiencies;
 - o Wellhead accessibility for rehabilitation, pump removal, inspections, etc.;
 - o Site sketch illustrating location of well in relation to buildings and nearby potential contaminant sources within 150 m (as described above, information will be transferred to a digital site plan modified from an air photo base plan); and,
 - o Water level measurements, and the depth of the well measured where possible.

During the well inspections, water quality samples were collected as required, to augment existing water quality information available for the subject systems.

1.4.6 Distribution and Treatment System Evaluations

Aqua Tech personnel documented the existing water supply distribution and treatment/disinfection systems. Where possible, the following information was collected for each system:

- Type and condition of pump, including make and model;
- Type and condition of controls;
- Type and condition of distribution piping, fittings and connections;
- Type and condition of water treatment systems, including make and model;
- Type and condition of disinfection systems, including make and model;
- Type and condition of freeze protection; and,
- Digital photographs illustrating piping, controls and treatment/disinfection systems, including deficiencies and general layout.

This information is presented on system schematics of the complete water supply systems, along with supporting tables that include all pertinent information related to the water supply source, well, distribution and treatment/disinfection systems. This information is presented in an individual appendix assigned for each site.

In addition to the above information, on-site water testing was performed for systems with operational chlorine disinfection systems. This was done using a chlorine test kit capable of reading in the range of 0.0-to 3.5 mg/L free chlorine. Chlorinated systems were assessed for compliance with the ***Draft Guidelines for Part III – Small Public Drinking Water Systems***, which requires a free chlorine residual of 0.4 mg/L for bulk water delivery, and a minimum of 0.2 mg/L for piped water distribution systems servicing five or more connections. Field parameters such as pH, electrical conductivity (EC), Total Dissolved Solids (TDS) and temperature were also obtained at all sites.

1.4.7 Report Format and Cost Estimates for Whitehorse Region

This report includes the assessment results and recommendations for upgrades to address deficiencies in a prioritized manner as requested in the Terms of Reference. Deficiencies are identified with respect to the requirements stipulated in the ***Canadian Groundwater Association Guidelines for Water Well Construction*** and the ***Draft Guidelines for Part III – Small Public Drinking Water Systems***. Upgrades are recommended to address these deficiencies, in addition to other improvements that may be warranted. Where appropriate, alternative upgrade options are provided. All recommendations include Class D cost estimates, and are classified according to the following three categories:

- Priority 1: Recommended upgrades and estimated costs to address potential immediate risk deficiencies (high hazards);
- Priority 2: Recommended upgrades and estimated costs to address remaining potential medium and high risk deficiencies (medium and high hazards); and,
- Priority 3: Recommended upgrades for typically low risk issues (low hazards), or recommended mechanical and functional upgrades and estimated costs.

The water system deficiencies identified during this study are typically hazard conditions, where risk could exist if there is exposure. For simplicity within the document, a “high risk”, implies that there is a high hazard condition (e.g. no cap on casing) that could pose a high risk if there was an exposure event (e.g. surface water or vermin entering casing). Likewise, other levels of risk and exposure are also referred to in the same manor.

The Draft Report for the Whitehorse Region Assessments was submitted to PMA in June 2005. This final report has been updated to make it relevant to the revised draft SPDWSR, to include some additional assessment and upgrade work that has been completed since the draft reports were submitted, and to make editorial and formatting changes where required. In accordance with the TOR, two copies of this final report have been prepared for PMA. One copy is also maintained at the EBA Whitehorse office. PDF copies of the report in its entirety have also been provided on compact disk to PMA.

1.4.8 Nomenclature and Report Format

This study involved collecting, compiling and reviewing a large amount of data. In labeling the data, EBA used the YTG building numbering classification for system, well and sample names. Where a well provides water supply to more than one building, the sample name consisted of the both building numbers that the well serves. For the one location where a building number was not provided (the Yukon Wildlife Preserve), the prefix YWP was used for each location, well and system.

Originally there were to be 22 water systems to be assessed in the Whitehorse Region. The Whitehorse region includes the immediate Whitehorse area, Alaska Highway north to Mendenhall, North Klondike highway north to Carmacks, South Klondike highway south to Fraser Camp (including Carcross), Tagish Road, and the Alaska Highway south of Whitehorse to the Lakeview Fire hall. During the work program, three additional systems at the recently acquired YTG Yukon Wildlife Preserve were added to the program. The Carcross Search and Rescue Building was also added to the program. This report includes water systems servicing 26 buildings, which are reported in 23 independent sections (Section 4 through Section 21).

The Property Management Agency has a number of individual clients, and therefore, the report was structured so that individual reports could be extracted and compiled for each client to maintain privacy and efficiency. The systems assessed included Fire Halls, Schools, Grader Stations, an R.C.M.P detachment, a Search and Rescue Building, Administrative Offices, various living quarters for YTG employees, and the buildings at the Yukon Wildlife Preserve. The report is structured such that there is a separate section for each system. Supporting assessment data was tabulated and provided in a separate appendix for each system. Appendix numbers correspond to the section of the report for each of the systems (e.g. Section 4 has supporting data provided in Appendix A4).

Supporting tables were named after the system for which they provide data. Each summary table has the building number followed by the table number and each figure has the building number followed by the figure number. The report is also provided as PDF digital files for each site including the report section and appendix for each system.

2.0 DISCUSSION OF PROPOSED AND EXISTING GUIDELINES

The proposed *Guidelines for Part III – Small Public Drinking Water Systems* are currently under development by YTG Environmental Health and Social Services (EHSS). In accordance with the Terms of Reference, these proposed guidelines (November 23, 2004) were used to determine compliance issues with respect to the systems assessed under this program. Since the completion of the draft reports for each Region, these guidelines were amended to a draft dated December 22nd, 2005. Accordingly, the final reports were also amended to reflect the latest draft of these guidelines. The most relevant sections of these draft Guidelines (December 22nd, 2005) as well as the Canadian Groundwater Association Guidelines for Water Well Construction pertaining to this study are summarized below:

- “Small public drinking water system” means a drinking water system which has:
 - a) less than 15 direct service connections to a piped distribution system; or
 - b) less than 5 delivery sites on a trucked distribution system.
- GUDI is an acronym for well water or groundwater under the direct influence of surface water.
- Well water under the direct influence of surface water means the water source for a well has been determined to be GUDI, using the Yukon’s Assessment for Well Water or Groundwater under the Direct Influence of Surface Water (GUDI), published by Queen’s Printer (Draft, December 22nd, 2005).
- According to Draft guidelines initial screening protocol, if a water source does not meet any one of the below criteria, the source shall be either identified as GUDI, or as potentially GUDI with further confirmatory assessment to be carried out:
 - Vulnerable location or type – the water system shall not be:
 - a) A spring, infiltration gallery, shallow collector system or artificial recharge system;
 - b) A well with a production zone less than 15m below the ground surface;
 - c) A well in an unconfined aquifer; or
 - d) A well completed in fractured or karst bedrock exposed at or near the land surface.

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- Proximity to surface water – the water source shall not be located within 60 m of any permanent, or intermittent or seasonal surface water body, including ponds, slough, lakes, rivers, streams, canals, lagoons, or any other surface water feature.
 - Well Construction – At a minimum, the well shall meet the requirements of the most recent version of the *Guidelines for Water Well Construction*, published by the Canadian Ground Water Association.
 - Water quality – The raw water from the source shall not exhibit evidence of contamination by or from surface water (e.g., significant occurrence of insects, insect parts, microorganisms such as *E. coli*, algae, *Giardia*, *Cryptosporidium*, or viruses; or significant and rapid shifts in water characteristics such as turbidity, temperature, conductivity, pH or chemistry that closely correlate to weather or surface water conditions).
 - An owner is responsible for the supply and delivery of safe drinking water to the users.
 - The owner is responsible for the maintenance and upgrade of the small public drinking water system, as necessary, for the purpose of providing safe drinking water to its users.
 - An owner of a small water system that obtains drinking water from a groundwater source shall:
 - a) Unless otherwise determined based on results of a comprehensive hydrogeological study, ensure that the drinking water well is located a minimum distance of:
 - i. 15 metres from a septic tank, sewage holding tank or contained privy;
 - ii. 30 metres from a soil absorption system, pit privy, or other potential sources of pollution that may pose a health and safety risk;
 - iii. 120 metres from a solid waste site, dump, or cemetery; and,
 - iv. 300 metres from a sewage lagoon or pit.
 - b) Use a well, located and constructed in accordance with criteria that meets or exceeds those outlined in the Canadian Groundwater Association Guidelines for Water Well Construction.
 - The owner of a small public water system that obtains water from a surface water source, or uses a well under the direct influence of surface water, shall ensure provision of treatment consisting of filtration and disinfection, or other treatment capable of producing a safe drinking water.
 - An owner upon selecting a drinking water source shall consider a source that is
 - o most likely to produce drinking water of a quality that meets the Guidelines for Canadian Drinking Water Quality, and
 - o is least likely to be subject to municipal, industrial and agricultural contamination, and/or other types of contamination resulting from human activities within the watershed.
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- If chlorine disinfection of the small public drinking water system is required, the owner shall ensure that the free chlorine residual concentration throughout the plumbing or piped distribution system is no less than 0.2 mg/L.
- An owner of a small public water system shall ensure that the infrastructure protecting the wellhead, pumphouse, storage tank and/or water treatment plant is designed and secured so as to prevent the unauthorized access by humans or entrance of animals.
- Particularly relevant requirements of the Canadian Groundwater Association Guidelines for Water Well Construction are provided below:
 - a) Section 3.7: The casing of any drilled well shall project not less than 500 mm above the established ground surface; and,
 - b) Section 4.1 and 4.2: The Guidelines for Water Well Construction consider that properly installed water tight casing must have a 50 mm (2") thick bentonite, or bentonite grout seal to effectively prevent the entrance of surface water into an aquifer, and to prevent the intermixing of formation water.

There are many other pertinent requirements involving permitting, application, system operators, seasonal facility start up procedures, well decommissioning, water holding tank cleaning, bulk water delivery, approvals to construct or modify etc. with the draft **Part 3 – Small Public Drinking Water Systems Regulations (SPDWSR)**. PMA should ensure that all water systems serving YTG maintained buildings that fall under this regulation are in compliance with the final version in it's entirety.

A meeting to discuss the implications of the draft regulations on the assessment of these systems was arranged between Ryan Martin, and an Environmental Health Officer from YTG Environmental Health and Social Services (EHSS) on Thursday June 9th. Key points discussed in the meeting are provided below:

- 1) It is the intent of the draft SPDWSR that all wells that do not have a surface casing complete with a sanitary surface seal (grout or bentonite seal) and intact casing to 6 m may be under the direct influence of surface water, which would necessitate further assessment (as per the GUDI guidelines) or adequate disinfection.
- 2) The maximum acceptable concentration (MAC) for arsenic within the Canadian Drinking Water Quality Guidelines is currently under review by Health Canada. The proposed guideline is low (0.005 mg/L) compared with the existing MAC (0.025 mg/L). The EHSS health officer felt that there was a very high probability of the lower guideline

being passed at any time in the near future. She indicated that there would likely be a grace period of at least one year for systems to come into compliance. This will have an impact on the treatment requirements for many water supply systems in the Yukon.

3.0 APPROACH TO WATER TREATMENT/ DISINFECTION

Drinking Water Officers in some jurisdictions in BC are adopting the “4,3,2,1,0, Dual Treatment” approach. This “multi-barrier” approach for water treatment requires 4-log (99.99%) removal of bacteria and viruses, 3-log (99.9%) removal/inactivation of *Giardia*, 2-log (99%) removal/inactivation of *Cryptosporidium*, turbidity less than 1 NTU, no total and fecal coliform and dual treatment (filtration and disinfection for example). This is the approach that the project team recommends for treatment system design for upgrades to the Yukon Small Water Systems. We understand that there is insufficient budget to implement all suggested upgrades immediately. Consequently, we recommend that a phased approach to treatment should also be implemented, by mitigating the highest risk with the best value as described below.

According to Dayton and Knight, Health Authorities in BC understand the realities of limited financial resources faced by small water systems. In such cases, the Health Authorities in BC may accept a multi-phase treatment approach starting with some type of primary disinfection initially, followed by additional upgrades as funds become available until full treatment (if required) is achieved. This report has been prepared with the assumption that YTG Environmental Health and Social Service would be amenable to this phased approach. For example, where a water system requires wellhead upgrades and disinfection treatment such as filtration followed by UV treatment (based on preliminary suitability, water quality and system characteristics), we have typically recommended a phased approach with an assigned level of priority as described previously. For this example, the Priority 1 upgrades may include shock chlorination (disinfection) of the well and water system, installing a properly sealed well cap and installing a NSF/ANSI 55-certified UV system. These UV systems (with appropriate raw water quality that in some cases may require pretreatment) are certified to provide 4-log (99.99%) inactivation of *E. coli*, and 2-log (99%) inactivation of *Cryptosporidium* and *Giardia*. This interim Priority 1 upgrade measure would mitigate most risk, however, would not provide 3-log inactivation of *Giardia*, nor dual treatment. During subsequent Priority 2 upgrades for the example system above (which would happen at a later date as funds become available), the NSF 61 filtration system (to 1 micron - absolute) would be installed in advance of the filter, and the

wellhead would be upgraded (e.g., casing extension, surface seal installation). This is a practical approach to mitigate the highest risks with the funding available on a priority basis.

Input from drinking water authorities in the Yukon regarding this proposed approach is recommended. For example, on a case-by-case basis, drinking water authorities may agree to treatment without the requirement for filtration to 1 micron (absolute), which would enable 3-log inactivation of *Giardia*. For comparison, the City of Whitehorse does not currently provide filtration to the 3-log level, even though it obtains water from a surface water source.

The installation of water treatment systems are not entirely regulated in Canada and the last word relies with the Health authorities. Health Canada recommends that water treatment systems be NSF certified. The NSF designation for UV systems is ANSI/NSF 55, while filtration is ANSI/NSF 61, and RO systems conform to NSF/ANSI 58. It was not within the scope of this project to design water treatment systems, but rather to identify deficiencies, and to provide class level cost estimates for upgrade alternatives. Where treatments system suggestions are provided herein, they are conceptual based on preliminary information available at this time, and to be used for estimating cost of upgrade alternatives. For all treatment system upgrades, it would be prudent to involve a water treatment engineer in system component selection, and to consult with the local health authorities in the process of system design. For all upgrade options, it has been recommended to budget for a 20% engineering cost for final system design.

4.0 BUILDING 1134-CARCROSS SCHOOL

4.1 Description of Existing Water Supply System

Building 1134, the Carcross School, is currently serviced with a “split” water supply system that distributes two separate water sources. Non-potable water for the toilets and irrigation are supplied by two wells located in well pits in the front yard of the School as indicated on Figure 1134-1 in Appendix A4. The wells are within 2 m of each other, and the coordinates of the wellheads, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6670157
- Easting: 516083

Potable water is delivered by bulk truck delivery to the School from a treated (filtered and chlorinated) Bennett Lake source and stored on site in a 6000 L fibreglass lined plywood tank. The potable water is distributed within the school through a pressurized system to the sink faucets and water fountains. A schematic of the potable water system is included in Appendix A4 as Figure 1134-B.

4.2 Description of Existing Wastewater Systems

Wastewater for the school is collected in a holding tank and pumped out regularly. There are also several residential septic tanks for houses located near the School; however, it appears that there are none located within 30 m of the wells.

4.3 Water Quality Results

4.3.1 Water Quality Results from Previous Sampling

There were no previous detailed potability results available for review for the Carcross School potable water system, or the non-potable system. The water quality from the wells was reported to have high concentrations of arsenic (Terry Jackson, pers. comm.), and these wells are therefore not in use for the potable supply to the School. The Government of Yukon Property Management Agency provided EBA with the results of bacteriological testing completed between October 2004 and March 2005. As indicated in Table 1134-1 in Appendix A4, for the 12 sampling events in this period, there were no positive results for *E.Coli* or Total Coliform.

4.3.2 Identification of Additional Analytical Testing Required

Additional analytical completed for the Carcross School potable supply included a detailed potability suite, ammonia and residual chlorine. The results of the detailed potability and ammonia analyses indicated that all parameters analyzed were in compliance with the GCDWQ criteria.

Field chemistry readings; however, indicated that the residual chlorine concentration obtained in the field at the time of the assessment indicated a concentration of 0.0 mg/L. According to the proposed Government of Yukon - Public Drinking Water Systems Regulation, the required concentrations for residual chlorine are 0.4 mg/L at the point of loading, and 0.2 mg/L or greater throughout the distribution system and at the point of consumption.

4.3.3 Indicators of Potential Contamination

There were no elevated concentrations of any indicator parameters that were analyzed for the Carcross School potable water supply. The source for the potable supply is delivered water from Bennett Lake, and therefore, potential nearby sources of contamination are not a direct concern for the School potable water system.

4.4 Conceptual Hydrogeology

The groundwater flow direction is inferred to range from westerly to easterly in the vicinity of the Carcross School, towards Bennett Lake and/or Nares Lake, likely with a southerly component. The School is located nearly equidistant to the surfacewater bodies and may be situated on or near a groundwater flow divide.

4.5 Potential Contaminant Sources

Potential groundwater contaminant sources from observations during the site investigation are compiled in Table 1134-4 in Appendix A4. Photos of potential contaminant sources are also provided in Appendix A4.

The only potential contaminant source within 40 m of the wells is an underground fuel storage tank that is approximately 2 m from nearest wellhead.

4.5.1 Spills Records and Contaminated Sites Search Results

Yukon Environment Branch were requested to perform a search of their spills records and contaminated sites inventory to identify spills or contaminated sites on or adjacent to the subject sites. Search results indicated that there had been a spill at the school which was reported on December 7, 1987 (Spill #8722). Approximately 50 L of liquid furnace oil had spilled and had reportedly contaminated the well water supply. There was no information provided as to whether the water at that time was used as potable water for the school, but at the present time the well water is not used for potable water. According to the spill report, there were efforts made at the time by the Yukon Territorial Government and the Environment Canada Environmental Protection Service to clean the spill area and decontaminate the water supply. The Environment Branch did not provide the spills records until after EBA had completed the assessment, and therefore, hydrocarbon parameters were not added to the analytical program. Additional assessment including EPH and PAH analysis to verify whether groundwater in the vicinity of these wells has been remediated prior to considering re-instating the use of these wells for domestic water supply.

4.6 Identified Water System Deficiencies and Associated Risk

4.6.1 High and Medium Risk Deficiencies

- As indicated previously, the concentration of residual chlorine in the Carcross School potable water system was measured at 0.0 mg/L at the time of the assessment. The lack of residual chlorine in the potable water distribution system is considered to be a high-risk deficiency.
- The potable water system lacked of a fill cap on the water holding tank and screen on the vent pipe for the delivered potable water system.

The assessment team did not have time or accessibility to inspect and confirm that no cross connection exists between the potable, and non-potable water supply systems.

4.6.2 Low Risk Deficiencies

As the wells are currently used for non-potable water only, the groundwater source quality is not an immediate concern. However, if the wells were to be considered for use as a potable supply, it should be noted that there were high-risk deficiencies observed including the proximity to an underground fuel storage tank, completion in well pits without proper surface seals and arsenic concentrations reportedly above the CDWQG. These wells should not be used for potable water in the current condition, nor prior to confirming arsenic and hydrocarbon parameter concentrations. These wellhead deficiencies (well pit, sanitary seal, accessibility (no lock etc.) are considered to be low risk at this time. There is; however, some risk of contamination of the aquifer. Proper well construction above grade is recommended.

4.7 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).

4.7.1 Priority 1

To mitigate the high-risk deficiency, the residual chlorine concentration in the potable water system must be increased. This may be achieved through ensuring the delivered free residual chlorine concentration is at least 0.4 mg/L, or by introducing a chlorine injection system within the school supply. Further assessment of the residual chlorine concentrations within the school system is required to properly address the problem. The first step towards addressing the low chlorine concentration in the School potable supply is to monitoring of residual chlorine concentrations at various points throughout the school system. If a chlorine injection system is required, the system could be comprised of inlet pipe with a flow meter, a chemical feeding pump, day tank, injection piping, spill containment deck and appurtenances. Alternatively, a smaller water storage tank with adequate access for maintenance and cleaning might ensure adequate residual chlorine concentrations. We understand that at the time of this final report, PMA has already commissioned a study of the chlorine concentrations throughout the system, and will be obtaining design recommendations to remedy this problem.

4.7.2 Priority 2

A proper fill cap should be placed in the water tank intake, and a proper screen should be placed over the vent pipe.

It is recommended that a YTG plumber familiar with the system inspect these systems to confirm that there is no cross-connection, and to label the plumbing appropriately.

4.7.3 Priority 3

Consideration should be given to upgrading these non-potable water wells to ensure contamination of the aquifer in which these wells are completed does not occur. Mitigative upgrades would include installation of a sanitary surface seal, casing extension, and re-plumbing and electrical upgrades.

The underground storage tank should be removed and proper testing completed to ensure that there is no residual hydrocarbon contamination associated with the previously mentioned fuel spill.

4.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

4.8.1 Priority 1

The cost to monitor residual chlorine concentrations at four points throughout the School's potable water distribution system over a month period to establish whether a chlorine system is required to be installed in the building to ensure the minimum residual chlorine concentration is estimated at **\$1,500.**

The cost to install a chlorine injection system to ensure adequate residual chlorine concentrations within the system is estimated to be **\$5000** for materials and labour. Routine monitoring of residual chlorine concentrations within the system will be required and occasional adjustment of chlorine dosing rates may be required to maintain target residual chlorine concentrations.

4.8.2 Priority 2

The cost for a proper intake cap and screen with labeling and coding of the interior plumbing would be in the order of **\$300**, assuming that this work is completed by a YTG maintenance personnel or plumber.

4.8.3 Priority 3

Consideration should be given to ensuring that the water wells have a proper sanitary seal, and are raised above grade. It is estimated that the “standard well upgrade” could be completed for both wells for approximately **\$8000**.

5.0 BUILDING 1137-CARCROSS FIRE HALL

5.1 Description of Existing Water Supply System

Building 1137, the Carcross Fire hall and Ambulance Bay, is currently serviced by a well located within the Fire hall building (see Appendix A5, Figure 1137-A). The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6670070
- Easting: 516069

The water supply system consists of a 100 mm diameter submersible pump installed inside a 150 mm diameter steel well casing. The pump feeds water into a pressure tank that is located beside the well inside the fire hall building along with the pump control box. The distribution piping extending from the pressure tank services the Fire hall and Ambulance Bay as indicated in the system schematic provided as Figure 1137-B in Appendix A5. The water from this well is used for domestic purposes only, and the well does not supply water for fire protection. It was not possible to open the well during the assessment due to the heavy steel drop pipe used to suspend the pump.

There is also an abandoned well located behind the water truck garage, adjacent to the Fire hall. The water truck garage is used for bulk water delivery to Carcross, and is filled at the garage. There is an intake from Bennett Lake that supplies water for the truck fill after it has been filtered and chlorinated. The lake water treatment equipment is located within the enclosure between the Carcross Fire hall and the water truck garage as indicated on Figure 1137-A in Appendix A5.

5.2 Description of Existing Wastewater Systems

There are several residential septic tanks located in the vicinity of the Carcross Fire hall. One residential septic tank and the septic tank for the Fire hall are both located within 30 m of the well, as shown on Figure 1137-A. It appears that there are septic holding tanks that are maintained through a regular pump-out program and do not discharge effluent to nearby septic fields.

5.3 Water Quality Results

5.3.1 Water Quality Results from Previous Sampling

There was no previous water quality information available for review during this study. However, previous sampling reportedly indicated elevated total arsenic concentrations.

There have also been positive bacteriological analyses for samples collected from the well as indicated in the questionnaire completed by Mr. Terry Jackson.

5.3.2 Water Quality Results from the Current Assessment

Total arsenic was the only parameter analyzed for the water sampled collected from the domestic water supply in building 1137. The total arsenic concentration in the May 11, 2005 sample was 0.0193 mg/L, which is below the current GCDWQ MAC of 0.025 mg/L but greater than the proposed MAC of 0.005 mg/L.

5.4 Conceptual Hydrogeology

The groundwater flow direction is inferred to range from southwesterly to southeasterly in the vicinity of the Carcross Fire hall, towards Bennett Lake and/or the Nares River. The well log identified as “Carcross Fire hall” reported that the well is 105.8 m (347 feet) deep completed in a confined aquifer underlying sand, clay, and till. The aquifer in which this well is completed is well protected from surface sources of contamination by the deep sequence of fine-grained soils overlying the aquifer.

5.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1137-4 in Appendix A5. Photos of potential contaminant sources are also provided in Appendix A5.

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

- o Above ground fuel storage tanks at 2,10,10 and 20 m respectively.

5.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results by YTG Environment Branch did not identify any concerns for this site.

5.6 Identified Water System Deficiencies and Associated Risk

5.6.1 Priority 1

The lack of disinfection is considered to be a Priority 1 risk deficiency for this water system.

5.6.2 Priority 2

The poor location of the well with respect to above ground fuel storage tanks and septic tanks is considered to be a Priority 2 risk deficiency.

5.6.3 Priority 3

There was likely no surface seal installed when the well was constructed, and it is not feasible to retrofit the well with an adequate surface seal. However, the concrete floor surrounding the well and the above ground casing stick-up do provide for some protection of the well head, and result in this being classified as a lower risk.

5.7 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).

5.7.1 Priority 1

The water distribution system for the Fire Hall and Ambulance Bay should be connected to the post-treatment water supply from Bennett Lake. A backflow preventer (double check valve) should be installed in the 3" line, and the solenoid moved so that the plumbing for potable water on the ambulance side can be plumbed in upstream of this flow switch. These are conceptual design recommendations based on the information available for the

purpose of planning and budgeting. Engineering input will be required for final system specifications.

This will mitigate the deficiencies related to the lack of disinfection and the poor well location relative to potential sources of contamination.

5.7.2 Priority 2

The Priority 1 mitigative upgrades will also mitigate the Priority 2 deficiencies identified.

5.7.3 Priority 3

The above-recommended upgrades will also mitigate the need for a proper surface seal around the well casing.

5.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

5.8.1 Priority 1

The cost to tie the existing distribution system for the Fire hall and Ambulance Bay into the treated Bennett Lake supply in the adjacent building is estimated to be approximately **\$2,500** including labour, materials, engineering and contingency.

5.8.2 Priority 3

The cost to decommission wells according to the Guidelines for Water Well Construction is approximately **\$1000/well**.

6.0 BUILDING 1153: CARCROSS GRADER STATION

6.1 Description of Existing Water Supply System

The water supply for the Carcross Grader Station is supplied by a well located on the east side of the Grader Station (see Appendix A6, Figure 1153-A). The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6671418
- Easting: 516896

The water supply system consists of a 100 mm diameter submersible pump installed inside a 150 mm diameter steel well casing. The system is equipped with sand filter and canister filtration systems, but there is currently no disinfection of the water supplied by the well. A system schematic is provided as Figure 1153-B in Appendix A6. It was not possible to open the well during the assessment due to the heavy steel drop pipe used to suspend the pump; however, Terry Jackson indicated that the well is approximately 33 m deep.

6.2 Description of Existing Wastewater Systems

The septic tank for the Carcross Grader Station is located on the west side (opposite the well) of the grader station, about 22 m from the well. The septic tank discharges effluent to a field located approximately 34 m from the wellhead.

6.3 Water Quality Results

6.3.1 Water Quality Results from Previous Sampling

The available water chemistry information indicated that the groundwater from the well complies with the current Canadian Drinking Water Guidelines (CDWQG) – Maximum Acceptable Concentrations (MAC) for the parameters analyzed with the exception of turbidity which was above the 1 NTU MAC for both sampling events. The total arsenic concentrations for both sampling events were below the current MAC of 0.025 mg/L, but greater than the proposed MAC of 0.005 mg/L. There were also exceedences of the GCDWQ Aesthetic Objectives (AOs) for color, iron and manganese. The water was also noted to be very hard.

6.3.2 Identification of Additional Analytical Testing Required

Additional analyses performed included dissolved metals, hydrocarbons and UV absorbance. The intent of the dissolved metals analyses was to assess the relationship between the elevated total metal concentrations and turbidity for evaluation of treatment alternatives. The remaining additional analyses were required due to the proximity of the well to potential hydrocarbon sources of contamination and the need for disinfection of the water supply.

The dissolved arsenic concentration was very similar to the total concentration, and there were no indications of hydrocarbon impacts to the well water supply.

6.3.3 Indicators of Potential Contamination

No indicator parameters were elevated above inferred background levels, indicating that the well water supply was not likely impacted by nearby surface sources of contamination including the salt storage and septic disposal on the site at the time of the assessment.

6.4 Conceptual Hydrogeology

The groundwater flow direction in the vicinity of the Carcross Grader Station is inferred to be south to southeasterly, towards Nares Lake. EBA obtained a well log for a well drilled at the Grader Station in Carcross in 1973. Terry Jackson indicated that this was not the same well as the one currently in use; however, he was unaware of the location of this abandoned well, nor the details of its abandonment. A well log for the existing well could not be obtained. The well log for the abandoned well indicates that the well depth is approximately 73.9 m. The sediments encountered during the drilling of the well consisted of sand and silt overlying clay at about 42 m below grade. Till was encountered beneath the clay and overlying weathered bedrock at about 70 m depth. The well is screened within the broken/weathered bedrock. If the same lithology exists at the existing well location, as the abandoned well, a 10 m thick silt layer may protect the aquifer.

6.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1153-4 in Appendix A6. Photos of potential contaminant sources are provided in Appendix A6.

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

- o Rock pit – 9 m;
- o Vehicle parking within 2 m;
- o Waste oil tank at approximately 18 m; and,
- o Salt storage within 22 m.

As mentioned previously, due to the proximity of the well to the rock pit, a used oil tank, and to an active industrial type area, EBA included hydrocarbon parameters in the additional water sampling program. Extractable petroleum hydrocarbons and Polycyclic Aromatic Hydrocarbons were not detected in the sample analyzed.

6.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results by YTG Environment Branch apparently did not identify any concerns for this site.

6.6 Identified Water System Deficiencies and Associated Risk

6.6.1 High and Medium Risk Deficiencies

High-risk deficiencies identified for the Carcross Grader Station water supply include the lack of disinfection, poor surface completion of the wellhead, and proximity of the well to surface sources of contamination including the wastewater disposal system, rock pit, waste oil tank, vehicle parking lot and salt storage area (assessed as high risk in light of current well construction). By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.

6.6.2 Low Risk Deficiencies

There was no oil-water separator or grease trap observed within the floor drain system.

6.7 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).

6.7.1 Priority 1

Two options have been presented to mitigate the high risk deficiencies described above.

Option 1: Upgrade existing well system

Installation of a proper disinfection system is recommended for the Carcross Grader Station water supply. The possibilities of using either chlorination or a NSF/ANSI 55 certified UV system may be evaluated for this well. A dual disinfection system (with filtration and disinfection) would mitigate the risk of the proximity to the sewer pipe (22 m). UV treatment is generally less expensive than chlorination; however pre-treatment would be required. An ion exchange system such as a softener used for pretreatment for iron, manganese and hardness in order to ensure proper operation of the UV system may also reduce the content of arsenic in the water depending on the form of arsenic (III or V). If chlorination is the preferred disinfection option, it would be worthwhile considering installation of the water softener system from a cost benefit perspective to increase the lifetime of fixtures and plumbing, while decreasing maintenance and cleaning.

These are conceptual design recommendations based on the information available for the purpose of planning and budgeting. Engineering input will be required for final system specifications.

Option 2: Drill new well at another location

Another option to consider would be to drill a new water supply well and decommission the existing well, versus upgrading the existing well and moving the potential contaminant sources (septic tank, septic field, waste oil tank, rock pit and salt storage area). The benefit of this option is the well could be constructed in compliance with the guidelines, and could

be located with consideration of potential contaminant sources and the inferred groundwater flow direction.

Another attempt should be made to obtain the well log for the existing well as this would provide valuable information regarding how well protected the aquifer is from surface sources of contamination.

6.7.2 Priority 2

If Option 1 is selected for Priority 1 upgrades, then the following Priority 2 upgrades are recommended. The wellhead completion should be improved to prevent the ponding of surfacewater around the well casing. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface seal to 3 m depth around the well casing. The ground surface should then be graded to promote surface drainage away from the well. The well should be assessed for well depth; depth to water and depth of pump installation to confirm assumed information on the well.

6.7.3 Priority 3

Install an oil-water separator or grease trap within the floor drain system.

As indicated previously, the proposed maximum acceptable concentration for arsenic is likely to change in the near future. If option 1 is chosen, and a softener system is not effective in removing arsenic to the proposed guideline, a point of use (POU) reverse osmosis (RO) system would certainly be effective in reducing arsenic and TDS. RO will also remove protozoa, virus and bacteria. This has been considered a lower risk at this time given that there will most likely be a grace period to give water system owners some time to implement the necessary treatment.

6.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other upgrades 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.

6.8.1 Priority 1

Option 1:

- The cost for a pre-treatment and UV disinfection system is estimated to be about **\$7,000**, while a chlorine injection system complete with retention tanks would cost in the order of **\$10,000** with pretreatment.
- Relocation of the fuel oil AST is estimated at **\$500**.
- Construction of a new rock pit, and decommissioning of the existing rock pit is estimated at **\$3000**.
- Relocation of salt storage area is estimated at **\$1000**.

Therefore, the total cost for this option is estimated at approximately **\$11,500 to \$14,500**.

Option 2:

- If a new well is drilled, the cost is estimated to be about **\$30,000**. The new well could be located in a safer location, constructed with a proper sanitary seal, and may have better water quality.

6.8.2 Priority 2

Option 1:

- The cost to upgrade the wellhead completion is estimated to be about **\$5,000**.
- Installation of a fence around the immediate wellhead is estimated at **\$2,000**.

Therefore, the total cost for this option is estimated at approximately **\$7,000**.

Option 2:

- Given the groundwater chemistry for the area, it is likely; that treatment for hardness, iron and manganese, will also be required. Disinfection may also be recommended. Estimated costs have not been included at this time.

6.8.3 Priority 3

The cost to install an adequate grease trap or oil-water separator is estimated to be about **\$3,000.**

In the event that RO is required for point of use removal of arsenic, the cost would be approximately **\$700.**

7.0 BUILDING 1500: FRASER CAMP

7.1 Description of Existing Water Supply System

Building 1500, Fraser Camp, is currently serviced by a water supply system that delivers water from a surfacewater source. The water is transported by penstock feed from Fraser Lake, and after going through a micro-hydroelectric generating station the water is piped to the Fraser Camp pump house. A site plan is provided as Figure 1500-A in Appendix A7.

Water is treated in the pump house by filtration through a 10-micron primary filter followed by a 1-micron secondary filter. An LMI proportional feed injection system delivers sodium hypochlorite solution for disinfection. There is a 5000 L water storage tank that acts as a backup supply system in the event of power loss. This water system supplies all of the potable water to Fraser Camp. Although the water is chlorinated, field chemistry at the site taken at the time of water sampling showed that the residual chlorine was at 0.01 mg/L, low for a chlorinated system.

Anecdotal information provided after the assessment and submission of the draft report for this region suggests that the water provided to Canada Customs and Revenue Agency buildings on this site (Residences and the Customs Office), does not pass through this treatment system and is therefore not disinfected.

Field notes and a system schematic, shown by Figure 1500-2, are located in Appendix A7.

7.2 Description of Existing Wastewater Systems

The on-site sewage disposal systems that serve the Fraser Camp are at least 1 km from and downgradient of Fraser Lake surfacewater supply.

7.3 Water Quality Results

7.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of drinking water from the Fraser Camp water system has previously been completed routinely by consultants under contract to Property Management Agency. EBA was provided access to the YTG database in order to review

the results of this previous bacteriological sampling. Eighteen samples were collected from this system between October 2004 and February 2006 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1500-1 in Appendix A7.

According to the YTG database, *E. coli* Bacteria was reported as absent in each of the eighteen samples for which results were provided. However Total Coliform was reported as being present three times over the sampling period. The most recent sampling event for which results were provided (February 6, 2006) was negative for both coliform and *E. coli*.

Detailed Potability Analyses

There were no previous water sampling results available for review, and as such, there were no previous records on which to make decisions regarding further analytical information to be collected at the time of the assessment.

7.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Fraser Camp that was identified to be included during the water system assessments is detailed below:

- Since there had been no previous data available for review detailed potability analysis was recommended. This analysis will aid in identifying the areas that will need to be given special attention with regards to further analysis and recommendations for a treatment system.
- Trihalomethane parameters (THM) were analyzed in samples collected from systems with existing chlorine disinfection systems. These include (bromodichloromethane, bromoform, chloroform, dibromochloromethane). THMs and other disinfection by-products are formed when chlorine reacts with naturally occurring organic matter in the source water. Some studies have linked THMs to increased risk of cancer
- Haloacetic Acid (HAA) analysis has been included for chlorinated systems. Similar to THMs, HAA can be present in chlorinated drinking water as a chlorinated water disinfectant byproduct formed when the chlorine reacts with natural organic matter in raw water supplies.
- Ammonia was included as a potential indicator of septic contamination.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature, as well as residual chlorine were completed.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted to ALS Environmental in Vancouver BC for analyses including detailed potability, THMs, HAA, and ammonia concentration. These results are summarized in Table 1500-2 in Appendix A7 and the laboratory reports are included in Appendix B.

- The water quality for the sample obtained on May 11, 2005 indicated that the water was very fresh, and was low in all major mineral constituents, as could be expected of a surfacewater source. The hardness (as CaCO₃) was reported to be 19.8 mg/L, which can be considered to be quite soft.
- The results showed that levels of THMs and HAA were below analytical detection.

The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed.

7.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. Chloride, nitrate and nitrite concentrations for the sample obtained on May 11, 2005 were low and can be considered to be within the normal background ranges for surfacewater.

7.4 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1500-4 in Appendix A7. Photos of potential contaminant sources are provided in Appendix A7.

There is no development, and minimal recreational use around Fraser Lake, the water source for the domestic supply to Fraser Maintenance Camp.

7.4.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search by YTG Environmental Programs Branch found that there had been multiple spills reported near Fraser Camp.

There had been a major leak reported on April 27, 1979. The spill has been recorded in the Environment Canada Spill Report Information Database as Spill 7907. Reportedly, the leak occurred when a cat ruptured a White Pass and Yukon Route pipeline during snow removal, and it had reportedly discharged 41958 L of diesel fuel onto the ice surface of a nearby alpine lake. There is no data at this time as to which lake was contaminated or as to whether the spill had contaminated the current potable water supply. There were efforts made at the time by the Environment Canada Environmental Protection Service, the Department of Indian Affairs and Northern Development, and the White Pass & Yukon Route company to clean up the spill. A large portion of the fuel had been pumped off of the ice surface and the remainder burned.

There had been another spill reported on June 8, 1990; recorded in the Environment Canada Spill Report Information Database as Spill # 9036. The leak had reportedly discharged 76 L of diesel fuel onto the rail bed ballast over 10 km of track. Due to the large area over which the leak was discharged there were no efforts made at the time by the Environment Canada Environmental Protection Service or the White Pass & Yukon Route company to decontaminate the affected area.

There had been reports of chronic discharge of contaminated water and sludge from garage sumps from the YTG Highway Maintenance Camp up to March 10, 1994. The discharges have been recorded in the Environment Canada Spill Report Information Database as Spill # 9423. The discharges had released an unknown quantity of contaminated water and sludge onto the ground outside around the fueling station. There were no efforts made at the time by any agency, but it is reported that BC MOE was advised about the contamination.

Environment Programs Branch also indicated that there had been a contaminated soil relocation permit issued in 2000 for the relocation of 50 m³ of contaminated soil that had resulted from a leaking fuel tank at a Canada Customs Residence.

Given that Fraser Lake is at least 1 km upgradient from Fraser Camp, it is considered extremely unlikely that any of these reported spills would impact on the quality of the surfacewater source.

7.5 Identified Water System Deficiencies and Associated Risk

7.5.1 High and Medium Risk Deficiencies

The backup storage tanks used in the Fraser Camp water supply system do not receive water that has been filtered. The water system is constructed in such a way that although the water in the backup water supply is chlorinated, it is not filtered. In the event of a power failure, Fraser Camp would have to rely on this unfiltered water supply. Chlorination alone is not effective in removing some protozoa e.g. such as *Giardia* and *Cryptosporidium* that could be associated with surfacewater sources.

As indicated previously, the water provided to Canada Customs and Revenue Agency buildings at this site is not treated. If PMA is responsible for providing water to CCRA, it would be prudent to complete upgrades to ensure that this system is modified to provide treated water to these buildings. Even if PMA is not responsible, it is recommended that CCRA be notified that water to their buildings is from a surfacewater source that is not treated, and therefore constitutes a high risk.

It has also been identified that there is no routine schedule or record keeping for residual chlorine testing. Routine testing and good record keeping must be conducted to ensure that the chlorination disinfection system is functioning properly. At the time of inspection it was found that the levels of residual chlorine were at 0.01 mg/L, which is considered to be very low for a chlorinated system. Follow-up testing completed by Katherine Johnston of EBA on March 23, 2006 found that the residual chlorine concentrations were 0.20 mg/L and 0.28 mg/L from two testing locations (laundry room sink, and hose bib in maintenance garage). These are acceptable residual chlorine concentrations, which suggest that the chlorine injection rate was increased between the initial assessment and the subsequent follow-up sampling event. Through proper monitoring and maintenance, the residual chlorine concentrations should be maintained at levels above 0.2 mg/L at the point of consumption.

In addition, there is no regular cleaning schedule for the storage tank, and without regular cleaning the sanitary condition of the water is susceptible to degradation.

7.5.2 Low Risk Deficiencies

There were no low risk deficiencies at this site, all deficiencies are considered to be high-risk.

7.6 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).

7.6.1 Priority 1

To mitigate any risk associated with the fact that in the event of a power failure, Fraser Camp must rely on the unfiltered water supply from the backup storage tanks, the water system should be re-designed in a manner such that the water storage tanks receive the same filtered and chlorinated water as the remainder of the system does.

Modifications to the water system should be completed to ensure that CCRA buildings receive filtered and chlorinated water.

A routine residual chlorine testing and record keeping system should be initiated to ensure that residual chlorine levels are at adequate levels.

Routine cleaning of the water storage tanks should be done on a regular basis. The large pressure tank should also be flushed annually with a 200 ppm chlorine solution.

7.6.2 Priority 2

There were no Priority 2 deficiencies at this site, all deficiencies are considered to be high-risk.

7.6.3 Priority 3

There were no low risk deficiencies at this site, all deficiencies are considered to be high-risk.

7.7 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

Costs to modify the water system to ensure treated water is provided to CCRA have not been included herein.

7.7.1 Priority 1

The cost to alter the existing water system so that the water entering the storage tanks is filtered would involve minor modifications to the plumbing system, and is estimated to cost **\$700.**

The costs to complete routine residual chlorine testing and storage tank cleaning would fall under the operations and maintenance budget.

7.7.2 Priority 2

There were no medium risk deficiencies at this site, all deficiencies are considered to be high-risk.

7.7.3 Priority 3

There were no low risk deficiencies at this site, all deficiencies are considered to be high-risk.

8.0 BUILDING 1322 GOLDEN HORN SCHOOL

8.1 Description of Existing Water Supply System

Building 1322, the Golden Horn School, is currently serviced by a water delivery system. Delivered water is fed to a large water storage tank that supplies potable water to the school. There is no treatment or disinfection system anywhere on the water system in the school; however, the water is chlorinated at the bulk water delivery site.

There is an abandoned well on the property that is no longer in use due to poor water quality. It is not a part of the existing water system. The abandoned well is shown on Figure 1322-1 in Appendix A8. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6718787
- Easting: 507049

Field notes and a system schematic, shown by Figure 1322-2, are located in Appendix A8.

Anecdotal information suggests that there may also have been another test well drilled at the site, which was unsuccessful. Terry Anderson was not aware of the location of this well at the time of the site visit, and it is unclear whether the well had been properly decommissioned.

Field chemistry readings using a Hach Colorimeter at the time of the assessment indicated that the water from a tap in the staff washroom had a residual chlorine concentration of 0.01 mg/L. According to the proposed Government of Yukon - Public Drinking Water Systems Regulation (YPDWSR), the required concentrations for residual chlorine is 0.2 mg/L or greater throughout the distribution system and at the point of consumption.

PMA retained EBA to complete a follow-up chlorine-monitoring event in March 2006. Katherine Johnston of EBA tested residual and total chlorine concentrations using a Hach Colorimeter at the Golden Horn School on March 28th, 2005. Samples were obtained at three locations in the building. Residual chlorine concentrations were observed to be 0.01 mg/L at the staff washroom (where previously tested) and at the Grade 2 Classroom tap and Computer Room tap. Total chlorine concentrations ranged between 0.02 and 0.03. Test results are summarized on Table 2. Chlorine concentrations during this second

sampling event were still noted to be well below the required 0.2 mg/L at the point of consumption.

8.2 Description of Existing Wastewater Systems

The septic tank for the Golden Horn School is located on the east side of the school, approximately 30 m south from the abandoned well. The septic tank discharges effluent to a field located approximately 50 m east of the tank.

8.3 Water Quality Results

8.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Golden Horn School water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Seven samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated Table 1322-1 in Appendix A8. As indicated by the data provided in the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the seven samples for which results were provided.

Detailed Potability Analyses

There were no previous water samples taken from this site for detailed potability testing. The school utilizes delivered water, which is treated and monitored by the contracted company Glacier Water Services. Reportedly, Glacier Water obtains their water from groundwater wells. It was beyond the scope of this assessment to assess this source.

8.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Golden Horn School that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature, as well as residual chlorine have been completed at the time of sampling for all chlorinated systems.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance. These results are summarized in Table 1322-2 in Appendix A8 and the laboratory reports are included in Appendix B.

8.3.3 Indicators of Potential Contamination

There is no risk of local contamination of the water system as Golden Horn School is on water delivery. Analytical for indicators of potential contaminant sources (nitrate, nitrite, chloride) was not completed during this program.

8.4 Potential Contaminant Sources

Potential groundwater contaminant sources from observations during the site investigation are compiled in Table 1322-4 in Appendix A8. Photos of potential contaminant sources are provided in Appendix A8.

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

- o Above ground fuel storage tanks approximately 7 m from wellhead inside the adjacent building.

8.4.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events for this site or neighbouring sites.

8.5 Identified Water System Deficiencies and Associated Risk

For the assessment of risk to the Golden Horn School water supply, it is assumed that the groundwater supply is not suitable due to quantity and aesthetic quality issues, and potential risk to the wells is limited to risk to the aquifer, as it is assumed that the school will remain on water delivery.

8.5.1 High and Medium Risk Deficiencies

The current water storage tank used to store the delivered water for the school water supply may require replacement or refurbishment. According to ATTS, the storage tank is made of steel with an epoxy coating and is likely unsuitable for potable water. It is suggested that the tank be inspected when it is accessible and empty during the summer months to determine its suitability. Confined space entry techniques must be used.

Golden Horn School relies on delivered water for its water supply, and although the water is chlorinated, the reading of residual chlorine at the time of inspection and follow-up inspection was only 0.01 mg/L. This is considered to be low for chlorine treated water and the level of chlorine in the water should be higher to ensure that the water is properly disinfected in the event that contaminants are introduced at some point within the distribution system. This likely results from the length of residence time in the storage tank, and the fact that the tank is vented.

8.5.2 Low Risk Deficiencies

- The fill pipe and vent pipe are ABS, which is not considered suitable for domestic water supply.
- There is no screen on the vent, and the vent and fill lines are not labelled.
- Existing water wells that are not properly decommissioned could act as potential pathways for contamination to enter the subsurface and potentially impact on groundwater quality.

8.6 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).

8.6.1 Priority 1

The existing water storage tank may require replacement if it does not meet public health standards. As mentioned previously, it is recommended that an opinion be solicited from a qualified inspector. If required, the replacement tank should be constructed of suitable materials and be designed for use as a potable water storage tank. Removing the existing tank from the current location would be difficult.

The residual chlorine concentration in the potable water system must be increased. This may be achieved through ensuring the delivered free residual chlorine concentration is at least 0.4 mg/L, or by introducing a chlorine injection system within the school supply. Further assessment of the residual chlorine concentrations within the school system is required to properly address the problem.

8.6.2 Priority 2

The ABS piping should be replaced with PVC or other suitable water distribution piping. The vent should be screened to ensure that vermin cannot enter the pipe, and the vent and fill line should be labelled.

8.6.3 Priority 3

According to the proposed Guidelines for Small Public Drinking Water Systems, an owner shall ensure that the decommissioning (abandonment) of a well is done in accordance with the criteria outlined in the *Guidelines for Water Well Construction*. A decision should be made as to whether these wells (one identified, and one not identified), may be used in the future. We understand that it is unlikely that these wells would be used in the future, due to

the fact that they were limited producers and had very high iron content. Consideration should be given to properly decommissioning these wells.

8.7 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

8.7.1 Priority 1

If necessary, replacing the current water storage tank could potentially require removing a wall in order to remove the old storage tank and install the new storage tank. The tank would likely have to be cut into sections to be removed, and would be labour intensive. The new tank itself would cost approximately **\$4000**; however the cost to remove the old wall or potentially build a new addition to house the water storage tank is not known at this time.

According to Dayton and Knight, who spoke with a steel tank supplier, refurbishing tanks with an epoxy coating is possible depending on the condition of the tank. They also suggested that the tank manufacturer inspect the tank. Apparently the painting costs about \$6 per square foot. This would amount to a cost of approximately **\$1500**.

The cost to install a chlorine injection system to ensure adequate residual chlorine concentrations within the system is estimated to be **\$5000** for materials and labour. Routine monitoring of residual chlorine concentrations within the system will be required and occasional adjustment of chlorine dosing rates may be required to maintain target residual chlorine concentrations.

8.7.2 Priority 2

The ABS piping should be replaced with PVC pipe at the same time as the tank replacement, if required. If this work is to be completed separately, it is estimated that it

would cost approximately **\$500** for labour and materials to remove and replace the piping with PVC.

Labelling and installation of a vermin screen could be completed at the same time as the above work and would cost approximately **\$200**.

8.7.3 Priority 3

Proper decommissioning of the existing abandoned wells in accordance with the Guidelines for Water Well Construction would cost in the order of **\$1000** per well including labour and materials.

9.0 BUILDING 1334: LAKEVIEW FIRE HALL

9.1 Description of Existing Water Supply System

The existing water supply at the Lakeview Fire Hall consists of a single well that supplies water to an elevated holding tank (4,550 L). Sodium Hypochlorite is injected by a Grundfos Digital Dosing chlorinator into the piping system prior to delivery to the overhead storage tank. There is a back-up LMI system in place as well. The water flows from the tank by gravity to an overhead truck fill for water delivery to local residents and also feeds into a pressurized domestic system servicing the fire hall. There is also an exterior public water station where local residents retrieve water. In addition, water is fed to two water-holding tanks used to fill the fire truck. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6702194
- Easting: 540097

The well was drilled by Fredalena Enterprises in 1992, and is reported to be 28 m deep. The static groundwater level at the time of drilling was reported to be 19.5 m below ground, and the wellhead is located approximately 1.8 m below grade inside a 1.2 m diameter steel culvert with a wooden box enclosure at surface.

Figures detailing the site features and system details are provided in Appendix 9.

9.2 Description of Existing Wastewater Systems

The wastewater disposal system for the Lakeview Fire Hall consists of a septic tank that discharges to an adjacent ground disposal field located about 34 m south of the well. The septic field is located at an elevation that is approximately 5 m lower than the ground surface at the wellhead, and downslope of the well.

9.3 Water Quality Results

9.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Lakeview Fire Hall water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Nine samples were collected from this system between October 2004 and March 2005, and were tested using the presence/absence test method for Total Coliform and *E. coli* by Yukon Environmental Health Services. Results are tabulated in Table 1334-1 in Appendix A9. According to the YTG database, *E. coli* Bacteria and Total Coliform bacteria was reported as absent in each of the nine samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Lakeview Fire Hall water system on June 15, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 1134-2 and are included in Appendix B. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was calcium-bicarbonate type with high hardness and a pH of approximately 8.22.
- At 0.556 mg/L, the iron concentration exceeded the Canadian Drinking Water Quality Guidelines (CDWQG) aesthetic limit of 0.3 mg/L.
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed.

9.3.2 Identification of Additional Analytical Testing Required

Analyses for trihalomethane and haloacetic acids were identified as additional requirements due to the operation of a chlorine disinfection system. The results of these additional

analyses indicated that all compounds analyzed were present in concentrations less than the detection limits of the respective analyses.

The assessment team completed analysis of the residual chlorine concentration of a water sample from the kitchen tap. The results indicated a concentration of 0.36 mg/L at the time of the inspection. Residual chlorine is currently monitored weekly at the Lakeview Fire hall, and results recorded over the previous six weeks indicated concentrations ranging between 0.25 and 0.31 mg/L. The results have been reported to range between 0.2 and 0.7 mg/L (pers. Comm. Fire Chief Jurgen Williams). These results indicate that the residual chlorine concentration is often less than the required concentration of 0.4 mg/L for water delivery (e.g. for pick-up at the truck fill). However, the results satisfy the requirement of 0.2 mg/L for the point of consumption for the domestic system within the Fire hall.

9.3.3 Indicators of Potential Contamination

No indicator parameters were assessed to be elevated above inferred background levels, indicating that the well water supply is not likely impacted by nearby surface sources of contamination.

9.4 Conceptual Hydrogeology

The groundwater flow direction in the vicinity of the Lakeview Fire hall is inferred to be southwesterly towards Marsh Lake. Predominantly well-graded granular sediments were reportedly encountered during the well drilling, and the well appears to have been terminated within a reasonably productive overburden aquifer. The static water level was reported to be about 19.5 m below ground and the well was terminated at about 28 m depth.

9.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1334-4 in Appendix A9. Photos of potential contaminant sources are provided in Appendix A9.

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

- o Above ground fuel storage tank at 27m.

9.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results found that there had been a spill reported November 22, 1987. The spill has been recorded in the Environment Canada Spill Report Information Database as Spill # 8717. There had reportedly been a transport that had lost control and crashed approximately 500 m south of the Lakeview Marina turnoff on the Alaska Highway. Due to frozen condition and lack of surface drainage area, environmental damage was reportedly minimal. Since the reported spill location is at least 1 km away from Lakeview Fire Hall, this spill is not considered to be a potential concern to the water quality at the Lakeview Fire Hall.

9.6 Identified Water System Deficiencies and Associated Risk

9.6.1 High and Medium Risk Deficiencies

The following high-risk and medium deficiencies were identified for the Lakeview Fire Hall water supply system:

- Poor surface completion of the wellhead below ground;
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- Chlorine injection valve cracked;
- Present piping configuration may allow water from the fire truck fill tanks to enter the potable water system which presents a health risk; and
- There is no backflow preventer on the hose bib line.
- Fire truck fill tanks do not appear to be cleaned regularly.
- The well is approximately 20 m from the sewer discharge pipe.

9.6.2 Low Risk Deficiencies

The following low-risk deficiencies were identified for the Lakeview Fire Hall water supply system:

- Peak demand flow may not be sufficient. According to YTG plumber, the domestic water tank is too small for peak demand, and the piping size should be increased.
- The overflow pipe discharges inside the building in the event of overfilling.
- The arsenic concentration exceeds the proposed maximum acceptable concentration.
- The gasoline AST is approximately 27 m from the wellhead. This has been identified as low risk because it is double walled tank with a Kam lock fill and small overflow containment.

9.7 Mitigative Options for Deficiencies

Mitigative options were developed to address the deficiencies identified in the previous section. Deficiencies are prioritized by risk in the following sections.

9.7.1 Priority 1

The wellhead completion should be improved to decrease the susceptibility to surface contamination. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface seal to 3 m depth around the well casing. The ground surface should then be graded to promote surface drainage away from the well. A fence should also be placed around the well to prevent access for animals and people.

The draft guidelines provide that wells “under the direct influence of surfacewater” require filtration and disinfection. As such, it is recommended that an adequate filter system to remove particles down to 1 micron (absolute) be installed.

Reportedly, the chlorine injection valve has already been repaired by YTG.

The configuration of the piping must be adjusted to eliminate the existing cross-contamination potential from the fire truck fill tanks. This would involve moving the solenoid valve for the fire truck fill tanks closer to the tanks and installing a backflow preventer. The domestic feed line should be installed prior to the solenoid valve, and should be increased from $\frac{3}{4}$ inch to 1-inch diameter. If not already completed, a backflow preventer should be installed on the hose bib line.

These are conceptual design recommendations based on the information available for the purpose of planning and budgeting. Engineering input will be required for final system specifications.

9.7.2 Priority 2

The fire truck fill tanks should be cleaned on a regular schedule, every 12 months should be sufficient.

The overflow piping should be extended to the outside of the building. This upgrade should be undertaken at the same time as the high risk piping adjustments.

9.7.3 Priority 3

Further investigation of the reported water quantity problems under peak demand should be evaluated. This would involve assessment of the actual demand versus the capabilities of the existing system. Modifications to the pump and/or tank sizes should be made as required, provided the well is capable of supplying water at the increased rate. The sustainable well yield may also have to be assessed.

As indicated previously, the proposed maximum acceptable concentration for arsenic is likely to change in the near future. Arsenic treatment would likely be required at such time as the guidelines change. This has been considered a lower risk at this time given that there will most likely be a grace period to give water system owners some time to implement the necessary treatment.

9.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

9.8.1 Priority 1

The cost for the recommended wellhead improvements is estimated to be about **\$5,000**.

The cost to adjust the piping configuration as recommended is estimated to be about **\$3,500** for materials and labour (4" backflow preventer costs approx. \$2500).

The cost to install a backflow preventer (1 " DCA) within the outside hose bib water line would cost approximately **\$400** installed.

9.8.2 Priority 2

The cost to include the fire truck fill tanks into the regular cleaning program for the domestic tank is estimated to be about **\$500** per cleaning and should be included in operations and maintenance of these systems.

The cost to adjust the overflow piping is included in the above high risk piping improvement estimate.

An assessment of the actual water demands and detailed evaluation of the existing system capabilities (not including a well yield evaluation) is estimated to be about **\$2,000**.

9.8.3 Priority 3

The costs to increase the domestic storage volume and/or increase the pump capacity are estimated to range from **\$5,000 to \$10,000**.

The cost for a point of entry arsenic removal system is in the order of **\$4,000**.

10.0 BUILDING 1391: HOOTALINQUA FIRE HALL

10.1 Description of Existing Water Supply System

The Hootalinqua Fire Hall is serviced by a water supply system that delivers water from a 156 m deep well with static water level of approximately 30 m below grade. A site plan is included as Figure 1391-A in Appendix A10. The well was drilled in 2002 by Cathaway Resources using a cable tool drill rig and is equipped with a surface seal to prevent contamination from surface sources. The wellhead is located in a pit that is approximately 14 m away from the fire hall. The coordinates of the wellhead, as measured by a handheld GPS device, are:

- UTM ZONE 8
- Northing: 6747128
- Easting: 489242

From the wellhead, the water system splits to service the two water storage tanks for fire fighting use, and to service the domestic water supply for the fire hall. There is no treatment in the system for water delivered to the water storage tanks, but to reduce biofouling, chlorine “pool pucks” are added directly to the water tanks. The domestic system is equipped with a sand trap and an inline 5-micron filter, but there is no disinfection system anywhere on the domestic system. A system schematic is provided as Figure 1391-B in Appendix A10.

10.2 Description of Existing Wastewater Systems

The septic tank for the Hootalinqua Fire Hall is located on the east side (opposite the well) of the fire hall, approximately 36 m from the wellhead. The septic tank discharges effluent to a field located to the east of the tank. The septic tank and effluent field are at approximately the same surface elevation as the ground surface at the wellhead; however they are likely both downgradient from the wellhead based on the inferred hydrogeology.

10.3 Water Quality Results

10.3.1 Water Quality Results from Previous Sampling

Bacteriological

Contractors for the Property Management Agency have routinely completed bacteriological sampling of water from the Hootalinqua Fire Hall water systems. EBA was provided access to the YTG database in order to review the results. Eighteen samples were tested from this system between October 2004 and March 2006, using the presence/absence test method or Total Coliform and *E. coli* by Yukon Environmental Health Services. Results are tabulated in Table 1391-1 in Appendix A10.

According to the YTG database, *E. coli* bacteria was reported as absent in each of the eighteen samples for which results were provided. However, Total Coliform was reported as present three times. Results were negative for the most recent sampling event.

Detailed Potability Analyses

A water sample was previously collected from the Hootalinqua Fire Hall water system on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 1391-2 and are included in Appendix B. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was sodium-sulphate bicarbonate type water with moderate hardness and a pH of approximately 8.
- At 0.556 mg/L, the iron concentration exceeded the CDWQG aesthetic limit of 0.3 mg/L.
- Turbidity for the sample obtained on October 5, 2004 also exceeded the CDWQG MAC of 1 NTU. Results of a follow-up sampling event on June 26th 2005 reported turbidity at 2.6 NTU, which was also above the applicable MAC.
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed.

10.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Hootalinqua Fire Hall that was identified to be included during the water system assessments is detailed below:

- Since the total iron concentration had previously exceeded the CDWQG, an analysis for dissolved metals was recommended in order to assist in determining potential treatment or rehabilitation measures.
- UV absorbance was included to determine potential for UV treatment as a disinfection option.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 19, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for dissolved metals analysis, as well as UV absorbance. These results are summarized in Table 1391-2 in Appendix A10 and the laboratory reports are included in Appendix B.

The additional analysis indicated that the dissolved iron concentration in the sample collected on May 19, 2005 was less than 0.030 mg/L, which, is much less than the current CDWQG aesthetic objectives of 0.03 mg/L. Therefore, the concentration found for total iron of 0.556 mg/L from previous testing can likely be attributed to suspended iron particles in the water. Well rehabilitation through additional well development, and/or additional filtration to remove iron associated with suspended particles would likely be a good measure to meet CDWQG aesthetic objectives.

10.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 4th 2004 is low and can be considered to be within the normal background ranges for groundwater in the Whitehorse area. Nitrate and nitrite concentrations for this sample are also low and within the normal background range for the Whitehorse area. Therefore, these water quality results do not suggest that the aquifer from which the groundwater is obtained for the Hootalinqua Fire Hall is under the influence of surfacewater sources or septic wastes.

The sample collected on May 19th, 2005 was also submitted for Polycyclic Aromatic Hydrocarbon (PAH) and extractable petroleum hydrocarbon analysis (EPH). Results were below analytical detection for all parameters analyzed.

10.4 Conceptual Hydrogeology

The aquifer in which well 1391 is completed is deep and confined under several sequences of silt and till. The aquifer is therefore considered to be well protected from surface sources of contamination so long as the well itself does not provide a pathway. Based on topography and proximity to surfacewater features, the groundwater flow direction is inferred to be in a northeasterly direction towards the Yukon River. The well at Hootalinqua Fire Hall is well protected from potential sources of contamination.

Pacific Hydrology Consultants Ltd. (PHCL) completed a 24-hour pump test of the well in September 2003. PCHL reports that the theoretical capacity of the well is greater than the test-pumping rate of 1.44 Lps (19 Igpm). The practical capacity of the Hootalinqua Fire hall well is limited by the size of pump that can be obtained to pump from the 150 mm casing. PCHL reported that the aquifer transmissivity is low at 4 to 8 m²/day.

A 200 mm casing was advanced for the first 140 m, and then 150 mm casing was advanced to approximately 160 m. The 150 mm casing extends to surface within the 200 mm casing. Apparently a steel plate is welded over the annulus between the two casings; however, there is no mention of a grout seal between the casings, nor is there mention of a 2 thick grout or bentonite sanitary seal outside of the 200 mm casing. Therefore, by definition of the draft Part III Small Water System Guidelines, the well should be considered to be under the direct influence of surfacewater even though it is extremely deep. Therefore, disinfection is required.

10.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1391-4 in Appendix A10. Photos of potential contaminant sources are also provided in Appendix A10.

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

- o Above ground fuel storage tank at 24m.

It should be noted that the above ground storage tank at the Hootalinqua Fire Hall has had the concrete supports oriented with respect to the supports on the tank that would make it susceptible to being knocked off the concrete supports in the event of contact with a vehicle, or an earthquake. This could potentially result in a piping to break or leak and cause a significant hydrocarbon spill.

With the exception of the above-mentioned AST, there were no other potential contaminant sources identified within 30 m of the wellhead. All parts of the sanitary sewer (discharge pipe, tank and absorption field) are greater than 30 m from the wellhead, downgradient from the well, and the hydrogeological conditions indicated a low risk of impact of the water source.

10.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events or contaminated sites on or near the property.

It was noted during our site inspection, by two different sources, that there had previously been a hydrocarbon spill resulting from a leak at the union for the transfer pipe in 2005 during the winter months. The UST is approximately 27 m from the well. The volume of fuel spilled is unknown, and it was unclear if the spill had not been properly cleaned up. Given the depth of the well, and the horizontal separation distance, it was considered unlikely that hydrocarbons from this spill would have impacted on deep groundwater quality. Nonetheless, hydrocarbon parameters (PAH and EPH) were included in the additional analytical testing. A noticeable diesel odour in the vicinity of the AST was obvious at the time of the assessment.

EBA included hydrocarbon parameters in the additional water sampling program during this assessment. Extractable petroleum hydrocarbons and Polycyclic Aromatic Hydrocarbons were not detected in the sample analyzed. Additional investigation into the hydrocarbon concentrations in soil in the vicinity of the spill may be warranted.

10.6 Identified Water System Deficiencies and Associated Risk

10.6.1 High and Medium Risk Deficiencies

The following high and medium risk deficiencies were identified for the Hootalinqua Fire Hall water supply system:

- Turbidity exceeds 1 NTU, the MAC for turbidity for a public water supply within the CDWQG.
- The water system does not have disinfection treatment. This could be downgraded to a lower risk depending on the follow-up sampling results for turbidity, bacteriological analyses and the upgrade of well completion.
- The wellhead is completed in a pit, which is not considered acceptable according to the Guidelines for Water Well Construction. Well casings must extend at least 500 mm above the ground surface. This is only a medium risk deficiency because the well has a double casing, and is reported to have a steel plate welded over the annulus at surface and the well is very deep. At the time of the upgrade, a bentonite grout seal should be installed between the 150 mm and 200 mm casings, and a surface seal retrofitted in the upper 2 m of the well. It was noted during the field assessment and field chemistry testing that a gaseous substance (likely carbon dioxide) was off gassing from the water when it was exposed to the atmosphere. Off gassing of CO₂ could potentially cause a risk of oxygen depletion in the well pit vault. All well pits should be considered as confined spaces, and the necessary precautions taken during wellhead upgrades.
- Based on anecdotal information, the well and/or the pumping system may not be sufficient to meet the peak demand flow. This would be a concern if the storage for fire fighting had been depleted, and the system was incapable of replenishing the fire supply at a sufficient rate.

10.6.2 Low Risk Deficiencies

The following low-risk deficiencies were identified for the Hootalinqua Fire Hall water supply system:

- Fire truck fill tanks do not appear to be cleaned regularly;
- High iron concentration in water source.
- Wellhead protection could be improved.
- AST fuel tank is within 30 m of well.

10.7 Mitigative Options for Deficiencies

Mitigative options were developed to address the deficiencies identified in the previous section. Deficiencies are prioritized by risk in the following sections.

10.7.1 Priority 1

- A commercial sized NSF 61 certified filter system should be installed prior to the split for the fire protection and domestic sides of the water system to decrease turbidity. A second filter canister filter (1 micron absolute) could then be installed on the domestic side. These are conceptual design recommendations based on the information available for the purpose of planning and budgeting. Engineering input will be required for final system specifications.

10.7.2 Priority 2

The wellhead completion should be improved to decrease the susceptibility to surface contamination. This would involve welding an extension onto the existing casing to bring the well casing to a minimum of 500 mm above ground level. Two options are provided below:

- Option 1: An above grade completion with a culvert, blown in foam insulation, bentonite surface seal (above the existing surface seal) and a fiberglass cover.
- Option 2: Pitless unit with vented locking lid, and bentonite surface seal above the existing surface seal.
- For both options, the following upgrades should also be completed:
 - The annulus between the 150 mm and 200 mm casing should be sealed with a grout or bentonite grout mixture for either of the above options.
 - When work on the wellhead is conducted, the well should be re-developed, cleaned and shock chlorinated. Mechanical agitation during chemical cleaning will assist in reaching anaerobic zones within the aquifer. This would likely result in improved well quality and yield.
 - Depending upon the success of the redevelopment and cleaning, further investigation of the reported water quantity problems under peak demand may need to be evaluated. This would involve assessment of the actual demand versus the capabilities of the existing system. Modifications to the pump and/or tank sizes should be made as required, provided the well is capable of supplying water at the increased rate. The sustainable well yield may also have to be re-assessed.
 - Adequate disinfection/treatment should be installed.

10.7.3 Priority 3

- The fire truck fill tanks should be cleaned on a regular schedule; every 12 months is likely sufficient. Include this as a routine operation and maintenance task.
- In order to control iron concentrations and aesthetic water quality, the well should be shock chlorinated every 6 months. Include this as routine operation and maintenance task.
- Consideration should be given to placing a fence around the well to prevent access for animals and people.
- The AST should be moved to the northeast corner of the fire hall so that it is greater than 30 m away from the well. Concrete supports should be perpendicular to the bottom of the tank supports.
- Consideration should be given to reducing the level of iron and colour within the system. A softening system is likely to be sufficient to remove iron and reduce colour (if caused by iron oxidation). However, sodium levels in the raw water are already high and the softening system would increase these levels. An option is to provide a separate potable water system that would blend the soft water with the raw water to keep sodium levels at reasonable levels.

10.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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 cost to install a commercial inline filter system capable of reducing turbidity to less than 1 NTU is **\$2500**.

10.8.2 Priority 2

- The cost for the recommended wellhead improvements is estimated to be about **\$4,000** for the above grade sanitary completion (option 1) or **\$5,000** for the pitless unit (option 2).

- It is estimated that installation of a grout seal between the casings would cost approximately **\$500**. This cost should be added to either option.
- Plumbing system effectiveness assessment is estimated at approximately **\$500**, and if a pump test is required, it is estimated at **\$2,000** assuming that the existing pump can be used for the test.
- Well redevelopment and chemical cleaning if required is estimated at **\$7000**.
- NSF/ANSI 55 certified UV and chlorination could both be considered for the disinfection system. A suitable UV system would cost approximately \$2500 installed, while proportional chlorination would cost in the order of \$7000 with retention tanks.

10.8.3 Priority 3

- The estimated cost to install a chain link fence around the wellhead is approximately **\$500**.
- The estimated cost for the relocation of the AST and associated relocation of transfer pipe is **\$1000**.
- It is estimated that the softener and necessary plumbing to blend the water would cost **\$4,000** installed.

11.0 BUILDING 1421: MENDENHALL FIRE HALL

11.1 Description of Existing Water Supply System

Building 1421, the Mendenhall Fire Hall, is currently serviced by a water supply system that delivers water from an approximately 43 m deep well (depth of well is anecdotal). The wellhead is located in a well house adjacent to the fire hall as indicated on Figure 1421-A. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6736960
- Easting: 436161

A site plan is provided as Figure 1421-A in Appendix A11.

Water from the well is delivered to an 8000 L storage tank located in the well house. From the initial storage tank the water is then pumped to a water fill station attached to the well house for use of local residents, a pressure tank inside the fire hall for domestic use, and two 5000 L storage tanks for fire fighting use. There is no treatment or disinfection system anywhere on the water supply system.

Field notes and a system schematic, shown by Figure 1421-B, are located in Appendix A11.

11.2 Description of Existing Wastewater Systems

The septic tank for the Mendenhall Fire Hall is located on the south side (opposite the well) of the fire hall, approximately 50 m from the wellhead. The septic tank discharges effluent to a field located south of the tank. The septic tank and effluent field are both located downslope from the well.

11.3 Water Quality Results

11.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Mendenhall Fire Hall water system has previously been completed under a YTG contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Two samples were collected from this system in 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1421-1.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the two samples for which results were provided. Results of bacteriological testing on three occasions (Jan 10, 2004, July 7, 2003, Feb. 25, 2003) are also posted on the wall in the water fill station. Each of these samples did not have *E.Coli* nor Total Coliform present.

Detailed Potability Analyses

There were no water sample results available for review for this system prior to the system assessment. There is no treatment of any kind on the water system; decisions on additional analytical were made with this information in mind.

11.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Mendenhall Fire Hall that was included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Since there were no previous detailed potability results available for review, the Drinking Water Package was recommended. This analysis will aid in identifying the areas that will need to be given special attention with regards to further analysis and recommendations for a treatment system.
- Ammonia was also included.

-
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature, as well as residual chlorine have been completed at the time of sampling for all systems.

Additional Analytical Results

Water samples were obtained during the water system assessment on May 10, 2005, and were submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance, detailed potability, and an ammonia concentration analysis. These results are summarized in Table 1421-2 in Appendix A11 and the laboratory reports are included in Appendix B.

- The raw water quality for the sample obtained on May 10, 2005 indicated that the groundwater source was calcium bicarbonate type with very high hardness and a pH of approximately 8.
- At 0.0554 mg/L, the total uranium concentration exceeded the maximum acceptable concentration (MAC) of 0.02 mg/L.
- At 0.757 mg/L, the total iron concentration exceeded the Canadian Drinking Water Quality Guidelines (CDWQG) aesthetic objective of 0.3 mg/L.
- The water quality results indicated with the exception of uranium and turbidity, which exceeded the respective maximum acceptable concentrations (MAC) established within the CDWQG, all other tested parameters were below their respective CDWQG MACs.
- For all parameters analyzed, with the exception of iron, the aesthetic objectives set out in the CDWQG were met.
- The hardness (as CaCO_3) was reported to be 259 mg/L, may be considered poor for aesthetic purposes.

Upon receiving the water quality results, EBA notified Tom Renwick of the YTG Property Management Agency of the uranium exceedence. Tom Renwick then notified the YTG Environmental Health and Social Services (EHSS) Department of the exceedence. EHSS checked their records, and previous analytical testing completed on this system had similar uranium concentrations. Follow-up routine sampling completed by YTG PMA on June 15th 2005 confirmed the elevated iron, uranium and turbidity. It is our understanding that the Fire hall, and Mendenhall community members who utilize this well for drinking water have been notified by EHSS who have issued an advisory and held public consultation. The water source at present is not be used for a drinking water source.

11.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration (4.69 mg/L) in the sample obtained on May 10, 2005 is relatively low and can be considered to be within the normal background ranges for groundwater in the area. Nitrate, nitrite, and ammonia concentrations for this sample are also relatively low and considered to be within the normal background range for the area. Therefore, these water quality results do not suggest that the aquifer from which the groundwater is obtained for Well 1421 is under the influence of surfacewater sources or septic wastes.

11.4 Conceptual Hydrogeology

The well log for this well has not yet been located. Well logs for four other wells within 1 km of the site; however, were available. The static water levels reported at the time of drilling were consistently greater than 15 m. The lithology of the area generally consists of sand, silt, gravel and cobbles overlying bedrock. The depth to bedrock varies from 3 m below grade to 30 m below grade. All wells drilled below 30 m in depth were completed in bedrock, and it is considered highly probable that Well 1421 is also completed in bedrock. There is insufficient information to establish a definite groundwater flow direction in this area; however, based on topography, and proximity to surfacewater, it is inferred that the groundwater flow direction is likely south or east. The depth of the wells in this area, and the deep sequence of overburden deposits over the bedrock decrease the vulnerability of the bedrock aquifer to surface sources of contamination.

11.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1421-4 in Appendix A11. Photos of potential contaminant sources are also provided in Appendix A11.

Potential contaminant sources within 30 m of the wellhead included:

- Distance to ASTs: 1 m and 20 m.

11.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events, nor contaminated sites for this site or neighbouring sites.

11.6 Identified Water System Deficiencies and Associated Risk

11.6.1 High and Medium Risk Deficiencies

- Elevated uranium concentrations above CDWQG maximum acceptable concentration for drinking water;
- Elevated turbidity above 1 NTU;
- Lack of disinfection for a well that serves as a drinking water pick-up station and is accessible to the public, does not likely have a surface seal to 6 m below grade, and is less than 30 m from a part of the sewage system;
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.
- Poor storage tank design for the potable water within the pumphouse makes it inaccessible for cleaning, and the tank has likely never been cleaned which could lead to deterioration of water quality; and
- Above ground heating oil tank is within 2 m of the wellhead, and overfilling, spills or leaks could compromise the safety of the water supply.

11.6.2 Low Risk Deficiencies

Two other potential sources of contamination are within 30 m of the wellhead.

- The rock pit is approximately 30 m from the wellhead; however, given the distance, and depth of the well, it is not likely a significant concern.
- A double walled above ground storage 4500 L above ground storage tank is located approximately 20 m away from the wellhead on the other side of the Fire hall, and in a downslope direction. The tank has a Kam lock fitting for filling, and a small overflow container. Given the tank design, and the depth of the well, it is not likely a significant concern.

11.7 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).

11.7.1 Priority 1

- Install a point of entry (POE) treatment system for uranium removal. It is recommended that a suitable POE system be designed through small scale pilot testing, and that the system be installed in advance of the potable water storage tank. Uranium removal to below the CDWQG is necessary to utilize this water source as a drinking water supply.
- It is recommended that a commercially sized 1-micron NSF 61 certified filtration system (to reduce turbidity below 1 NTU, and prevent passage of protozoa) and a chlorine disinfection system be installed at the POE. The system should be equipped with a suitable digital dosing chlorine injection pump with spill containment deck and appurtenances.
- The 2000 US gal polyethylene tank should be dismantled and removed from the building and replaced with a sectional tank that can meet the demand of the fire hall and water pick-up station. It is anticipated that the tank could be replaced with a 1250 US gal tank of suitable design for potable water storage and with an accessible cleaning port. Once the tank is replaced, it is recommended that a regular cleaning program (every 6 months) be initiated.
- The above ground heating oil tank that is immediately adjacent to the pumphouse should be relocated. At the time of the assessment, it was noted that the pumphouse is equipped with an electric baseboard heater. The AST may not be in use, nonetheless, it should be relocated to a distance at least 30 m from the wellhead, and built on a platform with containment capacity.

These are conceptual design recommendations based on the information available for the purpose of planning and budgeting. Engineering input will be required for final system specifications.

11.7.2 Priority 2

No medium risk deficiencies were identified.

11.7.3 Priority 3

With approval of YTG Environmental Health, it is considered likely that for the reasons stated above, the set back distances to these two existing potential contaminant sources (rock pit and double walled AST) could be relaxed.

11.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

11.8.1 Priority 1

- A point of entry (POE) treatment system for uranium removal is anticipated to cost in the order of **\$5000** for materials and labour.
- The filtration system would cost approximately **\$ 2500**.
- A chlorine injection system is estimated at **\$5000** for materials and labour.
- The cost to remove and replace the existing water storage tank with a suitable tank is estimated to cost approximately **\$4000** including parts and labour.
- Relocation of the above ground storage tank costs are negligible assuming that the tank is no longer needed. Allow **\$100** for disposal.

An additional 20% engineering and project management fee should be included, and a 20% contingency for budgetary purposes is suggested.

11.8.2 Priority 2

No medium risk deficiencies were identified.

11.8.3 Priority 3

Assuming that EHSS relaxes the setback distances for these potential contaminant sources in consideration of the hydrogeological conditions and the fact that the rock pit is 30 m and downslope from the well, and the UST has secondary containment and other anti spill devices, there would be no cost associated with these deficiencies.

12.0 BUILDING 1924 GOLDEN HORN FIRE HALL

12.1 Description of Existing Water Supply System

Building 1924, the Golden Horn Fire Hall, is currently serviced with a water supply system connected to a well. A site plan is included as Figure 1924-A in Appendix A12. The wellhead is located in an above ground tin enclosure that is 2 m away from the fire hall. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6718089
- Easting: 506919

Water from the well supplies a pressure tank and the domestic system, and also provides water to a large water storage tank that services both the fire fighting equipment and domestic usage within the fire hall. There is no treatment or disinfection system anywhere on the water supply system. A system schematic is shown by Figure 1924-2 and is located in Appendix A12.

12.2 Description of Existing Wastewater Systems

The septic tank for the Golden Horn Fire Hall is located on the northwest side (well is on the northeast side) of the fire hall. The location of the wastewater system is shown in a site plan is included as Figure 1924-A in Appendix A12. The septic tank is approximately 19 m from the well and it discharges effluent to a field located on the northwest side of the tank that is within 40 m of the wellhead. The sewage discharge pipe that exits the building and runs to the septic tank is estimated to be approximately 20 m from the well.

12.3 Water Quality Results

12.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Golden Horn Fire hall water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG

database in order to review the results of this previous bacteriological sampling. Seven samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1924-1 in Appendix A12. According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the six samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Golden Horn Fire Hall water system on October 24, 2004. The sample was collected from the kitchen tap. There is no treatment or disinfection on the water system, and so the water sample is considered to be representative of raw groundwater quality. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 1924-2 and are included in Appendix A12. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The raw water quality for the sample obtained on October 24, 2004 indicated that the groundwater source was magnesium-bicarbonate type with a pH of approximately 8.2 and very high hardness (348 mg/L as CaCO₃).
- At 0.0345 mg/L, the arsenic concentration for the sample obtained on October 24 exceeded the Canadian Drinking Water Quality Guideline (CDWQG) maximum acceptable concentration (MAC) of 0.025 mg/L. A sample collected on June 25th, 2005 also had arsenic concentrations above the MAC. It is anticipated that the maximum allowable concentration of arsenic will soon be lowered to 0.005 mg/L.
- For the sample obtained on June 25th, 2005, the turbidity at 1.21 mg/L was higher than the MAC of 1 mg/L.
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed. The elevated hardness is considered to be generally poor for aesthetic purposes.

12.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Golden Horn Fire Hall that was identified to be included during the water system assessments is detailed below:

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- Since the total arsenic concentration had previously exceeded the MAC, an analysis for both total and dissolved arsenic was recommended in order to assist in determining potential treatment or rehabilitation measures.
 - UV absorbance, to determine potential for UV treatment as a disinfection option.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for total and dissolved arsenic, as well as UV absorbance. These results are summarized in Table 1924-2 in Appendix A12 and the laboratory reports are included in Appendix B.

The additional analysis indicated that the total arsenic concentration in the sample collected on May 10 was 0.0207 mg/L, which is less than the current CDWQG MAC, however, it is greater than the proposed MAC of 0.005 mg/L. The dissolved arsenic concentration for this sample was 0.0185 mg/L. Although this value is also lower than the current guidelines for arsenic in drinking water, it is greater than the proposed future guideline. The significance of the dissolved concentration relative to the total arsenic concentration is that the arsenic cannot be attributed to suspended particles. Therefore, well rehabilitation to decrease turbidity, and/or filtration to remove arsenic associated with suspended particles would not be sufficient to meet the future Health Canada guidelines.

The sample obtained on June 25th, 2006 had arsenic concentrations above the MAC.

12.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 4th 2004 was low and can be considered to be within the normal background ranges for groundwater in the Whitehorse area. Nitrate and nitrite concentrations for this sample were also low and within the normal background range for the Whitehorse area. Therefore, these water quality results do not suggest that the aquifer from which the groundwater is obtained for the Golden Horn Fire Hall is under the influence of surfacewater sources or septic wastes.

12.4 Conceptual Hydrogeology

The water well record indicates that it is a 33 m deep bedrock well underlying silt and clay. The aquifer is well protected from surface sources of contamination because of the thick sequence of silt and clay overlying the bedrock. The inferred groundwater flow direction based on topography and proximity to surfacewater sources is northeast or easterly direction towards the Yukon River.

12.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1924-4 in Appendix A12. Photos of potential contaminant sources are also provided in Appendix A12.

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

- Above ground fuel storage tank at 22 m.

12.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events, nor contaminant issues at this site or neighbouring sites.

12.6 Identified Water System Deficiencies and Associated Risk

12.6.1 High and Medium Risk Deficiencies

The following high-risk deficiencies have been observed for the Golden Horn Fire Hall water supply system:

- The arsenic content of the water was above the MAC and proposed MAC for two out of three sampling events.
- There is no locking mechanism on the well enclosure and it is likely accessible to unauthorized persons.
- There is evidence of insects in the well enclosure and it is likely accessible to entrance by animals.
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines) and parts of

the septic system for the fire hall is located within 30 m of the well. It is unclear if the effluent field begins at a distance greater than 30 m.

- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.

12.6.2 Low Risk Deficiencies

- There is an above ground fuel storage tank for the Golden Horn Fire Hall that is located 22 m from the well. Although this is within the 30 m regulation set by the Guidelines for Part III: Small Public Drinking Water Systems, the nature of the ground and a reported low permeability layer of soil above the aquifer makes this a low risk rather than a high risk deficiency.
- It was noted during the system inspection that the well capacity could be inadequate to meet peak water consumption demand of the fire hall.
- The water tank has been subject to biofouling and there was reported to be sediment on the bottom of the tank. There is no routine cleaning schedule for the water storage tank that services both the domestic supply for the building and the overhead fill for fire protection.
- In addition to the above ground fuel storage tank, it was observed during the site investigation that there were jerry cans containing gasoline 10 m away from the wellhead. This suggests that some activities around the wellhead may be unsuitable for proper wellhead protection.

12.7 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).

The arsenic concentrations in this water system have been documented at levels above the CDWQG MAC, and therefore, this well should not be utilized as a potable water supply until upgrades have been completed to reduce the arsenic concentrations to below the MAC. PMA should consult with YTG Environmental Health and Social Services regarding posting of appropriate advisories. A bottled water station should be provided in the interim until this issue is mitigated.

12.7.1 Priority 1

Option 1:

Considering all of the known deficiencies with the current well, and the fact that it may be inadequate to meet the current demand of a fire hall (anecdotal information) it is an option that a new well could be drilled. The new well could be used as the main well and the current well would either be decommissioned or used as a backup well. Drilling a new well may also solve issues with the reported problems with water quantity. Ideally, the new well would have a maximum yield of at least 20 Igpm, and the pump system designed and installed to satisfy this pumping rate. The new well would have to satisfy the following conditions:

- The well must be equipped with a surface seal to 6 m and the casing must be extended above grade and kept in a locked enclosure that is inaccessible to animals and unauthorized personnel;
- The well must be located at a distance greater than 30 m from any potential source of contamination, including the above ground storage tank;
- If the new well still has arsenic content above the current or the proposed CDWQG guidelines, then a point of entry (POE) treatment system for arsenic removal should be installed. It is recommended that a suitable POE system be designed through small scale pilot testing, and that the system be installed in advance of the potable water storage tank. Arsenic removal to below the proposed new CDWQG guideline will be necessary to utilize this water source as a drinking water supply.

Option 2:

If it is decided that a new well will not be drilled to supply water for this system, then the following upgrades are recommended to mitigate risk:

- A surface seal to 3 m below ground level should be installed around the well casing;
- A point of entry (POE) treatment system for arsenic removal should be installed. It is recommended that a suitable POE system be designed through small scale pilot testing, and that the system be installed in advance of the potable water storage tank. Arsenic removal to below the proposed new CDWQG guideline will be necessary to utilize this water source as a drinking water supply;
- The wellhead enclosure should be upgraded with a lock and revamped to prevent access by animals and by unauthorized personnel.
- It is recommended that a NSF 61 certified commercial filtration system (10 micron and 1 micron absolute) followed by a chlorine disinfection system or NSF/ANSI 55 certified UV disinfection system be installed at the POE.

These are conceptual design recommendations based on the information available for the purpose of planning and budgeting. Engineering input will be required for final system specifications. If a new well were located in consideration of potential contaminant sources, and constructed properly, the filtration system might not be necessary according to the proposed guidelines. Disinfection is still recommended, however, for a publicly accessible water system. Further study would have to be done on the new well before recommendations on treatment could be made.

12.7.2 Priority 2

- The above ground storage tank should be moved so that it is no longer within 30 m of the well; alternatively, secondary containment and flexible hosing could be installed to mitigate risk of leaking, overfilling or rupture of transfer piping.

12.7.3 Priority 3

- If a back-up well is not drilled, further investigation of the reported water quantity problems under peak demand should be evaluated. This would involve assessment of the actual demand versus the capabilities of the existing system. Modifications to the pump and/or tank sizes should be made as required, provided the well is capable of supplying water at the increased rate. The sustainable well yield may also have to be assessed.
- Fire hall personnel should also be instructed to store potential contaminants such as jerry cans a safe distance away from the well. A fence should also be placed around the well to prevent access for animals and people.
- A regular cleaning schedule for the water storage tank would effectively eliminate significant biofouling in the water storage tanks. It is recommended that the storage tanks be properly cleaned and disinfected every 6 months.

12.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

12.8.1 Priority 1

- Posting appropriate advisories and providing a bottled water station is expected to cost in the order of **\$500**.
- A point of entry (POE) treatment system for arsenic removal is anticipated to cost in the order of **\$5000** for materials and labour.
- The filtration system is expected to cost in the order of **\$3,000** for materials and labour. Filtration may not be necessary if a new well were drilled and constructed properly (pending water quality results).
- A suitable disinfection system would cost between **\$4,000** and **\$9,500**.

Option 1:

- If a new well is to be installed with a proper surface seal and wellhead enclosure, assuming overburden to 30 m and a total depth of approximately 200 m, would likely cost in the order of **\$35,000** this includes the cost of materials and labour, as well as decommissioning the old well;

Option 2:

- If a new well will not be installed, the cost to complete standard upgrades (sanitary seal, well enclosure, freeze protection, and re-plumbing and electrical) would cost approximately **\$4000** to **\$5000** depending on the preferred option.

12.8.2 Priority 2

- The cost to relocate the above ground fuel storage tank, or to retrofit it with secondary containment and flex hose would be approximately **\$1,000** for materials and labour.

12.8.3 Priority 3

An assessment of the actual water demands and detailed evaluation of the existing system capabilities (not including a well yield evaluation) is estimated to be about **\$2,000**.

13.0 BUILDING 1950: IBEX FIRE HALL

13.1 Description of Existing Water Supply System

Building 1950, Ibex Valley Fire Hall, is currently supplied by a well that is approximately 11.8 m deep. A site plan is included as Figure 1950-A in Appendix A13. The wellhead is located in a pit approximately 12 m away from the fire hall. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6742155
- Easting: 483119

The water system from the well splits to supply both a pressure tank for domestic use in the fire hall and a 5000 L water storage tank that services the fire fighting equipment. There is an outside tap located at the front of the fire hall that can be used by the public for water pick-up. There is no treatment or disinfection system anywhere on the water supply system. A system schematic is provided in Appendix A13 - Figure 1950-2.

13.2 Description of Existing Wastewater Systems

The septic tank for the Ibex Valley Fire Hall is located south of the fire hall, approximately 30 m from the wellhead. A site plan is included as Figure 1950-A in Appendix A13. The septic tank discharges effluent to a field located south of the tank. The septic tank and effluent field are located downslope from the well. The sewer discharge pipe that runs to the septic system is located approximately 28 m from the well.

13.3 Water Quality Results

13.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Ibex Valley Fire Hall water system has previously been completed on a number of occasions by various consultants under contract to the Property Management Agency. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Eighteen samples were collected from this system between October 2004 and February 2006 and were tested

for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1950-1 in Appendix A13.

According to the YTG database, *E. coli* bacteria was reported as absent in each of the eighteen samples for which results were provided. Tests for Total Coliform bacteria had two positive results. The most recent sampling event (February 28th, 2006) was negative for the presence of total coliform bacteria.

Detailed Potability Analyses

A water sample was previously collected from the Ibex Valley Fire Hall water system on October 5, 2004. The sample was collected from the washroom sink; however, there is no treatment or disinfection, and so the water sample is considered to be representative of raw groundwater quality. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 1950-2 and are included in Appendix A13. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was calcium-bicarbonate type water with very high hardness and a pH of approximately 8.
- Although the nitrate concentration of 1.5 mg/L did not exceed the CDWQG maximum acceptable concentration (MAC) of 10 mg/L, the results were generally higher than normal.
- At 52 mg/L, chloride concentrations for the sample result provided were also in excess of background concentrations expected for the area.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 265 mg/L, is generally poor for aesthetic purposes.

13.3.2 Identification of Additional Analytical Testing Required

Additional parameters for testing from the Ibex Valley Fire Hall that were identified to be included during the water system assessments are detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.

- Detailed potability analyses were recommended for this site. This analysis includes identifying the physical characteristics of the water and determining the total major metals concentrations and dissolved anions contained in the drinking water.
- Ammonia was recommended for this site as previous testing has indicated elevated nitrate and chloride concentrations.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of sampling.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and an additional sample was obtained on May 19, 2005. Samples were submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance, ammonia, and detailed potability analyses. Analytical results are summarized in Table 1950-2 in Appendix A13 and the laboratory reports are included in Appendix B. Significant results are provided below:

- At 4.92 NTU, turbidity exceeded the CDWQG MAC of 1 NTU. Turbidity is typically considered to be a potential health concern if it is consistently above 1 NTU.
- The total iron concentration in the sample collected on May 19, 2005 was 0.852 mg/L, which is elevated from the previous sampling done in October 2005, and greater than the current CDWQG aesthetic objectives (AO) of 0.3 mg/L.

13.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The concentrations of nitrate and chloride in the water, 1.5 mg/L and 52 mg/L, respectively, in October 2004, had been significantly reduced. Nitrate levels were below the detection limits, and chloride levels had been reduced to 1.67 mg/L. These significant changes in the concentrations of nutrients in the water signifies that there are seasonal fluctuations in water quality, which offers evidence that the groundwater may be under the direct influence of surfacewater or is being seasonally impacted by an anthropogenic source of nutrients.

Elevated nitrate and chloride could also indicate that the septic system may be altering water quality within the shallow aquifer.

It is worthy of note that the Alaska Highway is approximately 70 m upslope of the well, and road salt or calcium chloride is used on the highway to prevent road icing in winter. It is also possible that this is impacting the groundwater quality of the aquifer in which this shallow well is completed.

13.4 Conceptual Hydrogeology

There is no well log for this well; however, the well is shallow and is likely in an unconfined aquifer. Groundwater quality suggests that the shallow aquifer may be under the direct influence of surfacewater. The groundwater flow direction can not be determined at this time, and is difficult to infer based on the information available.

13.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1950-4 in Appendix A13. Photos of potential contaminant sources are also provided in Appendix A13. A summary of potential contaminant sources within 30 m of the wells is provided below:

- Sewer line to septic tank 28 m (however, this is in compliance with the minimum 15 m set-back required by regulation).

13.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events or contaminant issues for this site or neighbouring sites.

13.6 Identified Water System Deficiencies and Associated Risk

13.6.1 High and Medium Risk Deficiencies

Site investigations and system inspections of the Ibex Valley Fire Hall water system found the following high and medium risk deficiencies:

- Chloride and nitrate concentrations have been observed to be variable and may indicate that the well is under direct influence of surfacewater and/or may be impacted by septic effluent. Furthermore, by definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface

water because it does not meet the requirements of the Guidelines for Water Well Construction.

- The water system is not equipped with a disinfection treatment system.
- It was observed that the split seal gasket well cap does not form a proper seal around the heat trace and electrical wiring.
- There was evidence in the well enclosure of rodent droppings and insects.
- There is no locking mechanism on the well enclosure and it could be accessible to unauthorized personnel.
- It appears that the outside hose bib is used as public water fill, and given the current well construction, lack of disinfection and indicators of potential surfacewater and/or septic impact, this could potentially become a liability.

13.6.2 Low Risk Deficiencies

- The water storage tanks for fire fighting purposes appear not to be cleaned regularly, and there is evidence of biofouling;
- The iron concentration was reported to exceed the CDWQG aesthetic objectives, and the water is very hard.
- There is no backflow prevention on the hose bib line.

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).

13.7.1 Priority 1

Evidence from the water quality samples for this well show that it is under the direct influence of surfacewater, and considering all of the known deficiencies with the current well, it is recommended that a new well should be drilled and the current well be decommissioned. The existing water system should not be used as a source of potable water in its current condition. It is recommended that a new well be installed to meet the following conditions:

- The well should be equipped with a surface seal to at least 6 m and the casing should be extended above grade (500 mm) within a lockable enclosure that is not inaccessible to animals and unauthorized personnel;

-
- The well must be located at a distance greater than 30 m from any potential source of contamination, including the above ground storage tank and all parts of the septic system;
 - The water from the new well must meet all CDWQG health based guidelines. If there are any exceedences in the CDWQG health-based guidelines then a treatment system must be designed and installed as necessary. A disinfection system may be recommended.

A test well was drilled by Double D Drilling of Whitehorse, Yukon under the direction of EBA in December 2005. Test Well 1950-B was drilled using the dual rotary drilling method to a depth of 65.5 m in bedrock. The location of W1950-B is indicated on Figure 1950-A in Appendix 13. The well was constructed in accordance with Canadian Groundwater Association Water Well Construction Guidelines. Possible water bearing fractures were encountered at 43.3 and 63.1 m below ground (m-bg), however significant flows were not encountered during drilling. Drilling was terminated at 65.5 m, which was the maximum depth the contractor was able to achieve with the available drill stem. Results of the Drilling Program are provided in a February 2nd 2006 letter report to PMA “Ibex Valley Fire Hall Test Well Drilling PMA Building #1950”. To enhance the yield of W1950-B, PMA could proceed with either drilling the well deeper or with hydrofracturing of the bedrock formation. Results of well testing and preliminary cost estimates for enhancing the yield of this well are outlined in an EBA letter “*Results of Short Term Pumping and Water Quality Analysis - PMA Building #1950*” dated March 31st, 2006.

13.7.2 Priority 2

- There are no Priority 2 upgrades recommended for this site; all deficiencies are considered to be either Priority 1 or 3.

13.7.3 Priority 3

- To prevent biofouling in the water storage tank, a regular cleaning schedule should be initiated; and,
- A double check valve should be installed on the hose bib line prior to re-plumbing the system.

13.7.4 Recommended Risk Mitigation Approach

- Discuss with Environmental Health and Social Services (EHSS) the best method for preparing notification that the water should not be used as drinking water. Post advisories as directed by EHSS.
- Provide bottled water until such time as the upgrades are completed.

13.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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 test well should be either drilled deeper, or hydrofractured to provide adequate yield to supply the domestic water supply. Estimated costs are provided in the March 31st report for this system. Estimated costs could range from **\$10,400** to **\$14,400**.
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction. It is estimated that this would cost approximately **\$1000**.
- The cost to render the outside hose bib inoperable would be approximately **\$100**;
- A minimum of **\$2500** should be allocated for water treatment.

13.8.2 Priority 3

- The cost of cleaning the tank every six months should fall under normal operation and maintenance costs.
- A double check valve could be installed for approximately **\$400**.

14.0 BUILDING 1953: TAGISH FIRE HALL

14.1 Description of Existing Water Supply System

The well source serving the Tagish Fire hall also provides a community water supply for local residents to obtain potable water. The well is located beside the Tagish Fire hall, which is on the east side of the Taku Subdivision access road. The 168 mm diameter well is reported to be 49.2 m deep and was installed by Midnight Sun Drilling in 1990. The wellhead is located in an above ground PWF wooden enclosure that is approximately 2 m away from the pump house and 27 m away from the fire hall. A site diagram is provided as Figure 1953-1 in Appendix A14. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6681131
- Easting: 538646

Water from the well is chlorinated for disinfection and then further treated to remove excess iron before entering an elevated storage tank in the fire hall. Water for pick-up at the public truck fill station passes directly from the iron removal duplexing unit to the outside hose bib and overhead truck fill. A system schematic is shown by Figure 1953-2 in Appendix A14.

14.2 Description of Existing Wastewater Systems

There is septic tank that discharges effluent to an in-ground disposal field located about 40 m to the east of the well. A site diagram showing the location of the septic system is provided as Figure 1953-1 in Appendix A14. Note that all parts of the sewage system are greater than 30 m from the wellhead.

14.3 Water Quality Results

Bacteriological

Bacteriological sampling of water from the Tagish Fire hall water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Nine samples were collected

from this system between September 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1953-1 in Appendix A14.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the nine samples for which results were provided.

Detailed Potability Analyses

Two water samples were previously collected from the Tagish Fire Hall water system on May 31, 2004 and October 4, 2004. Both samples were submitted to ALS Environmental in Vancouver BC for detailed potability analyses. The results of both these analyses are summarized in Table 1953-2 and are included in Appendix A14.

- The water quality for the samples obtained from both dates indicated that the groundwater source was calcium-bicarbonate type water with very high hardness (263 mg/L and 228 mg/L as CaCO₃ for each respective date).
- At 0.637 mg/L, the iron concentration for the sample obtained on May 31, 2004 exceeded the CDWQG aesthetic objective of 0.3 mg/L. The subsequent sampling event (October 4, 2004) had a much lower iron concentration, so it is expected that the iron softener was not operation at the time that this first sample was collected, or it was collected pre-treatment (raw water sample).
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed. The elevated hardness is considered to be generally poor for aesthetic purposes.

14.3.1 Identification of Additional Analytical Testing Required

Additional analytical for the Tagish Fire Hall that was identified for inclusion during the water system assessment is detailed below:

- Trihalomethane parameters (THM) were analyzed as there is an existing chlorine disinfection system. These include (bromodichloromethane, bromoform, chloroform, dibromochloromethane). THMs and other disinfection by-products are formed when disinfectants such as chlorine reacts with naturally occurring organic matter in the source water. Some studies have linked THMs to increased risk of cancer.
- Haloacetic Acid (HAA) analysis was included as well due to the presence of the chlorination system. Similar to THMs, HAA can be present in chlorinated drinking water as a chlorinated water disinfectant byproduct formed when the chlorine reacts with natural organic matter in raw water supplies.

- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of collecting.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 9, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for THM and HAA analysis. The results are summarized in Table 1953-2 in Appendix A14 and the laboratory reports are included in Appendix B.

At the time of the assessment, the residual chlorine concentration from a sample collected within the Fire hall was found to be 0.02 mg/L. The chlorine injector was also noted to be damaged, and has reportedly since been repaired. The observed residual chlorine concentration is significantly less than the required concentration of 0.2 mg/L at the point of consumption.

Property Management Agency retained EBA to complete a follow-up chlorine monitoring event prior to completion of this final report. Katherine Johnston, E.I.T. of EBA collected samples for residual chlorine testing using a Hach Colorimeter on March 23rd 2006. Samples were obtained from the public fill station, and from two locations within the Fire hall. Residual chlorine was observed to be 0.03 mg/L at the public fill, and 0.0 mg/L at both locations within the Fire Hall. The observed residual chlorine concentrations are significantly less than the required concentration of 0.2 mg/L at the point of consumption within the fire hall, and less than the 0.4 mg/L required for a bulk water fill station.

The additional analysis completed at the time of the assessment indicated that there were detectable concentrations of THMs, specifically bromodichloromethane, which had a concentration of 0.0023 mg/L, and chloroform, which had a concentration of 0.0054 mg/L. These parameters do not have an associated CDWQG; however, there is a MAC for total Trihalomethanes of 0.1 mg/L. The total trihalomethanes concentration for the sample collected on May 9 was 0.0078 mg/L, which is more than 10 times lower than the MAC. It was recommended that THM analysis be completed again in the near future when residual chlorine concentrations are in the normal operational range.

During the follow-up monitoring event completed by EBA in March 2006, the residual chlorine concentrations were observed to be lower than the previous sampling event. As such, THM analyses would not be representative of potential THM formation in this system during proper operation. Therefore, a sample was collected and submitted to ALS Environmental in Vancouver for THM formation potential. In a formation potential test, chlorine is added to the sample at the laboratory, and the sample is allowed to stand for 7

days so that potential chlorination byproducts (if any) would have adequate time to form. The THM formation potential (FP) test indicated that under lab conditions, the source water when subjected to a residual chlorine concentration of 3-5 mg/L had a total trihalomethanes concentration of 0.0147 mg/L, which is significantly less than the CDWQG MAC of 0.1 mg/L.

At 0.002 mg/L, dichloroacetic acid, a HAA was also found at a measurable concentration above the analytical detection limit. There are currently no CDWQG guidelines for HAAs; however, the EPA has set a MCLG (maximum concentration level goal) of zero mg/L for this parameter, and has a maximum concentration level of 0.06 mg/L for the sum of the concentrations of five Haloacetic Acids. Retesting for HAA concentrations at a higher chlorine concentration was also recommended in the draft report. In March 2006, EBA collected additional sample to be analyzed for HAA formation potential. Similar to the THMFP test, the sample was chlorinated and HAA concentrations were tested after 7 days. Similar to previous results, dichloroacetic acid was detected above the laboratory detection limit at 0.0039 mg/L, and total HAA's were below the EPA MCLG of 0.06 mg/L.

14.3.2 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 4, 2004 is low and can be considered to be within the normal background range for groundwater in the Tagish region. Nitrate and nitrite concentrations for this sample are also low and within the normal background range for the area. Therefore, these water quality results do not suggest that the aquifer from which the groundwater is obtained for the Tagish Fire Hall is under the influence of surfacewater sources or septic wastes.

14.4 Conceptual Hydrogeology

The groundwater flow direction in the vicinity of the Tagish Fire Hall is inferred to be in a south to southeasterly direction, towards Tagish Lake. The static groundwater level in the well was indicated to be about 7.6 m below ground at the time of drilling, and the total well depth is approximately 49 m. The well is screened within a coarser sand unit encountered below about 43 m of finer-grained silty sediments.

14.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1953-4 in Appendix A14. Photos of potential contaminant sources are provided in Appendix A14.

14.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events nor contaminant issues for this site or neighbouring sites.

14.6 Identified Water System Deficiencies and Associated Risk

14.6.1 High and Medium Risk Deficiencies

Several high priority deficiencies were identified for the Tagish Fire Hall water supply system including:

- Evidence of mice in the well enclosure;
- Lack of a surface seal around the well casing;
- Inadequate casing stick-up;
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- Lack of backflow prevention on the 50 mm line inside pumphouse;
- Low residual chlorine concentrations observed during both sampling events;
- The need for tank cleaning in Fire hall; and,
- Domestic water for the Fire hall currently comes from the truck fill fire storage tank, which is only used sporadically, and as mentioned previously, is not routinely cleaned.

14.6.2 Low Risk Deficiencies

- Low risk deficiencies identified included the need for the overflow piping to extend outside of the fire hall building.

14.7 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).

14.7.1 Priority 1

To mitigate the high priority deficiencies identified for the Tagish Fire Hall water supply system, the following upgrades are recommended:

- Clean the tank in the fire hall and undertake a regular cleaning program (every 6-12 months).
- Extend the well casing to a minimum of 500 mm above grade;
- Retrofit a surface seal around the well casing extending a minimum of 3 m below grade;
- Adjust site drainage to promote surface runoff away from the well;
- To address the issue of domestic water coming from the fire storage tanks, it is recommended that the solenoid control valve for fire water storage be moved from the pumphouse to the vicinity of the tank, and plumb the domestic water take off upstream of the solenoid valve to feed treated, chlorinated water to the jet pump that supplies potable water to the building. We understand that Community Development plans to move the chlorination system downstream of the iron softener system. This will result in inadequate retention time within the piping system to Fire hall.
- Install a backflow prevention device on the 50 mm line inside the pumphouse; and,
- Initiate a residual chlorine-monitoring program and adjust chlorination system as required to maintain residual chlorine concentration above 0.2 mg/L at the fire hall, and above 4 mg/L at the truck fill.

14.7.2 Priority 3

- To mitigate the low risk deficiencies identified, extend the overflow piping to the outside of the building.
- Technically, a well without a sanitary surface seal to 6 m in depth around the casing is considered by the draft regulations to be under the direct influence of surfacewater and therefore, necessitate filtration for protozoa. Based on the hydrogeological conditions (deep confined aquifer, driven well casing in a tight formation), it is considered that there is very limited risk that this aquifer is under

the direct influence of surfacewater, and hence it has been designated as a low risk in this assessment. It is likely that EHSS will allow some leniency on this definition and subsequent requirement for filtration if a qualified Hydrogeologist can, based on the hydrogeological conditions, support the fact that a well or aquifer is not under the direct influence of groundwater.

14.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

14.8.1 Priority 1

- The cost to upgrade the wellhead completion is estimated to be about **\$5,000**.
- The cost to move the solenoid valve and adjust the plumbing is estimated to be about **\$1000**.
- The cost to install a backflow prevention device is estimated to be about **\$500**.
- The cost to initiate and conduct a residual chlorine-monitoring program should be completed under an operation and maintenance budget.
- The cost to upgrade the chlorination system by adding a 120 US gal retention tank and flow restrictor is estimated at approximately **\$ 1100**.

14.8.2 Priority 3

- The cost to extend the overflow piping to the outside of the building would be about **\$300**.
- The cost to clean the tank in the fire hall and undertake a regular cleaning program (every 6-12 months) is estimated to be about **\$300** per cleaning event, and should be included in regular operation and maintenance.
- In the event that filtration for protozoa is required, it would cost in the order of **\$2500** to install; however, as mentioned previously, if the well is retrofitted with a surface seal, and given that the well is deep, and has been completed through thick sequences of silt and clay, it is likely that EHSS would agree with the opinion of a Hydrogeologist that this well is not under the direct influence of surfacewater. In this case, filtration for protozoa would not be required, and the existing disinfection would be deemed adequate.

15.0 BUILDING 1955: MOUNT LORNE FIRE HALL

15.1 Description of Existing Water Supply System

Building 1955, the Mount Lorne Fire Hall, is currently serviced by a well that is approximately 35 m deep. The wellhead is located in a pit approximately 4.5 m away from the fire hall. A site plan is provided as Figure 1955-A in Appendix A15. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6704424
- Easting: 507749

The water is delivered from the well to a pressure tank and then splits to serve the domestic water supply and two 5000 L water storage tanks for fire fighting use. A system schematic is shown by Figure 1955-B in Appendix A15. There is no treatment or disinfection system installed for this water supply system.

15.2 Description of Existing Wastewater Systems

The septic tank for the Mount Lorne Fire Hall is located south of the fire hall, approximately 30 m from the wellhead. A site plan that shows the position of the septic system relative to the well is provided as Figure 1955-A in Appendix A15. The septic tank discharges effluent to a field located south of the tank. The septic tank and effluent field are located at approximately the same elevation as the well.

15.3 Water Quality Results

15.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Mount Lorne Fire Hall water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Six

samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 1955-1 located in Appendix A15.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the six samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Mount Lorne Fire Hall water system on October 4, 2004. The sample was collected from the kitchen tap; however, there is no treatment or disinfection, and therefore the water sample is considered to be representative of raw groundwater quality. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 1955-2 and included in Appendix A15. EBA reviewed the analytical results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination. Relevant details are provided below:

- The raw water quality for the sample obtained on October 4, 2004 indicated that the groundwater source is calcium bi-carbonate type water with a pH of 8.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃), reported to be 206 mg/L, is considered as poor for aesthetic purposes.

15.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Mount Lorne Fire Hall that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of collecting.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance. These results are summarized in Table 1955-2 (Appendix A15) and the laboratory reports are included in Appendix B.

15.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. Chloride concentrations for the sample obtained on October 4, 2004 were low and are considered to be within the normal background ranges for groundwater in the Whitehorse area. Nitrate and nitrite concentrations for this sample were also low and within the normal background range for the Whitehorse area. Therefore, these water quality results do not suggest that the aquifer from which the groundwater is obtained for the Mount Lorne Fire Hall is under the direct influence of surfacewater sources or septic wastes.

15.4 Conceptual Hydrogeology

According to the driller's well log, the well is completed through approximately 2 m of silt, which is underlain by sand with varying degrees of silt to the depth of completion (35 m). The static water level as recorded on the drillers well log is 18.3 m below grade. Based on the lithology and water level, the aquifer in which the well is completed is inferred to be unconfined. Although unconfined aquifers are more vulnerable to contamination than confined aquifers, the thickness of the unsaturated zone and the presence of the silt layer at surface offers some protection of the aquifer from surface sources of contamination. The local groundwater flow direction is unknown at this time.

15.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 1955-4 in Appendix A15. Photos of potential contaminant sources are provided in Appendix A15.

There is a solid waste transfer station in the vicinity of the Mount Lorne Fire Hall. The perimeter of the solid waste transfer station is located 180 m to the north of the fire hall. Although no actual burying of refuse has recently been done, the solid waste transfer station used to be a burn pit, and then was converted into a landfill before being again converted into a solid waste transfer station. The solid waste transfer station is greater than the minimum 120 m required between any refuse disposal site and water well according to the draft Part III Small Public Drinking Water System Guidelines, but since the solid waste transfer station is potentially upgradient from the well (groundwater flow direction is unknown), the solid waste transfer station still has the potential to pose a risk to the water supply at Mount Lorne Fire Hall.

Government of Yukon's Environment Department generally requires that landfills implement a groundwater-monitoring plan as a condition of their Solid Waste Permit Number. It is our understanding that there are currently no groundwater monitoring wells in the vicinity of the site, and as such a groundwater-monitoring program is not in place. It is recommended that this be discussed with YTG Environment and Community Services Departments to determine who has responsibility to implement such a program.

15.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events or known contaminant issues for this site or neighbouring sites.

15.6 Identified Water System Deficiencies and Associated Risk

15.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being high or medium risk for the Mount Lorne Fire Hall water system:

- The wellhead is located in a pit below grade. The pit is prone to flooding and at the time of inspection the wellhead was no longer visible due to the silt that had built up over the wellhead due to prolonged flooding (over several years) or from the recent snowmelt event. At the time of the assessment, the well would be considered to be under the direct influence of surfacewater. Furthermore, by definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.

- The well is located in an enclosure that is not locked and may be accessible to animals and unauthorized personnel.
- There is no sanitary surface seal between the well casing and the well formation.
- There is no disinfection treatment system for this well.
- The well is in close proximity to a former landfill and active waste transfer station.

15.6.2 Low Risk Deficiencies

The following deficiencies were identified as being low risk for the Mount Lorne Fire Hall water system:

- The overflow from the water storage tank is higher than the tank so that if the tank were to be over-filled the water would spill over inside the building.

15.7 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).

15.7.1 Priority 1

The following Priority 1 upgrades were recommended in the draft report submitted in June 2005:

- The wellhead completion should be improved to prevent potential for surfacewater to travel through the top of the casing, or down the annulus between the casing and the formation. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface seal to 3 m depth around the well casing;
- A proper wellhead enclosure that is inaccessible to animals and unauthorized personnel should be constructed;
- The ground surface should then be graded to promote surface drainage away from the well; and,
- The well and water system should be shock chlorinated.

The Property Management Agency has commissioned Energy North Solutions to carry out the Priority 1 upgrades indicated above. These upgrades are in progress under the direction of EBA at the time that this final report is being completed. A separate report will be produced to provide well upgrade completion details as well as recommendations for the “standard wellhead upgrade” process for future well systems to be refurbished.

Additional Priority 1 Upgrades that are not currently in progress include:

- Because it is not feasible to install a surface seal to 6 m on an existing well the following disinfection system is proposed:
 - o An NSF-61 certified filtration system capable of filtering particles down to 1 micron in diameter should be installed; and,
 - o The adequacy of a chlorination system vs. a UV system should be considered. This is dependent on pre-treatment requirements, and demand. At this time it is assumed that a NSF/ANSI 55 certified UV disinfection system would be adequate, and would not require pre-treatment. This would be determined during pre-design.

15.7.2 Priority 2

- Given the relatively close proximity to the landfill, it is recommended that a drilling program be completed and monitoring wells be installed in the vicinity of the landfill and transfer station to determine groundwater flow direction and to ensure that leachate is not deriving from the former landfill. Similar groundwater monitoring programs are required for many other landfills in Yukon. A minimum of three monitoring wells would be required. PMA should consult with the Community Services and Environment departments of YTG to determine who would be responsible to implement a groundwater-monitoring program. Additional sampling of water from this well was completed on March 8, 2006 by EBA. A sample was collected to analyze for potential indications of contamination from the adjacent landfill. ALS Environmental in Vancouver analyzed the sample for Volatile Organic Chemicals, Polycyclic Aromatic Hydrocarbons and Organochlorine Pesticides. All parameters analyzed were below analytical detection limit, and below all Canadian Drinking Water Quality Guidelines for these chemicals. There were no chemicals identified in the water quality results from this most recent sampling event or the previous sampling that would suggest that there was impact on the water quality from the adjacent landfill at the time of sampling. The results of this sampling program will be reported in a letter report detailing well upgrades.

15.7.3 Priority 3

- The overflow for the water storage tank should be re-piped so that it is below the level of the tank.

15.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs.

Engineering costs for other 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.

15.8.1 Priority 1

- Because this work is being completed with frozen ground conditions, the cost of raising the well casing to at least 500 mm above ground level, installing a surface seal to 3 m or deeper, and building a new wellhead enclosure, would be in the order of **\$9,000** for materials and labour (including grading).
- It is expected that installation of the filtration system would cost in the order of **\$2500** for materials and labour.
- The installation of the UV disinfection system would likely cost in the order of **\$2500** for materials and labour.

15.8.2 Priority 2

A hydrogeological investigation and groundwater-monitoring program would likely cost in the order of **\$15,000** including drilling, installing 3 monitoring wells, testing and reporting.

15.8.3 Priority 3

- To re-pipe the overflow for the water storage tank it would likely cost in the order of **\$1000** for materials and labour.

16.0 YUKON WILDLIFE PRESERVE

16.1 Description of Existing Water Supply System

The Yukon Wildlife Preserve Main Office (building YWP-A) is currently serviced by a water supply system that delivers water from a bedrock well. The wellhead is located in a pit immediately west of the main office. A site plan is provided as Figure YWP-A in Appendix A16. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6749184
- Easting: 481827

In addition to servicing the main office potable water system, there is a hydrant tree at the wellhead prior to the existing softener system that feeds irrigation and animal water tanks. The current wellhead configuration lacked proper freeze protection. The only treatment on the main office water system at the time of the assessment was an iron softener. A system schematic is provided as Figure YWP-A in Appendix A16.

The Yukon Wildlife Preserve Kestrel Cottage (YWP-B) is currently serviced by a water delivery system. Water from a 3000 L water storage tank supplies potable water to the building. A system schematic is provided as Figure YWP-B in Appendix A16. There is no treatment or disinfection system, but the delivered water is chlorinated at the source. Field chemistry with a Hach Colorimeter at the site taken at the time of water sampling indicated that the residual chlorine was at 0.38 mg/L, which is considered adequate according to the proposed regulations.

Additionally, there is an abandoned well located inside the Kestrel Cottage that is no longer in use due to poor water quality. The well is not connected to the existing water system. A site plan is provided as Figure YWP-A in Appendix A16. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6748465
- Easting: 481835

YWP Building C (Phalarope Lodge) has been condemned, does not have an operating water system, and was not investigated.

The Yukon Wildlife Preserve Building D, the Ptarmigan Tower, is currently serviced by a water delivery system. Truck delivered water stored in a 3000 L water storage tank that supplies water to the building. A system schematic is provided as Figure YWP-D in Appendix A16. There is no treatment or disinfection system anywhere on the water system, but since the water is delivered it has been previously chlorinated at the source.

16.2 Description of Existing Wastewater Systems

The septic tank for the Yukon Wildlife Preserve Main Office is located north of the main office building and approximately 20 m northwest from the wellhead. The septic tank discharges effluent to a field located greater than 40 m northwest of the tank. The septic tank and effluent field are located down slope from the well. A site plan showing the septic system is provided as Figure YWP-A in Appendix A16.

The septic tank for the Yukon Wildlife Preserve Kestrel Cottage (staff house) is located northwest of the building and approximately 15 m north of the well that is currently not in use. The septic tank discharges effluent to a field located 15 to 25 m northwest of the wellhead. The septic tank and effluent field are located at approximately the same elevation as the grade elevation at the well. A site plan showing the septic system is provided as Figure YWPB-A in Appendix A16. It was reported that the septic system is malfunctioning and the septic field is likely clogged.

16.3 Water Quality Results

16.3.1 Water Quality Results from Previous Sampling

Bacteriological

The Yukon Government only recently acquired the Yukon Wildlife Preserve, and as such there had not yet been routine testing of the water supply for bacteriological analysis at the time of the assessment. YTG Environmental Health and Social Services (EHSS) had one previous result on file for the main office. On March 2nd, 2005, the water sample submitted was absent of both *E.Coli* and Total Coliform bacteria.

Building B (Kestrel Cottage) and Building D (the Ptarmigan tower) are serviced by water delivery. There were no bacteriological results available for review for the Main office (Building A). Yukon Water Services, the truck delivery company supplying the Kestrel

Cottage and the Ptarmigan Tower, provided a bacteriological result for their most recent test. Results for this sample taken May 31, 2005 indicated that *E.Coli* and Total Coliform were not present on the date sampled.

Prior to finalization of this report, EBA was provided with routine bacteriological test results from June 2005 to February 2006. Reportedly, *E.Coli* and total coliform bacteria were present in a sample collected on July 5th, 2005. Given the location of the well in proximity to wild animal pens and a septic field, the positive *E. coli* result is a very significant concern. Total coliform bacteria were also found to be present on one other occasion. For all other sampling events total coliform and *E. coli* were reported to be absent.

Detailed Potability Analyses

The staff house and the Ptarmigan tower are both on water delivery from Yukon Water Services Limited, which receives its water from the City of Whitehorse water supply. Water quality analysis done by the City of Whitehorse at sample station WH-3 indicated no exceedences of CDWQG health based or aesthetic parameters. Analytical results are tabulated in Table YWP-2.

There were no water quality results available at the time of the assessment for the Main Office on which to base decisions regarding further analytical data needed to be collected.

16.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Yukon Wildlife Preserve that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option for the main office.
- Since there had been no previous samples taken from the main office, detailed potability analyses were recommended. This analysis includes identifying the physical characteristics of the water and determining the total concentrations of major metals and dissolved anions contained in the drinking water.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the main office and the staff house, and tests for residual chlorine were completed at the Kestrel Cottage as well as the Ptarmigan tower.

A water sample was obtained from the main office during the water system assessment on May 19, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance, and detailed potability analyses. These results are summarized in Table YWPA-2 and the laboratory reports are included in Appendix B.

Additional Analytical Results

- The water quality for the sample obtained on May 19, 2005 indicated that the groundwater source is calcium-sulphate type water with extremely high hardness. The hardness (as CaCO_3) was found to be 688 mg/L, and is considered to be unacceptable for consumption by aesthetic standards (without treatment). Note that this is a raw water sample, and the softened water could not be sampled at the time of the assessment.
- The nitrate concentration was recorded as 2.61 mg/L, which although is not higher than the MAC of 10 mg/L, may be above the normal background concentrations for the Whitehorse area.
- The TDS concentration was 904 mg/L, which is above the CDWQG aesthetic objective of 500 mg/L.
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed.

16.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on May 19, 2005 was reported to be 26.5 mg/L and is considered to be above the normal background range for groundwater in the Whitehorse area. Nitrite concentrations for this sample were also found at concentrations that can be considered to be higher than the expected normal background concentration for the Whitehorse area. These results suggest that the aquifer from which the groundwater is obtained for the Yukon Wildlife Preserve may be under the influence of surfacewater sources, septic or animal wastes. It is considered unlikely that high chloride and nitrate levels may be a regional anomaly for the water quality in this area. As mentioned previously, total coliform and E.coli were observed in a sample collected on July 5th 2005. These results, along with the elevated nutrients observed in the same time period provide significant concern that this well was being impacted at the time of sampling.

16.4 Conceptual Hydrogeology

The well log for the drilled well serving YWP-A was available for review. The log indicates that the well was drilled through silt, sand and gravel into bedrock, which was encountered at 3.7 m below grade. The casing was reportedly driven into the bedrock to a depth of approximately 4.3 m. It should be noted that the draft guidelines require that a continuous casing be installed to 6 m below grade. As well, there is no indication that the casing was grouted into the bedrock. The well was drilled to a total depth of 102 m. The static water level was reported as 26.8 m below grade. The crude well capacity based on development was estimated at 12 USgpm. The groundwater flow direction is unknown and difficult to infer based on the undulating topography of the area.

16.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table YWP-A-4 for the main office and Table YWP-B-4 for the Kestrel Cottage in Appendix A16. Photos of potential contaminant sources are provided in Appendix A16.

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

- Muskox pens and other game enclosures are at 12 m and 25 m respectively, and
- Above ground fuel storage tank is 6 m from the well.

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

- Septic tank and effluent field are approximately 15 m away, and
- Above ground fuel storage tanks are 16 m and 30 m away from the well.

16.5.1 Spills Records and Contaminated Sites Search Results

The YTG Environmental Programs Branch did not report any concerns related to spills or known contaminant issues for any of the Yukon Wildlife Preserve sites.

16.6 Identified Water System Deficiencies and Associated Risk

16.6.1 High and Medium Risk Deficiencies

The following deficiencies were found to be high-risk for the Yukon Wildlife Preserve Main Office water system:

- Positive coliform and *E. coli* results.
- The well is located in a pit below grade, without a surface seal, and there was evidence of vermin presence inside the pit enclosure;
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- The well is located in an enclosure that is not locked and may be accessible to animals and unauthorized personnel;
- The well it is located within 30 m of the office septic system, as well as within 30 m of muskox pens;
- There is an above ground fuel storage tank located 6 m away from the wellhead;
- There is no disinfection system;
- Nitrate and chloride levels may be higher than expected background concentrations for the Whitehorse area; and,
- There is no backflow preventer on the irrigation hydrant tree.

For the Yukon Wildlife Preserve Kestrel Cottage, the high-risk deficiencies for the water system observed during the site assessment included:

- There is no floor in the crawl space that leads to the water storage tank and there is evidence of biofouling in the tank.
- The tank was not sanitary and appeared that it had not been cleaned recently if ever.
- Due to the lack of flooring in the crawl space leading to the tank, any attempt to clean the tank would likely track in dirt and make the cleaning process particularly difficult.

The water storage tank installation for the Yukon Wildlife Preserve Ptarmigan Tower is sub-standard and likely not acceptable for potable water storage. The fill cap had holes in it. Fill caps should be properly sealed to prevent insect/vermin entry to the water system.

The Yukon Wildlife Preserve is a recent acquisition of the Government of Yukon and it is unknown if the water systems had ever been tested while it was privately owned. It should be noted that while the preserve was privately owned, the main office acted as a residential dwelling. Since the Government of Yukon acquired the preserve, the building was

converted into a publicly accessible building and as thus the water system should be upgraded accordingly from a residential water system to a small public drinking water system.

16.6.2 Low Risk Deficiencies

The following deficiencies were found to be low-risk for the Yukon Wildlife Preserve Main Office water system:

- The raw water quality is highly mineralized; water quality analysis reported total dissolved solids as 904 mg/L and hardness as 688 mg/L. This high level of mineralization would necessitate pre-treatment for a disinfection system. The existing softener was not operational at the time of our previous assessment, and therefore, post treatment water quality was not available. It is assumed for costing purposes that the existing duplexing system is adequate to remove hardness.
- There is a raw water tap in the kitchen sink providing untreated water. This is low-risk for the current system as the only treatment system at the present time is a water softener. Once a disinfection treatment system is installed, however, this would provide a source of untreated water unless the current plumbing layout was altered.

The following deficiencies were found to be low-risk for the Yukon Wildlife Preserve Kestrel Cottage water system:

- The abandoned well has not been properly decommissioned;
- The well is located within 30 m of the in ground septic disposal that is currently malfunctioning and needs to be replaced. If the well is re-commissioned and put back into use for potable water then this would be considered a high-risk deficiency; and,
- There was no vermin screen on the vent for the outside water storage tank.
- The water piping is ABS, which is not approved for potable water.

The piping for the Ptarmigan Tower fill pipe and overflow was also of ABS construction, which is not suitable for potable use.

16.7 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).

16.7.1 Priority 1

Additional assessment is suggested to determine if there is a high-risk situation that exists for the Main Office water system. It is recommended that close attention be paid to sampling results for nitrate, nitrite and ammonia parameters as well as bacteriological test results. Sample results from June 26th, 2005 indicated that nitrate and chloride concentrations were still elevated. It is not clear whether the treatment system was in place prior to this most recent sampling event. Follow-up sampling during the spring freshet, and following well upgrades is recommended, and should include chloride, nitrate, nitrite and ammonia as well as bacteriological parameters as a minimum.

Costs for this additional assessment have not been included at this time. For the purpose of estimating cost for the YWP-A Main Office system, two options were presented in the draft report:

YWP-A Option 1:

- The wellhead completion should be improved. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface-seal to bedrock around the well casing. If possible, the casing should be extended to at least 6 m below grade by hanging a smaller diameter casing with a packer, and grouting the casing between the casing and the packer. We understand that Aqua Tech Supplies and Services have been retained by PMA to complete this work and it is in progress at the time of this final report.
- The ground surface around the wellhead should be graded to promote surface drainage away from the well;
- It was recommended that a NSF 61 certified commercial duplex filtration system (10 micron and 1 micron absolute) followed by a chlorine disinfection system be installed at the point of entry. The system should be equipped with a proportional feed digital dosing chlorine injection pump. Sodium hypochlorite dosing rates should be adjusted as necessary to maintain a residual chlorine concentration above 0.4 mg/L. We understand that a filtration and digital dosing chlorine injection pump with necessary appurtenances were installed in July 2005 shortly after the positive *E. coli* result and the publication of the draft report that preceded this report. The project team has not inspected the current system.
- A backflow preventer should be installed on the irrigation piping. This work should be completed by Aqua Tech in conjunction with the wellhead upgrades that are in progress.

The recommendations provided above are considered conceptual level based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.

YWP –A Option 2:

Pending results of the additional assessment that has been suggested above, a new well may be required, with a deep casing and surface seal (into bedrock) and the existing well properly decommissioned.

For the Yukon Wildlife Preserve Kestrel Cottage, there are also two options for mitigative upgrades for high-risk deficiencies in the water supply system. The options provided include, repairing and upgrading the existing infrastructure for the bulk delivery system, or re-commissioning the existing abandoned well.

YWP-B Option 1:

The water storage tank at the Yukon Wildlife Preserve Kestrel Cottage can not be properly accessed for cleaning. To mitigate this, it is recommended that a concrete floor be installed in the building crawl space to properly house a water storage tank. The tank should be dismantled, and a section removed, so that the height of the tank would render it accessible for cleaning. Re-plumbing with PVC should be completed at this time.

YWP-B Option 2:

Re-commissioning the existing well would require that the current septic system be removed and relocated to a distance of 30 m from the existing well. The following upgrades would be required for the existing well to be re-commissioned:

- The well would have to be properly cleaned and redeveloped;
- The wellhead completion should be improved. This would involve raising the well casing to a minimum of 500 mm above ground level and retrofitting a proper surface seal to 3 m depth around the well casing;
- A new wellhead enclosure that is inaccessible to animals and unauthorized personnel should replace the existing one and the ground surface should then be graded to promote surface drainage away from the well;
- A NSF-61 certified cartridge filter system (10 micron and 1 micron absolute) should be installed;
- A NSF/ANSI 55 certified UV disinfection system should be installed. Detailed potability analyses should be completed once the well is in working order, and this should include a sample to determine the UV absorbance of the water. Pretreatment to remove hardness, iron and manganese in order to facilitate proper operation of the UV would likely be required based on anecdotal information regarding the water quality from the well (hard and highly mineralized).

The following recommendations should be carried out so that the water system at the Yukon Wildlife Preserve Ptarmigan Tower is brought up to standards:

- The current water tank is inaccessible for cleaning. The storage tank should be replaced with a smaller 5000 L storage tank and be installed in a location that is accessible for cleaning. The new tank should be properly cleaned annually;

The recommendations provided above are considered conceptual level based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.

16.7.2 Priority 2

For the Yukon Wildlife Preserve Main Office, it is imperative that regular bacteriological testing for total and fecal coliform bacteria, as well as *E.coli* bacteria be completed. This testing should be done regularly and proper records must be maintained so that the safety and cleanliness of the water can be properly monitored.

ABS piping at the Yukon Wildlife Preserve Kestrel Cottage used in the water supply system should be replaced with PVC piping. This should be completed if **Option 1** from the high-risk mitigative options is chosen, or if there is a significant amount of time before **Option 2** is carried through.

ABS piping at the Yukon Wildlife Preserve Ptarmigan Tower should be replaced with PVC piping. Additionally, the cap for the water fill pipe should be replaced with one that will offer a proper watertight seal.

16.7.3 Priority 3

For the Yukon Wildlife Preserve Main Office, the following low-risk recommended changes should be carried out:

- Once the treatment system is installed, the raw water tap in the kitchen should be removed. For sampling purposes; however, it is recommended that there be a provision somewhere on the system for raw water sampling.

16.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

16.8.1 Priority 1

For the Yukon Wildlife Preserve Main Office, cost estimates for high-risk mitigative upgrades to the water supply system are as follows:

YWP- A Option 1:

- The cost for standard wellhead upgrades is estimated at **\$5000**.
- The cost to install buried transfer pipe (with heat trace and insulation) to the boiler room would be about **\$1,000**.
- The estimated cost to install a liner hanger, packer and grout is **\$2000** if the work is completed at the same time as the standard upgrades presented above.
- A duplex filtration system would cost approximately **\$2500** installed.
- A chlorination system with retention tanks and other appurtenances would cost in the order of **\$5000**.
- A backflow preventer would cost approximately **\$300** installed.
- The cost to relocate the game enclosures fences so that they are at least 30 m away from the well is estimated at **\$5000**, and could likely be completed by YWP summer staff.
- Removing the existing raw water tap from the kitchen would likely cost **\$300**.

YWP – A Option 2:

- The cost to drill, test and install a new well to similar depths as the existing well would likely cost in the order of **\$40,000**.

For the Yukon Wildlife Preserve Kestrel Cottage, there are also two options for mitigative upgrades for high-risk deficiencies in the water supply system. Cost estimates for high-risk mitigative upgrades to the water supply system are as follows:

YWP – B Option 1:

- The cost of taking apart the existing tank and pouring a concrete base underneath, including reconstructing some of the existing building would likely cost in the order of **\$15,000** for all materials and labour.

YWP – B Option 2:

- To recommission the existing well and tear down and replace the existing wellhead enclosure would likely cost in the order of **\$10,000**. The cleaning and recommissioning of the old well would likely cost about **\$8,000**.
- The cost to relocate the septic system has not been included, as this would be required for any option since it is failing. The tank and field should be installed so that they are more than 30 m away from the well.
- The cost for a pre-treatment and NSF/ANSI 55 certified UV disinfection system is estimated to be about **\$7,000**.

Option 3:

The cost to drill a new well to similar depths, and located so it is 30 m from the septic system, and other potential contaminant sources is estimated at **\$30,000**.

For the Yukon Wildlife Preserve Ptarmigan Tower, cost estimates for high-risk mitigative upgrades to the water supply system are as follows:

- **\$1,300** for a new 5000 L water storage tank;
- **\$700** for a new jet pump;
- **\$1,800** for labour to remove and replace the existing tank and install the jet pump.

16.8.2 Priority 2

Regular bacteriological testing for the Yukon Wildlife Preserve Main Office would fall under normal Operation and Maintenance costs for the Property Management Agency.

To replace the ABS piping at the Yukon Wildlife Preserve Kestrel Cottage with PVC piping would likely cost in the order of **\$500** for materials and labour.

To replace the ABS piping at the Yukon Wildlife Preserve Ptarmigan Tower with PVC piping and to replace the cap on the water fill intake would likely cost in the order of **\$500** for materials and labour.

17.0 BUILDINGS M0064 AND M0094 CARMACKS RCMP HOUSING

17.1 Description of Existing Water Supply System

Carmacks R.C.M.P. residences M0064 and M0094 share a common well that supplies the water supply systems for both homes. The well is located inside the basement of the M0064 residence. A site plan is provided as Figure M0064-A in Appendix A17. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884798
- Easting: 432697

The well feeds directly into a 5000 L water storage tank, after which the system splits to service each respective residence. Both systems are treated with iron softeners that are located in each residence. Water quality results; however, show that the M0064 water softening system was not operational at the time of sampling. System schematics are shown for each respective residence by Figures M0064-B and M0094-B and are located in Appendix A17.

17.2 Description of Existing Wastewater Systems

Both R.C.M.P. residences use a public sewage system provided by the Village of Carmacks. There is; however, a sewer service line that is located within 15 m of the wellhead. The sewage mains are located laterally and likely also upgradient from the well.

17.3 Water Quality Results

17.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the point of use at each of the residences have been previously completed on a number of occasions by Property Management Agency representatives as part of a separate contract. EBA was provided access to the YTG database in order to review the results of these previous bacteriological sampling events. Twenty samples were collected from the M0064 system, and twenty-nine samples were collected from the M0094 system between October 2004 and March 2006, and were tested

for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table M0064-1 in Appendix A17.

According to the YTG database, *E. coli* Bacteria was reported as absent in all samples from both residences for which results were provided. Total Coliform bacteria were reported as being present four times in samples from M0064. Total Coliform bacteria were reported as present in two samples from the M0094 residence.

17.3.2 Detailed Potability Analyses

Water samples had been previously collected from these water systems on October 5, 2004. A sample was collected from the kitchen tap in the M0064 residence and from the washroom tap in the M0094 residence. At the time of inspection in the M0064 residence, there was no functioning treatment system, and so the water sample is considered to be representative of raw groundwater quality. The samples were submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table M0064-2 and are included in Appendix A17. EBA reviewed the analytical results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination. Relevant results are provided below:

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source is calcium bicarbonate type water with high hardness and pH of approximately 8. As expected, the water from the M0094 residence was significantly softer due to the presence of an operational water softener, and had higher levels of sodium and potassium.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 214 mg/L in the M0064 residence, which is generally poor for aesthetic purposes, and 4 mg/L in the M0094 residence, which is considered to be very soft.

17.3.3 Identification of Additional Analytical Testing Required

Additional analytical that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option was recommended for both residences.

- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of sampling.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance for both residences. These results are summarized in Table M0064-2 and the laboratory reports are included in Appendix B.

17.3.4 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5 2004 is low and can be considered to be within the normal background ranges for groundwater in the Carmacks area. Nitrate and nitrite concentrations for this sample are also low and within the normal background range for the Carmacks area.

17.4 Conceptual Hydrogeology

Residents of the Central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of the Village core is northeast toward the Yukon River.

17.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table M0064-4 in Appendix A17. Photos of potential contaminant sources are provided in Appendix A17.

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

- Sewer main within 30 m,
- Sewer service lines within 15 m, and
- Two above ground fuel storage tank at 18 m.

17.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results did not identify any concerns for this site.

17.6 Identified Water System Deficiencies and Associated Risk

17.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as high-risk for the water system serving the M0064 and M0094 R.C.M.P. residences:

- The wellhead is located within 30 m of potential sources of contamination. There are two above ground fuel storage tanks located 18 m from the well;
- There is no surface sanitary seal (a grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- The hydrogeology of the area also indicates that there are no protective low permeability layers between the surface and the water table, and the well is likely less than 15 m deep and as such would be considered a shallow well;
- Positive total coliform results;
- Poor surface completion of the wellhead below the basement.

17.6.2 Low Risk Deficiencies

There were no low-risk deficiencies identified; all deficiencies are considered high-risk.

17.7 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).

17.7.1 Priority 1

Options to mitigate the deficiencies identified as high risk for the M0064 and M0094 Carmacks R.C.M.P. water systems are presented below.

- A treatment system should be installed such as a commercial inline filter at the point of entry before the water storage tank and two NSF/ANSI 55 certified UV disinfection systems at the point of use in each respective residence, after the existing water softeners. This is a conceptual design recommendation based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.
- There are existing water softeners in each residence; however it was found from the water quality results that the softener, as of October 2004, was not functional. It is possible that since that time the softener had been repaired, but it should nevertheless be ensured that both softeners are fully functional and adequate for use as pretreatment for the UV systems. Adjustment should be made to the existing softener to reduce sodium levels. Although sodium concentrations at 80 mg/L are below the CDWQG, they may be elevated for persons on sodium-reduced diets.
- Secondary containment should be provided for the two above ground fuel storage tanks that are approximately 18 m from the well. Alternatively, they could be replaced with double walled fuel storage tanks to mitigate any potential contamination of the well;

17.7.2 Priority 2

To address the remaining high-risk deficiencies, two options are presented below:

Option 1:

The first option involves upgrading the existing wellhead construction. In order to mitigate the remaining high-risk deficiencies identified in this report, the wellhead construction should be upgraded as follows:

- Raising the well casing to a minimum of 500 mm above ground level, installing a pitless adapter on the wellhead (the well casing and cap would protrude into the basement of the home);
- Due to the location of the wellhead, it would be difficult to retrofit a proper surface seal to 6 m depth, or even 3 m depth around the well casing without having to make significant renovations on the existing M0064 residence, and thus only a near surface seal could be installed. This would offer at least some protection to the

water source from surfacewater contamination, and the treatment system if properly maintained would mitigate the remaining risk; and,

Option 2:

- It is likely that within the next two to five years that the Village of Carmacks will be developing a municipal water distribution system that will service all of the central village, and will likely include these residences. To save the cost of redeveloping the wellhead construction on a well that may only be used for another two years, the treatment system alone may be adequate until the community system is installed. An opinion for Environmental Health and Social Service should be solicited to see if they are in agreement with this approach;
- Once the community system is installed, it is possible that the treatment system may no longer be needed at the M0064 and M0094 Carmacks R.C.M.P. Residences, and they could be removed and re-installed at other YTG maintained systems.

17.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

17.8.1 Priority 1

Class D cost estimates for mitigative options to address the high-risk water system deficiencies for these residences are provided below:

- The cost for the treatment system would amount to a total installed cost of **\$7,500** assuming that the existing softening systems are adequate for pre-treatment for UV treatment.
- Replacing the existing above ground fuel storage tanks with double walled secondary containment tanks would likely cost approximately **\$2,600** for each tank. Secondary containment with a polyethylene trough would cost approximately **\$1000** per tank. This may be the better option for a short-term solution given that a piped distribution system is likely to happen in the near future.

17.8.2 Priority 2

Option 1:

- The cost for the wellhead upgrades, would likely amount to approximately **\$1,200** for all materials and labour.

Option 2:

- The cost to connect with the planned community piped water distribution system would likely cost in the order of \$5000 for service connections.

18.0 BUILDING M0093: CARMACKS RCMP DETACHMENT

18.1 Description of Existing Water Supply System

Building M0093, the Carmacks R.C.M.P. Detachment, is currently serviced by a water supply system supplied from a 16 m deep well. The wellhead is located in a concrete manhole approximately 2 m from the detachment. A site diagram detailing the property is shown by Figure M0093-A and is located in Appendix A18. Water from the well is passed through an in-line strainer and then goes directly into the water system without any treatment. Figure M0093-B, located in Appendix A18 provides a system schematic showing the details of the water system. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884845
- Easting: 432680

18.2 Description of Existing Wastewater Systems

The Carmacks R.C.M.P. Detachment is serviced by a public piped sewage collection system provided by the Village of Carmacks. There is a sewer line that is located within 30 m of the wellhead.

18.3 Water Quality Results

18.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks R.C.M.P. Detachment water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Seven samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table M0093-1.

Coliform bacteria and *E. coli* bacteria were reported as absent in each of the seven samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Carmacks R.C.M.P. Detachment water system on October 5, 2004. The sample was collected from the washroom tap and is considered to be representative of raw groundwater quality. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table M0093-2 and are included in Appendix A18. EBA reviewed the analytical results to compare them 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.

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source is calcium bicarbonate type water with very high hardness.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 201 mg/L, and is considered to be poor for aesthetic purposes.

18.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks R.C.M.P. Detachment that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 10, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance. These results are summarized in Table M0093-2 and the laboratory reports are included in Appendix A18.

18.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. Chloride concentrations for the sample obtained on October 5, 2004 is low and can be considered to be within the normal background ranges for groundwater in the Whitehorse area. Nitrate and nitrite concentrations for this sample are also low and within the normal background range for the Whitehorse area.

18.4 Conceptual Hydrogeology

Residents of the Central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of the Village core is northeast toward the Yukon River.

18.5 Potential Contaminant Sources

Potential contaminant sources of contamination observed during the site investigation are compiled in Table M0093-4 in Appendix A18. Photos of potential contaminant sources are provided in Appendix A18.

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

- Two above ground fuel storage tank at 9 m.

18.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results did not identify any concerns for this site.

18.6 Identified Water System Deficiencies and Associated Risk

18.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being high-risk for the Carmacks R.C.M.P. detachment:

- The wellhead is located within 30 m of potential sources of contamination. There are two above ground fuel storage tanks located 9 m from the well.
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines).
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.
- The hydrogeology of the area also indicates that there are no protective low permeability layers between ground surface and the water table.
- At 16 m deep, the well is considered to be a relatively shallow well, and the static groundwater level is likely about 6 m below grade. Based on the depth of well, hydrogeological conditions, and the well's construction, it would be considered to be at high-risk of contamination from surfacewater sources.

18.6.2 Low Risk Deficiencies

There were no low-risk deficiencies identified for this site, all deficiencies are considered to be high-risk.

18.7 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).

18.7.1 Priority 1

There are two options available to mitigate the deficiencies identified as high risk for the Carmacks R.C.M.P. Detachment. For both of these options, a treatment system should be installed consisting of a NSF 61 certified commercial filtration system (to 1 micron absolute) and a NSF/ANSI 55 certified UV disinfection system. The water quality

indicates that it may be possible to use a UV system without pretreatment (softening), but further investigation must be done to determine this for certain. These are conceptual design recommendations based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications

Secondary containment should be installed on the two above ground storage tanks that are 9 m from the well to mitigate any potential contamination of the water system.

18.7.2 Priority 2

Option 1:

The first option involves upgrading the existing wellhead construction. In order to mitigate the high-risk deficiencies identified in this report, the Carmacks R.C.M.P. Detachment water system should be upgraded as follows:

- Rehabilitating the wellhead construction to retrofit a surface seal to 3 m in depth (6 m would not be possible), and extending the casing to 500 mm above grade.

Option 2:

- It is likely that within the next two to five years that the Village of Carmacks will be developing a municipal water distribution system that will service all of the central Village, and will likely include these residences. To save the cost of redeveloping the wellhead construction on a well that may only be used for another two years, the proposed disinfection/treatment system alone may be adequate until the community system is installed. An opinion for Environmental Health and Social Service should be solicited to see if they are in agreement with this approach;
- Once the community system is installed, it is possible that the treatment system may no longer be needed and could be removed and re-installed at other YTG maintained systems.

18.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

18.8.1 Priority 1

Class D cost estimates for mitigative options to address the high-risk water system deficiencies for the R.C.M.P detachment are provided below:

- The cost for the treatment system would amount to a total installed cost between **\$5,000** and **\$8,000**, depending on whether or not pretreatment is required.
- Replacing the existing above ground fuel storage tanks with double walled tanks would likely cost approximately **\$2,600** for each 1000 L tank, or a 2000 L tank could be installed for approximately **\$3,800**. Alternatively, secondary containment troughs could be installed for **\$1000** per well.

18.8.2 Priority 2

Option 1:

- The cost for the wellhead upgrades, including raising the wellhead, installing a surface seal to 3 m below grade, and installing a 150 mm pitless adapter would likely cost in the order of **\$5,000**.

Option 2:

- A service connection would likely cost in the order of **\$3,000**.

19.0 BUILDING M0201: CARMACKS RCMP HOUSING

19.1 Description of Existing Water Supply System

Building M0201, the Carmacks R.C.M.P. residence on Rawlinson St. currently has water supplied by a drilled well located in a below grade add-on to the basement of the house. A site diagram that shows the location of the wellhead and other details of the property is provided as Figure M0201-A and is located in Appendix A19. The system is equipped with a water softener; however, at the time of inspection the softener was out of salt regenerant and not operational. A schematic detailing the water supply system is provided as Figure M0201-B and is located in Appendix A19. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884996
- Easting: 432277

19.2 Description of Existing Wastewater Systems

The residence is serviced by a public piped sewage collection system provided by the Village of Carmacks. There are sewer mains and service line that are located within 30 m of the wellhead.

19.3 Water Quality Results

19.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks R.C.M.P. Rawlinson St. Residence water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Seven samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table M0201-1 located in Appendix A19.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the seven samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Carmacks R.C.M.P. Rawlinson St. Residence water system on October 5, 2005. The sample was collected from the kitchen tap and is considered to be representative of raw groundwater quality as the results indicate that the softener was not operational at the time of sampling. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table M0201-2 and are included in Appendix A19. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination. Relevant result are summarized below:

- The water quality for the sample obtained on October 5, 2004 indicated that the groundwater source is calcium-bicarbonate type water with high hardness.
- At 1.5 NTU, the turbidity of the water exceeded the CDWQG MAC of 1.0 NTU. At 2.3 NTU, turbidity also exceeded 1 NTU on a follow up sampling event completed for PMA in July 2005.
- At 0.371 mg/L, the iron concentration exceeds the CDWQG aesthetic objective of 0.3 mg/L.
- At 0.077 mg/L, the manganese concentration exceeds the CDWQG aesthetic objective of 0.05 mg/L.
- The water quality results indicate that all other health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 174 mg/L, and is considered high for aesthetic purposes.

19.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks R.C.M.P. Rawlinson St. Residence that was identified to be included during the water system assessments is detailed below:

- Since the total iron and manganese concentrations had previously exceeded the CDWQG aesthetic objectives, an analysis for both dissolved iron and dissolved manganese was recommended in order to assist in determining potential treatment or rehabilitation measures.
- UV absorbance, to determine potential for UV treatment as a disinfection option.

- Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 19, 2005, and was submitted to ALS Environmental in Vancouver BC for dissolved iron and manganese analysis, as well as UV absorbance. These results are summarized in Table M0062-2 and the laboratory reports are included in Appendix B.

The additional analysis indicated that the dissolved iron concentration in the sample collected on May 13, 2005 was less than 0.030 mg/L, and was significantly less than the previously reported total iron concentration and the CDWQG aesthetic objectives. Since the dissolved iron was considerably less than the total iron content, most iron can be attributed to suspended particles. The dissolved manganese concentration; however, for this most recent sample was 0.068mg/L. This value is higher than the CDWQG aesthetic objective. The significance of the high concentration of dissolved manganese shows that the overall manganese content cannot be attributed to suspended particles. Therefore, although well rehabilitation to decrease turbidity, and/or filtration to remove suspended particles could be sufficient to reduce the iron content and turbidity, it would not likely reduce manganese concentrations to below the CDWQG aesthetic objectives.

19.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5 2004 was low and can be considered to be within the normal background range for groundwater in the Carmacks area. Nitrate and nitrite concentrations for this sample were also low and within the normal background range for the Carmacks area.

19.4 Conceptual Hydrogeology

Residents of the central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction is northeast towards the Yukon River.

19.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table M0201-4 in Appendix A19. Photos of potential contaminant sources are provided in Appendix A19.

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

- Adjacent well at 22 m,
- Above ground fuel storage tank at 3 m, and
- Above ground fuel storage tank at 24 m.

19.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results did not identify any concerns for this site.

19.6 Identified Water System Deficiencies and Associated Risk

19.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being medium to high risk for the M0201 R.C.M.P. residence:

- The wellhead is located within 30 m of potential sources of contamination. There are two above ground fuel storage tanks located 3 m and 24 m from the well. In addition, there is an adjacent well 22 m from the M0201 well;
- Poor surface completion of the wellhead below ground (located in an attachment to the basement of the residence);
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- Based upon the hydrogeology of the area and the depths of many surrounding wells, this well is likely approximately 15 m deep, and as thus would be considered to be a shallow well. The well, therefore, would be considered to be at high-risk of contamination from surfacewater sources.
- Turbidity of the water is in exceedence of CDWQG MAC.

19.6.2 Low Risk Deficiencies

The following deficiencies were identified as being low-risk for the M0201 R.C.M.P. Residence:

- It was found during the site investigation that the water softener was out of salt regenerant. Additionally, water quality analysis from previous sampling in October 2004, indicated that the water softener was not functioning properly at that time either. This deficiency is identified as being low-risk, but due to the high iron and manganese in the water, if a UV disinfection system were to be installed then this deficiency would be upgraded to high-risk because UV treatment requires a properly functioning water softener if it is to be able to function properly.
- The pressure tank is located directly on top of the wellhead. This blocks access to the well so that maintenance or proper inspection is difficult. In addition, the pressure tank is likely too small and inefficient for a residence that currently houses a family of four or five.
- The submersible pump is in disrepair, and will likely need replacement in the near future.

19.7 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).

19.7.1 Priority 1

There are two options available to mitigate the deficiencies identified for the M0201 Carmacks R.C.M.P. Residence. For both options, the following Priority 1 mitigative options should be completed:

- A treatment system should be installed consisting of a NSF 61 certified inline filtration system capable of removing particles to 1 micron absolute and a NSF/ANSI 55 certified UV disinfection system, using the existing water softener for pretreatment. This is a conceptual design recommendation based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications;
- Further sampling will be required to determine if the softener is an adequate pretreatment system for UV disinfection; and,
- Secondary containment should be installed on the two above ground storage tanks, or they should be replaced with double walled fuel storage tanks.

19.7.2 Priority 2

To address remaining deficiencies, the following options are presented:

Option 1:

- The first option involves upgrading the existing wellhead construction. In order to mitigate the high-risk deficiencies identified in this report, the water system should be upgraded by rehabilitating the wellhead construction to retrofit a surface seal to 3 m in depth (6 m would not be possible), and extend the casing to 500 mm above grade.
- The pressure tank should be relocated to a convenient location and easy access to the wellhead should be available.

Option 2:

- It is likely that within the next two to five years that the Village of Carmacks will be developing a municipal water distribution system that will service all of the central village, and will likely include these residences. To save the cost of redeveloping the wellhead construction on a well that may only be used for another two years, the treatment system alone may be adequate until the community system is installed. An opinion for Environmental Health and Social Service should be solicited to see if they are in agreement with this approach.
- Once the community system is installed, it is likely that the treatment system may no longer be needed and could be removed and re-installed at another YTG maintained system.

The options presented above are conceptual design recommendations based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.

19.7.3 Priority 3

- See Priority 1 mitigative options for recommendations to improve the water softening system.
- Replace submersible pump with new pump.

19.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs.

Engineering costs for other 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.

19.8.1 Priority 1

Class D cost estimates for mitigative options to address the well deficiencies for this site are as follows:

- The installed cost for the treatment system would be approximately **\$5,000**, depending on the extent to which the pretreatment system needs to be repaired. The cost to add softening salt to the water softener would be minimal, and the cost would be higher if other repairs are needed. If the current water softening system is inadequate and needs to be replaced entirely, a duplex softener pretreatment would likely cost approximately **\$3000**.
- Replacing the existing above ground fuel storage tanks double walled secondary containment tanks would likely cost approximately **\$2,600** for each tank. Installing secondary containment would cost approximately **\$1000** per tank.

19.8.2 Priority 2

Option 1:

- The cost for the wellhead upgrades, including raising the wellhead, installing a pitless adapter, and installing a sanitary seal to 3 m in depth is estimated to be approximately **\$5000**.
- The cost to relocate the pressure tank would be **\$300** in materials and labour, and **\$1500** if it is determined that the tank should be replaced.

Option 2:

- A service connection to a piped community system would likely cost in the order of **\$3,000**.

19.8.3 Priority 3

- The cost to supply and install a new submersible pump is approximately **\$3100**.

20.0 BUILDING 6511: TANTALUS SCHOOL

20.1 Description of Existing Water Supply System

Building 6511, the Tantalus School, currently has water supplied from a 16.5 m deep well located in a small underground vault off of the basement mechanical room. A site plan showing the location of the wellhead and other details about the surrounding property is provided as Figure 6511-A located in Appendix A20. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884714
- Easting: 432684

The water is filtered through an automatic backwash filter. Disinfection treatment is not provided for this system. A system schematic is provided as Figure 6511-B in Appendix A20.

20.2 Description of Existing Wastewater Systems

Tantalus School is serviced by a piped sewer collection system provided by the Village of Carmacks. It is likely that there are sewage main lines or service lines that are within 30 m of the well.

20.3 Water Quality Results

20.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Tantalus School water system has previously been completed on a number of occasions by EBA Engineering for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Eight samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 6511-1 located in Appendix A20.

According to the information in the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the eight samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Tantalus School water system for detailed potability analysis on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results from this analysis are summarized in Table 6511-2 and are included in Appendix A20. EBA reviewed the analytical results to compare them with the Canadian Drinking Water Quality Guidelines (CDWQG) and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was calcium bicarbonate type water with high hardness and a pH of 7.9.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 208 mg/L, which is generally poor for aesthetic purposes.

20.3.2 Identification of Additional Analytical Testing Required

Additional analytical for Tantalus School that was included in the water system assessment is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed during the assessment.

Reportedly, an AST that is approximately 1 m from the well had previously been over-filled causing a spill of heating fuel relatively close to the wellhead. EBA is unaware of the cleanup measures that were employed, and whether all hydrocarbon impacted soils have been removed from the area. As such, Extractable Petroleum Hydrocarbons (EPH) and Polycyclic Aromatic Hydrocarbons (PAH) were included in the additional analytical to determine whether this release of hydrocarbon may have resulted in contamination of the water supply.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 13, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance, EPH and PAH. Results are summarized in Table 6511-2, located in Appendix A20, and the laboratory reports are included in Appendix B.

All health based and aesthetic objectives at the Tantalus School were met for the parameters analyzed. EPH and PAH were found to be below the analytical detection limits, and below CDWQG for benzo(a)pyrene. There is no evidence at present to suggest that the water system has been contaminated by hydrocarbons from the reported spill.

20.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5, 2004 was low and can be considered to be within the normal background range for groundwater in the Carmacks area. Nitrate and nitrite concentrations from this sample were also reported to be low and within the normal background ranges for the Carmacks area.

20.4 Conceptual Hydrogeology

Residents of the Central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of Village core is northeast towards the Yukon River. The static water level is likely approximately 6 m below grade.

20.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6511-4 in Appendix A20. Photos of potential contaminant sources are provided in Appendix A20.

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

- Sewer service lines are likely located within 30 m,
- An above ground fuel storage tank is located 1 m away.

20.5.1 Spills Records and Contaminated Sites Search Results

The Government of Yukon Environment Branch did not identify any recorded spill events or contaminated sites this site or for neighbouring sites.

20.6 Identified Water System Deficiencies and Associated Risk

20.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being high-risk for the Tantalus School water system:

- Poor surface completion of the wellhead below ground (in concrete enclosure adjacent to the basement maintenance room). There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- The wellhead is located within 30 m of potential sources of contamination including an above ground fuel storage tank located 1 m from the well.
- The hydrogeology of the area indicates that there are no protective low permeability layers between the surface and the water table. The well is considered to be shallow with a relatively high static water level making it susceptible to surface sources of contamination;
- There is no disinfection/treatment system for de-activation or removal of potential bacteria, virus and protozoa.

20.6.2 Low Risk Deficiencies

- The existing pump was identified as being inadequate for this water system.

20.7 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).

20.7.1 Priority 1

We understand that construction of a new school to replace the existing Tantalus school will be underway within the next year. The existing water system should be given particularly high priority because it provides untreated water on a regular basis to a high number of people, most of which are children. Therefore, even if the school is likely to be replaced in the near future, it should still be ensured that risks to the existing system are mitigated as much as possible. To mitigate the existing high risk, three options are provided below. All options require a proper disinfection treatment system for the school water supply system including an NSF approved commercial duplex filtration system to replace the existing filtration and a chlorination system with suitable retention. These are conceptual design recommendation based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.

Option 1:

This option proposes that the current well would be kept in use, but interim upgrades to the wellhead construction should be completed:

- The concrete floor of the wellhead enclosure should be raised by at least 300 mm so that it can be an adequate height above floor level of the adjacent maintenance room (where there is a back-up generator);
- The well should be equipped with a surface seal as deep as possible, equipped with a pitless adapter, and the casing should be extended at least 500 mm above the level of the floor in the wellhead enclosure;
- The above ground fuel storage tank that is located 1 m from the well should be removed to another location at least 30 m from the wellhead.

Option 2:

This option would involve drilling a replacement well that is located with respect to potential contaminant sources, and is a minimum of 30 m away from any potential sources of contamination:

- The well should be equipped with a surface seal to at least 6 m and the casing should be extended above grade (500 mm) and inaccessible to animals and unauthorized persons;
- The water from the new well must meet all CDWQG health based parameters. If there are any exceedences in the CDWQG health-based parameters additional treatment may be required in addition to the disinfection treatment described previously;
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction.

Option 3:

A well has already been drilled near Tantalus School that has been constructed for use by the new school once it is constructed. This well can be used as an interim water source for Tantalus School until the new school is built. For this option:

- A pitless unit would be installed on the new well casing, and the well equipped to prevent access by animals and unauthorized persons;
- A water distribution line would need to be installed underneath the existing parking lot, with proper freeze protection;
- Plumbing modifications would be required;
- The water from this well must meet all CDWQG health based parameters. If there are any exceedences in the CDWQG health-based parameters additional treatment may be required in addition to the treatment described previously. Further testing and analysis should be done to determine this;
- The old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction.

20.7.2 Priority 3

- The current jet pump should be replaced with a submersible pump of adequate capacity.

20.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

20.8.1 Priority 1

It is estimated that a suitable filtration system, and a proportional feed digital dosing chlorine injection pump with injection piping, spill containment deck and appurtenances, and adequate retention tank capacity would cost in the order of **\$10,000**.

The estimated costs for each option are as follows:

Option 1:

- Upgrading the current wellhead construction would cost approximately **\$3,000** for all materials and labour.

Option 2:

- The estimated cost for a new well installed with a proper surface seal, assuming overburden to a depth of approximately 20 m, would be approximately **\$25,000** for materials and labour.
- It would cost approximately **\$1,000** to decommission the existing water well and wellhead enclosure.

Option 3:

- The cost for wellhead upgrades, including installing a pitless unit with a locking cap, is estimated to be approximately **\$3,000**.
- The estimated cost to install a 20 m long water distribution line from the new school well to Tantalus School, considering that it must be installed under the existing parking lot, would be approximately **\$10,000**.
- Re-plumbing the water system within the school would likely cost **\$2,000**.

20.8.2 Priority 3

- A submersible pump with new pump controls to replace the existing jet pump would cost in the order of **\$3,000**.

21.0 BUILDING 6512: CARMACKS GRADER STATION

21.1 Description of Existing Water Supply System

Water to Building 6512, the Carmacks Grader Station, is supplied by a 55 m deep well located in an addition to the main shop. A site plan showing the location of the wellhead and site details is provided as Figure 6512-A in Appendix A21. The coordinates of the wellhead, as measured by a hand held GPS device were recorded as:

- UTM ZONE 8
- Northing: 6884956
- Easting: 433308

The water is filtered with an inline cartridge type filter. The submersible pump system is controlled by a pressure tank and pump controls. A system schematic is provided as Figure 6512-2 located in Appendix A21.

21.2 Description of Existing Wastewater Systems

The septic tank for the Carmacks Grader Station is located 20 m southeast of the well. The septic tank discharges effluent to a field located southeast of the tank. The in ground sewage disposal system also handles wastewater from the garage sumps located in the maintenance garage.

21.3 Water Quality Results

21.3.1 Water Quality Results from Previous Sampling

Bacteriological

No test results were provided to EBA for review. Bacteriological sampling of water from the Carmacks Grader Station water system may not have been previously completed because reportedly it is not used for drinking water.

Detailed Potability Analyses

A water sample was previously collected from the Carmacks Grader Station water system on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for analysis and included detailed potability analyses. The results from this analysis are

summarized in Table 6512-2 and are included in Appendix A21. EBA reviewed the analytical results to compare them 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.

- The water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was calcium-bicarbonate type water with very high hardness and a pH of 8.
- At 0.067 mg/L, the manganese concentration exceeds the CDWQG aesthetic objective of 0.05 mg/L.
- The water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO_3) was reported to be 261 mg/L, and is generally poor for aesthetic purposes.

21.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks Grader Station that was identified to be included during the investigation is detailed below:

- Since the total manganese concentration had previously exceeded the CDWQG aesthetic objectives, an analysis for dissolved iron and manganese was recommended in order to assist in determining potential treatment or rehabilitation measures.
- UV absorbance to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of sampling.
- Since there were no previous bacteriological results for the water system, a sample was taken to YTG Health services for analysis for *E. coli* and Total Coliform.

It was observed during the site inspection that there are potential sources of hydrocarbon contamination within 30 m of the well. Extractable Petroleum Hydrocarbons (EPH) and Polycyclic Aromatic Hydrocarbons (PAH) were included as potential indicators of contamination of the water supply from hydrocarbon sources.

Additional Analytical Results

A water sample was obtained during the water system assessment on May 25, 2005, and was submitted to ALS Environmental in Vancouver BC for analysis of dissolved iron and manganese, UV absorbance, EPH and PAH. These results are summarized in Table 6512-2 in Appendix A21 and the laboratory reports are included in Appendix B.

-
- EPH and PAH were found to be below analytical detection, and thus there was no evidence to suggest that the water system was being impacted by hydrocarbons at the time of sampling.
 - Bacteriological results for the water sample collected on May 25, 2005 reported both *E. coli* and Total Coliform as absent.

21.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5, 2004 was reported to be low and can be considered to be within the normal background ranges for groundwater in the Carmacks area. Nitrate and nitrite concentrations from this sample were also low and within the normal background range for the Carmacks area.

21.4 Conceptual Hydrogeology

Residents of the central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of Village centre is northeast toward the Yukon River.

21.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6512-4 in Appendix A21. Photos of potential contaminant sources are provided in Appendix A21.

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

- Septic field/rock pit at 20 m,
- Used oil tank at 28 m,
- Waste solvent drum at 30 m,
- Waste antifreeze drum at 30 m, and
- Two above ground fuel storage tanks at 25 m.

21.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results did not identify any concerns for this site.

21.6 Identified Water System Deficiencies and Associated Risk

21.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being high-risk for the Carmacks Grader Station:

- The wellhead is located within 30 m of potential sources of contamination. There are two above ground fuel storage tanks located 25 m from the well. There is a used oil tank, as well as a used solvent drum and a used antifreeze drum located approximately 30 m from the well. The septic system including the filed is within 30 m of the well. Additionally, the septic system also acts as a rock pit and may receive some hydrocarbon wastes from the garage sumps along with the domestic effluent into the septic system;
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- Poor surface completion of the wellhead (located in an attachment to the maintenance garage, concrete floor is cracked around the casing);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.
- The hydrogeology of the area indicates that there are no protective low permeability layers between the surface and the water table; and,
- There is no bacteriological testing program at this site.

21.6.2 Low Risk Deficiencies

- Iron above CDWQG aesthetic objective.

21.7 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).

21.7.1 Priority 1

It is likely that the cost associated with redeveloping the current well and removing to a safe distance any potential source of contamination, including the current septic and garage sump disposal system would likely be greater than the cost to drill a new well located properly with respect to potential contaminant sources, and constructed to meet the existing guidelines rather than to relocate the potential contaminant sources and upgrade the well. This would also result in a safer water supply source. There are two options available to mitigate the deficiencies associated with the water system at the Carmacks Grader Station.

Option 1:

The first option involves replacing the existing well and drilling the new well so that it satisfies the following conditions:

- The well must be located at least 30 m away from any potential source of contamination, preferably in an upgradient direction;
- The well should be equipped with a surface seal to at least 6 m and the casing should be extended above grade (500 mm) within a lockable enclosure that is not accessible to animals and unauthorized persons;
- The water from the new well must meet all CDWQG health based guidelines. If there are any exceedences in the CDWQG health-based guidelines then a treatment system must be designed and installed as necessary;
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction and the existing wellhead enclosure should be removed; and,
- Regular bacteriological testing should be implemented.

Option 2:

An alternative to overhauling the existing wellhead construction is available:

- It is likely that within the next two to five years that the Village of Carmacks will be developing a municipal water distribution system that will service all of the central village, and will likely include these residences. To save the cost of redeveloping the wellhead construction on a well that may only be used for another two years, the treatment system alone, with routine monitoring may be adequate until the

community system is installed. An opinion from Environmental Health and Social Service should be solicited to see if they are in agreement with this approach.

- Once the community system is installed, it is possible that the treatment system may no longer be needed and it could be removed and re-installed at other YTG maintained systems. Alternatively, a bottled water station could be provided.
- The old well should be properly decommissioned once the grader station connects to the community water supply in accordance with the Guidelines for Water Well Construction and the existing wellhead enclosure should be removed.
- Until the well deficiencies have been mitigated and while the well is still being used as a source of potable water, regular bacteriological testing should take place.

21.7.2 Priority 2

All identified risks are considered to be Priority 1.

21.7.3 Priority 3

All identified risks are considered to be Priority 1.

21.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

21.8.1 Priority 1

Option 1:

- It is recommended that **\$35,000** be budgeted for materials and labour to drill, test, complete and hook-up the well;
- It would cost approximately **\$1,500** to decommission the existing water well and wellhead enclosure;
- A minimum of **\$9,000** should be allocated for adequate water treatment and disinfection; and,

- Regular bacteriological testing for the Carmacks Grader Station would fall under normal Operation and Maintenance costs for the Property Management Agency.

Option 2:

- The costs to connect with the planned community distribution system would likely be paid for by others and recovered through taxation.
- The cost for providing bottled water would likely be about **\$500** initially and **\$100** per month in the interim until the community system is installed;
- The existing well should be properly decommissioned in accordance with the Guidelines for Water Well Construction and to remove the existing wellhead enclosure. It is estimated that this would cost approximately **\$1,500**.
- Regular bacteriological testing for the Carmacks Grader Station would fall under Operation and Maintenance costs.

22.0 BUILDING 6522: CARMACKS AIRPORT TERMINAL

22.1 Description of Existing Water Supply System

Building 6512, the Carmacks Airport Terminal, has water supplied from a 24 m deep well that is located in a pit approximately 17 m away from the terminal building. A site diagram that shows details of the property and the wellhead location is provided as Figure 6522-A, located in Appendix A22. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6887553
- Easting: 437781

The water system is equipped with a submersible pump, sediment filter, pressure tank and pump controls. A system schematic detailing the water system is offered by Figure 6522-B and is located in Appendix A22.

22.2 Description of Existing Wastewater Systems

The septic tank for the Carmacks Airport Terminal is located northeast of the terminal building and 22 m north of the wellhead. The septic tank discharges effluent to a field located north of the tank at a distance of 25 m from the wellhead. The septic tank and effluent field are at approximately the same elevation as the wellhead, but are likely upgradient of the well. Details of the location of the wastewater system are provided as Figure 6522-A located in Appendix A22.

22.3 Water Quality Results

22.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks Airport Terminal water system has previously been completed on a number of occasions by EBA for the Property Management Agency as part of a separate contract. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Five samples were collected from this system between October 2004 and March 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the

presence/absence test method. Results are tabulated in Table 6522-1 and are located in Appendix A22.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the five samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the washroom sink in the Carmacks Airport Terminal building on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results are summarized in Table 6522-2 and are included in Appendix A22. EBA reviewed the results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source is calcium bicarbonate type with very high hardness and a pH of approximately 8.
- At 2.9 NTU, the turbidity exceeded the CDWQG MAC of 1.0 NTU. Subsequent routine testing in July 2005 had turbidity that was reported at 17.6 NTU.
- At 0.4975 mg/L, the iron concentration exceeded the CDWQG aesthetic objectives (AO) of 0.3 mg/L. Likely due to the elevated turbidity in the sample collected in July 2005 the total iron concentration at 1.44 mg/L was significantly higher than the previous test result and well above the AO.
- At 0.25 mg/L, the manganese concentration exceeded the CDWQG aesthetic objective of 0.05 mg/L.
- Water quality results indicated that all other health based and aesthetic objectives were met for the parameters analyzed.
- The hardness (as CaCO₃) was reported to be 331 mg/L, and is generally poor for aesthetic purposes.

22.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks Airport Terminal that was identified to be included during the water system assessments is detailed below:

- Since total iron and total manganese had previously exceeded the CDWQG aesthetic objectives, an analysis for dissolved iron and manganese was recommended in order to identify potential treatment or rehabilitation measures.

-
- UV absorbance was included to determine the potential for UV treatment as a disinfection option.
 - Measurements in the field for total dissolved solids, conductivity, pH, and temperature.

22.3.3 Additional Analytical Results

A water sample obtained during field investigation on May 10, 2005 was submitted for analysis to ALS Environmental in Vancouver BC for dissolved iron and manganese, as well as UV absorbance. Results are summarized in Table 6522-2, located in Appendix A22, and the laboratory reports are included in Appendix B.

The additional analysis indicated that the dissolved iron concentration in the sample collected on May 13, 2005 was less than 0.03 mg/L, which is significantly less than the previously reported total iron concentration, and less than the CDWQG aesthetic objectives. The dissolved manganese concentration; however, for this most recent sample was 0.296 mg/L. This value is higher than the previously reported concentration of total manganese and is higher than the CDWQG aesthetic objective. The significance of the high concentration of dissolved manganese shows that the overall manganese content cannot be attributed to suspended particles. Therefore, although well rehabilitation to decrease turbidity, and/or filtration to remove suspended particles could be sufficient to reduce the iron content of the water, it would not likely reduce manganese concentrations to meet the aesthetic objectives.

22.3.4 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5, 2004 was reported to be low and can be considered to be within the normal background ranges for groundwater in the Carmacks area. Nitrate and nitrite concentrations from this sample were also reported to be low and within the normal background range for the Carmacks area. These water quality results suggest that the aquifer from which the groundwater is obtained was not under the influence of anthropogenic sources of nutrients or anions such as septic wastes at the time of sampling.

22.4 Conceptual Hydrogeology

Based on topography and proximity to surfacewater bodies, the groundwater flow direction in the vicinity of the site is inferred to be south or southwest towards the Yukon River.

22.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6522-4 in Appendix A22. Photos of potential contaminant sources are provided in Appendix A22.

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

- Septic field at 25 m, which is in contravention of the proposed regulation;
- Aviation fuel drums at 30 m, and
- Fuel storage trailer (at time of inspection) at 20 m.

22.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information and contaminated sites search results did not identify any concerns for this site.

22.6 Identified Water System Deficiencies and Associated Risk

22.6.1 High and Medium Risk Deficiencies;

The following deficiencies were identified as being high-risk for the Carmacks Airport Terminal:

- Turbidity at 2.9 NTU is in exceedence of the CDWQG MAC of 1.0 NTU.
- The wellhead is located within 30 m of potential sources of contamination. During the site inspection it was identified that there were aviation fuel drums located 30 m from the well and there was a mobile fuel storage trailer located 20 m from the well. The well is located on the gravel apron for the airport tarmac and there is potential that any aircraft, mobile fuel storage trailer, or other vehicle, can be moved within 30 m of the well and pose a risk of contamination.
- The septic field is less than 30 m in a direction inferred to be upgradient from the well.
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines).

- Poor surface completion of the wellhead below ground (in a pit below ground level).
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction.

22.6.2 Low Risk Deficiencies

There were no low-risk deficiencies identified at this site. All deficiencies are considered to be high-risk.

22.7 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).

22.7.1 Priority 1

Due to the location of the well on the airport apron, traffic and fuel handling activities within 30 m of the well are probable. In addition, based on the inferred groundwater flow direction, and the fact that the well is potentially downgradient of the airport terminal's septic field, it is being recommended that a new well be drilled at a safe location with respect to potential contaminants. The new water well should be sited and constructed in consideration of the following recommendations:

- The well must be located at least 30 m away from, and upgradient from any potential sources of contamination;
- The well should be equipped with a surface seal to at least 6 m below grade and the casing should be extended above grade (500 mm) so that it is lockable and not accessible to animals and unauthorized persons;
- The water from the new well must meet all CDWQG health based guidelines. If there are any exceedences in the CDWQG health-based guidelines then a treatment system must be designed and installed as necessary. It is likely that a treatment and disinfection system may be recommended.
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction.

22.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

22.8.1 Priority 1

- Assuming overburden to a depth of approximately 30 m, it is recommended that **\$25,000** be budgeted for materials and labour to drill, test, and complete the well.
- It is estimated that a pitless unit adapter and 40 m of distribution pipe to hook-up the well would cost approximately **\$8,000**.
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction. It is estimated that this would cost approximately **\$1000**.
- **\$9,000** should be allocated for water treatment if required.

23.0 BUILDING 6536: CARMACKS FORESTRY CREW QUARTERS

23.1 Description of Existing Water Supply System

The Carmacks Forestry Department Crew Quarters (Building 6536) has water supplied from a 10.5 m deep well approximately 3 m away from the crew quarters. The building is used seasonally, and the well is currently not used in the winter months. A site plan that shows the location of the well, as well as other details about the property, is provided as Figure 6536-A in Appendix A23. The coordinates of the wellhead, measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6886336
- Easting: 433882

During the assessment, the water system inside the crew quarters could not be inspected, because access could not be gained to the building. There is currently no heat trace to protect the pump or the piping, nor is there any kind of measure in place to prevent access by unauthorized persons to the well.

23.2 Description of Existing Wastewater Systems

The septic tank for the Carmacks Forestry Department Crew Quarters is located east of the crew quarters building (opposite to the well). The wellhead is located approximately 20 m from the septic tank. The septic tank discharges effluent to a field located east of the tank and approximately 20 m from the well. Septic field construction is unknown, however, it may consist of a leach pit. The septic tank and effluent field are both likely upgradient from the well. Figure 6536-A, located in Appendix A23, details the location of the septic system, well and other site features.

23.3 Water Quality Results

23.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks Forestry Department Crew Quarters water system has previously been completed by YTG this year. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling.

Two samples were collected from this system in 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 6536-1 located in Appendix A23.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the two samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Carmacks Forestry Department Crew Quarters water system on October 5, 2004. Because access to the building and water system was not possible at the time of assessment, it is unknown if there is a treatment or disinfection system, however it is considered unlikely based on the previous water quality results. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results are summarized in Table 6536-2 and are included in Appendix A23. EBA reviewed the analytical results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was calcium- bicarbonate type with a pH of 8.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 197 mg/L, and is considered poor for aesthetic purposes.

23.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks Forestry Department Crew Quarters that was identified to be included during the field inspection is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of sampling.

23.3.3 Additional Analytical Results

A water sample was obtained during the water system assessment on May 25, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance.

These results are summarized in Table 6536-2 located in Appendix A23 and the laboratory reports are included in Appendix B.

23.3.4 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5, 2004 was reported to be low and can be considered to be within the normal background range for groundwater in the Carmacks area. Nitrate and nitrite concentrations from this sample were also reported to be low and within the normal background range for the Carmacks area. These water quality results indicate that the well does not appear to be under the influence of anthropogenic sources of nutrients or anions such as septic wastes at the time of sampling.

23.4 Conceptual Hydrogeology

Based on topography and proximity to surfacewater bodies, the groundwater flow direction in the vicinity of the site is inferred to be east or southeast toward the Yukon River. The static water level for the well is 10.5 m below grade.

23.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6536-4 in Appendix A23. Photos of potential contaminant sources are provided in Appendix A23.

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

- Above ground fuel storage tank at 14 m;
- Septic Tank: 19 m (this meets existing and proposed regulation); and,
- Septic Field: starts at 20 m, which is in contravention of proposed regulation.

23.5.1 Spills Records and Contaminated Sites Search Results

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

23.6 Identified Water System Deficiencies and Associated Risk

23.6.1 High and Medium Risk

The following deficiencies were identified as high-risk for the Carmacks Forestry Department Crew Quarters:

- The well is located within 30 m of potential sources of contamination. There is an above ground fuel storage tank located 14 m from the well, and there is also a septic tank and field located 20 m upgradient (inferred) from the well;
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- Although the silt and clay near surface offers some protection from surface sources of contamination, the on-site sewage disposal system would discharge below this fine-grained layer. At 11 m deep, the well is considered to be a shallow well. The well, therefore, would be considered to be at high-risk of contamination from surface sources;
- The wellhead construction is poor. Currently all of the piping and wiring is exposed to the elements.

Access could not be gained to the crew quarters during the time of inspection and as thus the water supply system could not be properly assessed.

23.6.2 Low Risk Deficiencies

The following deficiencies were identified as low-risk for the Carmacks Forestry Department Crew Quarters:

- There is no freeze-protection for the well or plumbing.
- The well is located directly in front of the parking area around the crew quarters and could be damaged by a vehicle.

23.7 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).

23.7.1 Priority 1

Because the well is a shallow well in close proximity to potential sources of contamination, it is recommended that a new well should be drilled:

- The new well must be located at least 30 m away from any potential source of contamination;
- The well should be equipped with a surface seal to at least 6 m and the casing should be extended above grade (500 mm) within a lockable enclosure that is not inaccessible to animals and unauthorized personnel;
- The water from the new well must meet all CDWQG health based guidelines. If there are any exceedences in the CDWQG health-based guidelines then a treatment system must be designed and installed as necessary. It is likely that a treatment and disinfection system will be recommended.
- If the new well is successful, the old well should be properly decommissioned in accordance with the Canadian Guidelines for Water Well Construction.

23.7.2 Priority 2

Access to the crew quarters should be obtained so that a proper assessment of the existing water system can be completed in order to determine what options for treatment are available.

23.7.3 Priority 3

All low risk deficiencies for this water system are mitigated if a new well is drilled.

23.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

23.8.1 Priority 1

- Assuming overburden to a depth of approximately 20 m, it is recommended that **\$25,000** be budgeted for materials and labour to drill, test, completion, and hook-up of the well.
- If the new well is successful, the old well should be properly decommissioned in accordance with the Guidelines for Water Well Construction. It is estimated that this would cost approximately **\$1000**.
- An estimated amount of **\$5,000** should be allocated for water treatment if necessary.

24.0 BUILDING 6542: CARMACKS FORESTRY DISTRICT OFFICE

24.1 Description of Existing Water Supply System

The water system for Building 6542, the Carmacks Forestry Department District Office, is currently supplied from a 12 m deep well located in a small underground addition off from the basement of the district office. A site plan that shows the location of the well and gives other details about the property is provided as Figure 6542-A in Appendix A24. There is no treatment at present. A system schematic is provided as Figure 6542-B in Appendix A24. The coordinates of the wellhead, measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884838
- Easting: 432758

24.2 Description of Existing Wastewater Systems

The Carmacks Forestry Department District Office is serviced by a piped sewer collection system provided by the Village of Carmacks. There are service lines, and potentially sewer mains that are within 30 m the well. There is rudimentary sewage manhole (MH20E) that collects wastewater from the adjacent building 6528, and does not appear to be constructed properly. MH20E is approximately 24 m from the well that serves these buildings. There is a risk of sewage leakage to the subsurface, or overflow if it the system were to back up.

24.3 Water Quality Results

24.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks Forestry Department District Office water system has previously been completed by YTG this year. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Only two samples were collected from this system in 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 6542-1 located in Appendix A24.

According to the YTG database, *E. coli* and Total Coliform Bacteria were reported as absent in each of the two samples for which results were provided.

Detailed Potability Analyses

A water sample was previously collected from the Carmacks Forestry Department District Office water system on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for analysis and included a detailed potability analyses. The results of this analysis are summarized in Table 6542-2 and are included in Appendix A24. EBA reviewed the analytical results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The raw water quality for the sample obtained on October 5, 2004 indicated that the groundwater source was bicarbonate type water with a pH of approximately 8.
- The turbidity of the water was reported to be 1.2 NTU, which exceeds CDWQG MAC of 1.0 NTU. A sample collected during a subsequent routine sampling event completed by PMA representatives also had a turbidity reading that was slightly above 1 NTU.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO₃) was reported to be 197 mg/L, and is generally poor for aesthetic purposes.

24.3.2 Identification of Additional Analytical Testing Required

Additional analytical that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at the time of sampling.

Additional Analytical Results

A water sample was obtained during the field investigation on May 13, 2005, and was submitted for analysis to ALS Environmental in Vancouver BC for UV absorbance. These results are summarized with historical results in Table 6542-2 included in Appendix A24, and the laboratory reports are included in Appendix B.

24.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. The chloride concentration for the sample obtained on October 5, 2004 was reported to be low and can be considered to be within the normal background ranges for groundwater in the Carmacks area. Nitrate and nitrite concentrations from this sample were also reported to be low and within the normal background range for the Carmacks area. These water quality results indicate that the aquifer from which the groundwater is obtained for the Carmacks Forestry Department District Office was not being impacted by anthropogenic sources of nutrients or anions such as septic wastes at the time of sampling.

24.4 Conceptual Hydrogeology

Residents of the main Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of the Village core is northeast toward the Yukon River.

24.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6542-4 in Appendix A24. Photos of potential contaminant sources are provided in Appendix A24.

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

- Two above ground fuel storage tanks at 5 m and 24 m; and,
- An improperly constructed sewer manhole 24 m from well.

24.5.1 Spills Records and Contaminated Sites Search Results

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

24.6 Identified Water System Deficiencies and Associated Risk

24.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as being high-risk for the Carmacks Forestry District Office:

- The wellhead construction is susceptible to flooding because it is below ground in an attachment to the basement;
- The wellhead is located within 30 m of potential sources of contamination. There are two above ground fuel storage tanks within 30 m, one located 5 m from the wellhead inside the same basement of the office building and the other 24 m from the well outside near a neighboring building;
- Turbidity was in exceedence of CDWQG MAC for both samples collected.
- There is no surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- The well has been recorded to be 12.2 m in depth, and as thus would be considered to be 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 does not meet the requirements of the Guidelines for Water Well Construction;
- The hydrogeology of the area also indicates that there are no protective low permeability layers between ground surface and the water table.
- The well is considered to be at high-risk of contamination from surface sources.

24.6.2 Low Risk

Due to the location of the well in a small, enclosed attachment to the basement of the district office, and because it is incased in a PWF wooden enclosure that is covered by a layer of soil, it is very difficult to access the wellhead for maintenance purposes.

24.7 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).

24.7.1 Priority 1

There are two options provided herein to mitigate the Priority 1 deficiencies identified for the Carmacks Forestry Department District Office. The current well should ultimately be decommissioned once a safer water supply is obtained. The two mitigative options for water system improvement are outlined below.

Option 1:

A new well has recently been drilled for the new school in Carmacks. The first option to mitigate the high-risk deficiencies identified in this report would involve abandoning the current well and connecting to this new well. The following recommendations would have to be carried out for this proposed option to be put in place:

- A pitless unit would have to be installed on the existing wellhead for the new well;
- The water distribution line with proper cover, heat trace and insulation would need to be installed between the building and the well (a distance of approximately 80 m). The distribution line would cross underneath the existing road.

Option 2:

It is likely that within the next two to five years the Village of Carmacks will be developing a municipal water distribution system that will service all of the central village, and will likely include this site. To save on the capital cost of constructing an approximately 80 m distribution line and connecting to a well that would likely only be used by the district office for two to five years, the following option could be considered:

- The existing well construction could be upgraded. The well casing should be extended above grade and a pitless adapter and near surface seal should be installed;
- A disinfection treatment system should be installed, and considering the water quality, a pretreatment system would need to be installed;
- Secondary containment should be installed on both above ground storage tanks identified at the site; and,
- Once the community system piped distribution system is installed, the treatment system would likely no longer be needed and could be reinstalled at another PMA maintained site.

-

24.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

24.8.1 Priority 1

Class D cost estimates for mitigative option to address the well deficiencies for this site are as follows:

- For both mitigative options presented above, the existing well will ultimately be decommissioned in accordance with the Guidelines for Water Well Construction. It is estimated that this would cost approximately **\$1000**.

Option 1:

- The cost for a pitless connection to the new school well is estimated to be **\$3,000**.
- The cost of installing the water line is uncertain until further study can be completed, but will likely be in the order of **\$20,000**.
- The cost for a treatment system is estimated at **\$9,000** assuming a NSF-61 certified filtration system and a NSF/ANSI 55 certified UV disinfection system and duplex water softener for pretreatment.

Option 2:

- Wellhead upgrades would cost in the order of **\$500**.
- The capital cost for the interim treatment system is estimated at approximately **\$9,000** assuming a commercial in-line filtration system and a UV disinfection system with a duplex water softener to act as pretreatment.
- Replacing the existing above ground fuel storage tanks with double walled secondary containment tanks would likely cost approximately **\$2,600** for each tank.
- The cost of a service connection to the community distribution system would be approximately **\$3,000**.

25.0 BUILDING 6975: CARMACKS HEALTH CENTRE

25.1 Description of Existing Water Supply System

Building 6975, the Carmacks Health Centre, is currently supplied water from a 17.7 m deep well located in a well house approximately 3 m from the Health Centre building. The well supply serves both the Health Centre and the adjacent Nurses Residence. The well location and other site details are provided as Figure 6975-A in Appendix A25. There is a filtration and water softening system included on the water supply system that delivers water to the Health Centre. A schematic detailing the water supply system is provided as Figure 6975-B in Appendix A25. The coordinates of the wellhead, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6884848
- Easting: 433110

25.2 Description of Existing Wastewater Systems

The Health Centre and Nursing Station are serviced by a piped sewer collection system provided by the Village of Carmacks. There are service lines, and potentially sewer mains that are within 30 m the well.

25.3 Water Quality Results

25.3.1 Water Quality Results from Previous Sampling

Bacteriological

Bacteriological sampling of water from the Carmacks Health Centre water system has previously been completed by YTG this year. EBA was provided access to the YTG database in order to review the results of this previous bacteriological sampling. Two samples were collected from this system in 2005 and were tested for total coliform and *E. coli* by Yukon Environmental Health Services using the presence/absence test method. Results are tabulated in Table 6975-1 located in Appendix A25.

According to the YTG database, *E. coli* and Total Coliform Bacteria were absent in each of the two samples for which results were provided.

Detailed Potability Analyses

PMA representatives previously collected a water sample from the Carmacks Health Centre water system on October 5, 2004. The sample was submitted to ETL EnviroTest in Surrey BC for detailed potability analyses. The results of these analyses are summarized in Table 6975-2 in Appendix A25. EBA reviewed the analytical results to compare them with the CDWQG and to observe general water quality, identify and recommend additional sampling and analytical, and to identify potential indicators of contamination.

- The water quality for the softened water sample obtained on October 5, 2004 indicated that the water is a potassium sulphate type due to the softening process, but that the groundwater type, as evidenced from the surrounding well water quality is likely calcium bi-carbonate type.
- The water quality results indicated that all health based and aesthetic objectives were met for the parameters analyzed. The hardness (as CaCO_3) was reported to be less than 1 mg/L, is considered very soft as expected of softened water treated with an ion exchange system.

25.3.2 Identification of Additional Analytical Testing Required

Additional analytical for the Carmacks Health Centre that was identified to be included during the water system assessments is detailed below:

- UV absorbance, to determine potential for UV treatment as a disinfection option in both the main Health Centre building.
- Measurements in the field for total dissolved solids, conductivity, pH, and temperature were completed at both the main Health Centre Building and the Nursing Residence at the time of sampling.
- Extractable Petroleum Hydrocarbons (EPH) and Polycyclic Aromatic Hydrocarbons (PAH) were also collected for analysis to determine whether the documented fuel spill at the site had resulted in contamination of the water supply.

Additional Analytical Results

A water sample was collected by EBA during the field program on May 10, 2005, and was submitted to ALS Environmental in Vancouver BC for UV absorbance, PAH and EPH analysis. These results are summarized in Table 6975-2 in Appendix A25 and the laboratory reports are included in Appendix B.

EPH and PAH were below analytical detection limits, suggesting that at this time, the previously documented fuel spill is not impacting this well.

25.3.3 Indicators of Potential Contamination

Chloride, nitrate and nitrite concentrations can indicate impacts from surfacewater sources or septic waste. Chloride concentrations for the sample obtained on October 5 2004 is low and can be considered to be within the normal background ranges for groundwater in the Carmacks area. Nitrate and nitrite concentrations for this sample were also low and within the normal background range for the Carmacks area. Therefore, these water quality results suggest that the aquifer from which the groundwater is obtained for the Carmacks Health Center was not under the influence of anthropogenic sources of nutrients or anions such as septic wastes at the time of sampling.

25.4 Conceptual Hydrogeology

Residents of the Central Village of Carmacks obtain their water supply from wells completed in a permeable unconfined sand and gravel aquifer in glaciofluvial and recent alluvial deposits. The regional groundwater flow direction in the vicinity of Village Core is northeast toward the Yukon River.

25.5 Potential Contaminant Sources

Potential contaminant sources from observations during the site investigation are compiled in Table 6975 in Appendix A25. Photos of potential contaminant sources are provided in Appendix A25.

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

- Fuel powered generator at 2 m; and,
- Above ground fuel storage tank at 11 m.

25.5.1 Spills Records and Contaminated Sites Search Results

Investigation of available spills record information did not identify any concerns for this site. It was reported by the Environment Branch, however, that a soil relocation permit had been issued for this site in 2003. We understand that the a heating fuel oil leak in the underground line between the AST and the Health Centre had occurred approximately 4 years ago. EBA has not reviewed the results of the remedial excavation to remove the contaminated soils. The most recent water quality analysis shows no evidence of hydrocarbon contamination despite the close proximity to the well and the shallow nature of the aquifer.

25.6 Identified Water System Deficiencies and Associated Risk

25.6.1 High and Medium Risk Deficiencies

The following deficiencies were identified as high-risk for the Carmacks Health Centre:

- The wellhead is located within 30 m of potential sources of contamination. There is an above ground storage tank located 11 m from the well, and the fuel line that runs to the health centre has leaked in the past;
- The well is not equipped with a surface sanitary seal (grout or bentonite seal as required by the Canadian Groundwater Association's Well Construction Guidelines);
- By definition of the Draft Yukon GUDI Assessment Guideline, the well is potentially under the direct influence of surface water because it does not meet the requirements of the Guidelines for Water Well Construction;
- The hydrogeology of the area also indicates that there are no protective low permeability layers between the surface and the water table. At 17.7 m deep, the well is considered to be a relatively shallow. The well, therefore, would be considered to be at high-risk of contamination from surface sources;
- The wellhead is located in a pump house that contains a back-up generator for the health centre and the well casing only extends 60 mm above floor level.

25.7 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).

25.7.1 Priority 1

The following Priority 1 mitigative recommendations should be implemented to address the deficiencies associated with the water system at the Carmacks Health Centre.

- The existing 20-micron filtration system should be replaced with an NSF 61 certified inline commercial filtration system capable of removing particles down to 1 micron (absolute) in size.
- A NSF/ANSI 55 certified UV disinfection system should be installed, and the existing water softener should be adequate for use as a pretreatment system. This is a conceptual design recommendation based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications.
- It would not be possible to install a proper surface seal to 6 m below grade. The well casing should; however, be extended to at least 500 mm above the pump house floor, and a secondary containment system should be installed around the generator to mitigate any risk of fuel leakage.
- Secondary containment should be installed on the above ground storage tank, or else the tank should be replaced with double walled fuel storage tanks.
- The Point of Entry treatment system should be installed in the pump house if there is room available, so that it can offer treatment to both water supply systems that are dependent on the well.

25.8 Cost Estimates for Mitigative Options

Engineering costs for pre-design and preparation of process diagrams and specifications for project tendering for water treatment systems are estimated to be 25% of construction costs. Engineering costs for other 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.

25.8.1 Priority 1

Class D cost estimates for mitigative option to address the well deficiencies for this site are as follows:

- The cost for the proposed disinfection/treatment system would amount to a total installed cost of about **\$5,000**.
- To extend the well casing to 500 mm above the pump house floor level would cost approximately **\$500**, and a secondary containment tray underneath the generator and fuel lines in the pump house is estimated to cost approximately **\$1000**.
- Replacing the existing above ground fuel storage tank with a double walled secondary containment tank would likely cost approximately **\$3,800**.
- Placing the treatment system in the pump house should incur no more cost than placing it in the health centre.

26.0 BUILDING 1131 – CARCROSS SEARCH AND RESCUE OFFICE

26.1 Description of Existing Water Supply System

Water for Building 1131, The Carcross Search and Rescue Office, is currently supplied by bulk water delivery from the Village of Carcross community water system that is chlorinated at the source. Delivered water is stored in a 1200 L polyethylene water storage tank located within the building. Field chemistry completed during this assessment found free available chlorine concentration to be 0.01 mg/L, which is well below the required 0.2 mg/L at a point of use.

A schematic detailing the water supply system is provided as Figure 1131-B in Appendix A26. Photos of the water system are also included at the back of this appendix. The coordinates of the water intake, as measured by a hand held GPS device, were recorded as:

- UTM ZONE 8
- Northing: 6670005
- Easting: 516351

An abandoned well is located in an enclosure on the northwest corner of the building. It is anticipated that use of this well was discontinued due to elevated arsenic concentrations that are found in groundwater in the Carcross area.

26.2 Water Quality Results

26.2.1 Water Quality Results from Previous Sampling

Regular bacteriological sampling and detailed potability analyses have not been previously completed at this site. Routine sampling is however, completed for the treated source water.

26.2.2 Identification of Additional Analytical Required

It was assumed at the time of the site visit that this system would also be added to the routine sampling program that YTG is currently completing, and that potability results would be made available for this system. Additional analytical for the Carcross Search and

Rescue Office that was identified to be included during the water system assessments (assuming potability results would also be available) is detailed below:

- UV absorbance and UV transmissivity, as well as tannins and lignin, to determine potential for UV treatment as a disinfection option for this water system;
- Total organic carbon (TOC); and,
- Measurements in the field for total dissolved solids, conductivity, pH, temperature, and Free Available Chlorine (FAC).

A water sample was obtained during the water system assessment on August 10, 2005, and was submitted to ALS Environmental in Vancouver BC for analysis of the parameters indicated. These results are summarized in Table 1131-2 in Appendix A26 and the laboratory reports are included in Appendix B.

26.3 Potential Contaminant Sources

Potential contaminant sources on the property observed during the water system assessment are compiled in field notes in Appendix A26. Photos of potential contaminant sources are also provided in Appendix 23.

Potential contaminant sources within 30 m of the abandoned well include:

- An above ground storage tank (AST) located 17 m away; and
- A septic tank and field located approximately 18 m from the wellhead.

As the system is supplied by water delivery, the abandoned well does not pose a threat to the safety of the water supply. However, if the aquifer was ever to be used as a drinking water source the abandoned well could act as a preferential pathway for contaminants to reach the aquifer. It is recommended that this well be properly decommissioned.

26.4 Identified Water System Deficiencies and Associated Risk

26.4.1 High or Medium Risk Deficiencies

High and Medium risk deficiencies identified for this system include:

- FAC at the point of use was 0.01 mg/L, below the required 0.2 mg/L, and there is no routine monitoring of residual chlorine concentrations;
- The vent/overflow does not have a vermin proof screen; and,
- The water tank is not easily accessible for routine inspection and cleaning. It may be difficult to install a watertight access hatch in a polyethylene tank. If it is not possible to clean this tank in its current state, a replacement tank with suitable access should be installed.

26.4.2 Low Risk Deficiencies

The following low risk deficiencies were observed for this water system:

- Piping is constructed of ABS and is not suitable for drinking water;
- Vent and fill lines are not labelled on the exterior of the building; and,
- The abandoned well has not been properly decommissioned.

26.5 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).

26.5.1 Priority 1

The following recommendations are made to mitigate immediate risk to the water system:

- Install secondary disinfection consisting of a NSF/ANSI 55 certified UV system with filtration pretreatment (15 micron). We understand that the source water is filtered to 1 micron at source. The sample collected at the time of the assessment had a UV Transmittance % that is below the level recommended for UV treatment. Other samples from the same source (Bennett Lake) were found to be suitable to UV disinfection. It is considered likely that the sample was anomalous and that ANSI/NSF 55 certified UV treatment would be adequate. This is, however, only a conceptual design recommendation based on the information available for planning and budgeting purposes. Engineering input will be required for final system specifications;
- Install a vermin proof screen on the overflow/vent;

- Undertake immediate cleaning of holding tank including superchlorination. If it is not possible to clean this tank in its current state, a new tank should be installed with suitable access for routing cleaning;
- Implement a regular water storage tank cleaning program every 6 months; and,
- Initiate a routine bacteriological testing program.

26.5.2 Priority 2

There were no Priority 2 mitigative options identified.

26.5.3 Priority 3

At some time in the future, the ABS piping should be replaced with PVC piping and the vent and fill pipes should be labelled on the exterior of the building.

26.6 Cost Estimates for Mitigative Options

26.6.1 Priority 1

Estimated costs for materials and labour for recommended Priority 1 upgrades are provided below. An additional contingency allowance of 20% is suggested for budgetary purposes.

- A UV system (NSF/ANSI certified) with pretreatment would cost approximately **\$2,200** installed.
- The cost to install a vermin proof screen on the vent/overflow would be negligible and could be installed at the same time as the previous work.
- Should tank replacement be necessary, it is estimated that a replacement tank could be supplied and installed for approximately **\$2,500**.
- Initiating a routine water storage tank cleaning program and monitoring should fall under normal operations and maintenance costs. Monitoring of residual chlorine concentrations would not be necessary if the recommended UV system is installed.

26.6.2 Priority 3

- Replacing the ABS fill pipe with PVC, and attaching labels to the exterior of the building would likely cost in the order of \$300 for materials and labour. Consideration should be given to completing this work at the same time as Priority 1 upgrades to save on contractor mobilization/demobilization costs.

27.0 SUMMARY

The project team assessed the small public drinking water systems for 26 Government of Yukon maintained buildings in the Whitehorse Region in May 2005 in general accordance with the Terms of Reference and the project team's proposal. Key findings of this study are discussed below.

Based on water quality results provided from previous studies or collected during this study, most wells assessed in the Whitehorse region did not have exceedences of health-based parameters, or indicators of potential contamination from human or animal wastes.

Two sites had metals in exceedence of their respective CDWQG Maximum Acceptable Concentrations (MACs). The Mendenhall Fire hall had uranium concentrations above the MAC for uranium. Environmental Health issued advisories that this water should not be used as a drinking source and we understand that the water system is currently not in use. The Golden horn Fire Hall has had arsenic concentrations above the existing MAC for two out of three sampling events. If not done so already, Environmental Health should be notified and appropriate action taken to ensure that this is not used as a potable supply until upgrades are completed.

In total, eight water systems had turbidity higher than the CDWQG MAC of 1 NTU. Turbidity should be as low as possible, and consistently be below 1 NTU; however, it can exceed this level occasionally. Follow-up sampling has confirmed that where turbidity was above 1 NTU during previous sampling events, it was also above 1 NTU during the 2005 routine testing program. Installation of the recommended filtration systems should reduce turbidity in these systems. Well redevelopment could be considered as an option to reduce turbidity at these sites, and would subsequently result in less operation and maintenance of the recommended filtration systems.

The presence of total coliform bacteria can be a potential indicator of bacterial and/or viral contamination. In the Whitehorse region, six of the water systems served by five water sources have at some time in the past eighteen months had total coliform bacteria present in the samples results provided for review for this study. Total coliform bacteria are an indicator organism, and do not necessarily indicate water contamination by faecal waste; however the presence or absence of these bacteria in drinking water is often used to determine whether water disinfection is working properly, or whether treatment is required. We understand that YTG has commissioned routine sampling programs for the presence of total coliform and E.Coli bacteria,

and most water systems are sampled on a monthly basis. Water sources in which total coliform have been identified as present in the past year should be utilized with caution.

E. coli (a type of faecal coliform) was observed in one sample collected from the Yukon Wildlife Preserve Main Office Building. The presence of this indicator organism along with other potential indicators of impact from septic or animal waste, and potential hazard conditions associated with the well construction are of significant concern. Water treatment system upgrades have been completed, and well upgrades are in the process of being completed at the time of this report. Follow-up testing is recommended once the well upgrades are completed. Routine testing will be critical to the mitigation of risk to this system. *E.Coli* bacteria have not been identified in any other Whitehorse Region water systems on the dates sampled.

Water sources from four wells in the Whitehorse Region that are currently utilized for drinking water have concentrations of arsenic that exceed the proposed guideline and will require treatment or use of an alternate source of drinking water when these proposed guidelines come into effect.

In general, well construction for the wells serving the small public drinking water systems for YTG maintained buildings does not meet the current construction standards or the requirements of the proposed guidelines. Each of the wells assessed have not been completed with surface sanitary seals (bentonite or bentonite grout) between the well casing and the formation within at least the top 6 m of the well completion. Additionally, many wells are completed in pits below grade, which makes them potentially susceptible to surface sources of contamination. The proposed guidelines require that all water supplied by wells that do not have properly constructed wells, or wells without grout seals within the top 6 m would either require treatment consisting of both filtration and disinfection, or further GUDI assessment (Phase 2 and/or 3) to ensure that these systems are not at risk. Most of the water systems assessed do not have filtration or disinfection and as such, this has been identified as a high-risk deficiency. In addition, many wells assessed have potential sources of contamination located within 30 m of the wells.

Class D estimates of costs to mitigate identified deficiencies are provided in each section, and are summarized in Table 4.

The multi-barrier approach to safe drinking water includes the protection of drinking water at its source, adequate treatment, a clean distribution system operated by competent personnel and comprehensive testing of water quality. During this study, the project team evaluated the well construction and potential contaminant sources in the vicinity of wells to assess the level of

protection of the drinking water at its source, additionally the condition and adequacy of the treatment and distribution systems were evaluated. It was not within the scope of work to evaluate the operations, maintenance and testing programs for these systems, however, these are key to the multi-barrier approach and will be required by the proposed small public drinking water system regulations. It was obvious from this assessment that operator training and routine maintenance of the existing water systems needs improvement. Table 5 provides a summary of the level of risk assessed to each water system in consideration of the identified risk and existing barriers of protection (a “multi-barrier” approach). Risk factors included:

- Any parameter above a CDWQG maximum acceptable concentration (not including elevated turbidity or coliform presence);
- Indicators such as elevated turbidity, presence of coliform, or elevated chloride, nitrate or nitrite.
- Potential sources of bacteriological and/or viral contaminants within 30 m of the wellhead; and,
- The level of risk due to public accessibility of the well (public buildings, schools, residences etc.).

Risk mitigating factors that were considered included:

- Favorable hydrogeological conditions;
- Good well construction;
- Primary disinfection treatment (e.g., filtration to less than 1 micron absolute or membrane filtration, etc.); and,
- Secondary disinfection treatment (e.g., chlorination or UV treatment).

Priority was assessed based on the level of public accessibility to the buildings and their water systems. Systems that provide drinking water to publicly accessible buildings and employee residences were assessed as an overall Priority level of 1 (highest priority), while systems that are not publicly accessible were assigned a Priority level of 2 or 3 depending on the amount of use of the building and water system. The priority assessment presented in Table 5 can be used as a tool to assist PMA in prioritizing system upgrades. This prioritization system is illustrated in the following matrix:

Matrix 1: Illustration of “Priority 1 – High Risk Systems”

Overall risk based on multi-barrier approach	Priority Level based on public accessibility		
	Priority 1	Priority 2	Priority 3
High	Priority 1 – High Risk	Priority 2 – High risk	Priority 3 – High risk
Medium	Priority 1 – Medium Risk	Priority 2 – Medium risk	Priority 3 – Medium risk
Low	Priority 1 – Low Risk	Priority 2 – Low risk	Priority 3 – Low risk

As indicated in the matrix provided above, those buildings with water systems that were identified as having an overall high-risk, and serve public buildings or employee residences (Priority 1) should be addressed first from a cost benefit perspective. These systems we refer to as “Priority 1 – High Risk”. All deficiencies (with the exception of some Priority 3 upgrades which are purely mechanical/operational and do not pose a health risk) for each system should ultimately be addressed in order to mitigate health risk. It is suggested that all Priority 1 upgrades for all systems be completed as soon as possible. In general, we recommend that the best approach to mitigate risk would be to install disinfection treatment systems (Priority 1), and to carry out well improvements as soon as possible thereafter (Priority 2).

The Priority 1, High-risk Sites for the Whitehorse Region include:

- 1134: Carcross School;
- 1500: Fraser Camp;
- 1322: Golden Horn School;
- 1421: Mendenhall Fire hall;
- 1950: Ibex Fire hall;
- 1955: Mount Lorne Fire hall (however, well upgrades that are currently in progress at the time of this report should mitigate some risk to this water system);
- YWP-A - Yukon Wildlife Preserve Main Office (however, water treatment system upgrades and well upgrades should mitigate some risk to this water system);
- M0064/M0094: RCMP housing;
- M0093: Carmacks RCMP Detachment;
- M0201: RCMP housing;
- 6522: Tantalus School;
- 6536: Carmacks Forestry Crew Quarters; and,
- 6975: Carmacks Health Centre.

Installation of treatment systems will result in increased operation and maintenance costs for these systems. YTG should consider for budgetary purposes that the equivalent of a full time water system operator, with adequate training, would be required to coordinate the operation, maintenance and routine testing of these systems. Requirements of the proposed Guidelines for Small Public Drinking Water Systems, and any other applicable guideline or regulation should be implemented diligently within the “multi-barrier” approach.

A general recommendation for operation and maintenance for systems where upgrades are not immediately implemented that would mitigate significant risk is to inspect and disinfect (superchlorinate with 200 mg/L chlorine solution) every water well, tank and distribution system on a bi-annual basis (every 6 months).

28.0 RECOMMENDATIONS AND CONCLUSIONS

The recommended upgrade options presented within this report should be evaluated by YTG with regard to risk, preference and cost. Priority 1 upgrades should be completed as soon as possible. All Priority 2 upgrades should also be completed as soon as budget and scheduling permits in the future. Priority 3 conditions should be monitored to check if and when they may worsen to a Priority 2 or 1 situation. In consideration of building priority, YTG PMA should start by commissioning the implementation of Priority 1 upgrades recommended for systems that are identified as “Priority 1-High-risk”. Addressing Priority 1 deficiencies at other systems with an overall “lower risk” should follow based on level of risk until all Priority 1 upgrades are complete.

It is recommended that interim alternate sources of drinking water be provided for the following buildings, until such time as the Priority 1 upgrades have been implemented:

- 1421: Mendenhall Fire Hall;
- 1950: IBEX Fire Hall;
- 1924: Golden Horn Fire Hall; and,
- RCMP Residences M0064 and M0094.

For these systems, it is recommended that YTG PMA consult with YTG EHSS to determine the best approach to issuing advisories and implementing interim measures (boil-water advisories or provision of bottled water).

It is recommended that additional assessment be completed for some systems as soon as possible. This would include:

- Follow-up bacteriological testing for the presence of faecal coliform and *E. coli* at the five systems that have previously tested positive for total coliform should be completed. We understand that this has been completed through the PMA routine testing program.
- Re-sampling at the Yukon Game Preserve Main Office well YWP-A for chloride, nitrite, nitrates, ammonia and bacteriological parameters should be completed once well upgrades are complete. It is suggested that this be completed during the spring snow melt.

Additional Hydrogeological assessment may be required for the Yukon Wildlife Preserve main office well depending on results of the recommended follow-up sampling.

29.0 LIMITATIONS

Conclusions and recommendations presented in this report are based on the wellhead inspections, water supply source evaluations and distribution and treatment system evaluations as described in the previous sections. The project team attempted to identify all water system deficiencies in the amount of time allocated for each assessment, while working within the constraints of the scope, budget and accessibility. It is possible that some deficiencies or risks have not been identified within the level of effort this project afforded. EBA bears no responsibility for undiscovered deficiencies due to project limitations on level of effort. This report has been prepared for the exclusive use of the Government of Yukon. This report has been prepared in accordance with generally accepted hydrogeological and environmental engineering practices. For further limitations regarding the use of this report, reference should be made to the EBA Environmental Report - General Conditions attached, which form a part of this report.

30.0 CLOSURE

EBA trusts this report meets your present requirements. If you have questions or concerns, please do not hesitate to call the undersigned.

Respectfully submitted;
EBA Consultants Ltd.

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31.0 REFERENCES

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TABLES

TABLE 1: SUMMARY OF HISTORICAL BACTERIOLOGICAL RESULTS

		Any Positive Total Coliform Counts? (yes or no)	Any positive E.Coli results? (yes or no)	Most Recent Sampling Event Available for EBA Review	Is Most Recent Result Positive?	Time Period over which Sampling was Done	Fraction of Positive Results vs. Negative Results
Building #	Building Name						
1134	Carcross School	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/12
1137	Carcross Firehall	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/9
1153	Carcross Grader Station						-
1131	Carcross Search and Rescue						-
Fraser							
1500	Fraser Camp	yes	no	28-Feb-06	no	Sept-04 to Feb-06	3/18
1322	Golden Horn School	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/7
1334	Lakeview Firehall (Fill Station)	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/9
1391	Hootilingua Firehall	yes	no	28-Feb-06	no	Sept-04 to Feb-06	2/18
1421	Mendenhall Firehall	no	no	May 05	no	Apr-05 to May-05	0/2
1924	Golden Horn Firehall	no	no	2-Feb-05	no	Sept-04 to Mar-05	0/6
1950	Ibex Firehall	yes	no	28-Feb-06	no	Sept-04 to Feb-06	2/18
1953	Tagish Firehall (Fill Station)	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/9
1955	Mount Lorne Firehall	no	no	2-Feb-05	no	Sept-04 to Mar-05	0/6
YWP-A (1424)	Yukon Wildlife Preserve Main Office	yes	yes	28-Feb-06	no	Jun-05 to Feb 06	2/13
YWP-B	Yukon Wildlife Preserve Kestrel Cottage	no	no	31-May-04	no	May-04	0/1
Carmacks							
M0064	R.C.M.P Housing	yes	no	22-Feb-06	no	Oct-04 to Feb 06	4/20
M0093	R.C.M.P. Detachment	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/7
M0094	R.C.M.P Housing	yes	no	22-Feb-06	no	Sept-04 to Feb-06	2/29
M0201	R.C.M.P Housing	no	no	4-Mar-05	no	Sept-04 to Mar-05	0/7
6511	Tantalus School	no	no	2-Mar-05	no	Sept-04 to Mar-05	0/8
6512	Grader Station	no	no	25-May-05	no	May 05	0/1
6522	Carmacks Airport Terminal	no	no	23-Feb-05	no	Oct-04 to Feb 05	0/5
6536	Crew Quarters	no	no	May 05	no	Apr-05 to May-05	0/2
6542	District Office	no	no	May 05	no	Apr-05 to May-05	0/2
6975	Health Centre	no	no	May 05	no	Apr-05 to May-05	0/2



Table 2: Water Quality Results

	Building 1131 - Carcross Search and Rescue	Building 1134 - Carcross School	1137 - Carcross Firehall	Building 1153 - Carcross Grader Station			Building 1500 - Fraser Camp			Building 1322 - Golden Horn School			Building 1334 - Lakeview Firehall		Building 1391 - Hootalinqua Firehall			GCDWQ Criteria		
SOURCE:	Carcross	Carcross Block 53	Carcross Lot 7	Carcross Lot 10101			Fraser			Golden Horn Subdivision			Judas Creek		Mayo Road					
Location/ Resident Address																				
Treatment	Filtration and Chlorination at source	Filtration and Chlorination at source	None	Filtration			Chlorination and Filtration			Filtration and Chlorination at source			Chlorination		None					
Source of Water		Benett Lake Pumphouse	On-Site Well	On-Site Well			Fraser Lake, Microhydroelectric Generating Station			Delivery			On-Site Well		On-Site Well					
Purpose of Sampling	Additional Sampling	Additional Sampling	Additional Sampling	Baseline	Additional Sampling	Baseline	Baseline	Additional Sampling, Laundry Sink Tap in Truck Garage	Follow-Up Laundry Sink Tap in Truck Garage	Baseline	Additional Sampling	Follow-Up	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline			
Sample Location		Bathroom Sink	Laundry Sink		Kitchen Tap						Staff Washroom Tap	Staff Washroom Tap		Kitchen Tap		Kitchen Tap				
Date Sampled	10-Aug-05	11-May-05	11-May-05	1-Nov-04	11-May-05	26-Jun-05		11-May-05	23-Mar-06		10-May-05	23-Mar-06	15-Jun-05	9-May-05	5-Oct-04	19-May-05	26-Jun-05	Lower Limit	Upper Limit	
Physical Tests (ALS)																		AO	MAC	AO
Colour (CU)		<5.0		25		<5		<5.0					<5.0		10		<5			15
Conductivity (uS/cm)		68.8		584		610		43.2					678		447		423			
Total Dissolved Solids		40		332		377		22					405		259		271			500
Hardness CaCO3		28.9		294	269	308		19.8					163		92	131	90.2	AO >200 = poor, > 500 unacceptable ^A		
pH		7.58		7.9		8.14		7.71					8.22		8.0		8.23	6.5		8.5
Turbidity (NTU)		0.16		1.4		17.0		0.14					0.38		1.5		2.6		1	5
UV Absorbance	0.270	-	-		0.0001			-		0.0001			-	-		0.0103				
UV Transmissivity	53.703				99.98					99.98						97.7				
Dissolved Anions (ALS)																				
Alkalinity-Total CaCO3	-	25.5	-	245		282							276		108		114			
Chloride Cl	-	0.72	-	2		1.00		<0.50					6.67		2		1.50			250
Fluoride F	-	0.224	-	0.38		0.317		0.105					0.328		1.01		1.00		1.5	
Sulphate SO4	-	6.38	-	71.0		88.6		2.28					109		99.0		105			500
Nitrate Nitrogen N	-	<0.10	-	<0.1		<0.10		<0.10					<0.10		<0.1		<0.10		10	
Nitrite Nitrogen N	-	<0.10	-	<0.05		<0.10		<0.10					<0.10		<0.05		<0.10		1	
Ammonia Nitrogen N	-	<0.020	-					-		-		-	-							
Total Metals (ALS)																				
Aluminum T-Al		<0.010		<0.02		<0.010		<0.010					<0.010		<0.02		<0.010			
Antimony T-Sb		<0.00050		<0.0004		<0.0005		<0.00050					<0.00050		0.0006		<0.0005		0.006	
Arsenic T-As		0.00026	0.0193	0.0177		0.0158		<0.00010		-			0.0059	-	0.0022		0.00408		0.025	
Barium T-Ba		<0.020		0.0423		0.035		<0.020					0.021		0.0244		0.025		1	
Boron T-B		<0.10		<0.02		<0.10		<0.10					0.25		0.03		<0.10		5	
Cadmium T-Cd		<0.00020		<0.0002		<0.0002		<0.00020					<0.00020		<0.0002		<0.0002		0.005	
Calcium T-Ca		9.71		57.5		62.8		6.77					52.3		24.1		24.9			
Chromium T-Cr		<0.0020		0.001		<0.0020		<0.0020					<0.0020		<0.0008		<0.0020		0.05	
Copper T-Cu		0.0461		0.003		0.0015		0.277					0.020		<0.001		<0.0010		1	
Iron T-Fe		0.055		1.06		1.23		0.035					0.095		0.556		0.531			0.3
Lead T-Pb		<0.0010		0.0004		<0.0010		<0.0010					<0.0010		<0.0001		<0.0010		0.01	
Magnesium T-Mg		1.12		32.9		36.7		0.71					47.5		6.7		6.81			
Manganese T-Mn		<0.0020		0.068		0.0635		<0.0020					0.0327		0.033		0.0285			0.05
Mercury T-Hg		<0.00020		<0.0002		<0.0002		<0.00020					<0.00020		<0.0002		<0.0002		0.001	
Potassium T-K		0.45		2.8		2.62		0.28					3.22		1.7		1.64			
Selenium T-Se		<0.0010		<0.0004		<0.0010		<0.0010					<0.0010		<0.0004		<0.0010		0.01	
Sodium T-Na		2.1		14		16.8		<2.0					19.4		60		62.1			200
Uranium T-U		0.00081		0.0047		0.00457		0.00103					0.00054		0.0003		0.00078		0.02	
Vanadium T-V																				
Zinc T-Zn		0.05		0.059		<0.050		<0.050					<0.050		0.005		<0.050			5
Dissolved Metals (ALS)																				
Aluminum D-Al					<0.10											<0.020			0.1	
Antimony D-Sb					<0.0050											<0.0010			0.006	
Arsenic D-As		-	-		0.0188			-		-				-		0.004			0.025	
Barium D-Ba					<0.20											0.032			1.0	
Boron D-B					<1.0											<0.10			5	
Cadmium D-Cd					<0.0020											<0.00010			0.005	
Calcium D-Ca					59.9											36.2				
Chromium D-Cr					<0.020											<0.0010			0.05	
Cobalt D-Co																<0.0010				
Copper D-Cu					<0.010											<0.0020				1.0
Iron D-Fe					0.526											<0.030				0.3
Lead D-Pb					<0.010											<0.0020			0.01	
Lithium D-Li																<0.050				
Magnesium D-Mg					29.1											9.82				
Manganese D-Mn					0.08											0.039				0.05
Mercury D-Hg					<0.00020											<0.00020			0.001	
Molybdenum D-Mo																0.0213				
Nickel D-Ni																<0.010				
Potassium D-K					2.8															
Selenium D-Se					<0.010											<0.0020			0.01	
Silver D-Ag																<0.00010				
Sodium D-Na					11.5											82.4				200
Uranium D-U					0.0049											0.00126			0.02	
Zinc D-Zn					<0.50											<0.0050				5.0
Trihalomethanes																				
Bromodichloromethane	-	-	-	-				<0.0010		-										

Table 2: Water Quality Results

SOURCE:	Building 1421 - Mendenhall Firehall			Building 1924 - Golden Horn Firehall			Building 1950 - Ibex Valley Firehall		Building 1953 - Tagish Firehall				Building 1955 - Mount Lorne Firehall		Building 1424 (YWP-A) Yukon Wildlife Preserve Main Office		Building YWP-B Yukon Wildlife Preserve Staff Building		GCDWQ Criteria		
Location/ Resident Address	Mendenhall Subdivision			Golden Horn Lot 189			Ibex Valley		Tagish				Mount Lorne		Takhini Hot Springs Road		Takhini Hot Springs Road				
Treatment	No			No			No		Chlorination				No		No, Water Softener		No				
Source of Water	On-Site Well			On-Site Well			On-Site Well		On-Site Well				On-Site Well		On-Site Well		Delivery				
Purpose of Sampling	Baseline	Additional Sampling	Baseline	Baseline	Additional Sampling		Baseline	Additional Sampling	Baseline	Baseline	Additional Sampling	Additional Sampling	Baseline	Additional Sampling	Additional Sampling	Baseline	Baseline (City of Whitehorse)	Additional Sampling			
Sample Location	Mendenhall Community Association (ASL)						Washroom Tap	Kitchen Tap			Kitchen Tap	Kitchen Tap	Kitchen Tap	Kitchen Tap	Raw Water Tap from Kitchen		City of Whitehorse Waterhouse 3	Kitchen Tap			
Date Sampled	13-Mar-00	10-May-05	15-Jun-05	4-Oct-04	10-May-05	25-Jun-05	5-Oct-04	10-May-05	15-Jun-04	4-Oct-04	9-May-05	23-Mar-06	4-Oct-04	19-May-05	19-May-05	26-Jun-05	1-Dec-04	19-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)																		AO	MAC	AO	
Colour (CU)	<5	<5.0	<5	5		<5	5	<5.0	<5.0	<3			5		<5.0	<5	<5				15
Conductivity (uS/cm)	563	575	579	567		640	512	847	533	335			301		1270	1220	252				
Total Dissolved Solids	347	355	353	389		412	304	579	309	242			220		904	950	160				500
Hardness CaCO3	240	259	275	348		337	265	392	263	228			206		688	658	116		AO >200 = poor, > 500 unacceptable ^A		
pH	7.87	8.22	7.87	8.3		8.17	7.8	8.21	8.23	8.1			8.0		8.18	7.96	7.86		6.5		8.5
Turbidity (NTU)	<0.1	1.78	9.26	0.25		1.21	0.5	4.92	0.69	0.3		1	0.8		0.69	0.14	<0.1			1	5
UV Absorbance		<0.0010			<0.0010			<0.0010	-	-	-	-		0.0073	0.022						
% UV Transmittance		>99.9			>99.9			>99.9						98.33	95.06						
Total Organic Carbon												1.95									
Dissolved Anions(ALS)																					
Alkalinity-Total CaCO3	239	246	251	271		294	190	230	280	217			177		286	292	105				
Chloride Cl	2.4	4.69	4.85	2		1.27	52	1.67	3.36	1			<1		26.5	23.6	1.8				250
Fluoride F	0.33	0.435	0.409	0.47		0.406	0.23	1.05	0.167	0.17			0.17		0.185	0.12	0.16			1.5	
Sulphate SO4	65	71.8	67.9	98.5		101	23	109	23.8	24.6			32		35.9	394					500
Nitrate Nitrogen N	0.2	0.24	0.22	0.1		0.11	1.5	<0.10	<0.10	<0.1			0.1		2.61	0.58	0.04			10	
Nitrite Nitrogen N	<0.1	<0.10	<0.10	<0.05		<0.10	<0.05	<0.10	<0.10	<0.05			0.11		<0.10	0.50	<0.005			1	
Ammonia Nitrogen N		0.042			-			0.075	-	-	-	-			-						
Total Metals (ALS)																					
Aluminum T-Al	0.008	<0.010	<0.010	<0.02		<0.010	<0.02	<0.020	<0.010	<0.02			<0.02		<0.020	<0.020	0.016				
Antimony T-Sb		<0.00050	<0.0005	0.0007		<0.0005	0.0008	<0.0010	<0.00050	0.0007			0.0008		<0.0010	<0.0010	<0.0005			0.006	
Arsenic T-As	0.0001	0.00018	0.00012	0.0345	0.0207	0.0290	0.0037	0.00384	0.0017	0.0006	-	-	<0.0004		0.00044	0.00048	0.003			0.025	
Barium T-Ba	0.037	0.043	0.041	0.0169		<0.020	0.0928	0.13	0.071	0.0646			0.0318		<0.040	<0.040	0.03			1	
Boron T-B	<0.05	<0.10	<0.10	0.04		<0.10	<0.02	<0.20	<0.10	<0.02			<0.02		<0.20	<0.20	0.015			5	
Cadmium T-Cd	<0.0002	<0.00020	<0.0002	<0.0002		<0.0002	<0.0002	<0.00040	<0.00020	<0.0002			<0.0002		<0.00040	<0.00040	<0.00002			0.005	
Calcium T-Ca	68.8	72.6	77.7	45.9		49.1	74.2	115	72.1	51.2			62.1		162	155	24.5				
Chromium T-Cr	0.002	<0.0020	<0.0020	0.0016		<0.0020	0.0014	<0.0040	<0.0020	<0.0008			<0.0008		<0.0040	<0.0040	<0.001			0.05	
Copper T-Cu	0.006	0.558	0.709	0.04		0.0311	0.344	0.295	<0.010	0.024			0.016		0.0024	0.0032	0.011			1	
Iron T-Fe	<0.03	0.757	0.697	0.007		0.142	0.064	0.852	0.637	0.016			0.131		<0.030	<0.030	<0.2				0.3
Lead T-Pb	0.002	0.0034	0.0032	0.0013		0.0014	0.0013	0.0041	<0.0010	0.0011			0.0012		<0.0020	<0.0020	<0.0002			0.01	
Magnesium T-Mg	16.6	18.8	19.7	46.6		52.2	17.7	25.4	20.2	21.8			9.6		68.9	65.6	16.5				
Manganese T-Mn	<0.001	<0.0020	<0.0020	0.005		0.036	0.006	0.038	0.0218	0.003			0.004		<0.0040	0.0193	<0.01				0.05
Mercury T-Hg	<0.00005	<0.00020	<0.0002	<0.0002		<0.0002	<0.0002	<0.00020	<0.00020	<0.0002			<0.0002		<0.00020	<0.00020	<0.0002			0.001	
Potassium T-K	3.63	3.4	3.31	3		2.93	1.6	1.75	2.69	2.6			1.3		2.83	2.51	1.8				
Selenium T-Se	0.002	0.0025	0.0019	<0.0004		<0.0010	0.0006	<0.0020	<0.0010	<0.0004			<0.0004		<0.0020	<0.0020	<0.0005			0.01	
Sodium T-Na	24.7	24.6	23.2	17		18.6	13	27.7	8.5	7			4		51.5	39.8	8				200
Uranium T-U	0.0622	0.0554	0.0578	0.0024		0.00210	0.0058	0.00869	0.00646	0.0065			0.0028		0.00946	0.00854	0.0017			0.02	
Zinc T-Zn	0.019	0.091	0.091	0.066		<0.10	0.04	<0.10	0.141	0.02			0.019		<0.10	<0.10	0.006				5
Trihalomethanes																					
Bromodichloromethane	-			-				-			0.0023	0.0024									
Bromoform	-			-				-			<0.0010	<0.0010									
Chloroform	-			-				-			0.0054	0.0122									
Dibromochloromethane	-			-				-			<0.0010	<0.0010									
Total Trihalomethanes	-			-				-			0.0078	0.0147								0.1	
Haloacetic Acids																					
Bromoacetic Acid	-			-				-			<0.0020	<0.0020									
Bromochloroacetic Acid	-			-				-			<0.0020	<0.0020									
Chloroacetic Acid	-			-				-			<0.020	<0.020									
Dibromoacetic Acid	-			-				-			<0.0020	<0.0020									
Dichloroacetic Acid	-			-				-			0.002	0.0039									
Trichloroacetic Acid (TCA)	-			-				-			<0.0020	<0.0020									
Total Haloacetic Acids											<0.020	<0.020									
Field Chemistry (EBA)																					
pH		7.76						7.50			7.73	8.00		7.70	7.43			8.38	6.5		8.5
TDS		276						393			440	223		181	579			147			500
EC (uS/cm)		535						773			480	445		358	1134			288			
Temperature		17.4						12.8				18.9		15.9	9.2		5	5.6			
Free Available Chlorine											0.02	0.00					0.38				

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)
- = not tested



Table 2: Water Quality Results

SOURCE:	Building 6511 - Tantalus School		Building 6512 - Carmacks Grader Station		Building 6522 - Carmacks Airport			Building 6536 - Forestry Crew Quarters		Building 6542 - Forestry District Office			Building 6975 - Carmacks Health Centre		GCDWQ Criteria		
Location/ Resident	Carmacks		Carmacks		Carmacks			Carmacks		Carmacks			Carmacks				
Address	Lot 12-6 Group 903		Lot 10 Group 10		Lot 1066 Quad 115 I/1			Lot 12 Parcel C-1					Lot 123				
Treatment	Filtration		Filtration		No			No		No			Filter and Softener				
Source of Water	On-Site Well		On-Site Well		On-Site Well			On-Site Well		On-Site Well			On-Site Well (shares with 6975 B)				
Purpose of Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline	Baseline	Additional Sampling			
Sample Location	Home Ec. Room			Washroom Tap	Washroom Tap	Washroom Tap			Kitchen Tap		Washroom Tap			Kitchen Tap			
Date Sampled	5-Oct-04	13-May-05	5-Oct-04	25-May-05	5-Oct-04	13-May-05	6-Jul-05	5-Oct-04	25-May-05	5-Oct-04	13-May-05	6-Jul-06	5-Oct-04	12-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)															AO	MAC	AO
Colour (CU)	5		5		5		<5	5		5		<5	<3				15
Conductivity (uS/cm)	333		381		532		652	310		309		376	612				
Total Dissolved Solids	223		286		365		417	213		213		225	365				500
Hardness CaCO3	208		261		331		336	197		197		181	<1		AO >200 = poor, > 500 unacceptable ⁴		
pH	7.9		8.0		7.9		8.19	8.0		8.0		8.25	8.1		6.5	1	8.5
Turbidity (NTU)	0.3		1.0		2.9		17.6	0.95		1.2		1.23	0.15			5	
UV Absorbance		<0.0010		<0.0010		<0.0010			<0.0010		<0.0010		<0.0010				
% UV Transmittance		>99		>99		>99			>99		>99		>99				
Dissolved Anions (ALS)																	
Alkalinity-Total CaCO3	197		244		229		247	190		189		199	231				
Chloride Cl	2		5		1		0.93	2		2		1.18	5				250
Fluoride F	0.21		0.21		0.24		0.204	0.21		0.21		0.168	0.2			1.5	
Sulphate SO4	20.6		32.6		109		133	18.1		18.3		19.3	24.8				500
Nitrate Nitrogen N	<0.1		<0.1		<0.1		<0.10	<0.1		<0.1		<0.10	<0.1			10	
Nitrite Nitrogen N	<0.05		<0.05		<0.05		<0.10	<0.05		<0.05		<0.10	<0.05			1	
Ammonia Nitrogen N																	
Total Metals (ALS)																	
Aluminum T-Al	<0.02		<0.02		<0.02		<0.010	<0.02		<0.02		<0.010	<0.02			0.1	
Antimony T-Sb	0.0007		0.0007		0.0007		<0.0005	0.0007		0.0008		<0.0005	0.0007			0.006	
Arsenic T-As	<0.0004		0.0034		<0.0004		0.00052	0.0009		0.001		0.00103	0.0031			0.025	
Barium T-Ba	0.0634		0.0655		0.018		0.021	0.0739		0.723		0.073	0.0002			1	
Boron T-B	<0.02		<0.02		0.05		<0.10	<0.02		<0.02		<0.010	<0.02			5	
Cadmium T-Cd	<0.0002		<0.0002		<0.0002		<0.0002	<0.0002		<0.0002		<0.0002	<0.0002			0.005	
Calcium T-Ca	60.1		72.4		61.2		65.2	56.4		55.7		53.4	<0.5				
Chromium T-Cr	<0.0008		0.0018		0.0012		<0.0020	<0.0008		0.0011		<0.0020	0.001			0.05	
Copper T-Cu	0.052		0.003		<0.001		0.0042	0.001		0.002		<0.0010	<0.001			1	
Iron T-Fe	0.022		0.25		0.497		1.44	0.131		0.149		0.149	0.009				0.3
Lead T-Pb	0.0004		0.0002		0.0017		<0.0010	0.0003		0.0002		<0.0010	0.0002			0.01	
Magnesium T-Mg	13.2		19		40.4		42.2	12.7		12.3		11.6	<0.1				
Manganese T-Mn	0.013		0.067		0.25		0.255	0.021		0.022		0.025	0.001				0.05
Mercury T-Hg	<0.0002		<0.0002		<0.0002		<0.0002	<0.0002		<0.0002		<0.0002	<0.0002			0.001	
Potassium T-K	2.3		2.8		2.5		2.49	2.3		2.3		2.06	212				
Selenium T-Se	<0.0004		<0.0004		<0.0004		<0.0010	<0.0004		<0.0004		<0.0010	<0.0004			0.01	
Sodium T-Na	6		7		11		10.9	6		6		6.6	<1				200
Uranium T-U	0.0012		0.0017		0.0034		0.00244	0.0011		0.0011		0.00106	0.001			0.02	
Zinc T-Zn	<0.004		0.008		0.01		<0.050	0.004		<0.004		<0.050	<0.004				5
Dissolved Metals																	
Aluminum D-Al																0.1	
Antimony D-Sb																0.006	
Arsenic D-As																0.025	
Barium D-Ba																1.0	
Beryllium D-Be																	
Boron D-B																5	
Cadmium D-Cd																0.005	
Calcium D-Ca																	
Chromium D-Cr																0.05	
Cobalt D-Co																	
Copper D-Cu																	1.0
Iron D-Fe				<0.030		<0.030											0.3
Lead D-Pb																0.01	
Lithium D-Li																	
Magnesium D-Mg																	
Manganese D-Mn				0.0649		0.296											0.05
Mercury D-Hg																0.001	
Molybdenum D-Mo																	
Nickel D-Ni																	
Selenium D-Se																0.01	
Silver D-Ag																	
Sodium D-Na																	200
Thallium D-Tl																	
Titanium D-Ti																	
Uranium D-U																0.02	
Vanadium D-V																	
Zinc D-Zn																	5.0
Polycyclic Aromatic Hydrocarbons																	
Acenaphthene		<0.000050		<0.000050									<0.000050				
Acenaphthylene		<0.000050		<0.000050									<0.000050				
Acridine		<0.000050		<0.000050									<0.000050				
Anthracene		<0.000050		<0.000050									<0.000050				
Benz(a)anthracene		<0.000050		<0.000050									<0.000050				
Benzo(a)pyrene		<0.000010		<0.000010									<0.000010		0.00001		
Benzo(b)fluoranthene		<0.000050		<0.000050									<0.000050				
Benzo(g,h,i)perylene		<0.000050		<0.000050													

Notes:

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

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

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

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- = not tested



Table 2: Water Quality Results

SOURCE:	Building M0064 - R.C.M.P. Housing		Building M0093 - R.C.M.P. Detachment		Building M0094 - R.C.M.P. Housing		Building M0201 - R.C.M.P. Housing			GCDWQ Criteria		
Location/ Resident	Carmacks		Carmacks		Carmacks		Carmacks					
Address	Lot B-12		Lot B-12		Lot B-12		528 Rawlinson St					
Treatment	No, Water Softener Only		No		No, Water Softener Only		No					
Source of Water	On-Site Well, Shares		On-Site Well		On-Site Well, Shares		On-Site Well					
Purpose of Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling	Baseline			
Sample Location		Downstairs Laundry Tub Tap		Kitchen Sink		Kitchen Tap	Kitchen Tap	Downstairs Laundry Tub Tap				
Date Sampled	8-Oct-04	12-May-05	5-Oct-04	12-May-05	5-Oct-04	12-May-05	5-Oct-04	13-May-05	6-Jul-05	Lower Limit	Upper Limit	
Physical Tests (ALS)										AO	MAC	AO
Colour (CU)	5		5		5		10		<5			15
Conductivity (uS/cm)	373		328		481		309		326			
Total Dissolved Solids	231		216		284		190		200			500
Hardness CaCO3	214		201		4		174		157	AO >200 = poor, > 500 unacceptable ^A		
pH	8.0		7.9		8.3		7.9		8.25	6.5		8.5
Turbidity (NTU)	0.15		0.25		0.3		1.5		2.30		1	5
UV Absorbance		<0.0010		<0.0010		<0.0010		<0.0010				
% UV Transmittance		>99		>99		>99		>99				
Dissolved Anions (ALS)												
Alkalinity-Total CaCO3	201		188		215		171		178			
Chloride Cl	3		3		3		1		0.57			250
Fluoride F	0.2		0.21		0.2		0.21		0.173		1.5	
Sulphate SO4	21.4		18.9		21.8		14.8		14.3			500
Nitrate Nitrogen N	0.1		0.1		0.1		<0.1		<0.10		10	
Nitrite Nitrogen N	<0.05		<0.05		<0.05		<0.05		<0.10		1	
Ammonia Nitrogen N												
Total Metals (ALS)												
Aluminum T-Al	<0.02		<0.02		<0.02		<0.02		<0.010			
Antimony T-Sb	0.0006		0.0007		0.0008		0.0007		<0.0005		0.006	
Arsenic T-As	<0.0004		0.0004		<0.0004		0.0017		0.00198		0.025	
Barium T-Ba	0.0643		0.0583		0.0009		0.0779		0.079		1	
Boron T-B	<0.02		<0.02		<0.02		<0.02		<0.10		5	
Cadmium T-Cd	<0.0002		<0.0002		<0.0002		<0.0002		<0.0002		0.005	
Calcium T-Ca	63.9		57.9		1.2		52.5		47.4			
Chromium T-Cr	<0.0008		0.0016		0.0015		0.001		<0.0020		0.05	
Copper T-Cu	0.07	0.0116	0.045		0.068		<0.001		0.0011		1	
Iron T-Fe	0.009		0.052		0.031		0.371		0.324			0.3
Lead T-Pb	0.0005		0.0036		0.0002		<0.0001		<0.0010		0.01	
Magnesium T-Mg	13.4		12.1		0.1		10.9		9.29			
Manganese T-Mn	0.001		<0.001		<0.001		0.077		0.0643			0.05
Mercury T-Hg	<0.0002		<0.0002		<0.0002		<0.0002		<0.00020		0.001	
Potassium T-K	2.3		2.2		48.6		2.3		2.16			
Selenium T-Se	<0.0004		<0.0004		<0.0004		<0.0004		<0.0010		0.01	
Sodium T-Na	7		7		81		6		6.2			200
Uranium T-U	0.0011		0.0011		0.0009		0.0009		0.00075		0.02	
Zinc T-Zn	0.007		0.008		0.007		0.026		0.054			5
Dissolved Metals												
Aluminum D-Al											0.1	
Antimony D-Sb											0.006	
Arsenic D-As											0.025	
Barium D-Ba											1.0	
Boron D-B											5	
Cadmium D-Cd											0.005	
Calcium D-Ca												
Chromium D-Cr											0.05	
Cobalt D-Co												
Copper D-Cu		0.0078										1.0
Iron D-Fe								<0.030				0.3
Lead D-Pb											0.01	
Lithium D-Li												
Magnesium D-Mg												
Manganese D-Mn								0.0680				0.05
Mercury D-Hg											0.001	
Molybdenum D-Mo												
Nickel D-Ni												
Selenium D-Se											0.01	
Silver D-Ag												
Sodium D-Na												200
Uranium D-U											0.02	
Zinc D-Zn												5.0
Field Chemistry (EBA)												
pH		8.08		7.77		8.10		7.79		6.5		8.5
TDS		194		181		199		162				500
EC (uS/cm)		383		356		392		317				
Temperature		13.1		7.8		15.0		12.4				
Free Available Chlorine												

Notes:

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

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

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MAC = Maximum Acceptable Concentration (Health Based)

- = not tested



Table 3: Summary of Well Assessment Results (Page 1 of 2)
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification			GPS Coordinates			Well Details						Potential Contaminant Sources						Well Deficiencies				
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)	Well Casing Diameter (mm)	Well Log?	Well Depth (m bg)	Low Permeability Protective Layer?	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)	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.	Wellhead Above ground (m)	Well Cap	Surface	Seal	Apron Grading
1131	Carcross Search and Rescue Station	Carcross	6670005	516351	663	No well, system is on water delivery						12	Inside building	Greater than 60	AST 1	14	Abandoned well located on property	No well, system is on water delivery.				
1134	Carcross School	Carcross	6670157	516083	664	W1 - 150	No		Likely: Silt and Clay: ~10m to ~60m	1hp submersible pump	7.0	Greater than 60	2	200	AST 1	50	Lot with mechanical equipment 40m away	W1- 1.8 below grade	Split Cap Gasket	Unlikely	No, but ground slopes away from pit	
						W2 - 150	No	W2 - Greater than 60	Till: ~80m to ~100m	2hp submersible pump Size of pump meets needs					AST 2	50	UST - 2m	W2 - 1.1 below grade	Split Cap Gasket, 2 missing bolts	Unlikely	No, but ground slopes away from pit	
1137	Carcross Firehall	Carcross	6670070	516069	665	150	Yes	104.6	Silt and Clay - 8m to 60m Till - 83m to 98m	1hp submersible pump Size of pump meets needs			Inside building	100	AST 1 AST 2 AST 3 AST 4	10 2 20 10	Lot with mechanical equipment 50m away	0.12 above grade	Split Cap Gasket	Unlikely	Inside building	
1153	Carcross Grader Station	Carcross	6671418	516896	675	150	No - however have a log for an abandoned well on site.	33.5 m according to Terry Anderson	?			Approx. 34	4	Greater than 150	No	N/A	Used Oil - 18m Salt Storage - 22m Vehicle Park - 2m Rock Pit - 9m Metal Parts - within 10m Absorb-all Hopper - 6m Fuel Drums - between 30m and 60m	Approximately at grade (within 0.01)	Split Cap Gasket	Unlikely	Slopes towards wellhead enclosure	
1500	Fraser Camp	Fraser	6619679	497323	848	N/A	N/A	N/A	N/a	1hp jet pump Size of pump meets needs												
1322	Golden Horn School	Golden Horn	6718787	507049	739	150	Yes	125	?	Too little for school, well abandoned		Greater than 60m	3	Greater than 150	AST	7		Buried Underground	Metal Plate welded on	Unlikely	No	
1334	Lakeview Firehall	Marsh Lake	6702194	540097	678	150	Yes	28	Silt - 0m to 7m Clay - 21m to 28m		17.8	34m with an approximately 5m drop	4.0	Greater than 150	AST	27		1.7 below grade	Split Cap Gasket	Unlikely	No, but slopes away from pit	
1391	Hootlinqua Firehall	Mayo Road	6747128	489242	660	150	Yes	156	Silt and Clay - 30m to 156m	Complaints about the well capacity - too slow for fire hal		36	14	Greater than 150	AST	24	Rock pit - approx. 30m to 40m away	1.50m below grade	Split Cap Gasket	Yes	No, but slopes away from pit	
1421	Mendenhall Firehall	Mendenhall	6736960	436161	714	150	No	43.2	?	1/2hp submersible pump Size of pump meets needs		Approx. 50	7	Greater than 150	AST 1 AST 2	1 20		0.43 above grade	Split Cap Gasket	Unlikely	Inside building	
1924	Golden Horn Firehall	Golden Horn	6718089	506919	738	150	Yes	32.9	Silt and Clay - 4m to 29m Bedrock - 30m to 33m	Complaints about the well capacity - too slow for fire hal		Unknown Approximately 19m to 40m	2.1	Greater than 150	AST	22	2 Jerry Can - 10m	0.46 above grade	Split Cap Gasket	Unlikely	No, ground is even	
1950	Ibex Firehall	Ibex Valley	6742155	483119	736	150	No	11.8	Unlikely, shallow well	1/2hp submersible pump Size of pump meets needs	8.6	30m with a downward slope	11.6	Greater than 150	AST	Greater than 60m		1.75 below grade	Split Cap Gasket	Unlikely	No, but slopes away from pit	
1953	Tagish Firehall	Tagish	6681131	538646	670	150	Yes	48.8	Silt and Clay - 0m to 43m	3hp submersible pump Size of pump meets needs	7.8	40	1.7	Greater than 150	No	N/A	Fire Equipment Cache - 38m Aviation Fuel Drums - 48m	0.20 above grade	Split Cap Gasket	Unlikely	No, but slopes away from pit	
1955	Mount Lorne Firehall	Robinson Subdivision	6704424	507749	784	34.8	No	?	Silt to 1.75 m	30 USgpm (from log)	18.3	30	4.5	Greater than 150	No	N/A	Solid Waste Dump - 180m	Greater than 0.85m below ground		Unlikely	Slopes towards pit	
	Yukon Wildlife Preserve Main Office	Takhini Hotsprings Road	6749184	481827	747	150	Yes	102.8	Bedrock - 4m to 103m (LL where is log?)			Approx. 40 m	1	Greater than 150	AST	6	Baby Muskox Pen - 12m Animal Corals - 25m	1.4m below grade	Split Cap Gasket	No	No, but slopes away from pit	
	Yukon Wildlife Preserve Kestrel Cottage	Takhini Hotsprings Road	6748465	481835	721	150	No	55.8			42	15	Inside building	Greater than 150	AST 1 AST 2	16 >30	Animal Corals - 50m	Approximately at grade (within 0.2m)	Split Cap Gasket	No	Inside building	
YTG - Small Public Drinking Water Systems							-	-	-	-	-	> 30 m from any part of a sewage disposal system	-	-	-	>30 from any potential sources of pollution	>120 m from solid waste site, dump, or cemetery >300 m from sewage lagoon or pit	-	-	-		

Well Identification			GPS Coordinates			Well Details						Potential Contaminant Sources							Well Deficiencies				
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)	Well Casing Diameter (mm)	Well Log?	Well Depth (m bg)	Low Permeability Protective Layer?	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)	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.	Wellhead Above ground (m)	Well Cap	Surface	Seal	Apron Grading	
MO064	R.C.M.P. Housing	Carmacks	6884798	432697	526	150	No		No, shallow well	1/2hp submersible pump (shared between 2 residences) Size of pump meets needs		Greater than 150	Inside building	100	AST 3 and 4	18	Sewer line less than 30m	Below grade in basement	Split Cap Gasket	Unlikely		Inside building	
MO093	R.C.M.P. Detachment	Carmacks	6884845	432680	528	150	Yes	16.08 measured - log says 15m	No, shallow well	3/4hp submersible pump Size of pump meets needs		Greater than 150	2	75	AST 1 and 2	9	Sewer line less than 30m	1.14 below grade	Split Cap Gasket	Unlikely		No, ground is even	
															AST 3 and 4	40							
MO094	R.C.MP. Housing	Carmacks	6884798	432697	526	150	No		No, shallow well	1/2hp submersible pump (shared between 2 residences) Size of pump meets needs		Greater than 150	Inside building	100	AST 3 and 4	18	Sewer line less than 30m	Below grade in basement	Split Cap Gasket	Unlikely		Inside building	
MO201	R.C.MP. Housing	Carmacks	6884996	432277	530	150	No		No, shallow well	1/2hp submersible pump Size of pump meets needs		Greater than 150	Inside building	75	AST 1	3	Adjacent well - 22m	0.5 below grade	Split Cap Gasket	Unlikely		Inside building	
															AST 2	24							
6511	Tantalus School	Carmacks	6884714	432684	530	150	No	16.5	No	1hp jet pump Size of pump meets needs		Greater than 150	Inside building	Greater Than 150	AST	1	Irrigation well - 63m (Likely upgradient)	1.7 below grade	Split Cap Gasket	Unlikely		Inside building	
																	New Well - 150m (approx..)						
6512	Carmacks Grader Station	Carmacks	6884956	433308	532	150	Yes	54.9	No, sand and gravel	3/4hp submersible pump Size of pump meets needs	5.8	20	Inside Building	Greater Than 150	AST 1	25	Waste Oil Tank - 30m	0.3	Split Cap Gasket	No		Inside building	
																	Waste Solvent Drum - 30m						
															AST 2	25	Waste Antifreeze Drums - 30m and 70m						
																	Salt Storage - 80m						
6522	Carmacks Airport Terminal	Carmacks	6887553	437781	545	150	No	23.4 (May be pump)	?		15.3	25 (Could be upgradient)	17	Greater than 150	No	N/A	Asphalt Pile - 70m	0.6 below grade	Split Cap Gasket	Unlikely		No, ground is even	
																	Parking - 5m						
																	Aviation fuel drums - 30m						
6536	Carmacks Forestry Crew Quarters	Carmacks	6886336	433882	526	125	No	10.5	No, shallow well		6.1	20 (Likely upgradient)	3	Greater than 150	AST	14		0.5 above grade	Split Cap Gasket	No		No, ground is even	
6542	Carmacks Forestry District Office	Carmacks	6884838	432758	534	150	Yes	12.2	No, shallow well		1.5	Greater than 150	Inside building	100	AST 6	24	Septic manhole - 24m	1.2 below grade	Split Cap Gasket	Unlikely		Inside building	
															AST 7	5 (Inside same building)	Septic manhole - 30m						
6975	Carmacks Health Centre	Carmacks	6884848	433110	528	150	Yes	17.7	No, shallow well	1 1/2hp submersible pump Size of pump meets needs		Greater Than 150	4	50	AST 1	11	Hydrocarbon spill - 6m	0.06 above grade	Split Cap Gasket	Unlikely		Inside building	
															AST 2	50	Electric Generator - 2m (Inside same building)						
YTG - Small Public Drinking Water Systems							-	-	-	-	-	> 30 m from any part of a sewage disposal system	-	-	-	>30 from any potential sources of pollution	>30 from any potential sources of pollution >120 m from solid waste site, dump, or cemetery from sewage lagoon or pit	0.5 m stick-up required	-	Intact casing and grout seal required to 6 m below grade	-		

TABLE 4: SUMMARY OF OBSERVED DEFICIENCIES AND ESTIMATE COSTS (2 pages)

Building #	Building Name	HIGH AND MEDIUM RISK DEFICIENCIES	RECOMMENDED PRIORITY 1 MITIGATION	PRIORITY 1 ADDITIONAL ASSESSMENT	PRIORITY 1 COSTS				RECOMMENDED PRIORITY 2 MITIGATION	PRIORITY 2 - ADDITIONAL ASSESSMENT	PRIORITY 2 - COSTS				LOW RISK DEFICIENCIES	RECOMMENDED PRIORITY 3 - MITIGATION	PRIORITY 3 - COSTS				
					Labour and Materials	Engineering	Contingency	Subtotal			Labour and Materials	Engineering	Contingency	Subtotal			Labour and Materials	Engineering	Contingency	Subtotal	Total
1134	Carcross School	Lack of Residual Chlorine in System. Inadequate fill cap, vent screen and labelling.		\$1,500	\$5,000	\$1,250	\$1,000	\$8,800	Label exterior piping and install fill cap and vent screen.		\$300	\$60	\$60	\$400	Poor wellhead construction potential risk to aquifer.	Upgrade wellhead construction.	\$8,000	\$1,600	\$1,600	\$11,200	\$20,400
1137	Carcross Firehall	Lack of disinfection, poor wellhead construction. Proximity to potential contaminant sources.	Re-plumb to adjacent treated water supply.	\$0	\$2,500	\$500	\$500	\$3,500	None	None	\$0	\$0	\$0	\$0	No surface seal installed.	Mitigated with High Risk. Decommission well.	\$1,000	\$0	\$0	\$1,000	\$4,500
1153	Carcross Grader Station	Lack of disinfection, poor surface completion of wellhead, and proximity to surface sources of contamination.	Option 1: Installation of disinfection system. Relocation of potential contaminant sources	\$0	\$13,000	\$3,250	\$2,600	\$18,900	Option 1: Installation of disinfection system. Install Fence around wellhead.		\$7,000	\$0	\$0	\$7,000	No oil-water separator or grease trap. Arsenic may be above Proposed MAC.	Installation of oil-water separator or grease trap within a floor drain system.	\$3,700	\$740	\$740	\$5,200	\$31,100
			Option 2: Drilling of a new well and decommissioning of the existing well.		\$30,000	\$6,000	\$6,000	\$42,000	Option 2: Install Treatment as necessary, including disinfection. Costs not known at this time.		\$0	\$0	\$0	\$0							\$47,200
1500	Fraser Camp	Backup storage tanks receive unfiltered water, no routine testing, no regular cleaning. CCRA supply not disinfected.	Redesign system so that backup storage tanks receives filtered and chlorinated water. Routine residual chlorine testing, record keeping, routine cleaning of tanks.	\$0	\$700	\$175	\$140	\$1,000			\$0	\$0	\$0	\$0	No low risks.		\$0	\$0	\$0	\$0	\$1,000
1322	Golden Horn School	Storage tank likely unsuitable for potable water, very low level of free available chlorine (0.01 mg/L). Fill pipe and vent pipes are made of ABS. No screen on vent, and vent and fill lines not labelled.	Replacement (Option 1) or refurbishment (Option 2) of water storage tank, monitoring of free available chlorine concentrations at four outlet points over a one month period, Installation of chlorine injection system.	\$1,500	\$9,000	\$1,800	\$1,800	\$14,100	Replacing ABS pipes with PVC, put screen on vent pipe and label fill lines.		\$700	\$140	\$140	\$1,000	Existing water wells are not properly decommissioned.	Proper decommissioning of existing wells	\$2,000	\$400	\$400	\$2,800	\$17,900
					\$6,500	\$1,300	\$1,300	\$11,000													\$14,800
1334	Lakeview Firehall and Public Fill Station	Poor surface completion of wellhead below ground, water from fire truck fill tanks can enter into potable water system, no backflow preventer on hose bib line. Fire truck fill tanks appear to not be cleaned regularly.	Improvement of wellhead completion, Installation of an adequate filter system, elimination of cross contamination potential from fire truck fill tanks.	\$0	\$8,900	\$1,780	\$1,780	\$12,500	Regular cleaning of fire truck fill tanks; extending overflow pipes to outside of building (included in high risk cost) .	\$2,000	\$0	\$0	\$0	\$2,000	Low peak flow capacity, overflow pipe discharges inside building, exceeding arsenic concentration, gasoline AST close to wellhead.	Further evaluation of peak flow demand (not included in cost estimate), increasing peak flow capacity of the system (if required), arsenic treatment may be required.	\$11,500	\$2,875	\$2,300	\$16,700	\$31,200
1391	Hootlinqua Firehall	Turbidity exceeds 1 NTU. Wellhead is completed in a pit, peak flow demands may not be met.	Installation of proper filter system.	\$0	\$2,500	\$625	\$500	\$3,600	Improvement of wellhead completion, further investigations of peak flow demand. (2 options see Section 10.8.1)	\$2,000	\$14,500	\$2,900	\$2,900	\$20,300	Fire truck fill tanks appear not to be cleaned regularly, high iron concentration, poor wellhead protection, AST fuel tank is close to well.	Fence around wellhead, moving of AST to north east corner of firehall. Adding a softener, and plumbing in for blending.	\$5,500	\$1,100	\$1,100	\$7,700	\$31,600
1421	Mendenhall Firehall	Above acceptable uranium concentrations, elevated turbidity, lack of disinfection, probably no proper surface seal, proximity to sewage system, difficult to clean storage tank, proximity of above ground oil tank.	Installation of treatment system for uranium removal, filtration and chlorine disinfection system. Replacement of existing tank with smaller tank. Relocation of oil tank.	\$0	\$16,600	\$4,150	\$3,320	\$24,100			\$0	\$0	\$0	\$0	Proximity of two other sources of contamination.	Likely could be relaxed.					\$24,100
1924	Golden Horn Firehall	High arsenic content (above MAC), well enclosure not locked, evidence of insects in well enclosure, no surface sanitary seal, proximity to septic system. Proximity of above ground fuel tank.	Option 1: Post appropriate advisories and provide a bottled water station. Install new well with proper surface seal and wellhead enclosure	\$0	\$50,000	\$10,000	\$10,000	\$70,000	Relocation or retrofitting of fuel tank.		\$1,000	\$200	\$200	\$1,400	Inadequate well capacity, No cleaning schedule for water tank (biofouling), gasoline jerry cans were stored in proximity of wellhead.	Evaluation of existing system capabilities. Regular cleaning .	\$0	\$2,000	\$400	\$2,400	\$73,800
			Option 2: Post appropriate advisories and provide a bottled water station. Complete upgrade with treatment	\$0	\$19,500	\$3,900	\$3,900	\$27,300													\$31,100
1950	Ibex Firehall	Variable chloride and nitrate levels, no disinfection system, located in a pit and close to septic system, no sanitary surface seal and no proper seal around wiring, signs of animal presence, no proper well enclosure.	Completion of new well through drilling deeper or hydrofracturing, decommission of old well, water treatment system.	\$0	\$16,000	\$3,200	\$3,200	\$22,400			\$0	\$0	\$0	\$0	Exceeding iron AO, no backflow preventer on hose bib line, fire fighting storage tank seems not to be cleaned regularly (biofouling).	Regular cleaning schedule for storage tank, installation of double cheque valve on hose bib line.	\$400	\$80	\$80	\$560	\$22,960
1953	Tagish Firehall (Fill Station)	Mice presence in well enclosure, no surface seal, inadequate casing stick up, lack of backflow preventer, low residual chlorine concentration, need for tank cleaning.	Upgrade wellhead completion, installation of backflow preventer, adjust chlorine system, replumb fire storage tanks, regular cleaning of tank.	\$0	\$7,600	\$1,520	\$1,520	\$10,600			\$0	\$0	\$0	\$0	Inadequate overflow pipe.	Extend overflow pipe to outside of building.	\$300	\$60	\$60	\$400	\$11,000
1955	Mount Lorne Firehall	Wellhead located in pit, wellhead enclosure not locked, no sanitary surface seal, proximity to septic system, no disinfection treatment. Proximity to former landfill and active transfer station.	Upgrade wellhead completion, proper wellhead enclosure, installation of disinfection system.		\$14,000	\$2,800	\$2,800	\$19,600	Monitor groundwater flow direction at former landfill, locate missing well log.	\$15,000	\$0	\$0	\$0	\$15,000	Inadequate overflow.		\$1,000	\$200	\$200	\$1,400	\$36,000

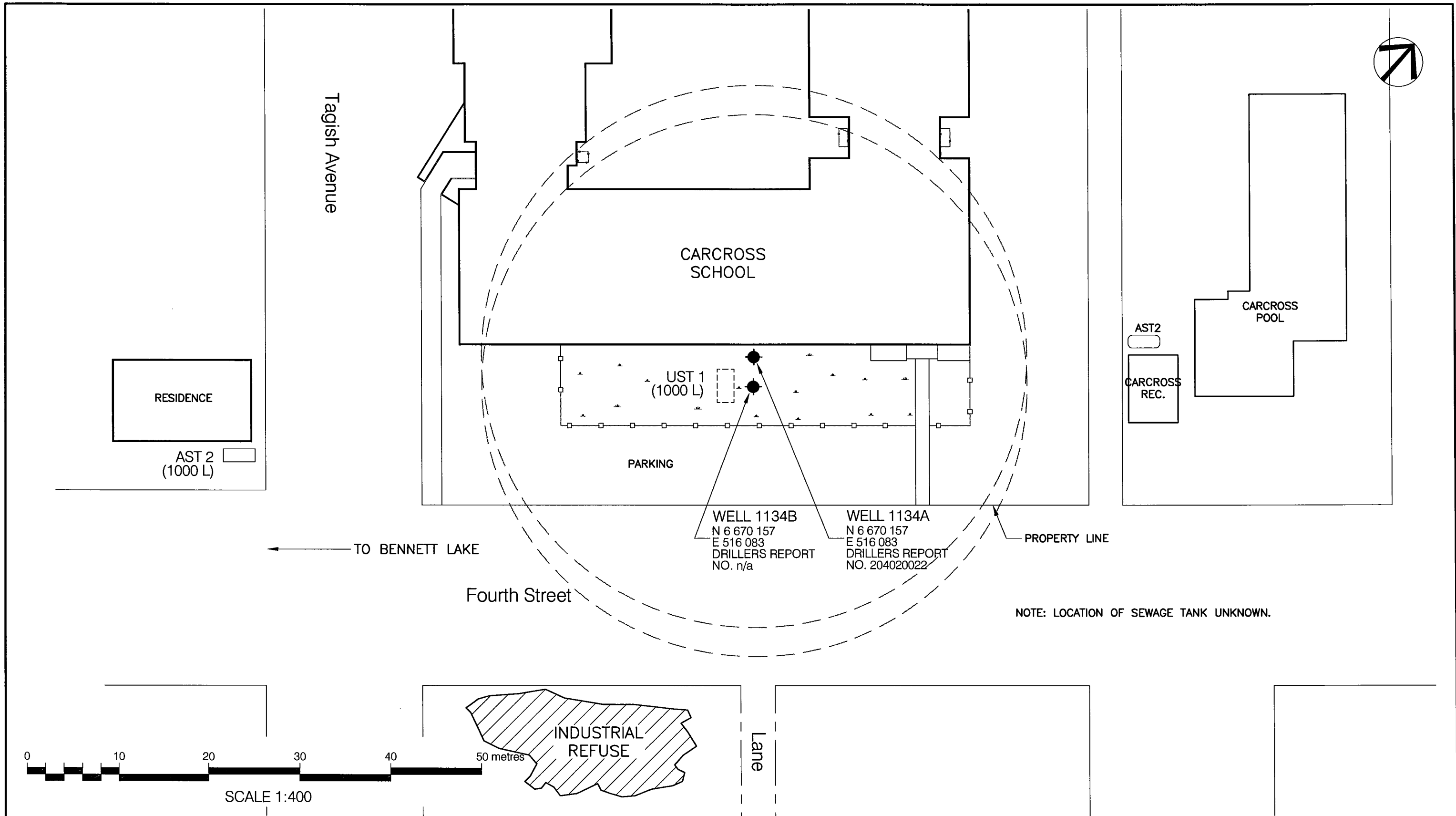
Building #	Building Name	HIGH RISK DEFICIENCIES	RECOMMENDED MITIGATION	ADDITIONAL ASSESSMENT	HIGH RISK COSTS				MEDIUM RISK DEFICIENCIES	RECOMMENDED MITIGATION	MEDIUM RISK COSTS				LOW RISK DEFICIENCIES	RECOMMENDED MITIGATION	LOW RISK COST				
					Labour and Materials	Engineering	Contingency	Subtotal			Labour and Materials	Engineering	Contingency	Subtotal			Labour and Materials	Engineering	Contingency	Subtotal	Total
YWP-A	Yukon Wildlife Preserve - Main Office	Positive E. coli result. Well is located in a pit, no surface seal, rodent presence inside enclosure, not locked, proximity of septic system, muskox pens and above ground fuel storage tank. No disinfection system, higher than normal nitrate levels. No backflow preventer on irrigation take-offs.	Option 1: Improvement of wellhead completion, proper wellhead enclosure, installation of an adequate filter system, water softener and chlorine disinfection system.	Additional sampling has been completed. Pending results of additional sampling, additional hydrogeological assessment may be required. Cost is not known at this time.	\$23,100	\$4,620	\$4,620	\$32,300	Lack of bacteriological testing or records of it.	Regular testing and record keeping.	\$0	\$0	\$0	\$0	Raw water tap in kitchen provides untreated water.	Installation of backflow preventer, removal of raw water tap from kitchen area.	\$300	\$60	\$60	\$400	\$32,700
			Option 2: Drill new well, plus treatment		\$49,500	\$9,900	\$9,900	\$69,300													\$69,700
YWP-B	Yukon Wildlife Preserve - Kestrel Cottage	Water storage tank and crawl space leading to tank not clean.	Option 1: Installation of concrete floor to properly house the water storage tank.	\$0	\$15,000	\$3,000	\$3,000	\$21,000	Piping made from ABS which is not approved for potable water.	Replacement of all ABS pipes with PVC.	\$500	\$100	\$100	\$700	Well not properly decommissioned, close proximity of a septic system, no screen on vent.						\$21,700
			Option 2: Re-commissioning of existing well, new wellhead enclosure, surface seal, pre-treatment and UV disinfection system (see 16.9).	\$0	\$25,000	\$5,000	\$5,000	\$35,000							No low risks.						\$35,700
			Option 3: Drill new well	\$0	\$30,000	\$6,000	\$6,000	\$42,000							Well not properly decommissioned, close proximity of a septic						\$42,700
YWP-D	Yukon Wildlife Preserve - Ptarmigan Tower	Water storage tank is not up to code.	Replacement of storage tank with a smaller tank in a location that is accessible for cleaning. Installation of 1/2 hp jet pump.	\$0	\$3,800	\$760	\$760	\$5,300	Fill caps have holes, fill pipe and overflow pipe made from ABS.	Replacement of fill caps and replacement of ABS piping with PVC.	\$500	\$100	\$100	\$700	No low risks.						\$6,000
M0064/ M0094	R.C.M.P Housing	Proximity of potential sources of contamination, no surface seal, shallow well, positive tests for total coliform. Well located in pit.	Install adequate disinfection system and secondary containment for ASTs.	\$0	\$8,500	\$2,125	\$1,700	\$12,300		Option 1: Upgrading of existing wellhead construction (see 17.7.1)	\$1,200	\$240	\$240	\$1,680	No low risks.						\$13,980
										Option 2: Connect to piped distribution (see 17.7.1). Service lines.	\$5,000	\$1,000	\$1,000	\$7,000							\$19,300
M0093	R.C.M.P. Detachment	Proximity of potential sources of contamination, no surface seal, shallow well. No disinfection	Install adequate disinfection system and secondary containment for ASTs.	\$0	\$10,000	\$2,000	\$2,000	\$14,000		Option 1: upgrade existing wellhead	\$5,000	\$0	\$0	\$5,000							\$19,000
										Option 2: Connect to piped distribution	\$3,000	\$0	\$0	\$3,000							\$17,000
M0201	R.C.M.P Housing	Proximity of potential sources of contamination, no proper surface seal, shallow well, well located in pit. No proper wellhead enclosure, exceeding turbidity. No disinfection.	Install adequate disinfection system and secondary containment for ASTs.	\$0	\$9,000	\$1,800	\$1,800	\$12,600		Option 1: upgrade existing wellhead	\$6,000	\$0	\$0	\$6,000	Pump in disrepair	Install new submersible pump	\$3,100	\$620	\$620	\$4,300	\$22,900
										Option 2: Connect to piped distribution	\$3,000	\$0	\$0	\$3,000							\$19,900
6511	Tantalus School	Poor surface completion of wellhead below ground, water from fire truck fill tanks can enter into potable water system, no disinfection/treatment.	Treatment plus interim upgrades, until move to new school.	\$0	\$13,000	\$2,600	\$2,600	\$18,200			\$0	\$0	\$0	\$0	Jet pump in disrepair	Replace with new submersible pump and controls	\$3,000	\$600	\$600	\$4,200	\$22,400
			Drill Replacement Well, plus treatment	\$0	\$36,000	\$7,200	\$7,200	\$50,400			\$0	\$0	\$0	\$0							\$54,600
			Connect to new well at new School site.	\$0	\$25,000	\$5,000	\$5,000	\$35,000			\$0	\$0	\$0	\$0							\$39,200
6512	Carmacks Grader Station	Proximity to potential sources of contamination, no surface sanitary seal, poor surface completion of wellhead below ground.	Construction of new well, decommissioning of existing well. Install treatment system.	\$0	\$45,500	\$9,100	\$9,100	\$63,700	No reported bacteriological testing program.	Regular bacteriological testing and record keeping.	\$0	\$0	\$0	\$0	High concentrations of iron and manganese.						\$63,700
			Use bottled water and issue advisory until such time as piped water system is available.	\$0	\$9,500	\$1,900	\$1,900	\$13,300													\$13,300
6522	Carmacks Airport Terminal	Proximity to potential sources of contamination, no surface sanitary seal, poor surface completion of wellhead below ground, turbidity.	Drill Replacement Well, and decommission existing well.	\$0	\$43,000	\$8,600	\$8,600	\$60,200			\$0	\$0	\$0	\$0							\$60,200
6536	Carmacks Forestry Crew Quarters	Proximity to potential sources of contamination, no surface sanitary seal, poor surface completion of wellhead below ground, turbidity.	Drill Replacement Well, and decommission existing well.	\$0	\$31,000	\$6,200	\$6,200	\$43,400			\$0	\$0	\$0	\$0							\$43,400
6542	Carmacks Forestry District Office	Proximity to potential sources of contamination, no surface sanitary seal, poor surface completion of wellhead below ground, turbidity.	Option 1: Connect to new well at new School site.	\$0	\$33,000	\$6,600	\$6,600	\$46,200			\$0	\$0	\$0	\$0							\$46,200
			Option 2: Treatment plus Interim Upgrades until piped distribution	\$0	\$17,500	\$3,500	\$3,500	\$24,500			\$0	\$0	\$0	\$0							\$24,500
6975	Carmacks Health Centre	Proximity of potential sources of contamination, no surface seal.	Replacement of filtration system, installation of UV disinfection system, extending well casing, replacement of storage tank.	\$0	\$10,300	\$2,060	\$2,060	\$14,400			\$0	\$0	\$0	\$0							\$14,400
1131	Carcross Search and Rescue	FAC below required 0.2 mg/L at point of use. Lack of regular water holding tank cleaning and residual chlorine monitoring.	Install filtration and UV to ensure adequately disinfected water supply. Note replacement tank included as contingency cost.	None Identified	\$2,700	\$540	\$3,040	\$6,280		None Identified	\$0	\$0	\$0	\$0	Piping constructed of ABS and is not suitable for drinking water.	Consider completing at same time as UV to save on mobilization /demobilization.	\$300	\$0	\$0	\$300	\$6,600



TABLE 5: OVERALL ASSESSED LEVEL OF RISK TO EXISTING WATER SUPPLY SYSTEMS USING MULTI-BARRIER APPROACH

		RISK INDICATORS				RISK MITIGATORS				OVERALL RISK AND PRIORITY		
Building #	Building Name	Exceedence of MAC other than total coliform or turbidity	Poor Quality Indicators (turbidity, coliform, nutrients)	Potential Bacteriological Contaminants within 30 m	Public Accessibility or Residence	Favourable Hydrogeological Conditions	Well Construction (surface casing, driven casing in tight formation etc..)	Treatment (primary)	Treatment (secondary)	Overall Risk	Rationale	Priority 1, 2 or 3
1131	Carcross Search and Rescue	No	No	n/a	No	n/a	n/a	Yes - at source	Yes - chlorination at source, but FAC low			
1134	Carcross School	No	No	n/a	Yes	n/a	n/a	Yes - at source	Yes - chlorination at source, but FAC low	High	High exposure, inadequate FAC	1
1137	Carcross Firehall	No	No	Yes	No	Yes	driven casing in tight formation	No	No	Moderate	Risk can easily be mitigated by plumbing into adjacent system	2
1153	Carcross Grader Station	No	turbidity	Yes	No	? - no log	? - no log	No	No	High	Not accessible to public. Log may assist in downgrading risk	2
1500	Fraser Camp	No	3/18 total coliform	Yes	Residences	n/a	n/a	Yes	Yes	Moderate - High	Safe operation in normal mode, but risk in event of power failure. Back-up supply not filtered.	1
1322	Golden Horn School	No	No	Yes	Yes	n/a	n/a	Yes - at source	?	High	High exposure, inadequate FAC	1
1334	Lakeview Firehall (Fill Station)	No	No	Yes	Yes	Yes - silt and clay	Yes	Yes - chlorination	No	Low	Well construction and treatment mitigate most risk	3
1391	Hootilingua Firehall	No	2/18 total coliform, turbidity	No	No	Yes	Well not driven - cable tool	No	No	High	coliform and turbidity	2
1421	Mendenhall Firehall	Yes - uranium	turbidity	Yes	Yes - public pick-up	? - no log, reportedly deep well				High	Uranium	1
1924	Golden Horn Firehall	Yes -arsenic	No	Yes	No	Yes	Yes - driven casing	No	No	Moderate - High	Depending on arsenic concentration	2
1950	Ibex Firehall	No	2/18 total coliform, turbidity, nutrients	Yes	Yes - outside hose bib.	? - no log	No	No	No	High	Indicators, risk, but no mitigation	1
1953	Tagish Firehall (Fill Station)	No	No	Yes	Yes	Yes	Yes - driven casing	Yes	No	Low	Well construction and treatment mitigate most risk	3
1955	Mount Lorne Firehall	No	No	Yes	No	Yes	Very poor	No	Np	High	Poor well construction - Upgrades in Progress	1
YWP-A	Yukon Wildlife Preserve - Main Office	Positive for E. coli	Positive for total coliforms 2/13	Yes	Yes	Deep bedrock - Surfacewater likely not connected to lower aquifer fracture zone	Well casing does not extend more than 6 m below grade, and may not be sealed in bedrock	No	No	High	Upgrades in progress that would eliminate some risk.	1
YWP-B	Yukon Wildlife Preserve - Kestrel Cottage	No	No	n/a	Residence	n/a	n/a	Yes - chlorination	?	Low	Delivered water, treated at source	3
YWP-D	Yukon Wildlife Preserve - Ptarmigan Tower	No	No	n/a	Residence	n/a	n/a	Yes - chlorination	?	Low	Delivered water, treated at source	3
M0064/M0094	R.C.M.P Housing	No	4/20 and 2/29 Total Coliform	Yes	Residences	? - no log	unlikely	No	No	High	Risk exists, but no barriers	1
M0093	R.C.M.P. Detachment	No	No	Yes	Yes	no	No	No	No	High	Risk exists, but no barriers	1
M0201	R.C.M.P Housing	No	Turbidity	Yes	Residence	? - no log, but unlikely based on depth and knowledge of area	unlikely	No	No	High	Risk exists, but no barriers	1
6511	Tantalus School	No	No	Yes	Yes	? - no log, but unlikely based on depth and knowledge of area	unlikely	No	No	High	Risk exists, but no barriers	1
6512	Carmacks Grader Station	No	No	Yes	No	no		No	No	High	Risk exists, but no barriers	2
6522	Carmacks Airport Terminal	No	Turbidity	Yes	No	? - no log	unlikely	No	No	High	Risk exists, but no barriers	2
6536	Carmacks Forestry Crew Quarters	No	No	Yes	Residence	? - no log	unlikely	No	No	High	Risk exists, but no barriers	1
6542	Carmacks Forestry District Office	No	Turbidity	Yes	No			No	No	High	Risk exists, but no barriers	2
6975	Health Centre	No	No	Yes	Yes	? - no log	Unlikely	No	No	High	Risk exists, but no barriers	1

APPENDIX A



NOTES:
1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.



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



EBA Engineering Consultants Ltd.

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

CLIENT:



Highways and Public Works
Property Management Branch

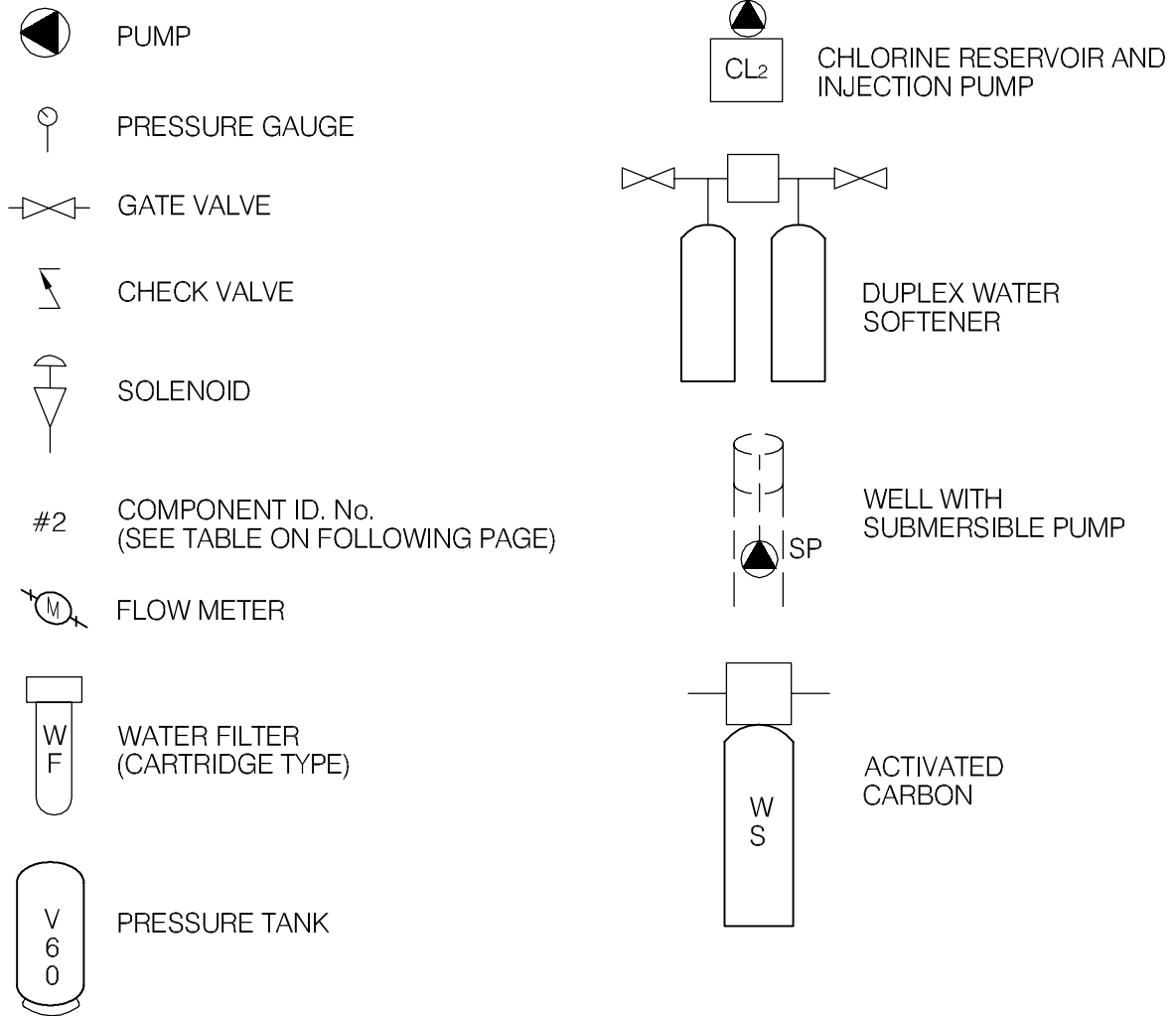
SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

CARCROSS SCHOOL
BUILDING 1134
SITE LOCATION DIAGRAM
WELL ID: 1134A & 1134B

REVISION ISSUE
0
DRAWING No.
FIGURE 1134A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

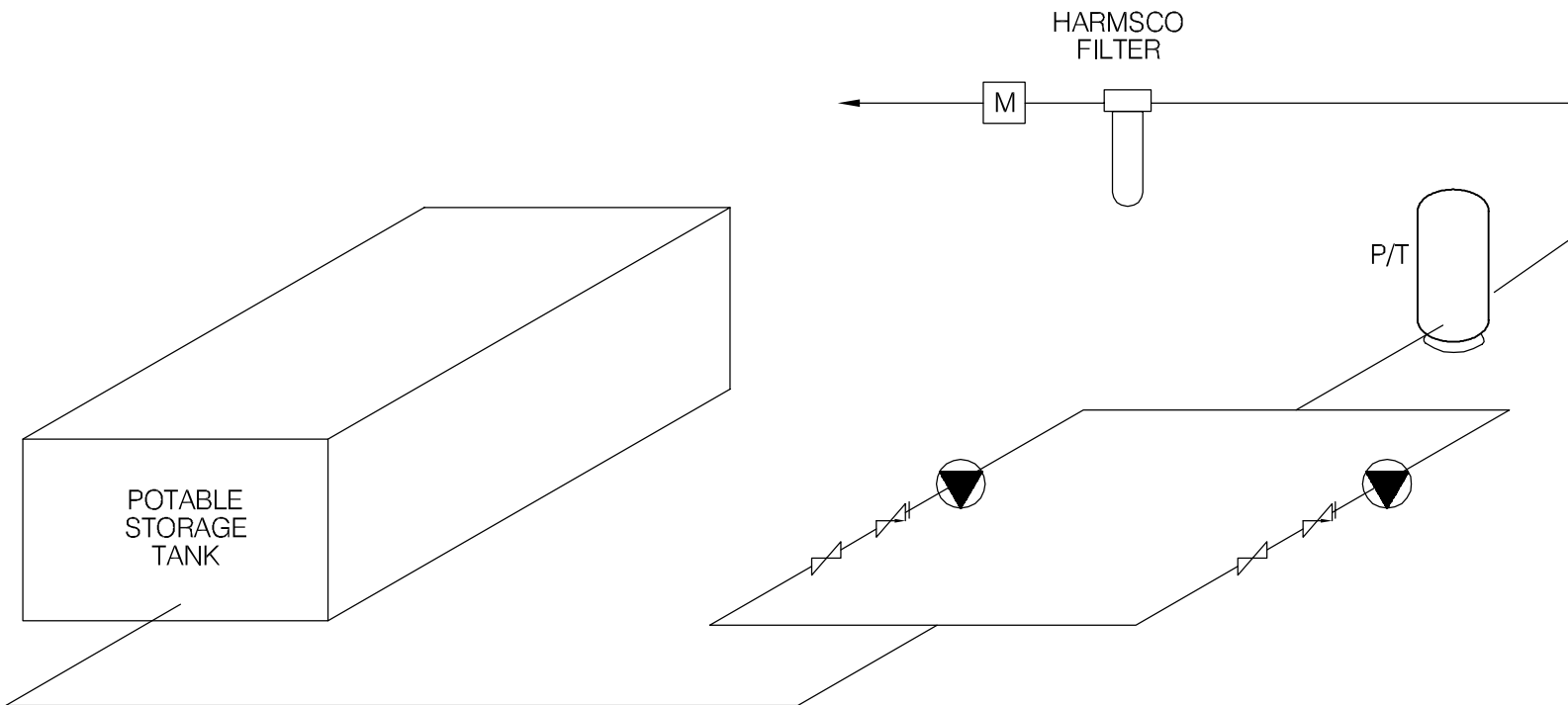
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1134
CARCROSS SCHOOL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1134B

**Whitehorse Region – Carcross School
Building # 1134**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	Pump #1 Well	GRUNDFOS				1 HP.
2	Pump #2 Well	JACUZZI				2 HP.
3	Pump #1 (Potable)	MONARCH	JKC-S3		1191	3/4 HP
4	Pump #2 (Potable)	MONARCH	MJS-75		5402	3/4 HP
5	Pressure Tank	MONARCH	FG42			42 Gallon
6	Storage Tank	CUSTOM				W x H x L 6' x 3' x 12'
7	Pressure Tank	MONARCH	M-302			
8						
9						
10						

TABLE 1134 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1134	Carcross School	12	Sept-04 to Mar-05	no	0/12	no	2-Mar-05	no



Table 1134-2: Water Quality Results

SOURCE:		Buiding 1134 - Carcross School		GCDWQ Criteria		
Location/ Resident		Carcross				
Address		Block 53				
Treatment		Public Water System				
Source of Water		Benette Lake Pumphouse				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location						
Date Sampled			11-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)			<5.0			15
Conductivity (uS/cm)			68.8			
Total Dissolved Solids			40			500
Hardness CaCO3			28.9	AO >200 = poor, > 500 unacceptable ^A		
pH			7.58	6.5		8.5
Turbidity (NTU)			0.16			5
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3			25.5			
Chloride Cl			0.72			250
Fluoride F			0.224		1.5	
Sulphate SO4			6.38			500
Nitrate Nitrogen N			<0.10		10	
Nitrite Nitrogen N			<0.10		1	
Ammonia Nitrogen N			<0.020			
Total Metals (ALS)						
Aluminum T-Al			<0.010			
Antimony T-Sb			<0.00050		0.006	
Arsenic T-As			0.00026		0.025	
Barium T-Ba			<0.020		1	
Boron T-B			<0.10		5	
Cadmium T-Cd			<0.00020		0.005	
Calcium T-Ca			9.71			
Chromium T-Cr			<0.0020		0.05	
Copper T-Cu			0.0461		1	
Iron T-Fe			0.055			0.3
Lead T-Pb			<0.0010		0.01	
Magnesium T-Mg			1.12			
Manganese T-Mn			<0.0020			0.05
Mercury T-Hg			<0.00020		0.001	
Potassium T-K			0.45			
Selenium T-Se			<0.0010		0.01	
Sodium T-Na			2.1			200
Uranium T-U			0.00081		0.02	
Zinc T-Zn			0.05			5
Field Chemistry (EBA)						
pH			7.94	6.5		8.5
TDS			30			500
EC (uS/cm)			60			
Temperature			17.2			
Free Available Chlorine			0.00			250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1134-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1134	Carcross School	Carcross	6670157	516083	664

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)
W1 - 150	?	No	?	Likely: Silt and Clay: ~10m to ~60m Till: ~80m to ~100m	?	1hp submersible pump	7.04
W2 - 150	?	No	W2 - Greater than 60		59.4	2hp submersible pump	

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
W1- 1.8 below grade	Split Cap Gasket	?	Unlikely	No, but ground slopes away from pit
W2 - 1.1 below grade	Split Cap Gasket, 2 missing bolts	?	Unlikely	No, but ground slopes away from pit

**Table 1134-4: Potential Contaminant Sources:
Building 1134 – Carcross School**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Industrial Refuse	Organic and inorganic chemicals.	40 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	unknown		
Septic fields	Biological and Inorganic parameters.	>60 m		
Gas stations	Organic and Inorganic parameters.	>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	2 m		
Above ground storage tanks (ASTs)	Organic parameters.	50 m, 50 m		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	Approx. 200 m to surfacewater		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

↳ non-potable water wells

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 11, 2005

WELL ID #	Owner	Location Description
1134	YTG	Carcross School

1. Well Location and Potential Contaminant Sources

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

Carcross

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

Carcross School

c. GPS location: 516083 Easting; 6670157 Northing; 664m elv. $\pm 9m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

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

Carcross School non-potable water

☐ 5 or more delivery sites on a trucked distribution system? If so how many 0

f. Nearest building, specify Carcross School

g. Distance from well to building 2m

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

i. Distance from well to nearest point of known field: Holding tank only ☒ No There are, however many residential septic tanks in the area, likely >60m lateral

j. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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- k. 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

There are residential septic holding tanks nearby

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

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

However, there is a junkyard ~60m away from the wells and many residential homes with mechanical gear and fuel/oil storage tanks on their property

- n. 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

Neither well was locked. Well has unfused 4x6 beams on top. Well has a put plywood casing screwed on only

Entrance by animals? ☒ Yes ☐ No

Well had no evidence of animals; well did contain some mouse droppings

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

Well has evidence of water staining; well has no evidence of water staining or flooding

- p. Is the well site well drained? ☒ Yes ☐ No

- q. 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 1.5 m

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: Lot w/ Mech Equip; Distance from well to Potential Source 1: 40 m

Potential Source 2: AST 1; Distance from well to Potential Source 2: 50 m

Potential Source 3: AST 2; Distance from well to Potential Source 3: 50 m

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

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

How many? There are 2 on the property ☐ in use ☐ abandoned ☐ require proper sealing

The well from the Carcross Fire Hall is nearby (<120m)

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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

measured values
58.315 m (pump)
bottom > 60 m
7.040 m (static)

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

e. Surface casing: ☐ Yes Diameter _____ ☐ No

f. Well casing: Diameter w1 - 15 cm
w2 - 15 cm Material: ☒ steel ☐ plastic ☐ concrete

g. Depth of well: w2 > 60 m ☒ measured (if possible) ☐ reported ☐ from log

h. Static water level below ground: 7.040 m

☒ 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 _____ slot size(s) _____

Location of screen: from _____ to _____ from log reported

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

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

w1 is in a pit with cement walls and w1 4"x6" wooden beam ceiling
w2 is in a pit within insulated pref enclosure

☒ 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 Yes W1 180cm, W2 84cm
- ii. Are there signs of ponding on the enclosure (e.g. water stains, etc.)? ☒ Yes ☐ No
W1 has serious signs of flooding and water stains
W2 has no evidence of ponding
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
In both cases
- iv. Any evidence of rodents? Specify W2 is clean, no evidence of rodents
W1 has some mouse droppings
- v. Does the well casing have a proper seal cap? ☐ Yes ☒ No

If no, describe condition both have split seal gasket caps, though
rusty, W2 has 2 missing bottom plates
and may not be properly sealed.

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 N/A - not used for potable water

Explain (filtration, disinfection etc...) _____

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

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 W1 - Grundfos
W2 - Jacuzzi Model _____
horsepower W1 - 1 hp capacity _____ voltage _____
W2 - 2 hp

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d. Date installed: unknown By: _____

e. For submersible pump, depth of setting below surface 58.315m bc → 22

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
in well pits

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: There is insulation and heat trace on both wells

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

See report

b. Recommendations: See Report

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PART B: EBA Site Inspection

Inspector: Ben Abisser

Date MAY 11-05

WELL ID #	Owner	Location Description
1134	VTG	CARROSS SCHOOL

6. Water Treatment

NOT USED FOR POTABLE WATER.

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 _____

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: CRAWL SPACE

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?

6FT X 3FT X 12FT RECTANGULAR.

What material is the tank constructed of? 3/4" PLY WOOD / FG LINER.

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 UNKNOWN

Comments: TANK HAS TO BE DRAINED ACCESS ON SIDE OF TANK.

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 UNKNOWN

Have there been any bacteriological analyses conducted previously? YES NO UNKNOWN

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

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

8. Conclusions

a. Comments on overall installation:

Water System is a Split System.

Non Potable Water is used for Toilets & Irrigation. Potable Water for Sinks & other fixtures.

Time Constraints for this work does not allow us to establish for certain that no cross connection exists.

b. Recommendations:

Complex Piping System must be coded to identify Non Potable & Potable Sources. System needs to be checked to assure no cross connection exists.

Potable Storage Tank should be in a location that allows easy inspection and cleaning. Chlorination equipment must be installed to effect proper chlorine residuals & contact time.

System components should be identified.

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PART C Property Manager/ System Operator Questionnaire

Inspector: FERRY JACKSON Date May 10/05
Property manager: Carross school

1) Water Source:

- a. Is the well water the major source of drinking water? ☐ Yes ☐ No
b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No {Toilets, urnals, irrigation}

2) Well information:

- a. When was your well installed? Year 22 hp Jacuzzi 1 well 1 hp gunfoss Month 1989
b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
c. Is there a driller's log for the well?: ☐ Yes ☐ No
d. Do you know the depth of your well? If so, please indicate: _____
e. Who was the well constructed by?
Indicate contractor's name: _____
f. Are you, the owner ☐ Yes or other: YTG
g. Who maintains the well? YTG
h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
i. Is there a buried fuel tank on the property? ☒ Yes ☐ No
If yes, is it ☒ in use ☐ abandoned
Is the location known? Beside Well heads
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? #2 1989 YTG
b. What type of pump do you have? 2 hp Jacuzzi
1 hp. Gunfoss
c. Pump delivers water to: ☒ pressure tank ☐ elevated tank ☐ other _____

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4) Water Treatment

a. Is your well water treated? ☐ Yes ☒ No

Type of treatment: ☐ chlorination ☐ iron and or manganese removal

other

sediment filter

5) Well Capacity:

a. Well capacity: User's opinion ☒ adequate ☐ inadequate

b. Are there any times of year when your well goes dry, or does not produce enough water?

c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

a. In general, do you like your water?: ☐ yes ☒ no

b. Does the water stain household plumbing? ☐ yes ☒ No ☐ slight ☐ severe

Type of stain: ☐ brown ☐ red ☐ black

c. Does the water contain sediment? ☒ Yes ☒ No ☐ occasional ☐ constant

d. Is there an unpleasant odour? ☐ Yes ☒ No

☐ Sulphur (rotten egg smell) ☐ Other _____

e. Is there an unpleasant taste? ☒ Yes ☐ No ☐ brackish ☐ Other _____

f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☐ no

g. Is water softener being used? ☐ Yes ☒ No

h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☒ No

If so, at what time intervals? _____

Who takes them? _____

i. Is there a history of bad bacterial analyses? ☒ Yes ☐ No

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

7) Do you have any overall comments or complaints about your water well system?

Well are used for Toilets, urinals, and
irrigation only

Environment
CanadaEnvironnement
Canada

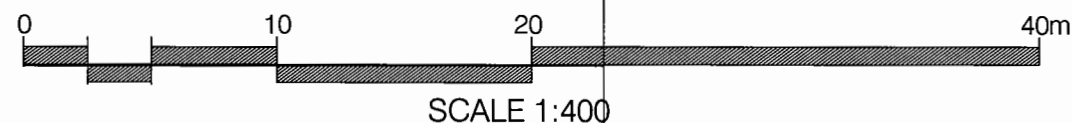
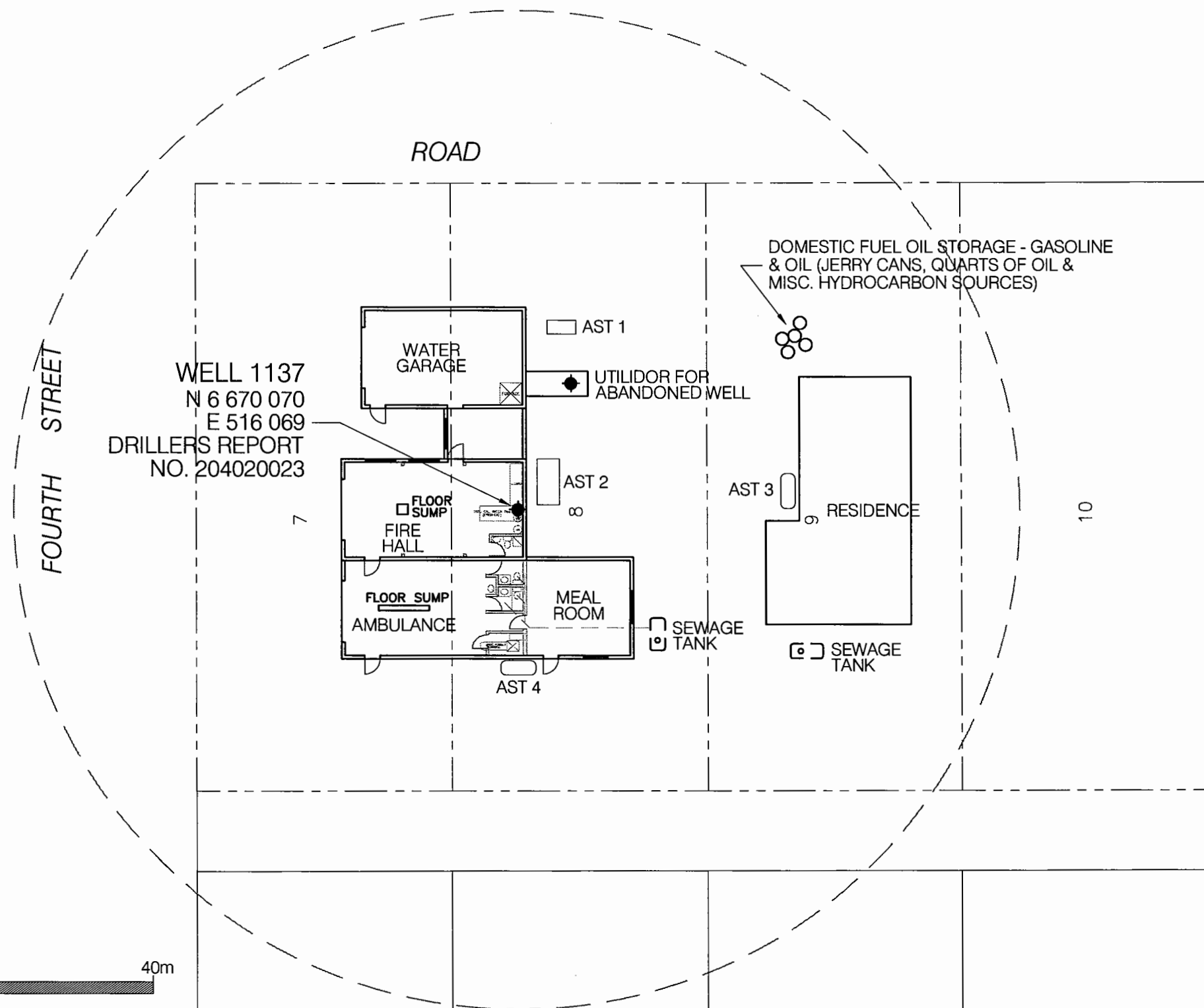
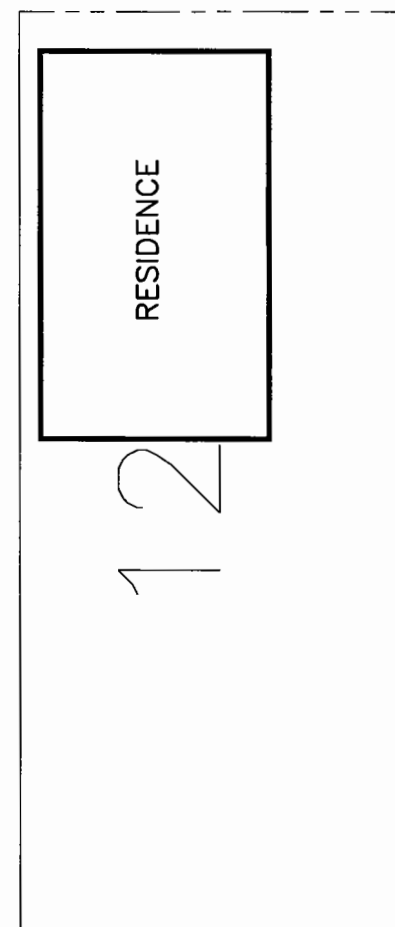
Enforcement and Emergencies Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	8722
Jurisdiction	Yukon
Community	Carcross
Address	
Highway	
Milepost	
Feature	Carcross
Location and Cause	School - overfilling of fuel tank
Latitude	60.166026
Longitude	-134.708601
Incident Date	12/7/1987 9:00:00 AM
Lead Agency	Yukon Territorial Government - other
Other Agency	Environment Canada - Environmental Protection Service
Company(s)	
Amount	50
Units	Litres
Quantity	Estimate
Release Description	Spilled
Additional Quantity	
Concentration	
Concentration Unit	
Phase	Liquid
Major Contaminant	Furnace Oil
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Outcome	spill occurred approx 1 wk ago - working to decontaminate school water supply - fuel entered water supply through broked filler pipe

**Photo 0115:** 1134 Wells 1 and 2, Water Fill, Underground Fuel Storage Tank**Photo 0120:** 1134 Well 2 Well Head in Pit**Photo 0121:** 1134 Well 1 Well Head in Pit**Photo 122:** 1134 Pressure Tanks and Flow Switch

**Photo 0497:** 1134 Heating Expansion Tank**Photo 0498:** 1134 Potable Water Pressure Tank**Photo 0500:** 1134 Storage Tank**Photo 0495:** 1134 Jet Pumps and Tank



- NOTES:
1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.
 2. LOCATIONS OF BUILDINGS & STRUCTURES ON THIS PROPERTY ARE APPROXIMATE ONLY.

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

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

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

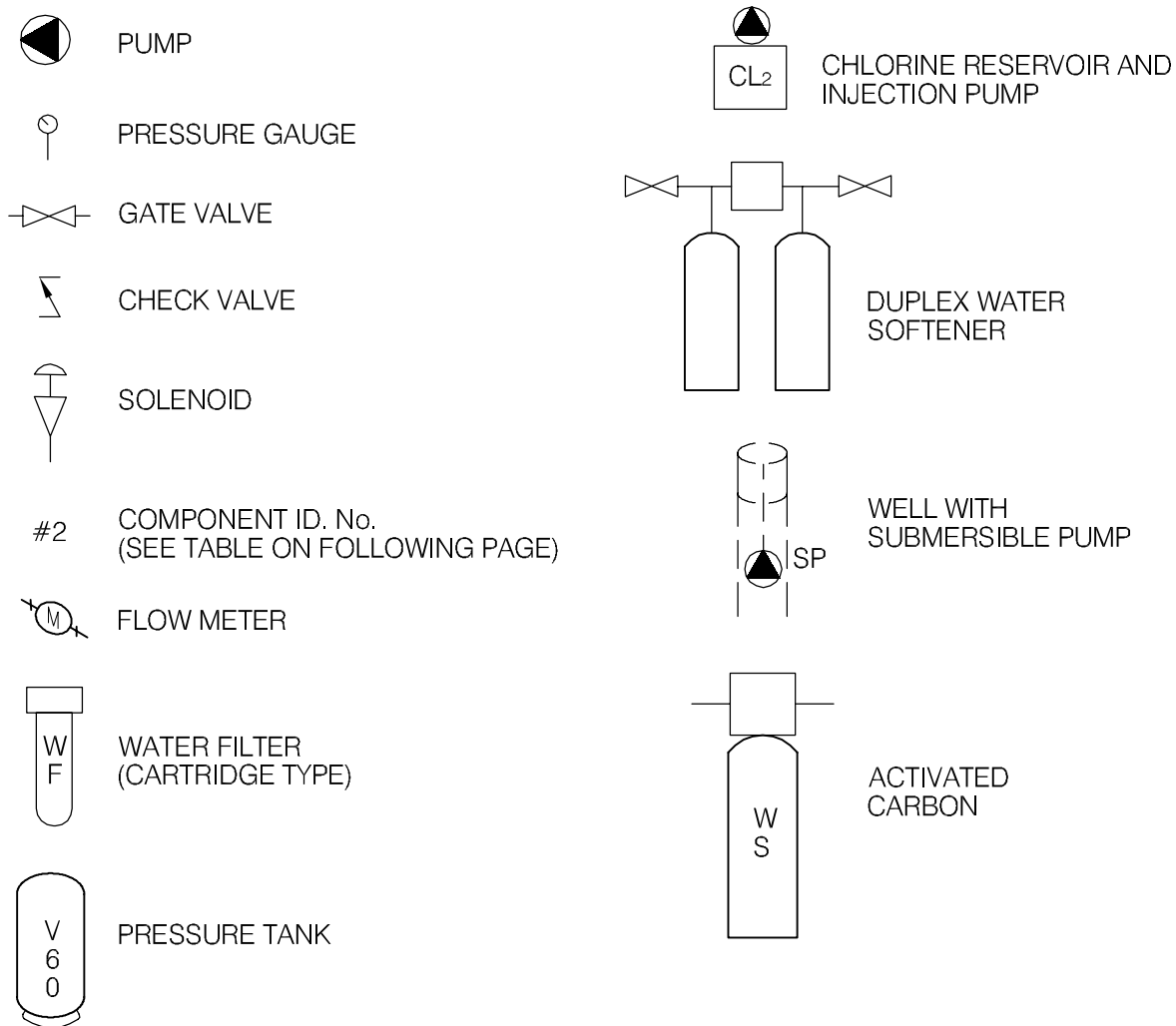
CLIENT:



Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
CARCROSS FIRE HALL BUILDING 1137 SITE LOCATION DIAGRAM WELL ID: 1137	REVISION ISSUE 0 DRAWING No. FIGURE 1137A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

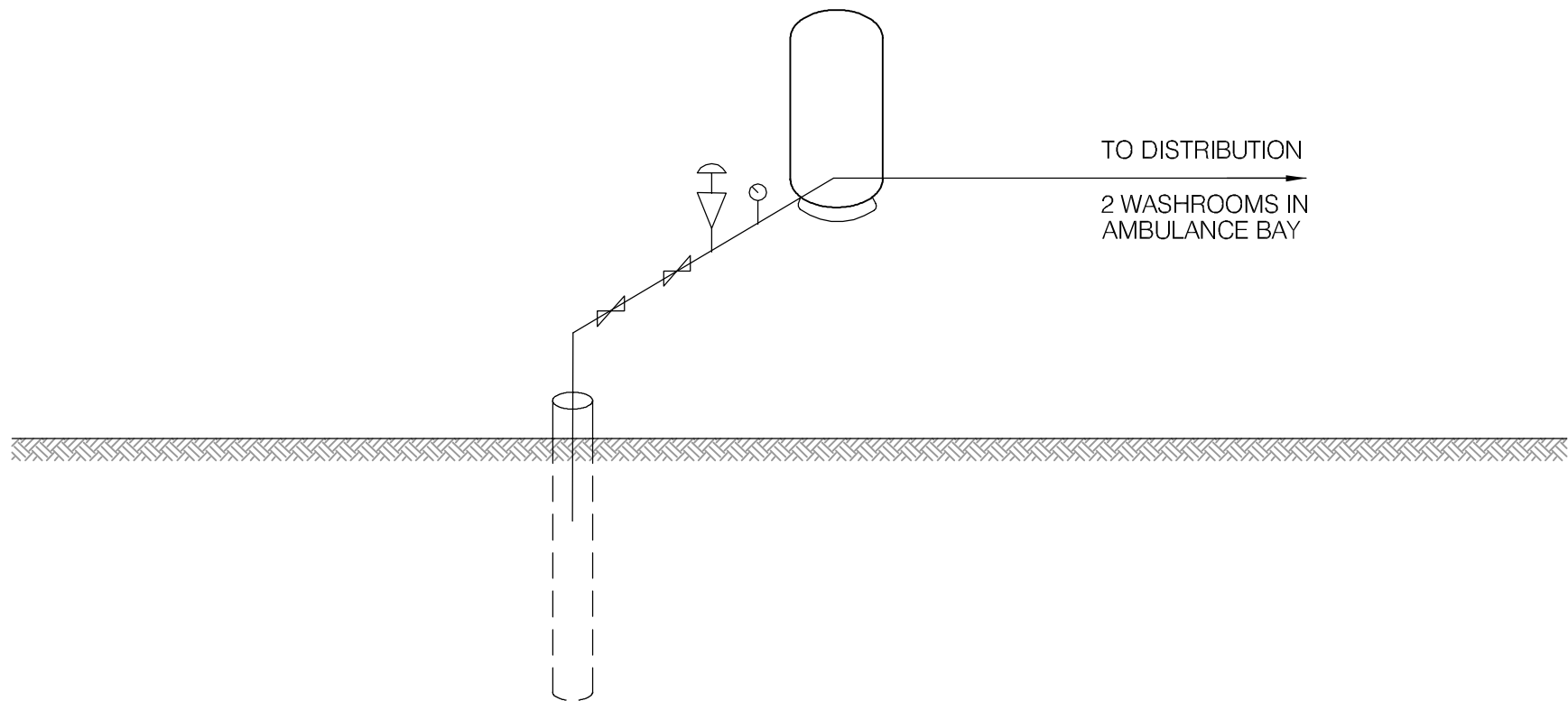
CHKD. RMM

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 WHITEHORSE REGION	
CLIENT  Yukon Highways and Public Works Property Management Branch		TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 1137 CARCROSS FIRE HALL BUILDING	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	DWG.: FIGURE 1137B
FILE NO. 1260002.001			

**Whitehorse Region – Carcross School
Building # 1134**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	Pump #1 Well	GRUNDFOS				1 HP.
2	Pump #2 Well	JACUZZI				2 HP.
3	Pump #1 (Potable)	MONARCH	JKC-S3		1191	3/4 HP
4	Pump #2 (Potable)	MONARCH	MJS-75		5402	3/4 HP
5	Pressure Tank	MONARCH	FG42			42 Gallon
6	Storage Tank	CUSTOM				W x H x L 6' x 3' x 12'
7	Pressure Tank	MONARCH	M-302			
8						
9						
10						

TABLE 1137 - 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?
1137	Carcross Firehall	9	Sept-04 to Mar-05	no	0/9	no	2-Mar-05	no



Table 1137-2: Water Quality Results

SOURCE:		Building 1137 - Carcross Fire Hall		GCDWQ Criteria		
Location/ Resident		Carcross				
Address		Lot 7 Block 3				
Treatment		No				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location			Laundry Sink			
Date Sampled			11-May-05	Lower Limit	Upper Limit	
Total Metals (ALS)				AO	MAC	AO
Arsenic T-As			0.0193		0.025	
Field Chemistry (EBA)						
pH			8.02	6.5		8.5
TDS			195			500
EC (uS/cm)			381			
Temperature			8.6			

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1137-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1137	Carcross Fire Hall	Carcross	6670070	516069	665

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	1976	Yes	104.6	Silt and Clay - 8m to 60m Till - 83m to 98m	64	1hp submersible pump Size of pump meets needs	?

Well Construction Details				
Above	Well Cap	Well Screen	Seal	Grading
0.12 above grade	Split Cap Gasket	1.2m of 80 slot 1.5m of 40 slot	Unlikely	Inside building

**Table 1137-4: Potential Contaminant Sources
Building 1137 – Carcross Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Industrial Refuse	Organic and inorganic chemicals.	50 m		
Septic fields	Biological and Inorganic parameters.	Unknown		
Sewage lines, tanks or lift stations	Biological, inorganic and organic parameters	19 m		
Above ground storage tanks (ASTs)	Organic parameters.	2 m, 10 m, 10 m, 20 m		
Naturally occurring sources of contamination	Arsenic in Groundwater and Radionuclides, Bacteria, Viruses from Surfacewater Sources	Approx. 100 m to surfacewater		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination



SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Martin
Luke LebelDate May 11, 2005

WELL ID #	Owner	Location Description
1137	YTS	Carcross FireHall

1. Well Location and Potential Contaminant Sources

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

Carcross, see Fig 1137-A

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

Carcross FireHallc. GPS location: 516069 Easting 6670070 Northing 665 elevation ± 11 d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
services the firehall☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify The well is located within the
garage of the Carcross Firehall

g. Distance from well to building _____

h. If there is an effluent disposal field, is its location known? ☒ Yes ☐ Noi. Distance from well to nearest point of known field: There are multiple septic holding
tanks nearbyj. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral

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- k. 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

There are residential septic tanks within 30m

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

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

- the well is ~50m from a junkyard and ~10m from a residential home with various old vehicles, fuel/oil storage tanks
- n. 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
is located within the local volunteer fire dept w/ locked doors. Although inside, there is evidence (cobwebs, grime, etc.) that area is not cleaned regularly

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

- p. Is the well site well drained? ☒ Yes ☐ No N/A

- q. Is there a buried fuel tank on the property? ☐ Yes ☐ No There is a Buried Fuel Tank nearby (<120m) at the Carcross School
- If yes, is it ☒ in use ☐ abandoned

Is the location known? ☒ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 2; Distance from well to Potential Source 1: ~2m

Potential Source 2: AST 1; Distance from well to Potential Source 2: ~10m

Potential Source 3: AST 3; Distance from well to Potential Source 3: ~20m

Potential Source 4: AST 4; Distance from well to Potential Source 4: ~10m

- s. Are there other wells on this property? ☐ Yes ☒ No
There are 2 wells, however, from the Carcross school within 120m of the well
How many? _____ ☒ in use ☐ abandoned ☐ 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
Located within firehall garage
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
- * g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- * h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☐ in pit ☐ pitless adaptor ☐ in a building
within a garage of the Carcross Fire Hall
☐ 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 12cm above grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☐ Yes ☐ No
There are mineral deposits from pipe leakage
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☒ No
It is, however, within the firehall
- iv. Any evidence of rodents? Specify There is no evidence of rodents
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
The condition of it, however, is poor due to water leakage as there are mineral deposits and rust present.
If no, describe condition _____

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...) _____

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

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: The well is located inside of a heated and insulated building

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

The well is located in a garage where oil and other automotive chemicals can potentially leak around the wellhead

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: Bert HUBNER

Date May 11/05

WELL ID #	Owner	Location Description
1137	YTG	CARROSS FIRE HALL

6. Water Treatment

— WELL —

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 _____

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 Not Available
- 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: Pressure Tank

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

8. Conclusions

a. Comments on overall installation:

THIS INSTALLATION IS NOT UP TO
STANDARDS.
THE WELL REQUIRES EXTENSIVE TREATMENT.
THIS SYSTEM CAN BE FED FROM THE
ATTACHED COMMUNITY WATER SYSTEM.

b. Recommendations:

ABANDON THE WELL, PUMP WATER
SUPPLY FROM ATTACHED COMMUNITY
WATER SYSTEM WHICH IS FILTERED
AND CHLORINATED.

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PART C Property Manager/ System Operator Questionnaire

Inspector: STARKY JACKSON Date May 10/05
Property manager: Carcass fire hall

1) Water Source:

- a. Is the well water the major source of drinking water? ☐ Yes ☒ No
- b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year _____ Month _____
- b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
- c. Is there a driller's log for the well?: ☐ Yes ☐ No
- d. Do you know the depth of your well? If so, please indicate: _____
- e. Who was the well constructed by?
Indicate contractor's name: _____
- f. Are you, the owner ☐ Yes or other: _____
- g. Who maintains the well? VTG
- h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
- i. Is there a buried fuel tank on the property? ☐ Yes ☐ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? _____
- b. What type of pump do you have? 1 hp
- c. Pump delivers water to: ☒ pressure tank ☐ elevated tank ☐ other _____

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4) Water Treatment

a. Is your well water treated? ☐ Yes ☒ No

Type of treatment: ☐ chlorination ☐ iron and or manganese removal
other _____

5) Well Capacity:

a. Well capacity: User's opinion ☒ adequate ☐ inadequate

b. Are there any times of year when your well goes dry, or does not produce enough water?

c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

a. In general, do you like your water?: ☒ yes ☐ no

b. Does the water stain household plumbing? ☐ yes ☐ No ☒ slight ☐ severe

Type of stain: ☒ brown ☐ red ☐ black

c. Does the water contain sediment? ☐ Yes ☐ No ☒ occasional ☐ constant

d. Is there an unpleasant odour? ☐ Yes ☒ No

☐ Sulphur (rotten egg smell) ☐ Other _____

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

f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☐ no

g. Is water softener being used? ☐ Yes ☒ No

h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☒ No

If so, at what time intervals? _____

Who takes them? _____

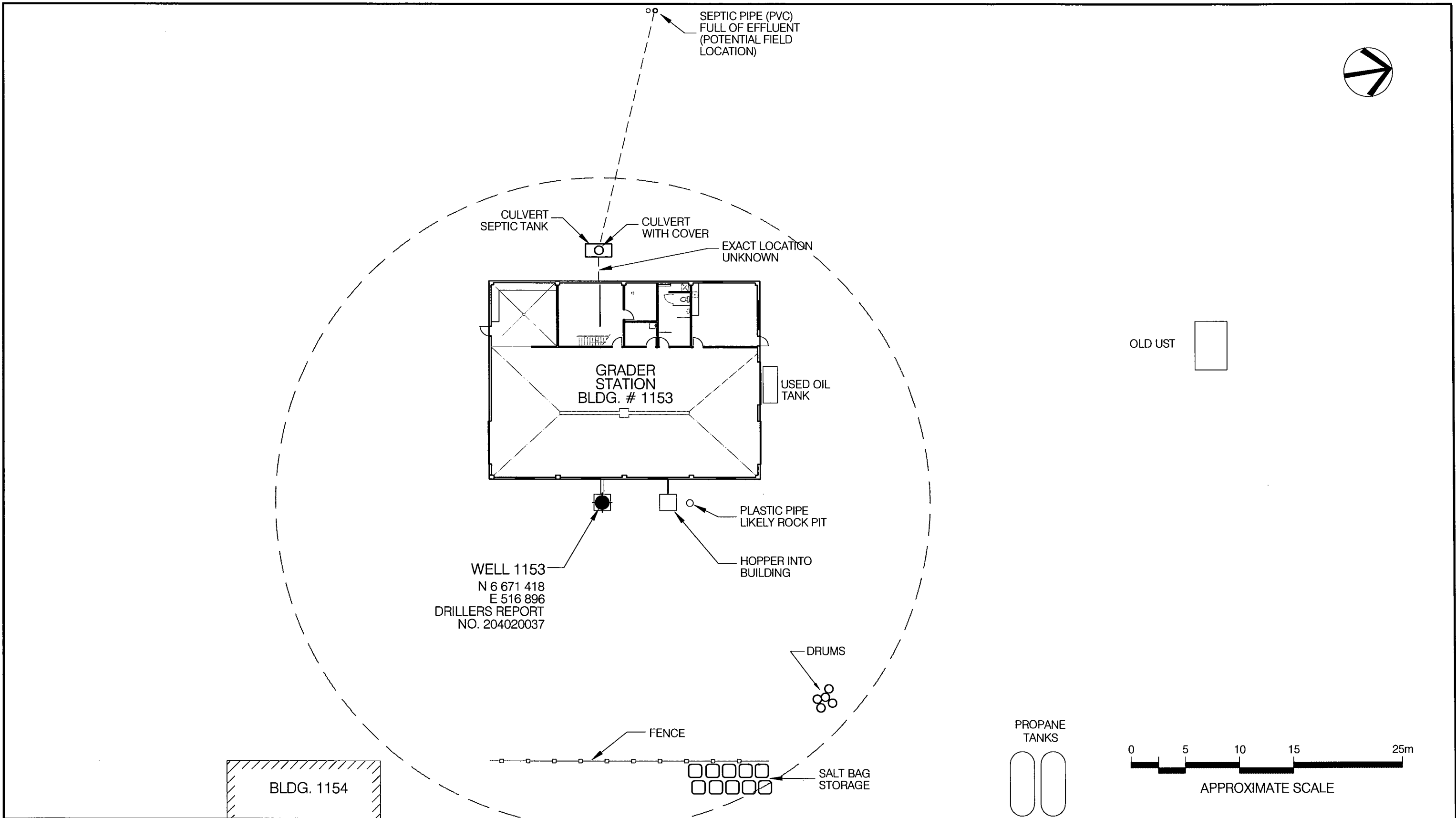
i. Is there a history of bad bacterial analyses? ☒ Yes ☐ No

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

7) Do you have any overall comments or complaints about your water well system?

*Well is used for non potable water
only should not be used as drinking
water*

**Photo 0123:** 1137 Carcross Firehall Front View**Photo 0129:** 1137 Well, Pressure Tank and Pump Controls**Photo 0124:** 1137 Above Ground Storage Tanks Adjacent to Well**Photo 0125:** 1137 Neighbouring Building with Mechanical Equipment, Fuel and Oil Storage (foreground), Commercial Junkyard (background)



NOTES:

1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.
2. LOCATION OF BUILDINGS & STRUCTURES ON THIS PROPERTY ARE APPROXIMATE ONLY.

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

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



EBA Engineering Consultants Ltd.

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

CLIENT:



Highways and Public Works
Property Management Branch

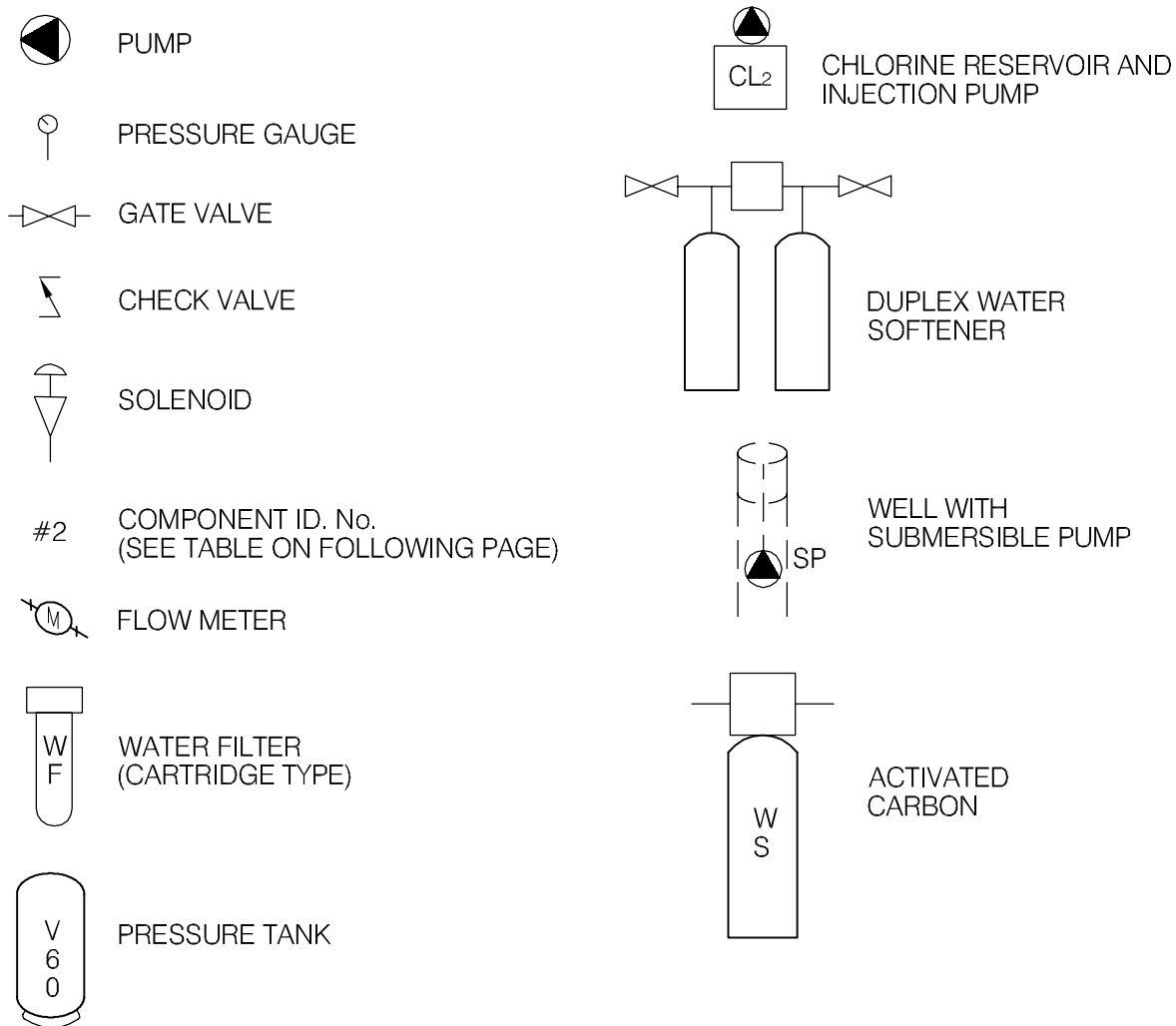
**SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION**

**GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS**

**CARCROSS YTG GRADER
STATION BUILDING 1135
SITE LOCATION DIAGRAM
WELL ID: 1153**

REVISION ISSUE
0
DRAWING No.
FIGURE 1153A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

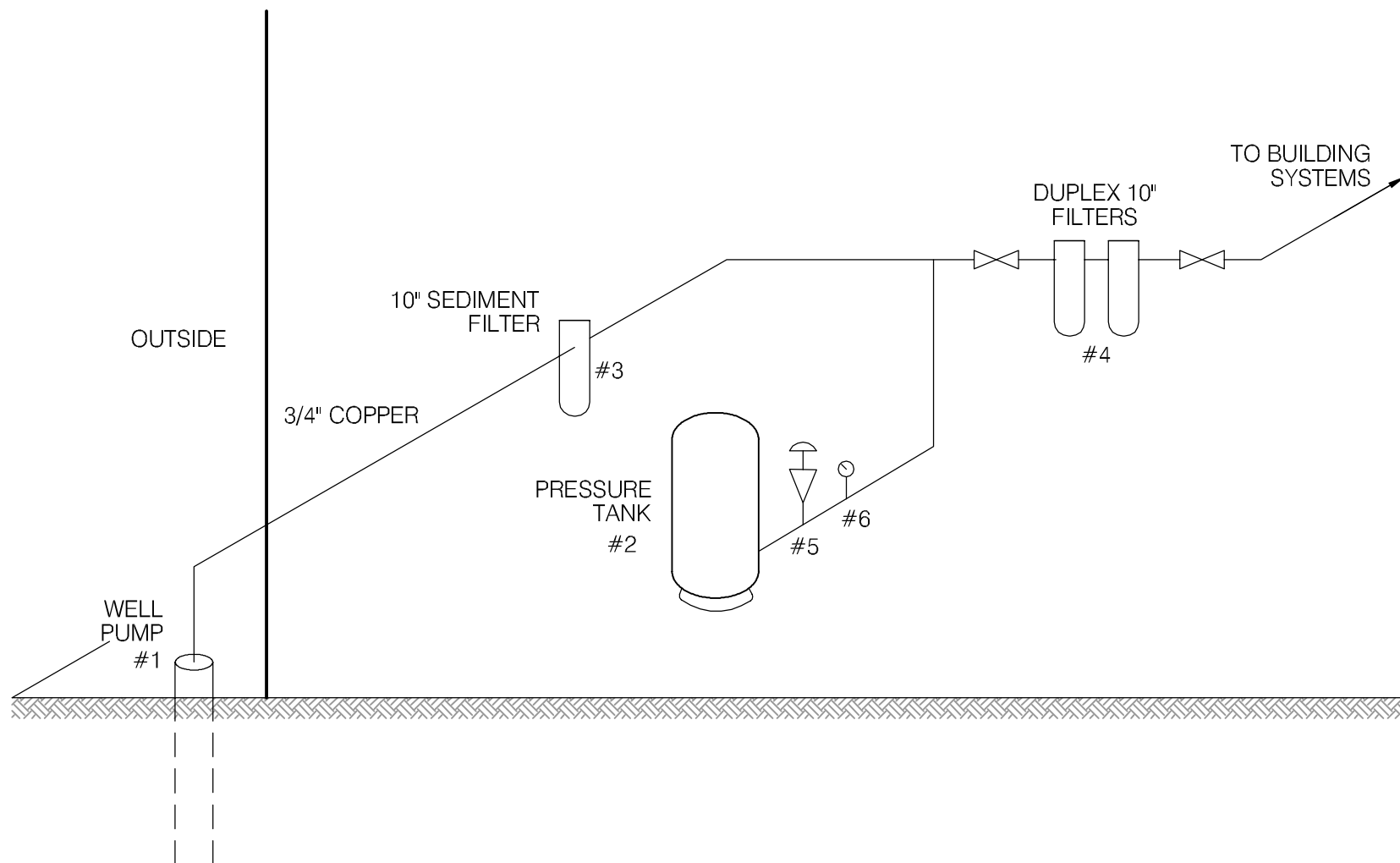
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



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Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1153
CARCROSS GRADER STATION

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1153B

**Whitehorse Region – Carcross Grader Station
Building # 1153**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUBMERSIBLE ^{PUMP}					
2	PRESSURE TANK	CHALLENGER	PC66			
3	SEDIMENT FILTER	OMNI PURE	10"			
4	DUPLEX FILTER	AMETEK 10"	10" CLEAR.	CPS GAC 10		3/4" x 10"
5	PRESSURE SWITCH	PUMPTROL	FSG 2			1/4" FIPT.
6	PRESSURE GAUGE		2 1/2"			0-100PSI
7						
8						
9						
10						

Table 1153-2: Water Quality Results

SOURCE		Building 1153 - Carcross Grader Station		GCDWQ Criteria		
Location/ Resident		Carcross				
Address		Lot 10101				
Treatment		Filtration				
Source of Water		On-Site Well				
Purpose of Sampling	Baseline	Additional Sampling	Baseline			
Sample Location		Kitchen Tap				
Date Sampled	1-Nov-04	11-May-05	26-Jun-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)	25		<5			15
Conductivity (uS/cm)	584		610			
Total Dissolved Solids	332		377			500
Hardness CaCO3	294	269	308	AO >200 = poor, > 500 unacceptable ^A		
pH	7.9		8.14	6.5		8.5
Turbidity (NTU)	1.4		17.0		1	5
UV Absorbance	<0.0010					
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3	245		282			
Chloride Cl	2		1.00			250
Fluoride F	0.38		0.317		1.5	
Sulphate SO4	71.0		88.6			500
Nitrate Nitrogen N	<0.1		<0.10		10	
Nitrite Nitrogen N	<0.05		<0.10		1	
Ammonia Nitrogen N						
Total Metals (ALS)						
Aluminum T-Al	<0.02		<0.010			
Antimony T-Sb	<0.0004		<0.0005		0.006	
Arsenic T-As	0.0177		0.0158		0.025	
Barium T-Ba	0.0423		0.035		1	
Boron T-B	<0.02		<0.10		5	
Cadmium T-Cd	<0.0002		<0.0002		0.005	
Calcium T-Ca	57.5		62.8			
Chromium T-Cr	0.001		<0.0020		0.05	
Copper T-Cu	0.003		0.0015		1	
Iron T-Fe	1.06		1.23			0.3
Lead T-Pb	0.0004		<0.0010		0.01	
Magnesium T-Mg	32.9		36.7			
Manganese T-Mn	0.068		0.0635			0.05
Mercury T-Hg	<0.0002		<0.0002		0.001	
Potassium T-K	2.8		2.62			
Selenium T-Se	<0.0004		<0.0010		0.01	
Sodium T-Na	14		16.8			200
Uranium T-U	0.0047		0.00457		0.02	
Vanadium T-V						
Zinc T-Zn	0.059		<0.050			5
Dissolved Metals (ALS)						
Aluminum D-Al	<0.10				0.1	
Antimony D-Sb	<0.0050				0.006	
Arsenic D-As	0.0188				0.025	
Barium D-Ba	<0.20				1.0	
Boron D-B	<1.0				5	
Cadmium D-Cd	<0.0020				0.005	
Calcium D-Ca	59.9					
Chromium D-Cr	<0.020				0.05	
Cobalt D-Co						
Copper D-Cu	<0.010					1.0
Iron D-Fe	0.526					0.3
Lead D-Pb	<0.010				0.01	
Lithium D-Li						
Magnesium D-Mg	29.1					
Manganese D-Mn	0.08					0.05
Mercury D-Hg	<0.00020				0.001	
Molybdenum D-Mo						
Nickel D-Ni						
Potassium D-K	2.8					
Selenium D-Se	<0.010				0.01	
Silver D-Ag						
Sodium D-Na	11.5					200
Uranium D-U	0.0049				0.02	
Zinc D-Zn	<0.50					5.0
Trihalomethanes						
Bromodichloromethane	-					
Bromodifluoromethane	-					
Chlorodifluoromethane	-					
Dibromochloromethane	-					
Total Trihalomethanes	-				0.1	
Organic Parameters						
Tannin and Lignin						
Total Organic Carbon C						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	<0.000050					
Acenaphthylene	<0.000050					
Acridine	<0.000050					
Anthracene	<0.000050					
Benz(a)anthracene	<0.000050					
Benz(a)pyrene	<0.000010				0.00001	
Benz(b)fluoranthene	<0.000050					
Benz(g,h,i)perylene	<0.000050					
Benz(k)fluoranthene	<0.000050					
Chrysene	<0.000050					
Dibenz(a,h)anthracene	<0.000050					
Fluoranthene	<0.000050					
Fluorene	<0.000050					
Indeno(1,2,3-c,d)pyrene	<0.000050					
Naphthalene	<0.000050					
Phenanthrene	<0.000050					
Pyrene	<0.000050					
Quinoline	<0.000050					
Extractable Hydrocarbons						
EPH10-19	<0.30					
EPH19-32	<1.0					
LEPH	<0.30					
HEPH	<1.0					
Haloacetic Acids						
Bromoacetic Acid	-					
Bromochloroacetic Acid	-					
Chloroacetic Acid	-					
Dibromoacetic Acid	-					
Dichloroacetic Acid	-					
Trichloroacetic Acid (TCA)	-					
Field Chemistry (EBA)						
pH	7.71			6.5		8.5
TDS (ppm)	235					500
EC (uS/cm)	460					
Temperature (deg C)	10.3					
Free Available Chlorine (mg/L)						

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1153-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1153	Carcross Grader Station	Carcross	6671418	516896	675

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	1984	No	?	?	?	?	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
Approximately at grade (within 0.01)	Split Cap Gasket	?	Unlikely	Slopes towards wellhead enclosure

**Table 1153-4: Potential Contaminant Sources
Building 1153 – Carcross Grader Station:**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Rock Pit	Organic and inorganic chemicals.	9 m		
Vehicle Parking	Biological¹ , inorganic ² and organic parameters.	2 m		
Waste Oil Tank	Biological , inorganic and organic parameters.	18 m		
Drums	Biological , inorganic and organic parameters.	30 m to 60 m		
Septic tank	Biological and Inorganic parameters.	22 m		
Septic Field	Biological and Inorganic parameters.	34 m	6671388	516858
Salt Storage	Inorganic parameters	22 m		
Sewage lines, tanks or lift stations	Biological , inorganic and organic parameters.	Approx. 20 m		
Above ground storage tanks (ASTs)	Organic parameters.	N/A		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	Well Head in Pit.		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 11, 2005

WELL ID #	Owner	Location Description
1153	YTG	Carcross Grader Station

1. Well Location and Potential Contaminant Sources

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

Carcross

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

Carcross Grader Station, Tagish Road

c. GPS location: 516898 Easting 6671488 Northing 675m ± 6m

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
Services carcross maintenance camp

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

f. Nearest building, specify Carcross Maintenance Camp Garage

g. Distance from well to building 4m

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

i. Distance from well to nearest point of known field: ~34m

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

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- k. 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

Sewage tank ~22m away, Field 34m away, Rock pit and used oil

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

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

- n. 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
only painted tin casing and put plywood There are few signs of animals
unfastened on top

- o. Is well site subject to flooding? ☒ Yes ☐ No
Heavy water stains and dampness. Signs of flooding.
Still wet after a long period of dry weather.

- p. Is the well site well drained? ☐ Yes ☒ No
There is little drainage surrounding ground is level with the height of the well head or slightly above

- q. 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 _____

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

☒ Yes ☐ No Describe _____

If yes, specify the source: ☐ dump ☐ sewage lagoon ☐ cemetery ☐ other
Salt ~22m away

Potential Source 1: Used oil; Distance from well to Potential Source 1: 18m

Potential Source 2: Vehicle Park; Distance from well to Potential Source 2: 2m

Potential Source 3: Rock Pit; Distance from well to Potential Source 3: 9m

Potential Source 4: Metal Parts; Distance from well to Potential Source 4: Lithin 10m
- Drums less than 60m but greater than 30m
- Hopper into building - 6m

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

How many? _____ ☐ in use ☐ abandoned ☐ 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 122cm ☐ No
prf wooden enclosure with painted tin casing
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
- * g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- * h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☒ in pit ☐ pitless adaptor ☐ in a building
A wooden prf enclosure with a tin casing.
☒ 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 well head is almost exactly at grade level
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
There are signs of dampness on the pvt studs and on piping insulation. Ponding likely. There is also rust on well head.
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☒ No
well head is not insulated. Piping has styrofoam insulation and sackcloth blanket to insulate it.
- iv. Any evidence of rodents? Specify There are some (few) mouse droppings
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
split cap. Although it is rusty and grimy with a small open hole for heat trace and grimey electrical
If no, describe condition _____

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...) only a 3-line filters

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

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: heat trace on all and insulation on above ground piping only

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

-There is a major concern with flooding. There is evidence that the well casing and surface casing has been flooded due to rust, stains, ect.

-The well is in very close proximity to many potential contaminants such as salt, metal, used oil, effluent,

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: BERT ALBISSER

Date MAY 11/05

WELL ID #	Owner	Location Description
<u>1153</u>	<u>YTG</u>	<u>CARCROSS MAINTENANCE CAMP</u>

6. Water Treatment

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

☐ chlorination ☐ iron and or manganese removal ☒ other SEDIMENT

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 ~~no~~
- 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

8. Conclusions

a. Comments on overall installation:

SYSTEM IS NOT UP TO NEW STANDARDS.

b. Recommendations:

INSTALL CHLORINATION SYSTEM WITH PROPER RETENTION FACILITY. IMPROVE FILTRATION SYSTEM TO COMMERCIAL QUALITY FILTERS.

RAISE WELL CASING TO 18" ABOVE GRADE AND INSTALL PROPER SURFACE SEAL.

INITIATE CHLORINE RESIDUAL TESTING PROCEDURE.

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PART C: Property Manager/ System Operator Questionnaire

Inspector: TERREY JACKSON Date May 10 2005

Property manager: Y.T.G. Carcross Corridor Station

1) Water Source:

- a. Is the well water the major source of drinking water? ☐ Yes ☐ No
- b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year 1984 Month _____
- b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
- c. Is there a driller's log for the well? ☐ Yes ☐ No
- d. Do you know the depth of your well? If so, please indicate: 110' 1/2 hp pump.
- e. Who was the well constructed by?
Indicate contractor's name: _____
- f. Are you, the owner ☐ Yes or other: _____
- g. Who maintains the well? Y.T.G.
- h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
- i. Is there a buried fuel tank on the property? ☐ Yes ☒ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? _____
- b. What type of pump do you have? _____
- c. Pump delivers water to: ☒ pressure tank ☐ elevated tank ☐ other _____

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4) Water Treatment

a. Is your well water treated? ☐ Yes ☒ No

Type of treatment: ☐ chlorination ☒ iron and or manganese removal

other filters

5) Well Capacity:

a. Well capacity: User's opinion ☒ adequate ☐ inadequate

b. Are there any times of year when your well goes dry, or does not produce enough water?

c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

a. In general, do you like your water?: ☐ yes ☒ no

b. Does the water stain household plumbing? ☒ yes ☐ No ☐ slight ☐ severe

Type of stain: ☒ brown ☐ red ☐ black

c. Does the water contain sediment? ☒ Yes ☐ No ☐ occasional ☐ constant

d. Is there an unpleasant odour? ☒ Yes ☐ No

☒ Sulphur (rotten egg smell) ☐ Other _____

e. Is there an unpleasant taste? ☒ Yes ☐ No ☐ brackish ☐ Other _____

f. Hardness: Is it hard to lather with soap?: ☒ yes, very ☐ moderate ☐ no

g. Is water softener being used? ☐ Yes ☒ No

h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☒ No

If so, at what time intervals? _____

Who takes them? _____

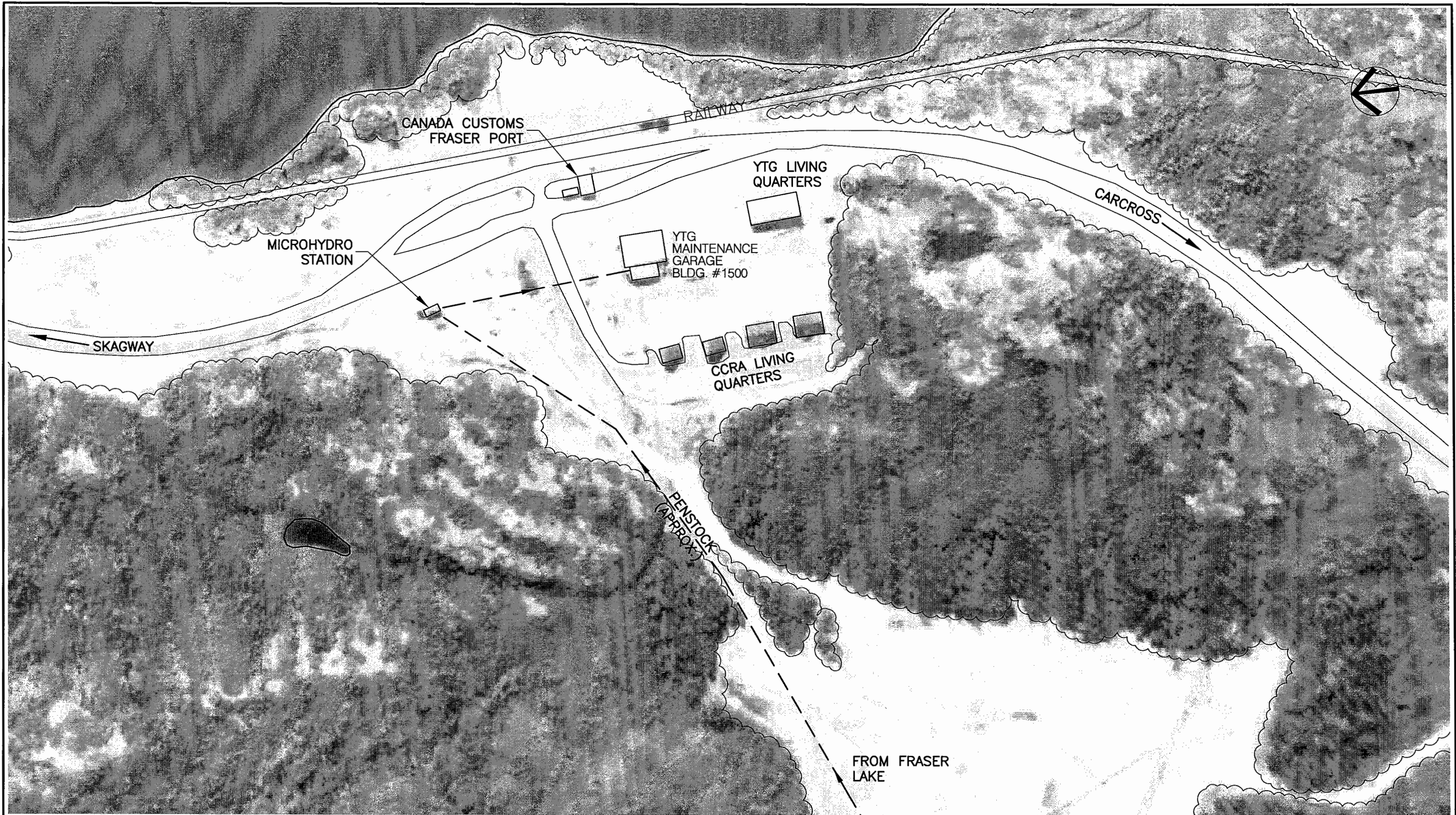
i. Is there a history of bad bacterial analyses? ☒ Yes ☐ No

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

7) Do you have any overall comments or complaints about your water well system?

should only be used for nonpotable situations

**Photo 0131:** 1153 Well Head**Photo 0134:** Floor Drain System**Photo 0135:** Water Tanks/Brine Tanks**Photo 0136:** Pressure Tank and Three In-Line Filters



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.

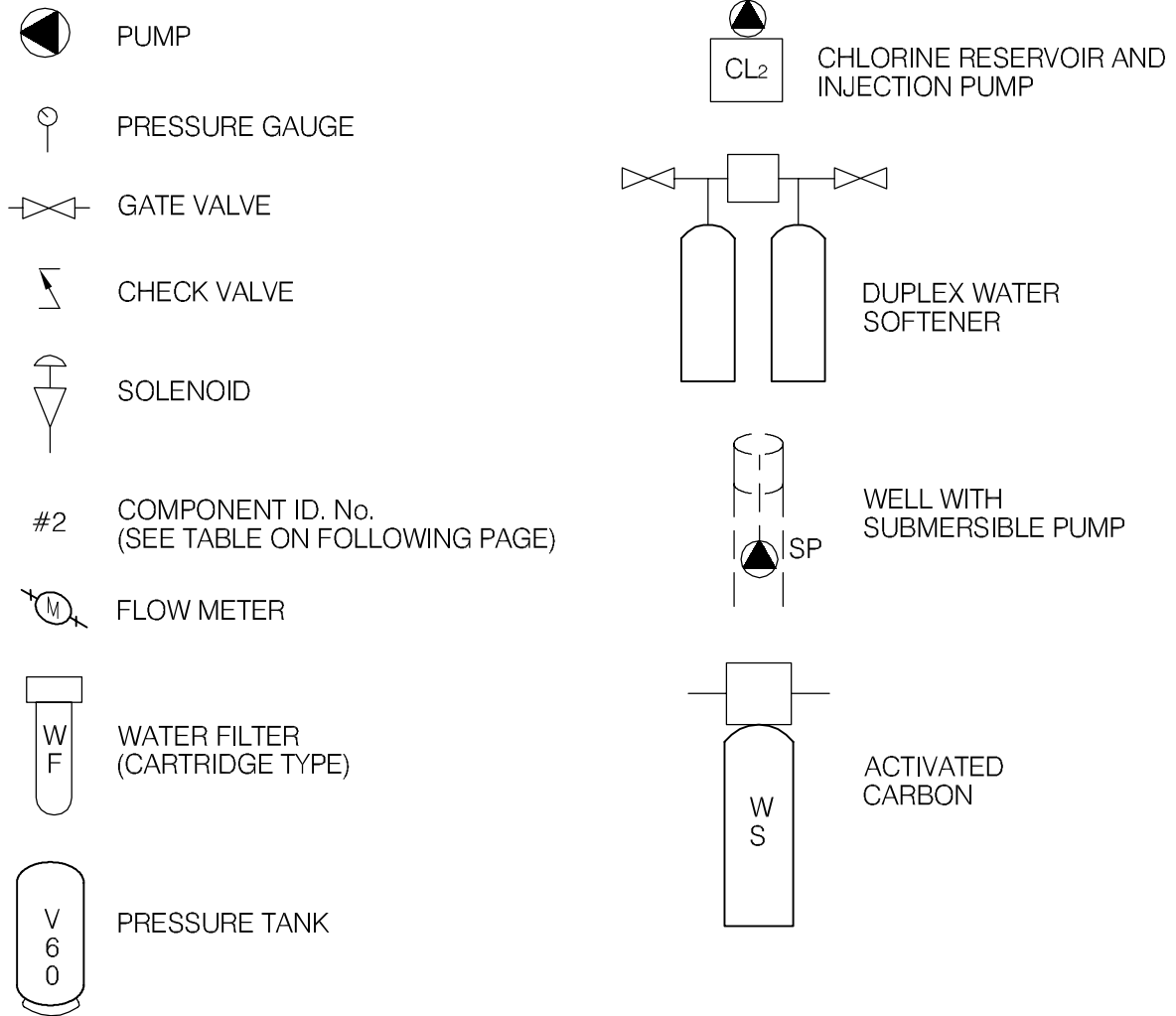
0	ISSUED FOR CLIENT REVIEW	DD/MM/YY	XXX
No.	DESCRIPTION	DATE	APPROVED
	REVISION		

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

Yukon
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
FRASER CAMP SITE 1500 SITE LOCATION DIAGRAM	REVISION ISSUE 0 DRAWING No. FIGURE 1500A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

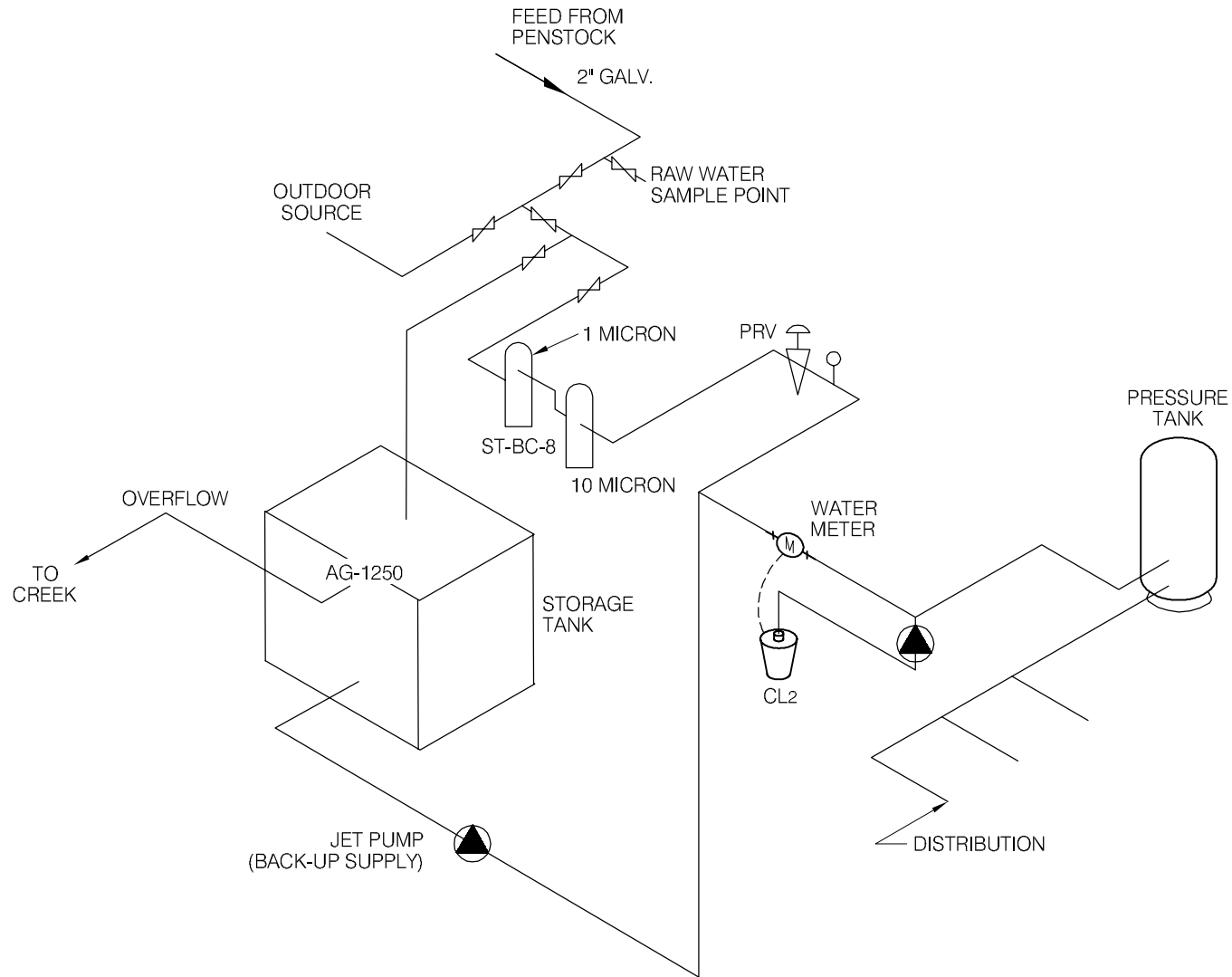
CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1500
FRASER CAMP

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1500B

Whitehorse Region – Fraser Camp
Building # 1500

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	PRESSURE CONTROL	WATTS	BUAG25			2"
2	PRIMARY FILTER	HARMSCO	ST-BC-8	PD-10-20	156066-06-07-01	2" x 20"
3	SECONDARY FILTER	HARMSCO	ST-BC-8	PD-10-20	156066-06-07-01	2" x 20"
4	CHLORINE INJECTION	LMI	A771-35851		HYZ3638649	3/8"
5	FLOWMETER PULSER	LMI	RFP-20			
6	CHLORINE SOLUTION TANK	LMI.	30 GALLON			30 GALLON
7	WATER TANK.		AG1250			1250 GALLON
8	JET PUMP.	MONARCH	JKS-S4		9004	1HP.
9	PRESSURE TANK.	THERMEX	JOB # 7341		C REG E 8463-1	600 GALLON
10						

TABLE 1500 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1500	Fraser Camp	6	Sept-04 to Mar-05	yes	1/6	no	2-Mar-05	no



Table 1500-2: Water Quality Results

SOURCE:		Building 1500 - Fraser Camp		GCDWQ Criteria		
Location/ Resident		Fraser				
Address						
Treatment		Chlorination and Filtration				
Source of Water		Fraser Lake, Microhydroelectric Generating Station				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location			Laundry Sink Tap in Truck Garage			
Date Sampled			11-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour	(CU)		<5.0			15
Conductivity	(uS/cm)		43.2			
Total Dissolved Solids			22			500
Hardness	CaCO3		19.8	AO >200 = poor, > 500 unacceptable ^A		
pH			7.71	6.5		8.5
Turbidity	(NTU)		0.14		1	5
Dissolved Anions (ALS)						
Alkalinity-Total	CaCO3					
Chloride	Cl		<0.50			250
Fluoride	F		0.105		1.5	
Sulphate	SO4		2.28			500
Nitrate Nitrogen	N		<0.10		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		<0.00010		0.025	
Barium	T-Ba		<0.020		1	
Boron	T-B		<0.10		5	
Cadmium	T-Cd		<0.00020		0.005	
Calcium	T-Ca		6.77			
Chromium	T-Cr		<0.0020		0.05	
Copper	T-Cu		0.277		1	
Iron	T-Fe		0.035			0.3
Lead	T-Pb		<0.0010		0.01	
Magnesium	T-Mg		0.71			
Manganese	T-Mn		<0.0020			0.05
Mercury	T-Hg		<0.00020		0.001	
Potassium	T-K		0.28			
Selenium	T-Se		<0.0010		0.01	
Sodium	T-Na		<2.0			200
Uranium	T-U		0.00103		0.02	
Zinc	T-Zn		<0.050			5
Trihalomethanes						
Bromodichloromethane			<0.0010			
Bromoform			<0.0010			
Chloroform			<0.0010			
Dibromochloromethane			<0.0010			
Total Trihalomethanes			<0.0040		0.1	
Haloacetic Acids						
Bromoacetic Acid			<0.0020			
Bromochloroacetic Acid			<0.0020			
Chloroacetic Acid			<0.020			
Dibromoacetic Acid			<0.0020			
Dichloroacetic Acid			<0.0020			
Trichloroacetic Acid (TCA)			<0.0020			
Field Chemistry (EBA)						
pH			8.27	6.5		8.5
TDS			17			500
EC (uS/cm)			37			
Temperature			8.1			
Free Available Chlorine			0.01			250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1500-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1500	Fraser Camp	Fraser	6619679	497323	848



**Table 1500-4: Potential Contaminant Sources
Building 1500 – Fraser Camp**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northi ng	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines and lift stations	Biological , inorganic and organic parameters.	>>30 m		
Septic tanks and fields	Biological and Inorganic parameters.	>>30 m		
Gas stations	Organic and Inorganic parameters.	>>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	>>30 m		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	Water system utilizes surface water source.		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Mardin
Luke LebelDate May 11, 2009

WELL ID #	Owner	Location Description
1500	YTG	Fraser Camp

1. Well Location and Potential Contaminant Sources

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

Fraser

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

Fraser Camp, Alaska Highway, Whitepass Summitc. GPS location: 497323 Easting; 6619679 Northing; 848m elev., ± 7md. Is there electric power? ☒ Yes ☐ Noe. Does the well system have: The water is piped from surface water source in a nearby lake☐ 15 or more service connections to a piped distribution system? If so how many _____
Services maintenance camp, customs, and residences☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify Any building is >>60m away from the surface water sourceg. Distance from well to building ✓h. If there is an effluent disposal field, is its location known? ☐ Yes ☐ Noi. Distance from well to nearest point of known field: It is ^{very} unlikely that there is an effluent disposal field within 150m of the water sourcej. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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k. 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

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

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

n. 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

o. Is well site subject to flooding? ☐ Yes ☐ No

p. Is the well site well drained? ☐ Yes ☐ No

q. 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 _____

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

unlikely anywhere near the water source

☐ Yes ☐ No Describe _____

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

Potential Source 1: _____; Distance from well to Potential Source 1: _____

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ 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 _____ Material: ☐ steel ☐ plastic ☐ concrete
- g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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 _____
- 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 _____
- 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 _____
- v. Does the well casing have a proper seal cap? ☐ Yes ☐ No
- If no, describe condition _____

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.

The water is taken directly from a surface water source

If yes is there treatment ☒ Yes ☐ No

Explain (filtration, disinfection etc...) LMI proportional feed chlorinator

4. Aquifer Supplying This Well:

- a. The aquifer is: ☐ bedrock ☐ granular sediment ☐ unknown
- The water is directly from a surface water source
- b. Does water level and/or well capacity show seasonal fluctuation? ☐ Yes ☐ No

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
combination flow meter pulser for the chlorination system
RFP-20 2788800 Gal (U.S.)

k. Is the pump and piping protected from freezing? ☐ Yes ☐ No
unknown, likely

If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

This system is not from a well, but is rather from a surface body of water, Fraser Lake. The water is piped down to run a hydroelectric generating station, and water is taken from that to supply the system. There is a LMI proportional feed chlorinator used to treat the water.

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
1500	YTG	FRASER MAINTENANCE CAMP

6. Water Treatment

PENSTOCK FEED

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 _____

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

☒ Yes ☐ No .01 reading.

Tested at WATER ROOM TAP (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 N/A

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: Water Room

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: Overhead Forced Air unit

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?

AG 1250

What material is the tank constructed of? FIBRE GLASS.

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 NEEDS CLEANING.

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 ☒ UNKNOWN

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:

THE SYSTEM HAS ALL THE NECESSARY COMPONENTS TO PROVIDE SAFE DRINKING WATER TO THE FACILITY.

b. Recommendations:

A REGULAR STORAGE TANK CLEANING SCHEDULE SHOULD BE INITIATED.
CHLORINE RESIDUAL TESTING SHOULD BE SCHEDULED WITH PROPER RECORDS OF TEST RESULTS.
THE LARGE PRESSURE TANK SHOULD BE FLUSHED WITH 200PPM CHLORINE SOLUTION ANNUALLY.

Environment
CanadaEnvironnement
Canada**Enforcement and Emergencies Section**

91782 Alaska Highway, Whitehorse, YT Y1A 5B7

PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	7907
Jurisdiction	Yukon
Community	Fraser Camp
Address	
Highway	
Milepost	
Feature	Fraser Camp
Location and Cause	WPYR Pipeline - rupture caused by damage done by cat during snow removal operations
Latitude	59.716667
Longitude	-135.066667
Incident Date	4/27/1979 6:00:00 AM
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	Department of Indian Affairs and Northern Development
Company(s)	White Pass & Yukon Route
Amount	41958
Units	Litres
Quantity	Estimate
Release Description	Leaked
Additional Quantit	
Concentration	
Concentration Unit	
Phase	Liquid
Major Contaminant	Diesel
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Outcome	fuel spilled on ice surface of alpine lake - sorbent boom used and fuel pumped off - remaining burned - suggested contaminated snow be removed

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Canada

Enforcement and Emergencies Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	9036
Jurisdiction	Yukon
Community	Fraser Camp
Address	
Highway	
Milepost	
Feature	Fraser Camp
Location and Cause	leak from fuel source for locomotive train - over 6 M of track inside Canada border - started in Alaska, USA
Latitude	59.716667
Longitude	-135.066667
Incident Date	6/8/1990
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	
Company(s)	White Pass & Yukon Route
Amount	76
Units	Litres
Quantity	Estimate
Release Description	Leaked
Additional Quantit	
Concentration	
Concentration Unit	
Phase	Liquid
Major Contaminant	Diesel
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Outcome	no recovery was attempted as fuel escaped into railbed ballast over 6 M of track



Environment
Canada

Environnement
Canada

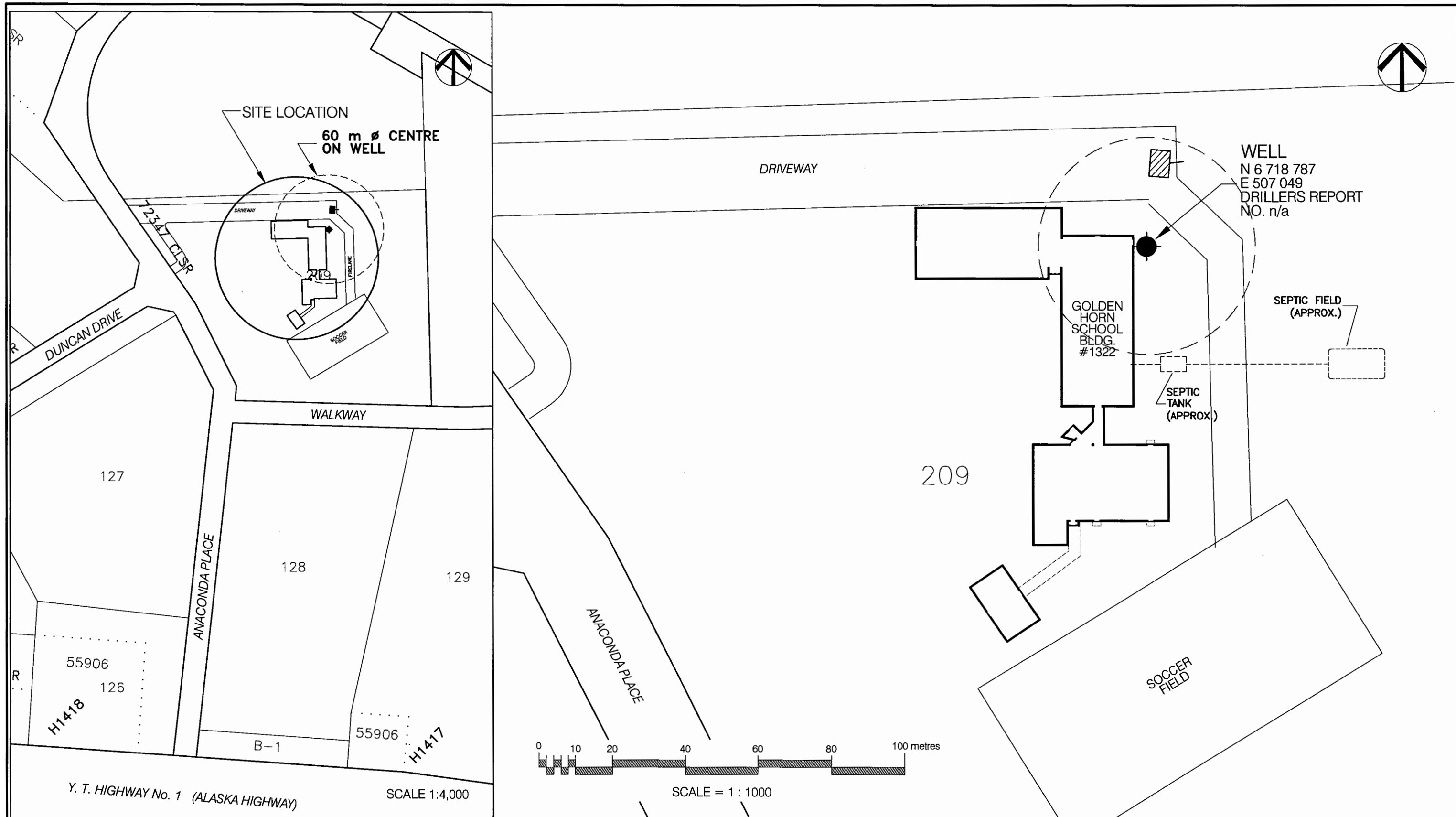
Enforcement and Emergencies Section
91782 Alaska Highway, Whitehorse, YT Y1A 5B7
PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	9423
Jurisdiction	Yukon
Community	
Address	
Highway	Klondike Highway
Milepost	
Feature	Fraser
Location and Cause	YTG Highway Maintenance Camp - discharge of contaminated water and sludge from garage sump - spills at refueling area
Latitude	59.71635842
Longitude	-135.04431478
Incident Date	3/10/1994
Lead Agency	Provincial / Territorial - other
Other Agency	
Company(s)	YTG Highways
Amount	
Units	
Quantity	Unknown
Release Description	Chronic Discharge
Additional Quantitit	
Concentration	
Concentration Unit	
Phase	Liquid
Major Contaminant	Hydrocarbons
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Outcome	contaminated water and sludge being dumped outside on ground - ground around fueling station contaminated - runoff into creek - advised BC MOE

**Photo 0111:** 1500 Maintenance Garage with access to Water Equipment Room**Photo 0112:** 1500 Hydroelectric Generating and Penstock Station**Photo 0484:** 1500 Water Storage Tanks**Photo 0486:** 1500 Filter System, 1 Micron Filter (left) and 10 Micron Filter (right)

**Photo 0485:** 1500 LMI Chlorinator**Photo 0109:** 1500 Jet Pump and Backup Water Reservoir**Photo 0489:** 1500 Pressure Tank**Photo 0487:** 1500 Penstock Feed



NOTES:
1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.

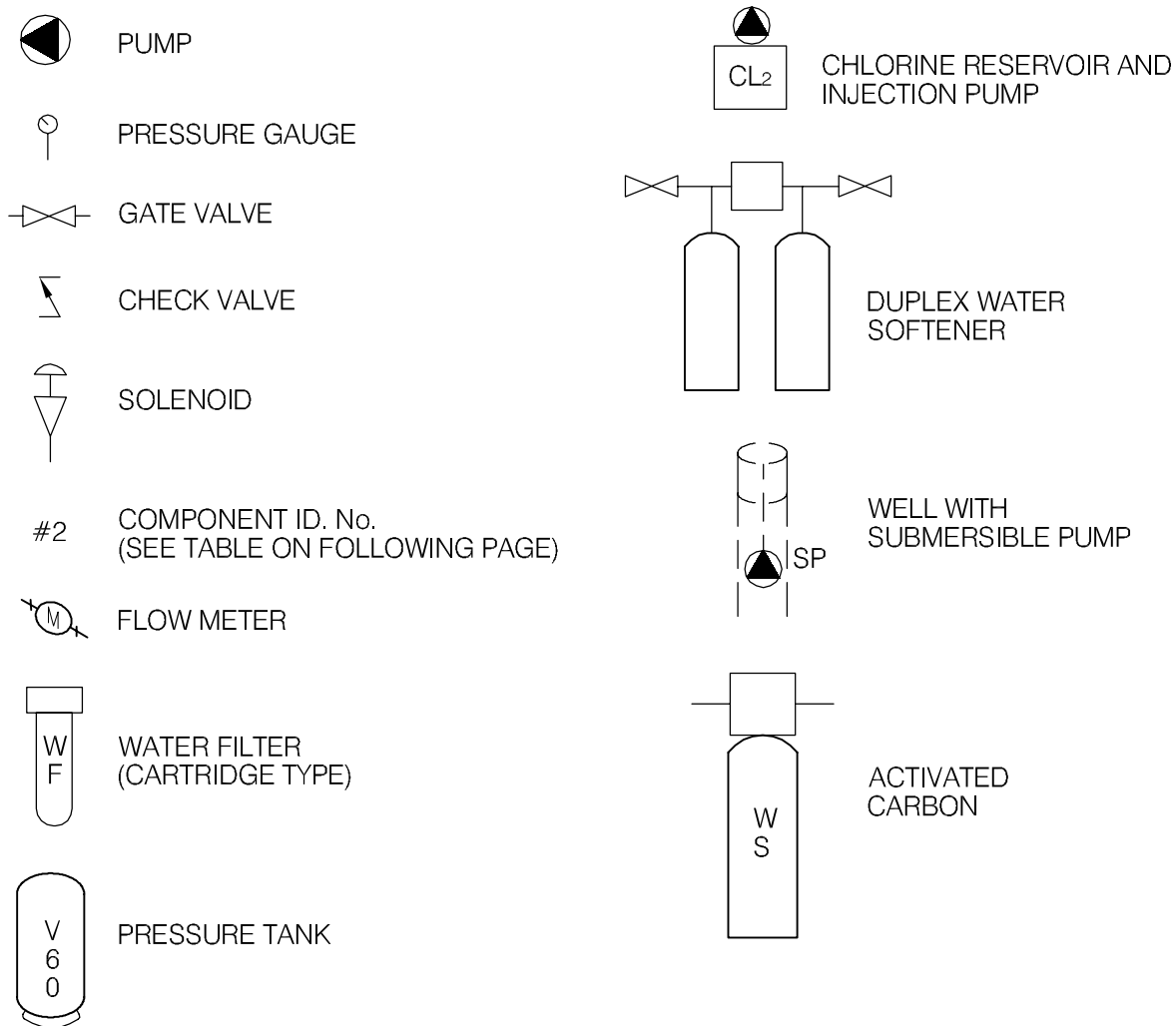
30 m RADIUS FROM WATER WELL FOR CONSIDERATION OF PROXIMITY TO POTENTIAL CONTAMINANT SOURCES.

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

EBA Engineering Consultants Ltd.	CLIENT:
DESIGNED BY: R. MARTIN	Yukon
DRAWN BY: J. BUYCK	Highways and Public Works
DATE: JUNE 2005	Property Management Branch
SCALE: AS SHOWN	
PROJECT No.: 1260002.001	
ACAD FILENAME: GOLDEN HORN SCHOOL	

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
GOLDEN HORN SCHOOL BUILDING 1322 SITE LOCATION DIAGRAM WELL ID: 1322	REVISION ISSUE 0
	DRAWING No. FIGURE 1322A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

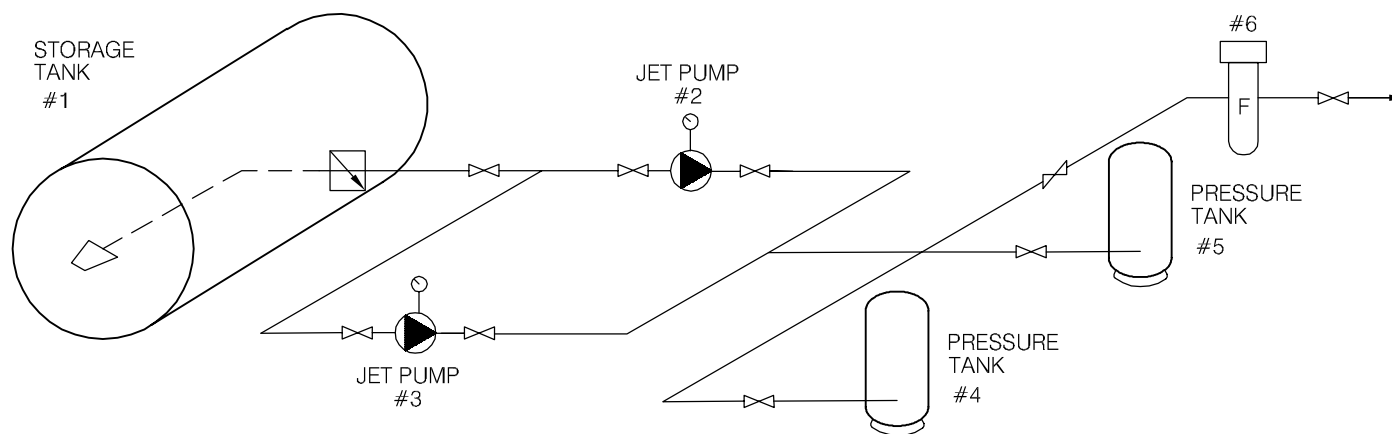
CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1322
GOLDEN HORN SCHOOL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1322B

**Whitehorse Region – Golden Horn School
Building # 1322**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	STORAGE TANK					6Ft ϕ x 10'L
2	JET PUMP #1	MYERS	MJC-100		1596	1 1/4" x 1"
3	JET PUMP #2	MYERS	MJC-100			
4	PRESSURE TANK #1		PMD 52		B 90685140	
5	PRESSURE TANK #2		PMD 52		B 89257660.	
6	WATER FILTER	AMETEK	1 1/2" BB			1 1/2 x 10"
7	WATER FILTER CART	"	JOIDP97			3 3/4" x 10"
8						
9						
10						

TABLE 1322 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1322	Golden Horn School	7	Sept-04 to Mar-05	no	0/7	no	2-Mar-05	no



Table 1322-2: Water Quality Results

SOURCE:	Building 1322 - Golden Horn School		GCDWQ Criteria		
Location/ Resident	Golden Horn Subdivision				
Address					
Treatment	Public Water System				
Source of Water	Delivery				
Purpose of Sampling	Baseline	Additional Sampling			
Sample Location		Staff Washroom Tap			
Date Sampled		10-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)			AO	MAC	AO
UV Absorbance		<0.0010			
Field Chemistry (EBA)					
pH		7.83	6.5		8.5
TDS		208			500
EC (uS/cm)		410			
Temperature		13.9			
Free Available Chlorine		0.01			250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1322-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1322	Golden Horn School	Golden Horn	6718787	507049	739

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	?	?	?	?	?	Too little for school, well abandoned	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
Burried Underground	Metal Plate welded on	?	Unlikely	No

**Table 1322-4: Potential Contaminant Sources
Building 1322 –Golden Horn School**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines, mains and lift stations	Biological , inorganic and organic parameters.	>>30 m		
Septic tanks	Biological and Inorganic parameters.	29 m	6718759	507053
Septic fields	Biological and Inorganic parameters	>60 m		
Gas stations	Organic and Inorganic parameters.	800 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	7 m	6718786	507042
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	Greater than 150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination



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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 10, 2005

WELL ID #	Owner	Location Description
1322	YTG	Golden Horn School

1. Well Location and Potential Contaminant Sources

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

Golden Horn Subdivision

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

Golden Horn School

c. GPS location: 507049 Easting 6718787 Northing, 739m elev. $\pm 7m$

d. Is there electric power? ☐ Yes ☒ No

e. Does the well system have:

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

Abandoned

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

f. Nearest building, specify Golden Horn School

g. Distance from well to building approximately 3 m

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

i. Distance from well to nearest point of known field: > 60m

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

29m to septic tank

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- k. 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

Septic tank 25m away

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

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

- n. 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

The well is buried underneath a road, the wellhead is welded shut

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

- p. Is the well site well drained? ☒ Yes ☐ No

- q. 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 _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: Heating Oil Tank; Distance from well to Potential Source 1: 7m inside water storage building

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ 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 15 cm Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: N/A - abandoned
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☐ in pit ☐ pitless adaptor ☐ in a building
N/A - abandoned, Buried underground
☐ 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 Buried underground
- 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 _____
- v. Does the well casing have a proper seal cap? ☐ Yes ☐ No

If no, describe condition _____

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...) _____

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

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 N/A

g. Pump delivers water to: ☐ pressure tank ☐ elevated tank ☐ other N/A

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: _____

l. Comments on pump installation: The well was abandoned after installation due to low flow rate and high iron content

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: Bert ABRISSEER

Date MAY 10 - 05

WELL ID #	Owner	Location Description
1322	YTG	GOLDEN HORN SCHOOL

6. Water Treatment

- a. Is well water treated? ☐ Yes ☐ No; Type of treatment: DELIVERED WATER
- ☐ 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: ELECTRICAL ROOM

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?

6" ~~Ø~~ x 10 Ft L

What material is the tank constructed of? LINED STEEL.

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 NO DRAIN

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~~ UNKNOWN

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:

WATER SYSTEM IS A PROFESSIONAL
INSTALLATION AS DESIGNED.

b. Recommendations:

WATER STORAGE TANK IS NOT AN
ACCEPTABLE STORAGE TANK FOR
DRINKING WATER.
A UV SYSTEM SHOULD BE USED TO
ASSURE BAC + VIRUS FREE WATER.

N - 6718787
E - 0507048



Driller's Report 204100459

Page 1 of 1

LOG FOR GOLDEN
HORN SCHOOL

Location: Golden Horn_Well1 Dunkin Street WHSE

NAD 83 Zone 8 Easting 507041 Northing 6718778 Elevation ASL 1 m.

Location Accuracy: Horizontal 30-100 (topo)

Vertical unknown or unreliable

Purpose of well: Commercial - not fabrication or manufacturing

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	4.88 m.		GRAVEL, silt cobbles		
2	4.88	125 m.		BEDROCK		

WELL CONSTRUCTION

Well No. 2041004591 Completion date Drilling method Well type

Casing: OS Diameter 15.24 mm. Material Wall thickness mm. Depth to m.

Comments

Surface/Env'l seal: Material Diameter mm. Depth from to m. Volume cu. m.

Gravel Pack ? Material Diameter mm. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Screen Sections

Section From to Slot size/
perforation diameter

1

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

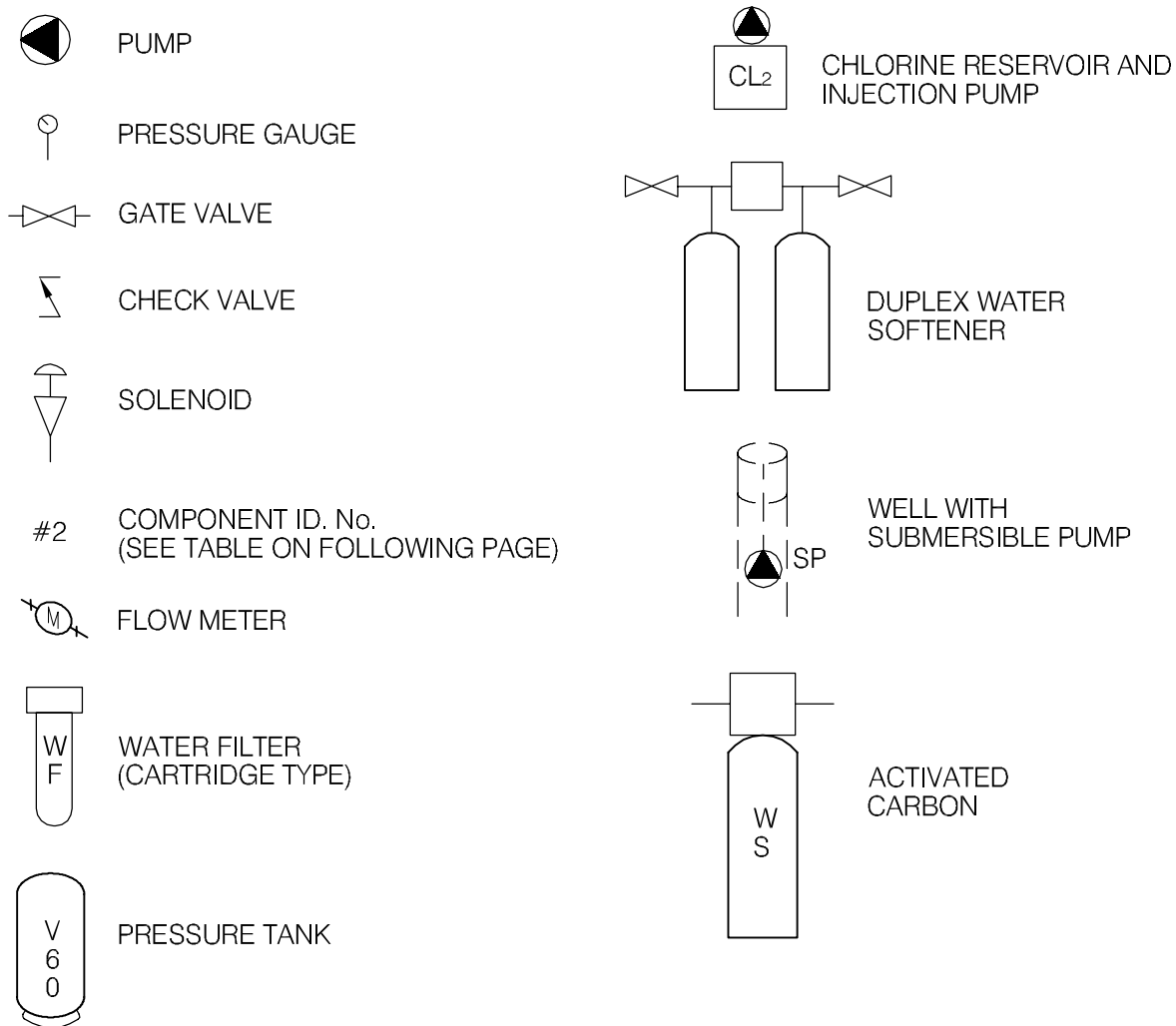
2041004591 Unfinished

Final Status

No

**Photo 0082:** 1322 Wellhead**Photo 0084:** 1322 Water Tank**Photo 0086:** 1322 Pressure Tanks and Filter

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

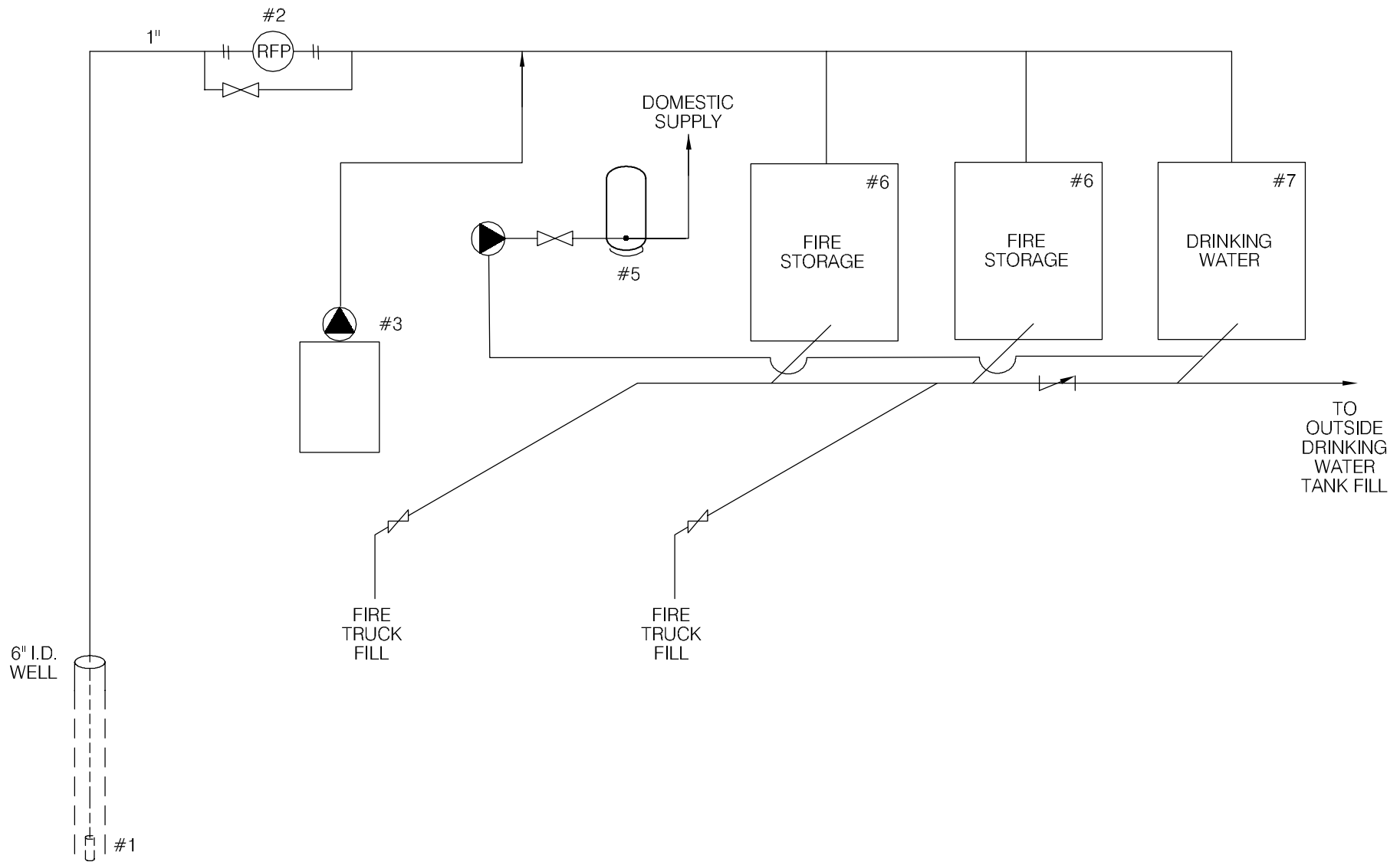
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1334
LAKEVIEW FIRE HALL - MARSH LAKE

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1334B

**Whitehorse Region – Lakeview Firehall
Building # 1334**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" Sub. Pump	Goulds	25G100412		K24278	4"
2	1" Flow Meter Pump. HAYES.					1"
3	CHLORINATION SYSTEM	GRANDFOS.	DME8-10	96412847	692	3/8"
4	DOMESTIC PUMP	MYERS.	H150S			1 1/4" x 3/4
5	PRESSURE TANK.	WELL RITE	WR60-02			
6	STORAGE TANKS		FIRE WATER			6'4" x 5'4
7	STORAGE TANK		DRINKING WATER			6'4" x 5'4
8	SPARE CHLORINE PUMP	LMI	A161-162S.			3/8"
9						
10						

TABLE 1334 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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
Building #	Building Name						
1334	Lakeview Firehall (Fill Station)	9	Sept-04 to Mar-05	no	0/9	no	2-Mar-05

Table 1334-2: Water Quality Results

SOURCE:		Building 1334 - Lakeview Fire Hall		GCDWQ Criteria		
Location/ Resident	Judas Creek Subdivision,					
Address						
Treatment	Chlorination					
Source of Water	On-Site Well					
Purpose of Sampling	Baseline	Additional Sampling				
Sample Location		Kitchen Tap				
Date Sampled		9-May-05	Lower Limit	Upper Limit		
Physical Tests (ALS)			AO	MAC	AO	
Colour (CU)	<5.0				15	
Conductivity (uS/cm)	678					
Total Dissolved Solids	405				500	
Hardness CaCO3	163		AO >200 = poor, > 500 unacceptable ^A			
pH	8.22		6.5		8.5	
Turbidity (NTU)	0.38			1	5	
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3	276					
Chloride Cl	6.67				250	
Fluoride F	0.328			1.5		
Sulphate SO4	109				500	
Nitrate Nitrogen N	<0.10			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	0.0059			0.025		
Barium T-Ba	0.021			1		
Boron T-B	0.25			5		
Cadmium T-Cd	<0.00020			0.005		
Calcium T-Ca	52.3					
Chromium T-Cr	<0.0020			0.05		
Copper T-Cu	0.020			1		
Iron T-Fe	0.095				0.3	
Lead T-Pb	<0.0010			0.01		
Magnesium T-Mg	47.5					
Manganese T-Mn	0.0327				0.05	
Mercury T-Hg	<0.00020			0.001		
Potassium T-K	3.22					
Selenium T-Se	<0.0010			0.01		
Sodium T-Na	19.4				200	
Uranium T-U	0.00054			0.02		
Zinc T-Zn	<0.050				5	
Trihalomethanes						
Bromodichloromethane	<0.0010					
Bromoform	<0.0010					
Chloroform	<0.0010					
Dibromochloromethane	<0.0010					
Total Trihalomethanes	<0.0040			0.1		
Haloacetic Acids						
Bromoacetic Acid	<0.0020					
Bromochloroacetic Acid	<0.0020					
Chloroacetic Acid	<0.020					
Dibromoacetic Acid	<0.0020					
Dichloroacetic Acid	<0.0020					
Trichloroacetic Acid (TCA)	<0.0020					
Field Chemistry (EBA)						
pH	7.99	6.5			8.5	
TDS	330				500	
EC (uS/cm)	650					
Temperature	10					
Free Available Chlorine	0.36				250	

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1334-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1334	Lakeview Fire Hall	Marsh Lake	6702194	540097	678

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	1992	Yes	28	Silt - 0m to 7m Clay - 21m to 28m	?	?	17.8

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.7 below grade	Split Cap Gasket	Yes 1.2m	Unlikely	No, but slopes away from pit

**Table 1334-4: Potential Contaminant Sources
Building 1334 – Lakeview Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	Approximately 800 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 20 m		
Septic fields	Biological and Inorganic parameters.	34 m		
Gas stations	Organic and Inorganic parameters.	>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	27 m	6681117	538692
Aviation Fuel Drums	Organic parameters	48 m	6621185	538644
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes: ***Bold highlighting of distances indicates non-compliance with proposed guidelines***

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin

Date May 9, 2005

WELL ID #	Owner	Location Description
1334	YTG	Lakeview Fire Hall

1. Well Location and Potential Contaminant Sources

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

Judas creek subdivision, Marsh Lake

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

Lakeview Fire Hall

c. GPS location: 0540097 Easting; 6702194 Northing Elv. 678 m $\pm 6m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
water is piped to a public-use storage tank

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

f. Nearest building, specify Lakeview Fire Hall, 4 m

g. Distance from well to building 4 m
0540097 Easting; 6702193 Northing, Elv 676m $\pm 22m$

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

i. Distance from well to nearest point of known field: 34 m and with ~5m drop

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

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- k. 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

Fuel tank 27m away

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

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

- n. 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
There is only a broken lock and a large flower pot on top

Entrance by animals? ☐ Yes ☒ No
There was no evidence of animals near the wellhead

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

It is located in a pit

- p. Is the well site well drained? ☒ Yes ☐ No

The grade elevation at the pit is higher than the surrounding ground

- q. 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 _____

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

☒ Yes ☐ No Describe _____

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

0540068
6702188
Elv 675m
± 15m
Potential Source 1: Gas Storage Tank; Distance from well to Potential Source 1: 27m

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- a. When was well installed? Year 1992 Month June
- 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 1.2m ☐ No
Galvanized steel culvert with a pwf 0.78m square box at surface
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
(6")
- g. Depth of well: 28.2m ☐ measured (if possible) ☐ reported ☒ from log
- h. Static water level below ground: 19.6m at time of drilling
☐ 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 4 ft slot size(s) 25 slot
Location of screen: from 88 ft to 92 ft from (log) reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☒ in pit ☐ pitless adaptor ☐ in a building
The pit is walled by a 1.2m galvanized steel culvert with a pwf box on top
☐ 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 1.8m below grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
Evidence of water stains on culvert and the pit is in a generally unsanitary condition
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☒ No
- iv. Any evidence of rodents? Specify There is no direct evidence of rodents, despite general unsanitary condition of pit
- v. Does the well casing have a proper seal cap? ☐ Yes ☒ No

If no, describe condition _____

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...) Chlorine treatment

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

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: June 8, 1992 By: Fredelena Enterprises

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

f. Drop pipe for submersible pump: ☒ steel ☐ plastic
(likely)

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
a valve must first be installed

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: Heat trace

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
1334	YTG.	LAKEVIEW FIRE HALL.

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 _____

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

☐ Yes ☒ No _____ reading.

Tested at 36 (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 **NOT APPLICABLE.**

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: IN FIRE HALL

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

(FIRE HALL STORAGE TANK)

What are the tank size and dimensions?

~~N/A~~ AG 1250

What material is the tank constructed of?

~~N/A~~ FIBREGLASS

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 ~~N/A~~

Does the lid have a tight seal and is it watertight when closed? YES (NO) ~~N/A~~

Does the tank have an overflow or high level whistle? (YES) NO ~~N/A~~ SIB PIPED OUTSIDE.

Is the water tank drain accessible? YES (NO) ~~N/A~~ NO DRAIN.

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: VERY LITTLE

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:

TANK FIRE SOLENOID VALVE SHOULD BE MOVED TO THE TANK AREA. 3/4" DOMESTIC WATER PIPE S/B INSTALLED AT A POINT PRIOR TO THE SOLENOID TO SUPPLY FRESH CONTAMINATED WATER TO THE BUILDING. PRESENT PIPING CONFIGURATION PRESENTS A HEALTH RISK FROM CONTAMINATED WATER OF FIRE TANK. CL2 INJECTION VALVE CRACKED.

b. Recommendations:

MOVE SOLENOID.
DISCONNECT PRESENT FEED TO DOMESTIC PUMP.
INSTALL 1" FEED LINE TO PUMP SYSTEM.
INSTALL BACKFLOW PREVENTER IN FIREMAN SUPPLY LINE.
PIPE OVERFLOW TO OUTSIDE PIPING TO PREVENT INDOOR FLOODING.
INSTALL NEW INJECTION VALVE RIGHT AWAY.

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PART C: Property Manager/ System Operator Questionnaire

Inspector: JERRY Jackson Date April 9/05
Property manager: V.T.G.

1) Water Source:

- a. Is the well water the major source of drinking water? ☒ Yes ☐ No
b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year JUNE Month 1992
b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
c. Is there a driller's log for the well?: ☒ Yes ☐ No
d. Do you know the depth of your well? If so, please indicate: 1992'
e. Who was the well constructed by?
Indicate contractor's name: Fredbye Contracting
f. Are you, the owner ☐ Yes or other: inspector
g. Who maintains the well? Community Services
h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
i. Is there a buried fuel tank on the property? ☐ Yes ☒ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? Fredbye Contracting 1992
b. What type of pump do you have? 1 hp. GOULD 25G100412
c. Pump delivers water to: ☐ pressure tank ☒ elevated tank ☐ other _____

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4) Water Treatment

- a. Is your well water treated? ☒ Yes ☐ No

Type of treatment: ☒ chlorination ☐ iron and or manganese removal
other _____

5) Well Capacity:

- a. Well capacity: User's opinion ☐ adequate ☐ inadequate

- b. Are there any times of year when your well goes dry, or does not produce enough water?

The well is good but the tank inside is too small

- c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

- a. In general, do you like your water?: ☒ yes ☐ no

- b. Does the water stain household plumbing? ☐ yes ☒ No ☐ slight ☐ severe

Type of stain: ☐ brown ☐ red ☐ black

- c. Does the water contain sediment? ☐ Yes ☒ No ☐ occasional ☐ constant

- d. Is there an unpleasant odour? ☐ Yes ☒ No

☐ Sulphur (rotten egg smell) ☐ Other _____

- e. Is there an unpleasant taste? ☐ Yes ☒ No ☐ brackish ☐ Other _____

- f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☒ no

- g. Is water softener being used? ☐ Yes ☒ No

- h. Are samples for bacterial analysis (coliforms) taken regularly? ☒ Yes ☐ No

If so, at what time intervals? *2 week*

Who takes them? *Community Services* *1/76*

- i. Is there a history of bad bacterial analyses? ☐ Yes ☒ No

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

7) Do you have any overall comments or complaints about your water well system?

In Peak Demand pump, is small, pipe to tanks from pump should be increased.

JUNE 8, 1992.

WELL LOG JUDAS CREEK FIREHALL

MARSH LAKE
FIREHALL.

0-6' SILT & SAND.
6-23' SILT, SAND, SOME GRAVEL.
23-72' SAND
72-86' SAND, GRAVEL & CLAY (FAIRLY PACKED).
86-92' SAND, SOME GRAVEL & CLAY.

DEPTH OF WELL 92'

STATIC LEVEL 64'

PUMPING LEVEL @ 15 G.P.M. 65' AFTER 8 HRS OF PUMPING.
RECOVERY ALMOST INSTANT TO STATIC

SCREEN 25 SMT EXPOSED 4'

COMMENTS: BAILED WELL FOR 2 HRS @ 40 G.P.M.
AND DREW WATER DOWN TO 72'.

RECOVERY TO CLOSE, TO STATIC, WAS 20 SECONDS.

WOULD NOT HESITATE TO PUMP @ 50 G.P.M. WITHOUT ANY
PROBLEMS.

WATER SAMPLES TAKEN IN. TO NEATH.

FREDERICK ENTERPRISES LTD.

Fred Jonesoff

393-6216

Environment
CanadaEnvironnement
Canada**Enforcement and Emergencies Section**

91782 Alaska Highway, Whitehorse, YT Y1A 5B7

PH: 867.667.3400 FAX: 867.667.7962

Spill Report Information

Spill #	8714
Jurisdiction	Yukon
Community	
Address	
Highway	Alaska Highway
Milepost	KM 1414
Feature	Marsh Lake
Location and Cause	500 m S Lake View Marina turn-off - transport went off road and jackknifed resulting in punctured saddle fuel tank
Latitude	60.465833333333
Longitude	-134.252222222222
Incident Date	11/22/1987 3:30:00 PM
Lead Agency	Environment Canada - Environmental Protection Service
Other Agency	Yukon Territorial Government - Highways
Company(s)	Diablo Transportation Inc (California)
Amount	0.4
Units	Tonnes (Metric)
Quantity	Actual
Release Description	Spilled
Additional Quantit	
Concentration	
Concentration Unit	
Phase	Liquid
Major Contaminant	Diesel
2nd Contaminant	
3rd Contaminant	
4th Contaminant	
Outcome	min env dmg - fuel absorbed by snow and ground in road-side ditch - no surface water drainage in area - transport hauling explosives - not damaged



Photo 0071: 1334 Wellhead



Photo 0072: 1334 DME Chlorinator and LMI Chlorinator back-up system.

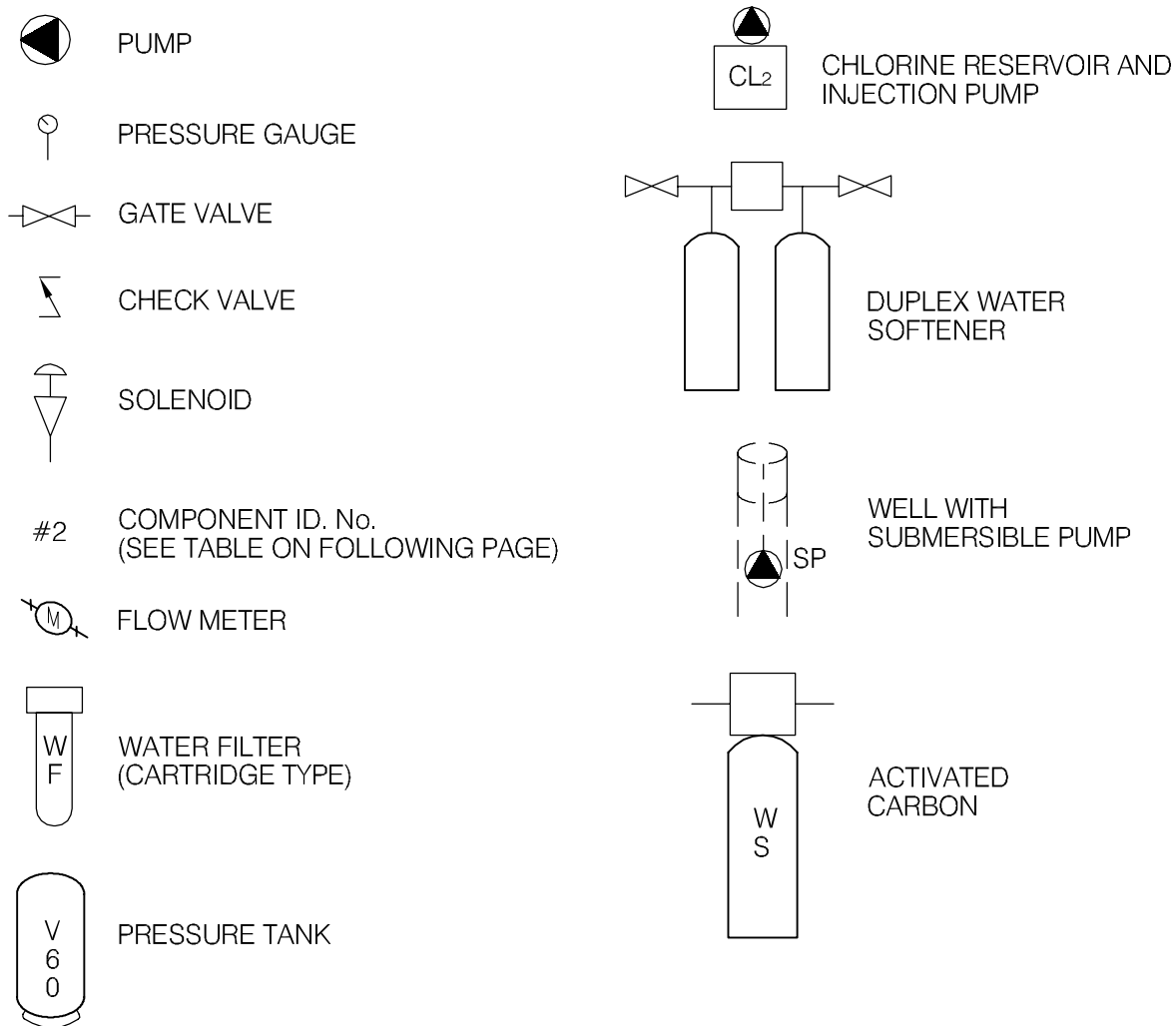


Photo 0073: 1334 Flow Meter



Photo 0074: 1334 Tanks and Truck Fill (domestic tank far right)

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

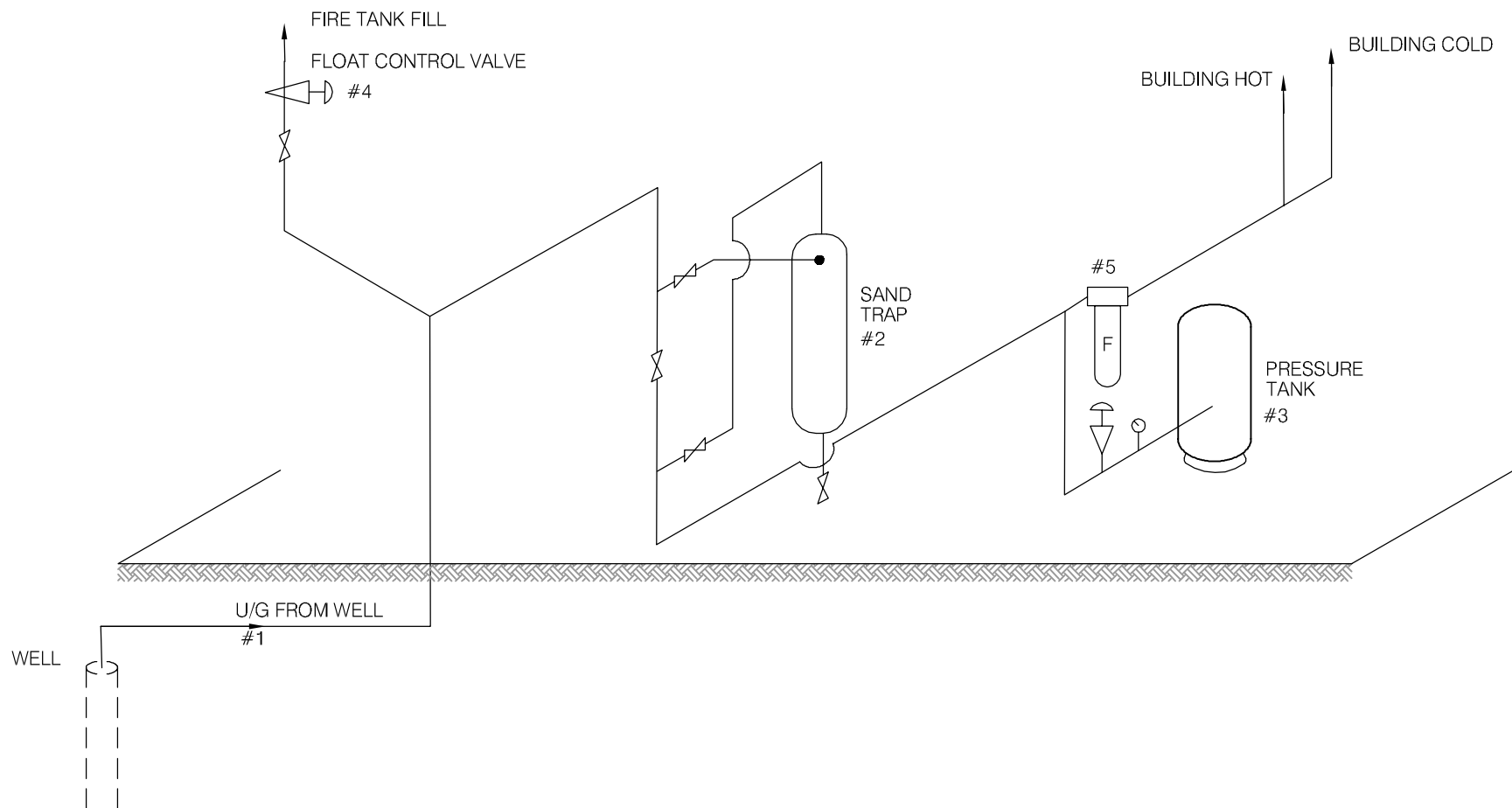
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1391
HOOTALINQUA FIRE HALL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1391B

Whitehorse Region – Hootalinqua
Building # 1391

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" Sub. Pump					4" - 1 1/2 HP.
2	SAND TRAP.	LAKOS	SANDMASTER			3/4"
3	PRESSURE TANK.		P220-TSR.		10997	
4	FILL CONTROL	ASCO	1" SOLENOID VALVE			1" FIPT.
5	INLINE FILTER	N/A	3/4" x 10"			5 MICRON
6						
7						
8						
9						
10						

TABLE 1391 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1391	Hootilingua Firehall	9	Sept-04 to Feb-06	yes	2/18	no	28-Feb-06	no



Table 1391-2: Water Quality Results

SOURCE		Building 1391 - Hootalingqua Firehall			GCDWQ Criteria		
Location/ Resident Address		Mayo Road					
Treatment		Water Softener					
Source of Water		On-Site Well					
Purpose of Sampling		Baseline	Additional Sampling	Baseline			
Sample Location		Kitchen Tap					
Date Sampled		5-Oct-04	19-May-05	26-Jun-05	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)		10		<5			15
Conductivity (uS/cm)		447		423			
Total Dissolved Solids		259		271			500
Hardness CaCO3		92	131	90.2	AO >200 = poor, > 500 unacceptable ^A		
pH		8.0		8.23	6.5		8.5
Turbidity (NTU)		1.5		2.6		1	5
UV Absorbance			0.0103				
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3		108		114			
Chloride Cl		2		1.50			250
Fluoride F		1.01		1.00		1.5	
Sulphate SO4		99.0		105			500
Nitrate Nitrogen N		<0.1		<0.10		10	
Nitrite Nitrogen N		<0.05		<0.10		1	
Ammonia Nitrogen N							
Total Metals (ALS)							
Aluminum T-Al		<0.02		<0.010			
Antimony T-Sb		0.0006		<0.0005		0.006	
Arsenic T-As		0.0022		0.00408		0.025	
Barium T-Ba		0.0244		0.025		1	
Boron T-B		0.03		<0.10		5	
Cadmium T-Cd		<0.0002		<0.0002		0.005	
Calcium T-Ca		24.1		24.9			
Chromium T-Cr		<0.0008		<0.0020		0.05	
Copper T-Cu		<0.001		<0.0010		1	
Iron T-Fe		0.556		0.531			0.3
Lead T-Pb		<0.0001		<0.0010		0.01	
Magnesium T-Mg		6.7		6.81			
Manganese T-Mn		0.033		0.0285			0.05
Mercury T-Hg		<0.0002		<0.0002		0.001	
Potassium T-K		1.7		1.64			
Selenium T-Se		<0.0004		<0.0010		0.01	
Sodium T-Na		60		62.1			200
Uranium T-U		0.0003		0.00078		0.02	
Vanadium T-V							
Zinc T-Zn		0.005		<0.050			5
Dissolved Metals (ALS)							
Aluminum D-Al		<0.020				0.1	
Antimony D-Sb		<0.0010				0.006	
Arsenic D-As		0.004				0.025	
Barium D-Ba		0.032				1.0	
Boron D-B		<0.10				5	
Cadmium D-Cd		<0.00010				0.005	
Calcium D-Ca		36.2					
Chromium D-Cr		<0.0010				0.05	
Cobalt D-Co		<0.0010					
Copper D-Cu		<0.0020					1.0
Iron D-Fe		<0.030					0.3
Lead D-Pb		<0.0020				0.01	
Lithium D-Li		<0.050					
Magnesium D-Mg		9.82					
Manganese D-Mn		0.039					0.05
Mercury D-Hg		<0.00020				0.001	
Molybdenum D-Mo		0.0213					
Nickel D-Ni		<0.010					
Potassium D-K							
Selenium D-Se		<0.0020				0.01	
Silver D-Ag		<0.00010					
Sodium D-Na		82.4					200
Uranium D-U		0.00126				0.02	
Zinc D-Zn		<0.0050					5.0
Trihalomethanes							
Bromodichloromethane							
Bromoform							
Chloroform							
Dibromochloromethane							
Total Trihalomethanes						0.1	
Organic Parameters							
Tannin and Lignin							
Total Organic Carbon C							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene							
Acenaphthylene							
Acridine							
Anthracene							
Benzo(a)anthracene							
Benzo(a)pyrene						0.00001	
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(k)fluoranthene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Fluorene							
Indeno(1,2,3-c,d)pyrene							
Naphthalene							
Phenanthrene							
Pyrene							
Quinoline							
Extractable Hydrocarbons							
EPH10-19							
EPH15-32							
LEPH							
HEPH							
Haloacetic Acids							
Bromoacetic Acid							
Bromochloroacetic Acid							
Chloroacetic Acid							
Dibromoacetic Acid							
Dichloroacetic Acid							
Trichloroacetic Acid (TCA)							
Field Chemistry (EBA)							
pH			8.39		6.5		8.5
TDS (ppm)			200				500
EC (uS/cm)			395				
Temperature (deg C)			10.5				
Free Available Chlorine (mg/L)							

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1391-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1391	Hootilingua Firehall	Mayo Road	6747128	489242	660

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	2002	No	156	Silt and Clay - 30m to 156m	?	Complaints about the well capacity - too slow for fire hall	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.50m below grade	Split Cap Gasket	?	Yes	No, but slopes away from pit

**Table 1391-4: Potential Contaminant Sources
Building 1391 – Hootalingua Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines, tanks or lift stations	Biological , inorganic and organic parameters.	Approx. 24 m		
Septic fields	Biological and Inorganic parameters.	36 m	6747135	489268
Rock Pit	Organic and Inorganic parameters.	Approx 30 m to 40 m	6747132	489263
Gas stations	Organic and Inorganic parameters.	Approx. 750 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>150 m		
Above ground storage tanks (ASTs)	Organic parameters.	24 m	6747140	489255
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes: ***Bold highlighting of distances indicates non-compliance with proposed guidelines***

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 19, 2005

WELL ID #	Owner	Location Description
1391	YTG	Hootalingua Firehall

1. Well Location and Potential Contaminant Sources

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

Five Mile, Mayo Road

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

Parcel H (Mayo Road)

c. GPS location: 489242 Easting 6747128 Northing 660m elevation ± 6m

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

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

Hootalingua Firehall only

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

f. Nearest building, specify Hootalingua Firehall

g. Distance from well to building 14m

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

i. Distance from well to nearest point of known field: 36m

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

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- k. 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

Septic tank 36m away, Risk greater than that

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

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

- n. 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
There are no locks and neither the rd or the hatch are fastened on

Entrance by animals? ☐ Yes ☒ No
Cobwebs, ants, evidence of mice

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

There appears to be no water staining or dampness but for the rust on the well head

- p. Is the well site well drained? ☒ Yes ☐ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST; Distance from well to Potential Source 1: 24m

Potential Source 2: Rock Pit; Distance from well to Potential Source 2: ~30-40m

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- * a. When was well installed? Year 2002 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: 515 ft ☐ measured (if possible) ☒ reported ☐ from log
- * h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
wellhead in pwp and insulated wooden enclosure
☒ 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 Yes 1.5m 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
Inside walls only. None directly protecting well head. There is an extra compartment above compartment enclosing well head
- iv. Any evidence of rodents? Specify Mouse droppings present. Since wood it is accessible
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
split cap
If no, describe condition _____

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...) water softener only

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 *likely, well pumps very slowly*

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: 2002 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
for fires

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

i. Is there provision for taking water samples before water reaches storage? ☒ Yes ☐ No
However near floor, nearly inaccessible

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

k. Is the pump and piping protected from freezing? ☒ Yes ☐ No
*Heat trace. Insulated walls in enclosure and insulated piping.
Heat trace goes along entire line*
If yes, describe: _____

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 ALBUSER

Date May 20/05

WELL ID #	Owner	Location Description
<u>B/391</u>	<u>YTG</u>	<u>HOTEL AQUA FIRETRAIL</u>

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 _____

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?

2x AG 1250

What material is the tank constructed of? Fibre Glass

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 CHLORINATED WITH PUCKS

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:

PROFESSIONAL INSTALLATION. GOOD QUALITY
& WORKMAN SHIP.
SHOULD HAVE COMMERCIAL SIZE FILTER ON
FILL LINE TO KEEP TANKS CLEAN
(30 MICRON)

b. Recommendations:

INSTALL COMMERCIAL SIZE FILTER ON
WATER LINE BETWEEN SAND TRAP &
PRESSURE TANK. INSTALL CHLORINATOR
AFTER INLINE FILTER.

Already Entered Wells or Tanks:

Well Deliver More Information

Recommendation:

Year Drilled Well Size

2002	6-inch

Sodium Potassium Iron

☐ ☐ ☒

Year Installed Size

2002	1200-gallons

Construction Material

fiberglass

Year Cleaned	Cleaned By
1998	1998
1999	1999
2000	2000
2001	2001
2002	2002
2003	2003
2004	2004
2005	2005
2006	2006
2007	2007
2008	2008
2009	2009
2010	2010
2011	2011
2012	2012
2013	2013
2014	2014
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2099	2099
2100	2100

1

Sodium	Potassium	Iron	UV Treatment	Reverse Osmosis	Filter Type

☒ Sediment

Sodium	Potassium	Iron	UV Treatment	Reverse Osmosis	Filter Type	Chlorination

Sediment	☐	☐	☐	☒

Sodium	Potassium	Iron	UV Treatment	Reverse Osmosis	Filter Type	Chlorination	More Information

☒	Sediment				

Add/Edit Buildings Water Systems

Find Building

Buildings Pick List:

1391

Already Entered Wells or Tanks:

Hootalinqua Firehall & Com. Hall

From	To	Formation	Description of Work
0'	100'	SAND/CLAY	
100'	144'	silt compact	
144'	190'	sand	
190'	198'	sand/silt	
198'	296'	sand/silt/clay	
296'	304'	sand/gravel	
304'	309'	sand/gravel	
309'	350'	gravel/sand silt	
350'	461'	sand/silt/gravel	
461'	471'	sand/silt/gravel	
471'	492'	sand/sily/gravel	
492'	515'	sand/gravel/clay	8-inch casing down to 471' and 6-inch rest of the way/19 gpm

WELLS_DRILLED_BY_SubForm

PROJECT: YTG - Hootalinqua Firehall Well		CASING STICKUP: 0.6 m (2 ft)		WELL NO: 1-02	
PHCL PROJECT NO: C730101		STATIC WATER LEVEL: 33.0 m (108.23 ft) bgs		PUMPING TEST: Yes	
LOCATION: North of Whitehorse		COMPLETION DEPTH: 156.7 m (514 ft)		WATER ANALYSIS: Yes	

DEPTH	DESCRIPTION	ELEVATION (m)	SYMBOL	WELL DATA	REMARKS
-5 ft m	Ground Surface	0.0			Note that the 150 mm (6") diameter well casing was cut off 1.2 m (4 ft) below ground, with the 200 mm (8") diameter outer casing cut off 1.5 m (5 ft) below ground. A steel plate is welded over the opening between the casings. Static water level of 33.60 m (110.23 ft) below the 0.6 m (2 ft) casing stickup corresponds to a level of 31.77 m (104.23 ft) below the casing of the permanent installation, which is enclosed in an underground chamber. Note that the 200 mm (8") casing shoe is at 143.0 m (469 ft); for well screen details, see below. Top of well screen assembly = 151.5 m (497 ft). Total length of K-type packer and riser pipe = 0.7 m (2.3 ft). 3.7 m (12 ft) of 1.0 mm (0.040") screen, with a total length of 3.8 m (12.5 ft). The screen is exposed between 153.0 and 156.0 m (502 and 512 ft). Nominal diameter of 150 mm screen is 124 mm (4.875"). 0.6 m (2 ft) of 125 mm (5") solid pipe, closed with a threaded steel plate at the bottom at 156.7 m (514 ft).
20	Sand, Clay and Sandy Clay 0.0 to 30.5 m (0 to 100 ft) - with 0.15 m (0.5 ft) thick gravel bed at 24.4 to 24.5 m (80 to 80.5 ft)				
45					
70					
95		-30.5			
120	Sand 30.5 to 37.8 m (100 to 146.6 ft) - containing a hard cemented layer from 37.8 to 39.6 m (124 to 130 ft)				
145		-44.1			
170	Silt 44.1 to 57.9 m (144.6 to 190 ft) - compact				
195		-57.9			
220	Sand 57.9 to 60.4 m (190 to 198 ft) - water-bearing	-60.4			
245	Sand, Silt and Clay 60.4 to 90.2 m (198 to 296 ft) - sand, silt and sandy silty clay				
270					
295		-90.2			
320	Sand and Gravel 90.2 to 92.7 m (296 to 304 ft) - silty, cleaner below 92.7 m (304 ft)	-94.2			
345	Gravel, Sand and Silt 94.2 to 103.0 m (309 to 350 ft) - interbedded; thin water-bearing layers; cleaner sand and gravel layer from 96.0 to 97.5 m (315 to 320 ft)				
370	Clay 103.0 to 140.5 m (350 to 461 ft) - silty interbeds throughout	-106.7			
395					
420		-140.5			
445		-143.6			
470	Sand 140.5 to 150.9 m (461 to 471 ft) - silty and gravelly; water-bearing				
495	Gravel, Sand and Silt 143.6 to 150.0 m (471 to 492 ft) - interbedded, thin water-bearing layers	-150.0			
520	Sand 150.0 to 157.0 m (492 to 515 ft) - coarse, trace of gravel and silt; cleaner water-bearing; clay at 157.0 m	-157.0			
545					

CONTRACTOR: Cathway Water Resources		DATE: Mar-Aug/2002		PACIFIC HYDROLOGY CONSULTANTS LTD. Consulting Hydrogeologists Suite 201, 1537 West 8th Avenue VANCOUVER, B.C. Canada V6J 1T5 Telephone: (604) 730-6990
DRILLING METHOD: Cable Tool		BY: rt		
PAGE: 1 of 2		FIGURE: 3		



Photo 0188: 1391 Well Head Enclosure (front), Hootalinqua Firehall and Above Ground Fuel Storage Tank (back)



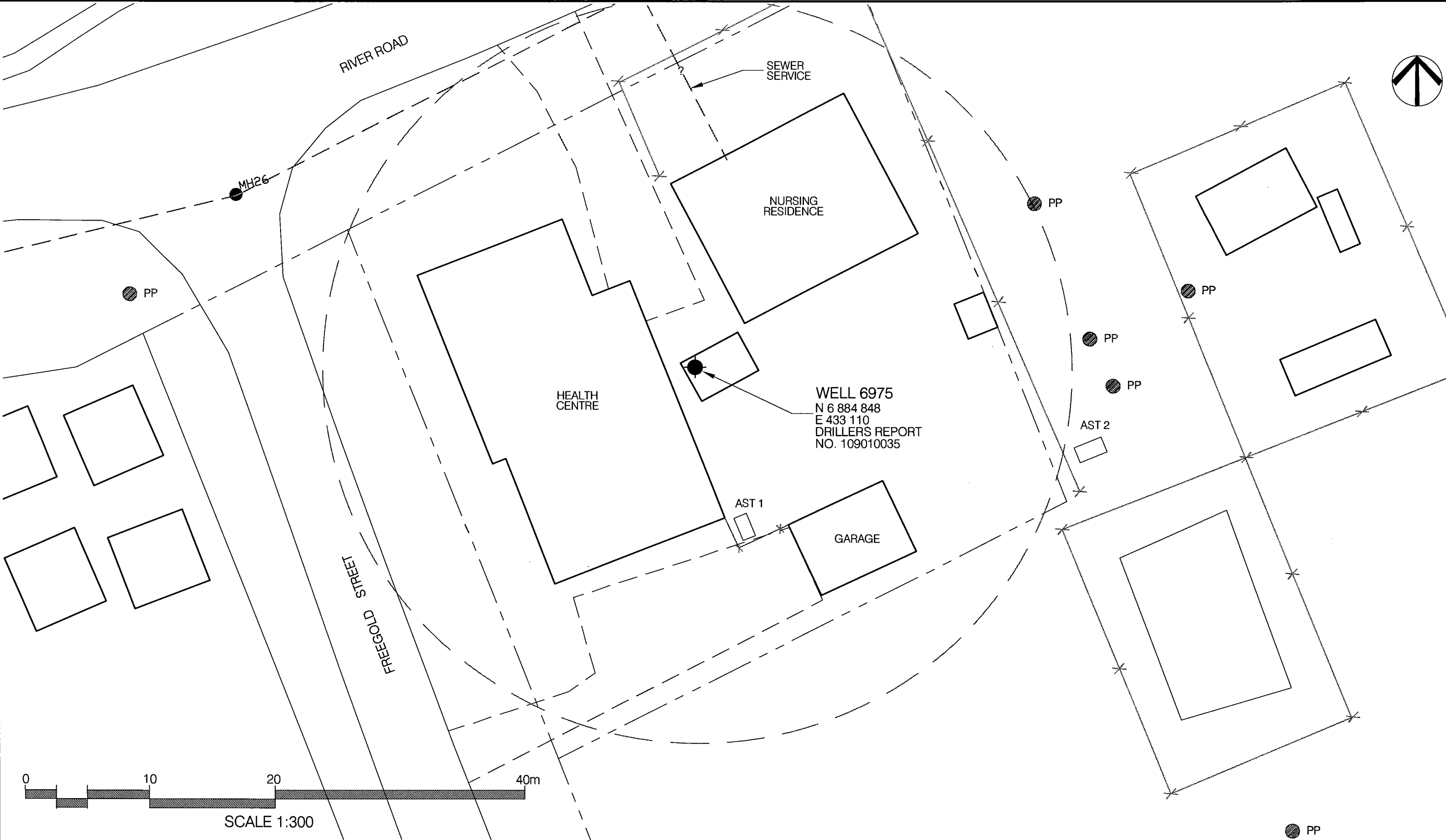
Photo 0189: 1391 Septic Field



Photo 0190: 1391 Well Head



Photo 0013: 1391 Water Storage Tanks



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.

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



EBA Engineering Consultants Ltd.

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

CLIENT:



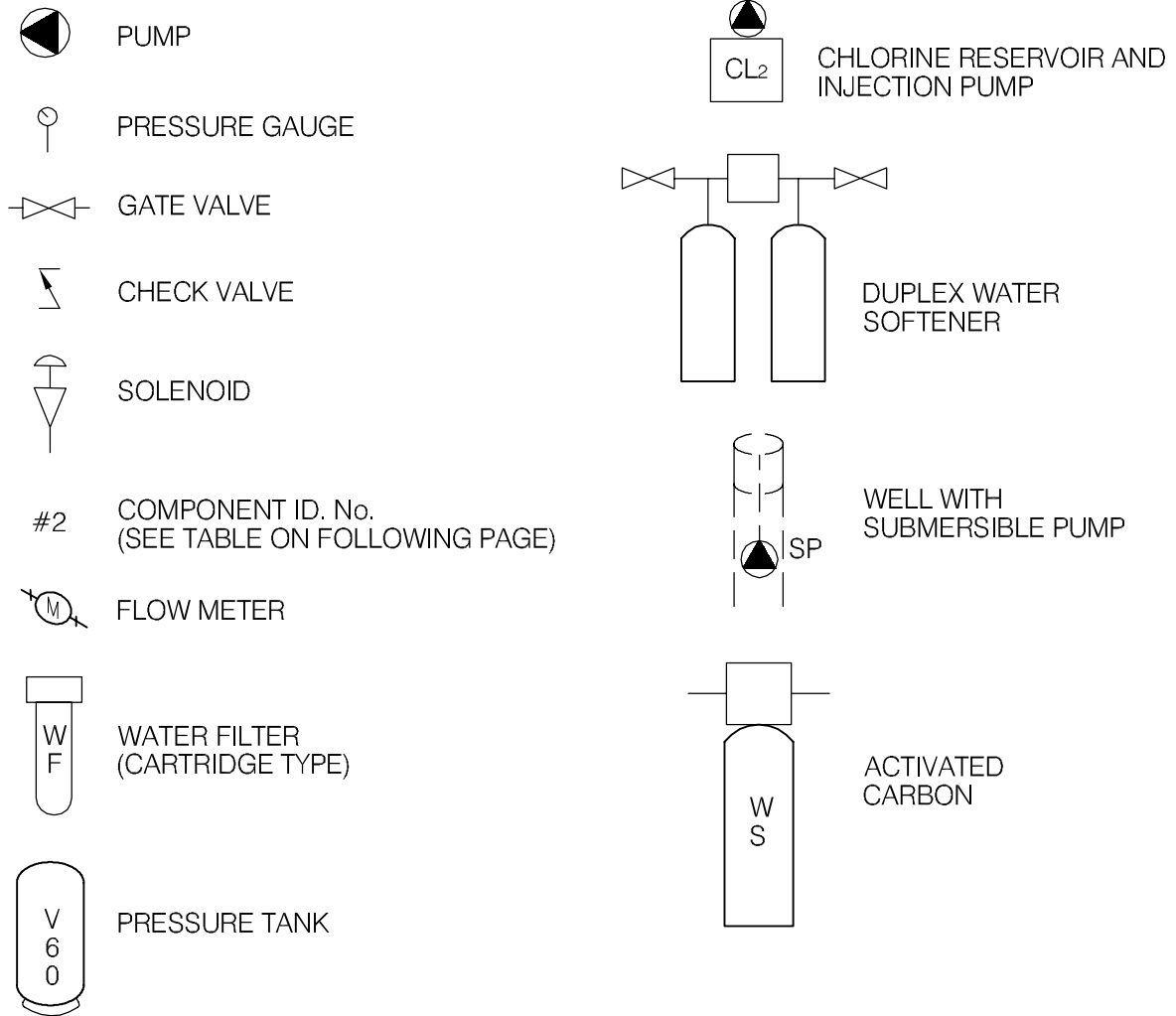
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

CARMACKS HEALTH CENTRE
BUILDING 6975
SITE LOCATION DIAGRAM
WELL ID: 6975
REVISION ISSUE
0
DRAWING No.
FIGURE 6975A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

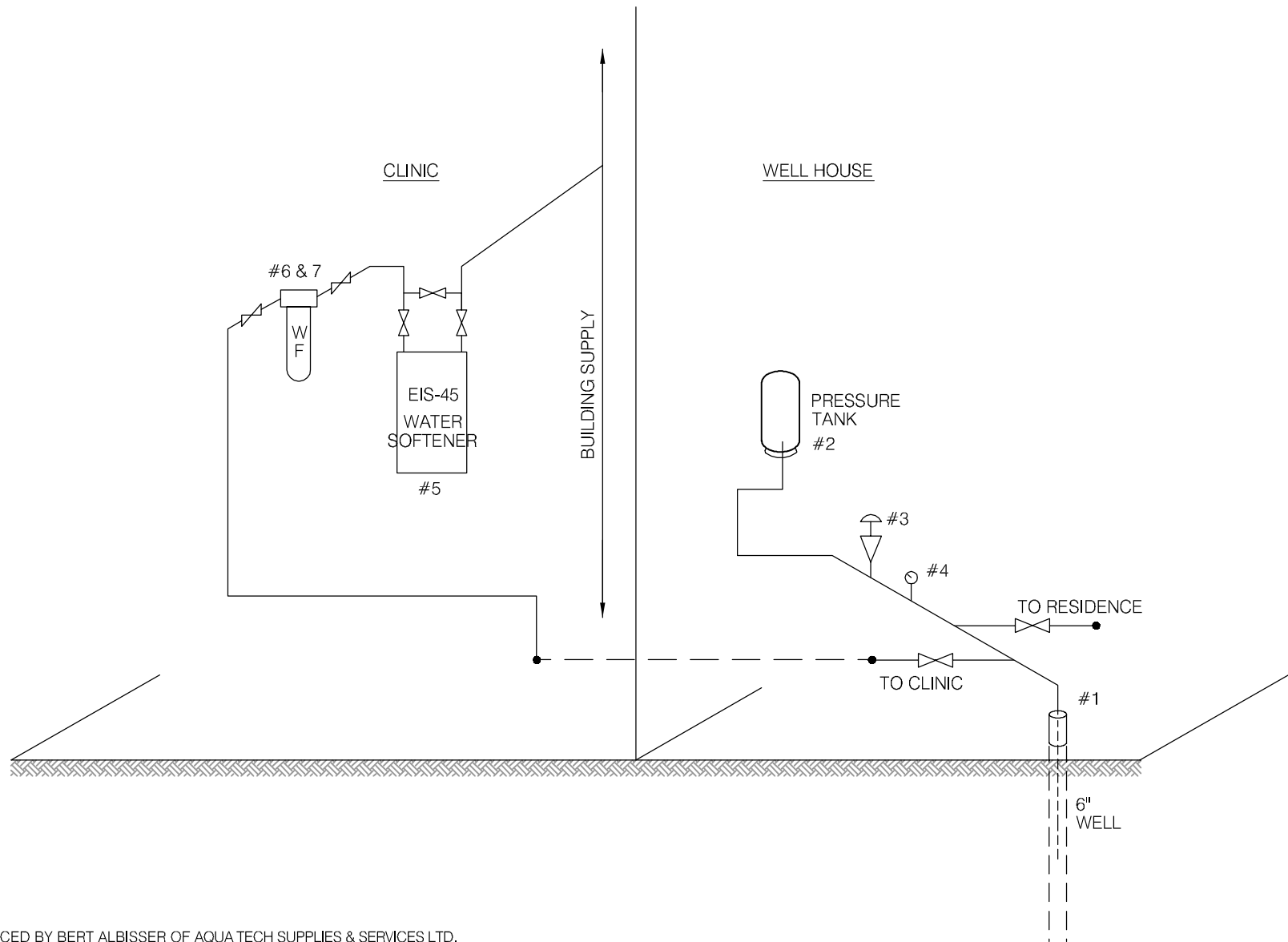
CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 6975
CARMACKS HEALTH CENTRE

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 6975B

Whitehorse Region – Health Centre

Building # ~~6875~~ 6975
6875

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	SUB. PUMP	MONARCH	16CISEX		828	4" - 1/2 HP.
2	PRESSURE TANK	CHALLENGER	PC 244			307 l
3	PRESSURE SWITCH	SEQ. D	FSG-2			1/4 FIFT x 2 HP
4	PRESSURE GAUGE	MARSH	0-100			1/4" FIFT.
5	WATER SOFTENER	WATERTECH	E1545 MI			45000 GRAIN
6	PRE FILTER	AMETEK.	1" BIG BLUE			4"x10"
7	FILTER CART	PLYMOUTH	51-BB			20 HICKON
8						
9						
10						

TABLE 6975 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6975	Health Centre	2	Apr-05 to May-05	no	0/2	no	May 05	no



Table 6975-2: Water Quality Results

SOURCE:		Building 6975 A - Carmacks Health Centre		Building 6975 B - Carmacks Nursing Residence		GCDWQ Criteria		
Location/ Resident		Carmacks		Carmacks				
Address		Lot 123		Lot 123				
Treatment		Filter and Softener		UV System				
Source of Water		On-Site Well (shares with 6975 B)		On-Site Well (shares with 6975 A)				
Purpose of Sampling		Baseline	Additional Sampling	Baseline	Additional Sampling			
Sample Location			Kitchen Tap		Laundry Sink Tap			
Date Sampled		5-Oct-04	12-May-05		12-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)						AO	MAC	AO
Colour (CU)		<3						15
Conductivity (uS/cm)		612						
Total Dissolved Solids		365						500
Hardness CaCO3		<1				AO >200 = poor, > 500 unacceptable ^A		
pH		8.1				6.5		8.5
Turbidity (NTU)		0.15					1	5
UV Absorbance			<0.0010		<0.0010			
Dissolved Anions (ALS)								
Alkalinity-Total CaCO3		231						
Chloride Cl		5						250
Fluoride F		0.2					1.5	
Sulphate SO4		24.8						500
Nitrate Nitrogen N		<0.1					10	
Nitrite Nitrogen N		<0.05					1	
Ammonia Nitrogen N								
Total Metals (ALS)								
Aluminum T-Al		<0.02					0.1	
Antimony T-Sb		0.0007					0.006	
Arsenic T-As		0.0031					0.025	
Barium T-Ba		0.0002					1	
Boron T-B		<0.02					5	
Cadmium T-Cd		<0.0002					0.005	
Calcium T-Ca		<0.5						
Chromium T-Cr		0.001					0.05	
Copper T-Cu		<0.001					1	
Iron T-Fe		0.009						0.3
Lead T-Pb		0.0002					0.01	
Magnesium T-Mg		<0.1						
Manganese T-Mn		0.001						0.05
Mercury T-Hg		<0.0002					0.001	
Potassium T-K		212						
Selenium T-Se		<0.0004					0.01	
Sodium T-Na		<1						200
Uranium T-U		0.001					0.02	
Zinc T-Zn		<0.004						5
Polycyclic Aromatic Hydrocarbons								
Acenaphthene			<0.000050					
Acenaphthylene			<0.000050					
Acridine			<0.000050					
Anthracene			<0.000050					
Benz(a)anthracene			<0.000050					
Benzo(a)pyrene			<0.000010					
Benzo(b)fluoranthene			<0.000050					
Benzo(g,h,i)perylene			<0.000050					
Benzo(k)fluoranthene			<0.000050					
Chrysene			<0.000050					
Dibenz(a,h)anthracene			<0.000050					
Fluoranthene			<0.000050					
Fluorene			<0.000050					
Indeno(1,2,3-c,d)pyrene			<0.000050					
Naphthalene			<0.000050					
Phenanthrene			<0.000050					
Pyrene			<0.000050					
Quinoline			<0.000050					
Extractable Hydrocarbons								
EPH10-19			<0.30					
EPH19-32			<1.0					
LEPH			<0.30					
HEPH			<1.0					
Field Chemistry (EBA)								
pH			8.05		7.90	6.5		8.5
TDS			291		225			500
EC (uS/cm)			571		444			
Temperature			15.0		8.5			
Free Available Chlorine								250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6975-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6975	Health Centre	Carmacks	6884848	433110	528

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	?	Incomplete	17.68	No, shallow well	?	1 1/2hp submersible pump Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.06 above grade	Split Cap Gasket	?	Unlikely	Inside building

**Table 6975-4: Potential Contaminant Sources
Building 6975 – Carmacks Health Centre**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1500 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	600 m up-gradient		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Unknown		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	50 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	11 m and 50 m	6884883	433115
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	50 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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*Incomplete Log

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin.
Luke Label

Date May 12, 2005

WELL ID #	Owner	Location Description
<u>6975</u> (possibly 6977)	<u>YTB</u>	<u>Carmacks Health Center -</u>

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Carmacks Health Center

c. GPS location: 0433110 Easting 6884948 Northing 528m elevation ±8m

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
Health Center and nearby residence

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

f. Nearest building, specify Health Center

g. Distance from well to building ~4m

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

i. Distance from well to nearest point of known field: area of any septic field within local
area - piped sewer system w/lines <30m

j. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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k. 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

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

m. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No
solid waste dump ~ 1 km away

n. 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
locked door; inside building

Entrance by animals? ☒ Yes ☐ No
no apparent evidence of any animals

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

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

q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely
There is, however, a buried fuel line that has leaked hydrocarbons and contaminated the soil
If yes, is it ☐ in use ☐ abandoned ~ 6m from the well & see report - contaminated soil was relocated
Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

433115
686480
535m
Potential Source 1: AST 1; Distance from well to Potential Source 1: ~11m

Potential Source 2: AST 2 (large diesel fuel tank); Distance from well to Potential Source 2: ~50m

Potential Source 3: River; Distance from well to Potential Source 3: ~50m

Potential Source 4: hydrocarbon spill; Distance from well to Potential Source 4: ~6m
Electric generator ~ 2m within same building

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

There was a leak from the AST in the line running to the station. Some soil contamination

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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 5m x 2.5m ☐ No
The well is located within a utility building
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
and rope split casing, There is an open hole for heat trace
- *g. Depth of well: 17.68m ☐ measured (if possible) ☒ reported ☐ from log
- *h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☒ in pumphouse ☐ in pit ☐ pitless adaptor ☒ in a building
shares with pressure tank and backup electric generator. Utility building is heated and insulated
☐ 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 no, it is 6cm above grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☐ Yes ☒ No
well area seems very clean
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☐ No
The well head is within a heated, insulated building
- iv. Any evidence of rodents? Specify no evidence of rodents
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition _____

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.
There was a hydrocarbon spill ~ 6m away - has been remediate &
If yes is there treatment ☒ Yes ☐ No

Explain (filtration, disinfection etc...) water softener

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

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
Tap in building, on line to pressure tank

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

k. Is the pump and piping protected from freezing? ☒ Yes ☐ No
The well is located within a heated, insulated building. There is heat trace on all piping and down to pump
If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
6975	YTG	CALMARKS HEALTH CENTRE RESIDENCE

6. Water Treatment

a. Is well water treated? ☒ Yes ☒ No; Type of treatment: UV SYSTEM

☐ chlorination ☐ iron and or manganese removal ☒ other LIV

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 *UNKNOWN*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *UNKNOWN*
- 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: _____

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

8. Conclusions

a. Comments on overall installation:

UV SYSTEM INSTALLATION REQUIRES ATTENTION. THE TWO UV REACTORS DO NOT HAVE FLOW RESTRICTORS INSTALLED TO ASSURE FULL UV EXPOSURE, NO UV MONITOR IS PRESENT TO MEASURE UV STRENGTH. THE PIPING FEEDING THE REACTORS PROMOTES UNEVEN FLOW DISTRIBUTION AGGRAVATING THE ABOVE PROBLEM.

b. Recommendations:

RENEW THE PIPING SYSTEM. INSTALL ONE FILTER SYSTEM TO HANDLE THE FULL FLOW. INSTALL UV MONITORS ON BOTH REACTORS ALONG WITH THE APPROPRIATE FLOW RESTRICTORS.
INSTALL PRETREATMENT IF REQUIRED
THIS SYSTEM IS AN ACCIDENT WAITING TO HAPPEN.



Driller's Report 109010035

Page 1 of 1

Location: Nursing Station Well Lot 124 CRMK

NAD 83 Zone 8 Easting 433111.13 Northing 6884897.0 Elevation ASL 1 m.

Location Accuracy: Horizontal 30-100 (topo)

Vertical unknown or unreliable

Purpose of well: Commercial - not fabrication or manufacturing

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	1.22 m.		SAND and gravel		
2	1.22	2.13 m.		fine SAND		
3	2.13	17.68 m.		TILL		

WELL CONSTRUCTION

Well No. 1090100351 Completion date Drilling method Well type

Casing: OS Diameter mm. Material Wall thickness mm. Depth to m.

Comments

Surface/Env'l seal: Material Diameter mm. Depth from to m. Volume cu. m.

Gravel Pack? ☐ Material Diameter mm. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Screen Sections

Section	From	to	Slot size/ perforation diameter
1			

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

1090100351 m. m. Lps

Final Status New, in use for intended purpose

No

GROUNDWATER QUALITY

Well No. 1090100351 Field Measurement Date 10-Dec-02

Electrical Conductivity 605 μ S

pH 7.58

Temperature 6.45 $^{\circ}$ C

Groundwater Type

Turbidity/sand content

Well disinfection

Was the well disinfected on completion of pump installation? ☐Bacterial testing done? ☐

Lab

Date

Chemical testing done? ☐

Lab

Date



Photo 0137: 6975 Health Center (right), Wellhouse (center) and Nursing Residence (left)



Photo 0002: 6975 Wellhead



Photo 0138: 6975 Above Ground Fuel Storage Tank and Hydrocarbon Spill Site



Photo 0139: Substation and Above Ground Fuel Storage Tank (back)



Photo 0142: 6975 Health Center Water Treatment System



Photo 0143: 6975 Nursing Residence Water Treatment System

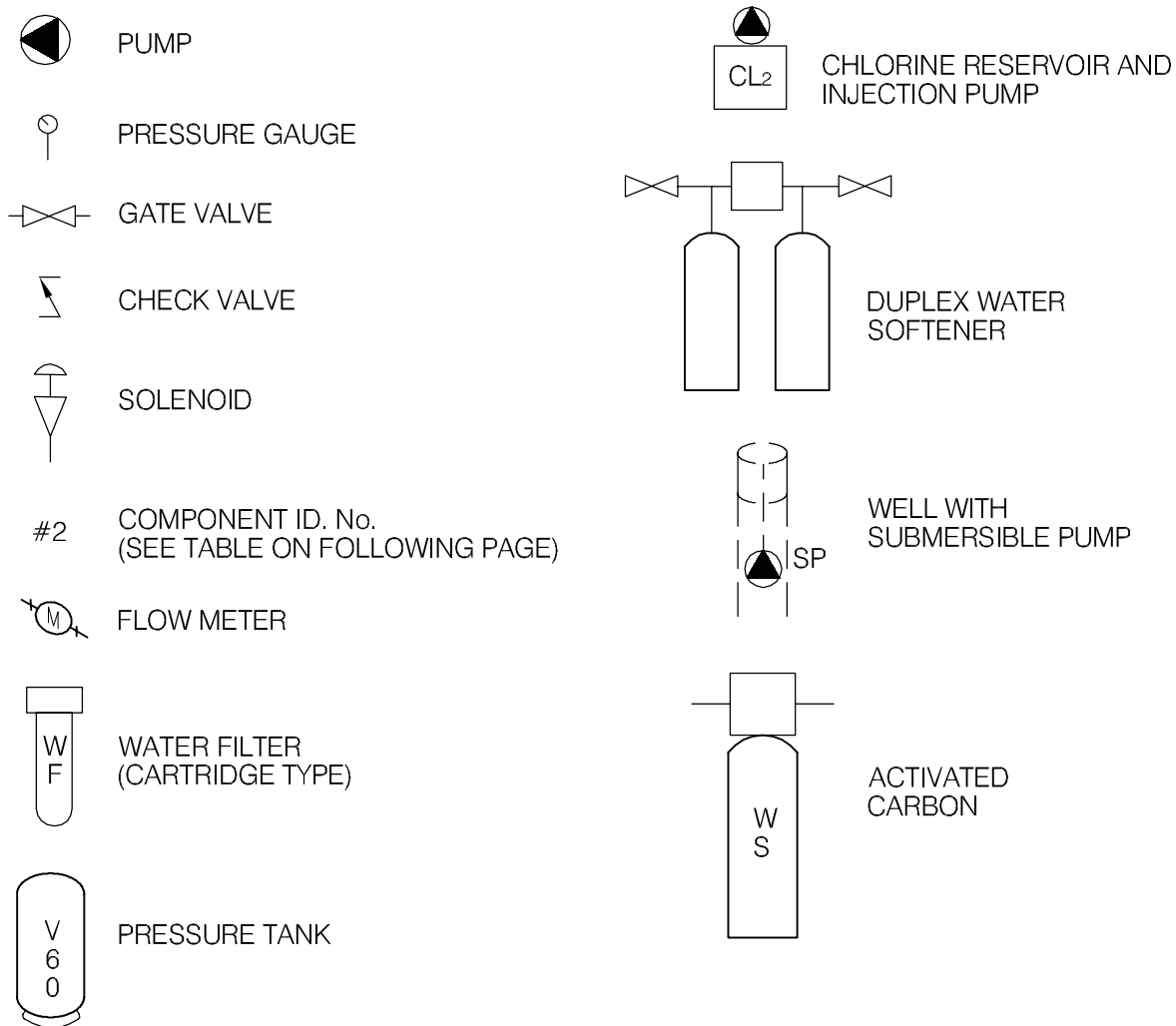


Photo 0141: 6975 Pressure Tank (right) and Backup Electrical Generator



Photo 0001: 6975 Pump Control Box

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

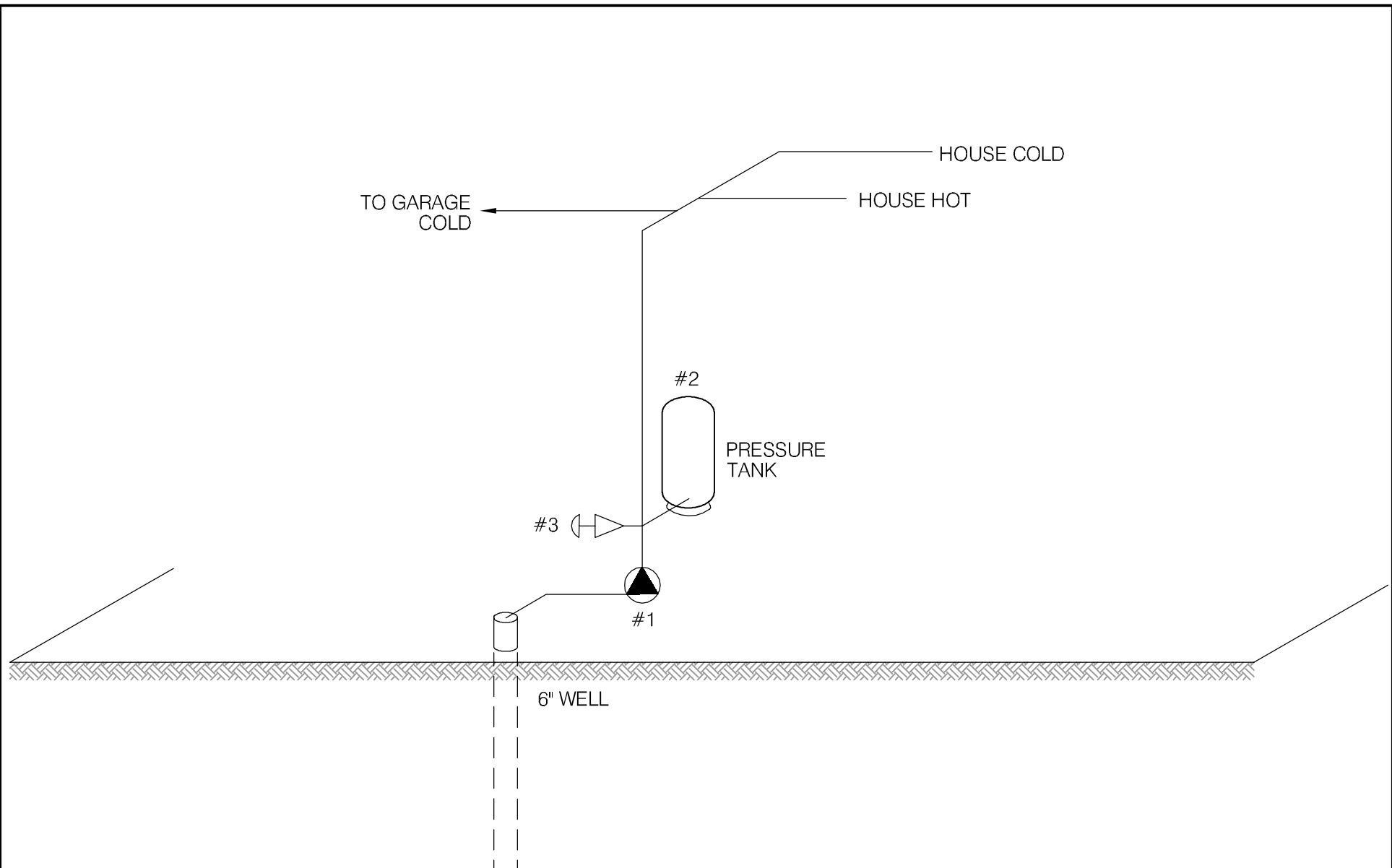
DATE APRIL 2006

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 WHITEHORSE REGION		
CLIENT  Yukon Highways and Public Works Property Management Branch			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 6542 CARMACKS FORESTRY OFFICE		
DATE	APRIL 2006	DWN.	JSB	CHKD.	RMM
FILE NO.	1260002.001	DWG.:	FIGURE 6542B		

Whitehorse Region – District Office
Building # 6542

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	JET Pump	~~THE~~ MONARCH	R120		782	1" x 1 1/2 Hp.
2	PRESSURE TANK	PNEUMATIC TANK	STECHARGE	30FG.		
3	PRESSURE SWITCH	SER. D	FSG-2			
4						
5						
6						
7						
8						
9						
10						

TABLE 6542-1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6542	District Office	2	Apr-05 to May-05	no	0/2	no	May 05	no



Table 6542-2: Water Quality Results

SOURCE:		Building 6542 - Forestry District Office			GCDWQ Criteria		
Location/ Resident		Carmacks					
Address							
Treatment		No					
Source of Water		On-Site Well					
Purpose of Sampling		Baseline	Additional Sampling	Baseline			
Sample Location		Washroom Tap					
Date Sampled		5-Oct-04	13-May-05	6-Jul-06	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)		5		<5			15
Conductivity (uS/cm)		309		376			
Total Dissolved Solids		213		225			500
Hardness CaCO3		197		181	AO >200 = poor, > 500 unacceptable ^A		
pH		8.0		8.25	6.5		8.5
Turbidity (NTU)		1.2		1.23		1	5
UV Absorbance			<0.0010				
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3		189		199			
Chloride Cl		2		1.18			250
Fluoride F		0.21		0.168		1.5	
Sulphate SO4		18.3		19.3			500
Nitrate Nitrogen N		<0.1		<0.10		10	
Nitrite Nitrogen N		<0.05		<0.10		1	
Ammonia Nitrogen N							
Total Metals (ALS)							
Aluminum T-Al		<0.02		<0.010		0.1	
Antimony T-Sb		0.0008		<0.0005		0.006	
Arsenic T-As		0.001		0.00103		0.025	
Barium T-Ba		0.723		0.073		1	
Boron T-B		<0.02		<0.010		5	
Cadmium T-Cd		<0.0002		<0.0002		0.005	
Calcium T-Ca		55.7		53.4			
Chromium T-Cr		0.0011		<0.0020		0.05	
Copper T-Cu		0.002		<0.0010		1	
Iron T-Fe		0.149		0.149			0.3
Lead T-Pb		0.0002		<0.0010		0.01	
Magnesium T-Mg		12.3		11.6			
Manganese T-Mn		0.022		0.025			0.05
Mercury T-Hg		<0.0002		<0.0002		0.001	
Potassium T-K		2.3		2.06			
Selenium T-Se		<0.0004		<0.0010		0.01	
Sodium T-Na		6		6.6			200
Uranium T-U		0.0011		0.00106		0.02	
Zinc T-Zn		<0.004		<0.050			5
Dissolved Metals							
Aluminum D-Al						0.1	
Antimony D-Sb						0.006	
Arsenic D-As						0.025	
Barium D-Ba						1.0	
Beryllium D-Be							
Boron D-B						5	
Cadmium D-Cd						0.005	
Calcium D-Ca							
Chromium D-Cr						0.05	
Cobalt D-Co							
Copper D-Cu							1.0
Iron D-Fe							0.3
Lead D-Pb						0.01	
Lithium D-Li							
Magnesium D-Mg							
Manganese D-Mn							0.05
Mercury D-Hg						0.001	
Molybdenum D-Mo							
Nickel D-Ni							
Selenium D-Se						0.01	
Silver D-Ag							
Sodium D-Na							200
Thallium D-Tl							
Titanium D-Ti							
Uranium D-U						0.02	
Vanadium D-V							
Zinc D-Zn							5.0
Polycyclic Aromatic Hydrocarbons							
Acenaphthene							
Acenaphthylene							
Acridine							
Anthracene							
Benz(a)anthracene							
Benz(a)pyrene						0.00001	
Benz(b)fluoranthene							
Benz(g,h,i)perylene							
Benz(k)fluoranthene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Fluorene							
Indeno(1,2,3-c,d)pyrene							
Naphthalene							
Phenanthrene							
Pyrene							
Quinoline							
Extractable Hydrocarbons							
EPH10-19							
EPH19-32							
LEPH							
HEPH							
Field Chemistry (EBA)							
pH		7.89			6.5		8.5
TDS		182					500
EC (uS/cm)		358					
Temperature		6.6					
Free Available Chlorine							

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6542-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6542	District Office	Carmacks	6884838	432758	534

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	1973	Yes	12.20	No, shallow well	?	?	1.52

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.2 below grade	Split Cap Gasket	Yes 1.5m perforated	Unlikely	Inside building

**Table 6542-4: Potential Contaminant Sources
Building 6542 – Carmacks Forestry District Office**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1300 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	450 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Unknown		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	200 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	5 m and 24 m	6884835 6884839	432764 432736
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	100 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Martin
Luke LeberDate May 13, 2005

WELL ID #	Owner	Location Description
<u>6542</u>	<u>YTG</u>	<u>Carmacks Forestry District Office</u>

1. Well Location and Potential Contaminant Sources

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

Carmacks

- Well serves both building on-site
- some use for drinking water
- get water from store usually
but some drink from well.

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

Carmacks Forestry District Officec. GPS location: 432758 Easting, 6884838 Northing, 534m elev. ± 9md. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____well serves both buildings on site☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify Forestry office, attached to basement inside

g. Distance from well to building _____

h. If there is an effluent disposal field, is its location known? ☐ Yes ☒ Noi. Distance from well to nearest point of known field: N/Aj. Well location relative to field: ☐ upslope ☐ downslope ☐ lateralN/A

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k. 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

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

m. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No
Solid waste dump ~1km away

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

Unauthorized access by humans? ☒ Yes ☐ No *Located inside forestry building. Buildings can be locked*
Entrance by animals? ☐ Yes ☒ No *Nothing to prevent animals. no traces, however*

o. Is well site subject to flooding? ☐ Yes ☒ No
no evidence

p. Is the well site well drained? ☒ Yes ☐ No
No apparent water staining

q. Is there a buried fuel tank on the property? ☐ Yes ☒ No *unlikely*

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☒ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: FAST 7 ; Distance from well to Potential Source 1: 5m *inside same building on the basement*

Potential Source 2: AST 6 ; Distance from well to Potential Source 2: 24m

Potential Source 3: septic manhole 1 ; Distance from well to Potential Source 3: 24m

Potential Source 4: septic manhole 2 ; Distance from well to Potential Source 4: 30m

s. Are there other wells on this property? ☐ Yes ☒ No
RCMP wells nearby ~80m and ~100m

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- a. When was well installed? Year 1973 Month August
- 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 6 ☒ No
- f. Well casing: Diameter 6" Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: 40 ft ☐ measured (if possible) ☐ reported ☒ from log
- h. Static water level below ground: 5 ft at time of drilling
☐ 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 5 ft slot size(s) perforated
Location of screen: from 29 ft to 34 ft 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
☒ 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 AT PERMANENT 4 FT BELOW
- 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 _____

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...) _____

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, no reports of

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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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
6SA2	YTG	CARMACKS FORESTLY Compound DISTRICT OFFICE

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 _____

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 *N/A*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *N/A*
- 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 30FG*

Where is it located?

Comments: *Basement*

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:

THIS SYSTEM IS TOTALLY OBSOLETE. THE
EQUIPMENT IS 20 YEARS +, THE WORK IS
NOT ACCESSIBLE FOR SERVICING.

b. Recommendations:

DRILL A NEW WELL AND REPLACE THE
WATER SYSTEM TO SUIT NEW REGS.



Driller's Report 109010066

Page 1 of 1

Location: New Forestry House Well Lot 12 Parcel C-1 CRMK

NAD 83 Zone 8 Easting 432699 Northing 6884857 Elevation ASL 1716 ft.

Location Accuracy: Horizontal 300-1000 (topo)
Vertical 30.5 metres (100ft)

Purpose of well: Municipal - residences and other grouped structures

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	1	ft.	Sandy CLAY	Gravel	
2	1	15	ft.	SAND and GRAVEL		
3	15	17	ft.	SAND		
4	17	22	ft.	SAND and GRAVEL	Cobbles	
5	22	26	ft.	SAND and GRAVEL		wet
6	26	27	ft.			hard pan
7	27	29	ft.	SAND and GRAVEL		water
8	29	32	ft.		Cobbles	hard pan
9	32	40	ft.	SAND and GRAVEL		

WELL CONSTRUCTION

Well No. 1090100661 Completion date 8/ 7/1973 Drilling method Air Rotary (conventional) Well type Overburden

Casing: OS Diameter 5 in. Material Steel Wall thickness Depth to 40 ft.

Comments Bottom of casing is closed

Surface/Env'l seal: Material Diameter Depth from to Volume

Gravel Pack ? Material Diameter Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments
Perforated

Screen Sections

Section From to Slot size/
perforation diameter
1 25 30 ft.

WELL DEVELOPMENT AND STATUS

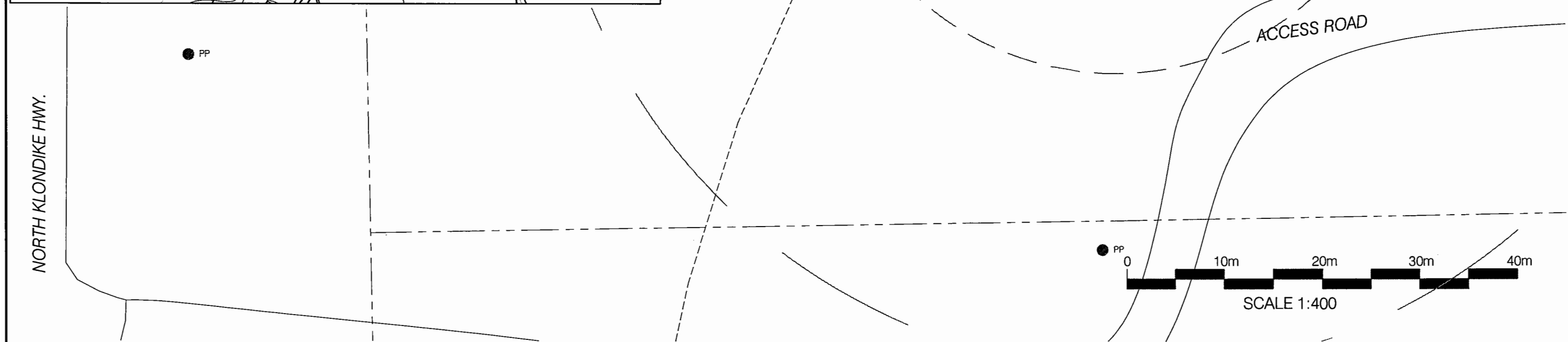
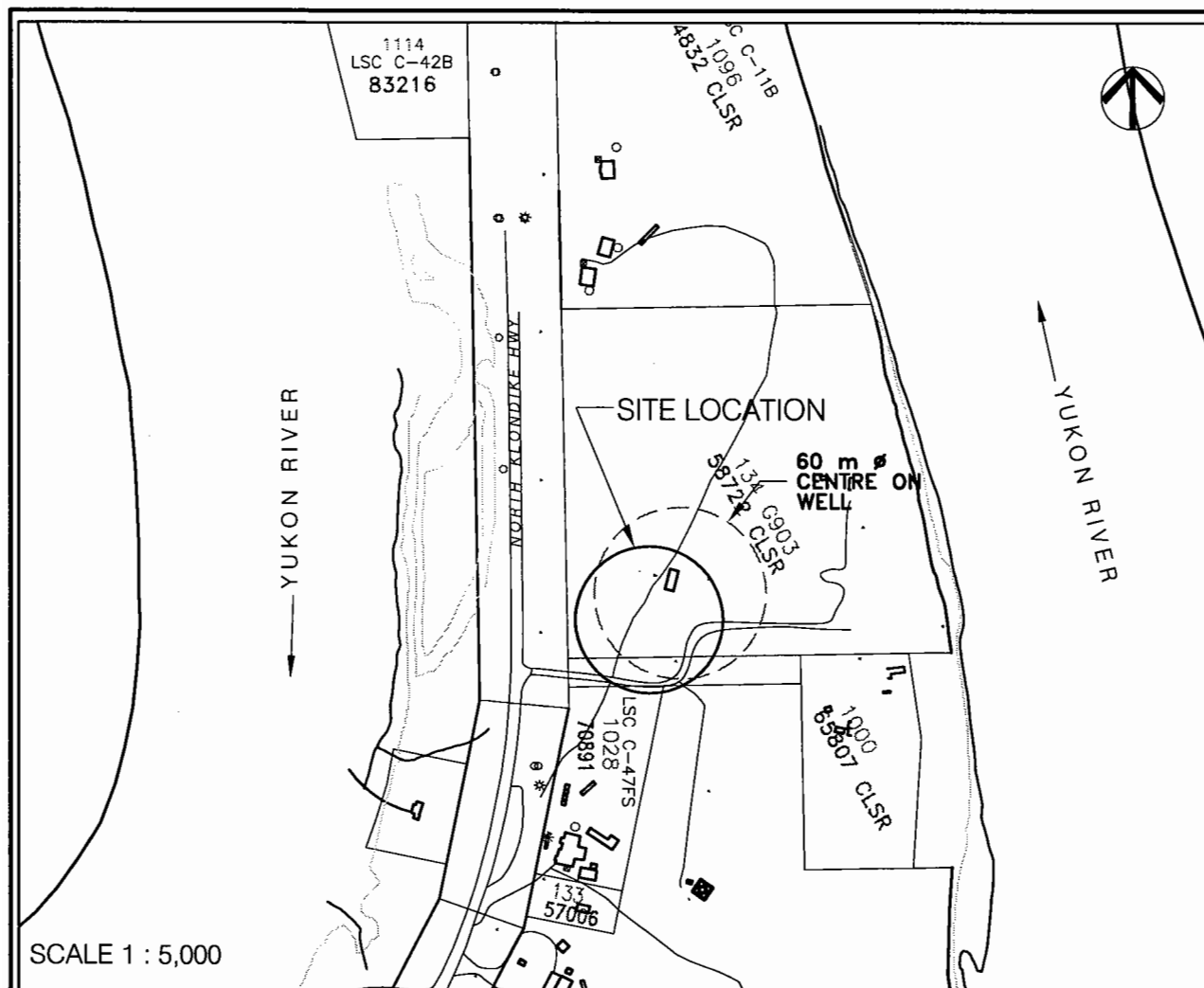
Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

1090100661 Air lifting None 5 ft. 50 gpm Bailing

Final Status New, in use for intended purpose

No

**Photo 0155:** 6542 Forestry District Office (wellhead located inside underneath)**Photo 0023:** 6542 Jet Pump**Photo 0020:** 6542 Wellhead**Photo 0022:** 6542 Pressure Tank



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.

REVISION	DESCRIPTION	DATE	APPROVED
0	ISSUED FOR CLIENT REVIEW	DD/MM/YY	XXX



EBA Engineering Consultants Ltd.

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

CLIENT:



Highways and Public Works
Property Management Branch

**SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION**

**GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS**

**CARMACKS FORESTRY CREW QUARTERS
BUILDING 6536
SITE LOCATION DIAGRAM
WELL ID: 6536**

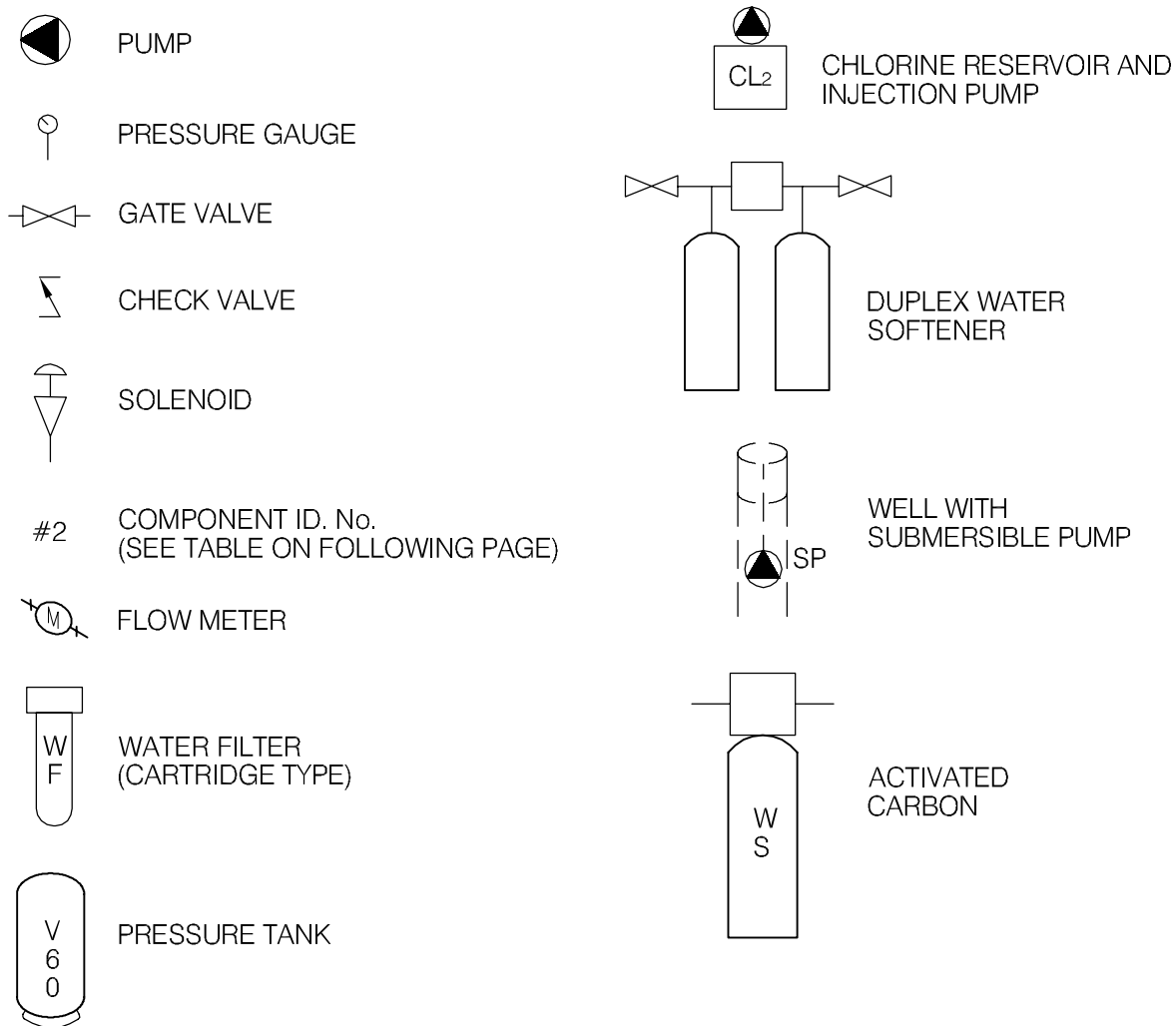
REVISION ISSUE

0

DRAWING No.

FIGURE 6536A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND

TABLE 6536-1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6536	Crew Quarters	2	Apr-05 to May-05	no	0/2	no	May 05	no



Table 6536-2: Water Quality Results

SOURCE:		Building 6536 - Forestry Crew Quarters		GCDWQ Criteria		
Location/ Resident		Carmacks				
Address		Lot 12 Parcel C-1				
Treatment		No				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location			Kitchen Tap			
Date Sampled		5-Oct-04	25-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)		5				15
Conductivity (uS/cm)		310				
Total Dissolved Solids		213				500
Hardness CaCO3		197		AO >200 = poor, > 500 unacceptable ^A		
pH		8.0		6.5		8.5
Turbidity (NTU)		0.95			1	5
UV Absorbance			<0.0010			
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3		190				
Chloride Cl		2				250
Fluoride F		0.21			1.5	
Sulphate SO4		18.1				500
Nitrate Nitrogen N		<0.1			10	
Nitrite Nitrogen N		<0.05			1	
Total Metals (ALS)						
Aluminum T-Al		<0.02			0.1	
Antimony T-Sb		0.0007			0.006	
Arsenic T-As		0.0009			0.025	
Barium T-Ba		0.0739			1	
Boron T-B		<0.02			5	
Cadmium T-Cd		<0.0002			0.005	
Calcium T-Ca		56.4				
Chromium T-Cr		<0.0008			0.05	
Copper T-Cu		0.001			1	
Iron T-Fe		0.131				0.3
Lead T-Pb		0.0003			0.01	
Magnesium T-Mg		12.7				
Manganese T-Mn		0.021				0.05
Mercury T-Hg		<0.0002			0.001	
Potassium T-K		2.3				
Selenium T-Se		<0.0004			0.01	
Sodium T-Na		6				200
Uranium T-U		0.0011			0.02	
Zinc T-Zn		0.004				5
Field Chemistry (EBA)						
pH			8.72	6.5		8.5
TDS			79			500
EC (uS/cm)			158			
Temperature			6.5			
Free Available Chlorine						250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6536-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6536	Crew Quarters	Carmacks	6886336	433882	526

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)
125	?	No	10.460	No, shallow well	?	?	6.090

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.5 above grade	Split Cap Gasket	No	No	No, ground is even

**Table 6536-4: Potential Contaminant Sources
Building 6536 – Carmacks Forestry Crew Quarters**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	3500 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	2600 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx.12 m		
Septic fields	Biological and Inorganic parameters.	20 m likely up-gradient	6886342	433866
Helicopter Fueling Station	Organic and Inorganic parameters.	150m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	14 m	6886346	433875
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination



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*No Well Log

6530
6528

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 13, 2005

WELL ID #	Owner	Location Description
<u>6536</u>	<u>YTG</u>	<u>Carmacks Forestry Crew Quarters</u> <u>↳ ACROSS RIVER</u>

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Forestry compound off of the North Klondike highway

c. GPS location: 433882 Easting 6886336 Northing 526m elevation

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many No
services crew quarters (1 building)

☐ 5 or more delivery sites on a trucked distribution system? If so how many No

f. Nearest building, specify Carmacks forestry crew quarters

g. Distance from well to building 3m

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

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

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

likely up gradient from well

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- k. 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

septic is ~ 20m from the well

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

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

- n. 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

The well head is outside at the front of the crew quarters

Entrance by animals? ☐ Yes ☒ No

The well is directly outside

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

- p. Is the well site well drained? ☒ Yes ☐ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☒ No very unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☐ Yes ☐ No Describe _____

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

Potential Source 1: AST; Distance from well to Potential Source 1: ~ 14m

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- *a. When was well installed? Year 1977 Month July
- 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
well is outside
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: 10.960m b.c. ☒ measured (if possible) ☐ reported ☒ from log
- h. Static water level below ground: 6.090m b.c.
☒ 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 5.5m slot size(s) 10mm
Location of screen: from 1.5m to 7.0m 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
☐ in a wooden enclosure other, describe In nothing. The well is outside
- 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 no, well is 0.5m above grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☐ Yes ☐ No
There is no enclosure
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☒ No
- iv. Any evidence of rodents? Specify Likely, the well is outside
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
If no, describe condition split cap gasket

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...) _____

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
No reports of seasonal fluctuation

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
unknown

*h. Are there automatic pump controls: ☐ Yes ☐ No
unknown

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

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

k. Is the pump and piping protected from freezing? ☐ Yes ☒ No
The well is directly outside with no head trace, no insulation, no encasing. The well appears to be under construction
If yes, describe:

l. Comments on pump installation: Could not access the inside of building

6. Conclusions

a. Comments on overall installation:

b. Recommendations:



Driller's Report 109010067

Page 1 of 1

Location: YTG Forestry Well Portion of Lot 1066 CRMK LIKELY CREW QUARTERS - OTHER SIDE RIVER
NAD Zone Easting Northing Elevation ASL ft.
Location Accuracy: Horizontal Purpose of well:
Vertical
Permafrost encountered?

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	4 ft.		Silty CLAY		
2	4	5 ft.		SAND		
3	5	8 ft.		GRAVEL	Cobbles	
4	8	28 ft.		SAND and GRAVEL		
5	28	30 ft.		loose GRAVEL		
6	30	40 ft.		SAND and GRAVEL		

WELL CONSTRUCTION

Well No. **1090100671** Completion date Drilling method Well type
Casing: OS Diameter in. Material Wall thickness Depth to ft.
Comments

Surface/Env'l seal: Material Diameter Depth from to Volume

Gravel Pack ? ☐ Material Diameter Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

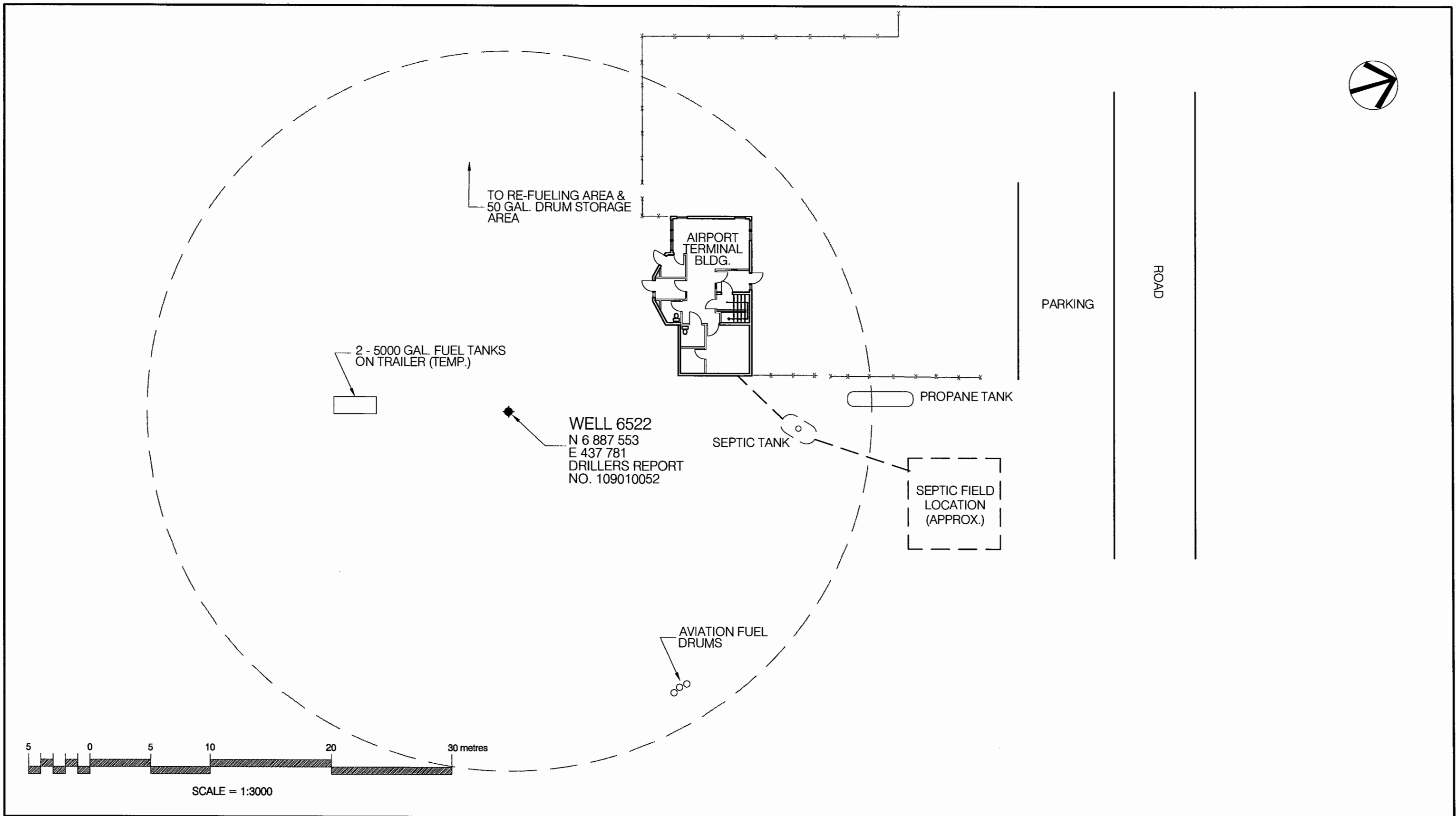
Screen Sections

Section	From	to	Slot size/ perforation diameter
1	29	34 ft.	

WELL DEVELOPMENT AND STATUS

Well ID **1090100671** Developed by Wellhead completion Adapter depth Static water level ft. Yield Estimate gpm Estimate method
Final Status
No

**Photo 0163:** 6536 Wellhead (front) and Forestry Crew Quarters (back)**Photo 0164:** 6536 Wellhead**Photo 0165:** 6536 Septic Field (left) and Forestry Crew Quarters (right)



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

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

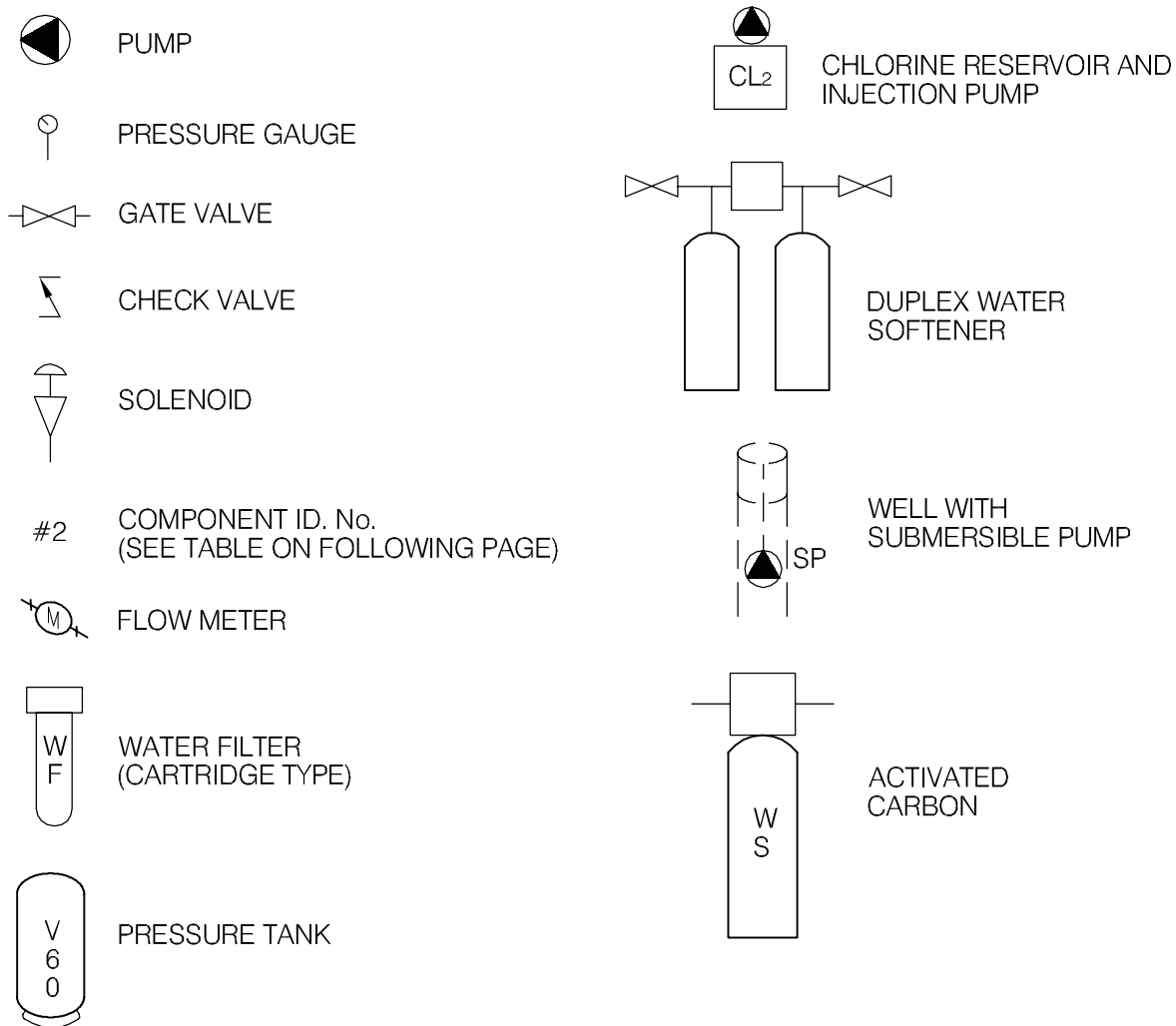
REVISION			
No.	DESCRIPTION	DATE	APPROVED
0	ISSUED FOR CLIENT REVIEW	DD/MM/YY	XXX

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

CLIENT:	 Highways and Public Works Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
CARMACKS AIRPORT TERMINAL BUILDING 6522 SITE LOCATION DIAGRAM WELL ID: 6522	REVISION ISSUE 0 DRAWING No. FIGURE 6522A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

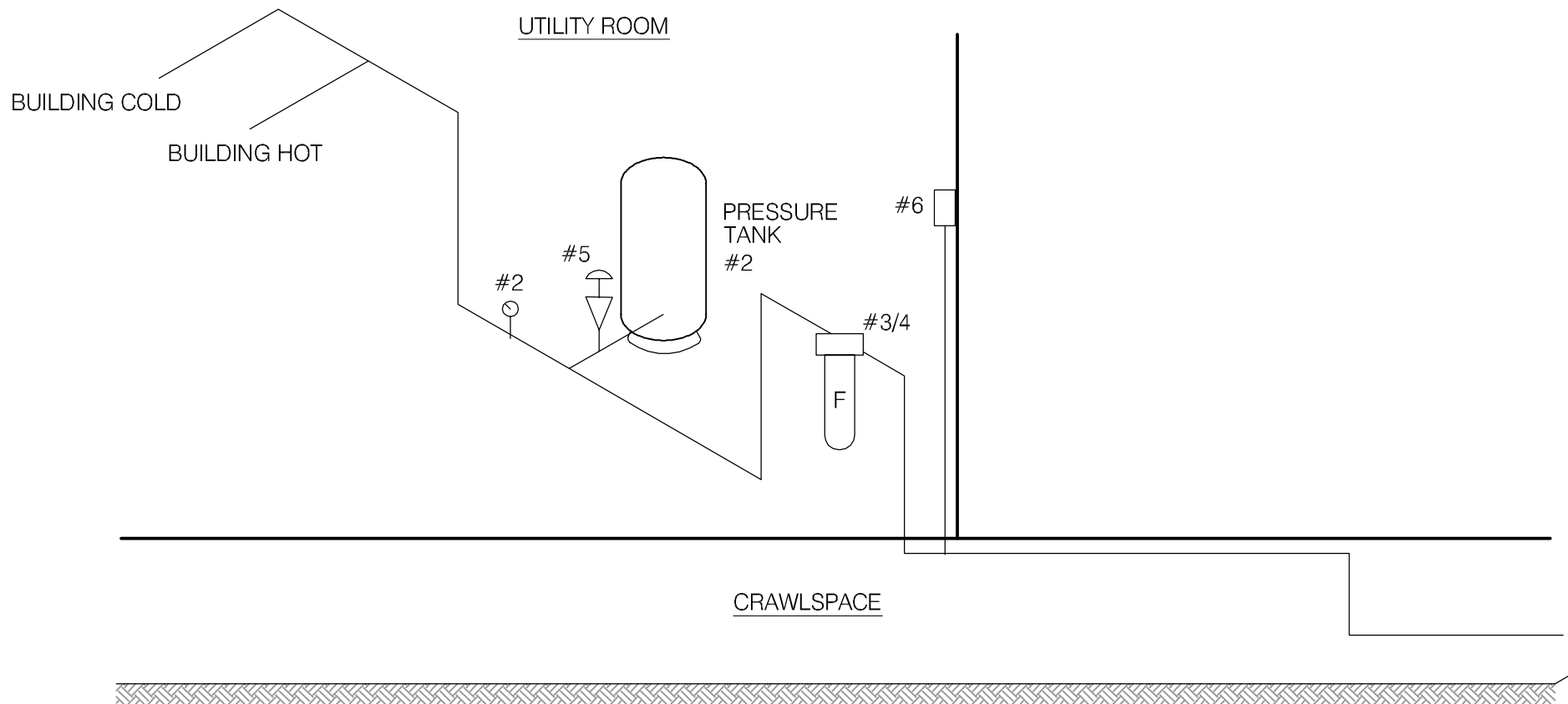
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 6522
CARMACKS AIRPORT

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 6522B

**Whitehorse Region – Carmacks Airport Terminal
Building # 6522**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	SUB PUMP.					4" x 1/2 Hr.
2	PRESSURE TANK	WELXTROL	WX-202			
3	SEDIMENT FILTER	CUNO	3/4" x 10"			2" x 10
4	FILTER CARTR.	STRING WOUND.	10 MICRON			
5	PUMP CONTROL	SQ: D.	FSG-2			1/4" NPT
6	HEAT T/STAT	PYROTEMAX	INDOOR.			
7						
8						
9						
10						

TABLE 6522 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6522	Carmacks Airport Terminal	5	Oct-04 to Feb-05	no	0/5	no	23-Feb-05	no



Table 6522-2: Water Quality Results

SOURCE:		Building 6522 - Carmacks Airport			GCDWQ Criteria		
Location/ Resident		Carmacks					
Address		Lot 1066 Quad 115 I/1					
Treatment		No					
Source of Water		On-Site Well					
Purpose of Sampling		Baseline	Additional Sampling	Baseline			
Sample Location		Washroom Tap	Washroom Tap	6-Jul-05	Lower Limit	Upper Limit	
Date Sampled		5-Oct-04	13-May-05				
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)		5		<5			15
Conductivity (uS/cm)		532		652			
Total Dissolved Solids		365		417			500
Hardness CaCO3		331		336	AO >200 = poor, > 500 unacceptable ^A		
pH		7.9		8.19	6.5		8.5
Turbidity (NTU)		2.9		17.6		1	5
UV Absorbance			<0.0010				
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3		229		247			
Chloride Cl		1		0.93			250
Fluoride F		0.24		0.204		1.5	
Sulphate SO4		109		133			500
Nitrate Nitrogen N		<0.1		<0.10		10	
Nitrite Nitrogen N		<0.05		<0.10		1	
Ammonia Nitrogen N							
Total Metals (ALS)							
Aluminum T-Al		<0.02		<0.010		0.1	
Antimony T-Sb		0.0007		<0.0005		0.006	
Arsenic T-As		<0.0004		0.00052		0.025	
Barium T-Ba		0.018		0.021		1	
Boron T-B		0.05		<0.10		5	
Cadmium T-Cd		<0.0002		<0.0002		0.005	
Calcium T-Ca		61.2		65.2			
Chromium T-Cr		0.0012		<0.0020		0.05	
Copper T-Cu		<0.001		0.0042		1	
Iron T-Fe		0.497		1.44			0.3
Lead T-Pb		0.0017		<0.0010		0.01	
Magnesium T-Mg		40.4		42.2			
Manganese T-Mn		0.25		0.255			0.05
Mercury T-Hg		<0.0002		<0.0002		0.001	
Potassium T-K		2.5		2.49			
Selenium T-Se		<0.0004		<0.0010		0.01	
Sodium T-Na		11		10.9			200
Uranium T-U		0.0034		0.00244		0.02	
Zinc T-Zn		0.01		<0.050			5
Dissolved Metals							
Aluminum D-Al						0.1	
Antimony D-Sb						0.006	
Arsenic D-As						0.025	
Barium D-Ba						1.0	
Beryllium D-Be							
Boron D-B						5	
Cadmium D-Cd						0.005	
Calcium D-Ca							
Chromium D-Cr						0.05	
Cobalt D-Co							
Copper D-Cu							1.0
Iron D-Fe			<0.030				0.3
Lead D-Pb						0.01	
Lithium D-Li							
Magnesium D-Mg							
Manganese D-Mn			0.296				0.05
Mercury D-Hg						0.001	
Molybdenum D-Mo							
Nickel D-Ni							
Selenium D-Se						0.01	
Silver D-Ag							
Sodium D-Na							200
Thallium D-Tl							
Titanium D-Ti							
Uranium D-U						0.02	
Vanadium D-V							
Zinc D-Zn							5.0
Polycyclic Aromatic Hydrocarbons							
Acenaphthene							
Acenaphthylene							
Acridine							
Anthracene							
Benz(a)anthracene							
Benzo(a)pyrene						0.00001	
Benzo(b)fluoranthene							
Benzo(g,h,i)perylene							
Benzo(k)fluoranthene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Fluorene							
Indeno(1,2,3-c,d)pyrene							
Naphthalene							
Phenanthrene							
Pyrene							
Quinoline							
Extractable Hydrocarbons							
EPH10-19							
EPH19-32							
LEPH							
HEPH							
Field Chemistry (EBA)							
pH			7.66		6.5		8.5
TDS			320				500
EC (uS/cm)			625				
Temperature			13.0				
Free Available Chlorine							

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6522-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6522	Carmacks Airport Terminal	Carmacks	6887553	437781	545

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	1992	No	23.4 (May be pump)	?	?	?	15.315

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.6 below grade	Split Cap Gasket	?	Unlikely	No, ground is even

**Table 6522-4: Potential Contaminant Sources
Building 6522 – Carmacks Airport Terminal**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	5 km		
Cemetery	Biological¹ , inorganic ² and organic parameters.	5 km		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 19 m		
Septic fields	Biological and Inorganic parameters.	25 m likely up-gradient	6887575	437789
Airplane fueling station	Organic and Inorganic parameters.	100 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Aviation fuel drums (ASTs)	Organic parameters.	30 m	6887562	437811
Mobile aviation fuel storage tanks	Organic parameters.	20 m (temporary)		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Martin
Luke LebelDate May 13, 2005

WELL ID #	Owner	Location Description
6522	YTG	Carmacks Airport Terminal

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Carmacks Airport Terminal, Campbell Highwayc. GPS location: 6887553, 437781d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many NO☐ 5 or more delivery sites on a trucked distribution system? If so how many NOf. Nearest building, specify Terminal Buildingg. Distance from well to building 17mh. If there is an effluent disposal field, is its location known? ☒ Yes ☐ Noi. Distance from well to nearest point of known field: 22 to tank, 25 to fieldj. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral↳ could be upgradientTANK = 6887575 N
437789 E

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k. 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

Septic field and tank ~ 22m away

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

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

n. 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

well is in part enclosed pit that is built shut. However, not locked

Entrance by animals? ☐ Yes ☒ No

There are few signs of mouse droppings - access is possible however

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

There is some evidence of water staining

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

well is located next to a drainage (minor for runoff) ditch

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

NOT OBVIOUS

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe Fuel Storage

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

Potential Source 1: Drums; Distance from well to Potential Source 1: ~

Potential Source 2: Temp Tanks; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- * a. When was well installed? Year 1992 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
grimey and rusty w/ open holes for heat trace and electrical
- * g. Depth of well: 22.835m bc ☒ measured (if possible) ☐ reported ☐ from log
FOR DEEPER (MAY BE PUMP)
- * h. Static water level below ground: 15.375m bc
☒ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
part enclosed pit
☒ 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 Yes -
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
↳ some moisture evident on PUF @ bottom of enclosure
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
- iv. Any evidence of rodents? Specify None obvious, but likely accessible
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition spld cap w gasket
→ obvious holes

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...) -sediment filter

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

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

There is a raw water tap in pit

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

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

There is heat trace (all) styrofoam insulation protecting piping; fibreglass insulation in wellhead enclosure
If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

- Well Pit
- Potential. Contam within 30m
- No GFI on Heat tape
- Requires Disinfection

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
6522	YTG	CHAMACKS AIRPORT

6. Water Treatment

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

☐ chlorination ☐ iron and or manganese removal ☒ other SED. FILTRATION

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 *N/A*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *N/A*
- 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: PRESSURE TANK (UTILITY ROOM)

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: _____

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:

THIS INSTALLATION REQUIRES TO BE UPGRADED
TO MEET SPECIFICATIONS. CASING WILL NEED
TO BE EXTENDED TO 18" ABOVE GRADE.
SURFACE SEAL WILL NEED TO BE INSTALLED.

b. Recommendations:

INSTALL SURFACE SEAL
EXTEND CASING ABOVE GROUND.
INSTALL GFI PROTECTION ON HEAT TAPE.
INSTALL MOST SUITABLE TREATMENT SYSTEM.



Photo 0148: 6522 Wellhead Enclosure (pitt, front) and Mobile Aviation Fuel Storage



Photo 0149: 6522 Wellhead



Photo 0150: 6522 Wellhead Enclosure (pitt, front), Carmacks Airport Terminal Building (back left), and Septic Field (back center)



Photo 0153: 6522 Aviation Fuel Drums

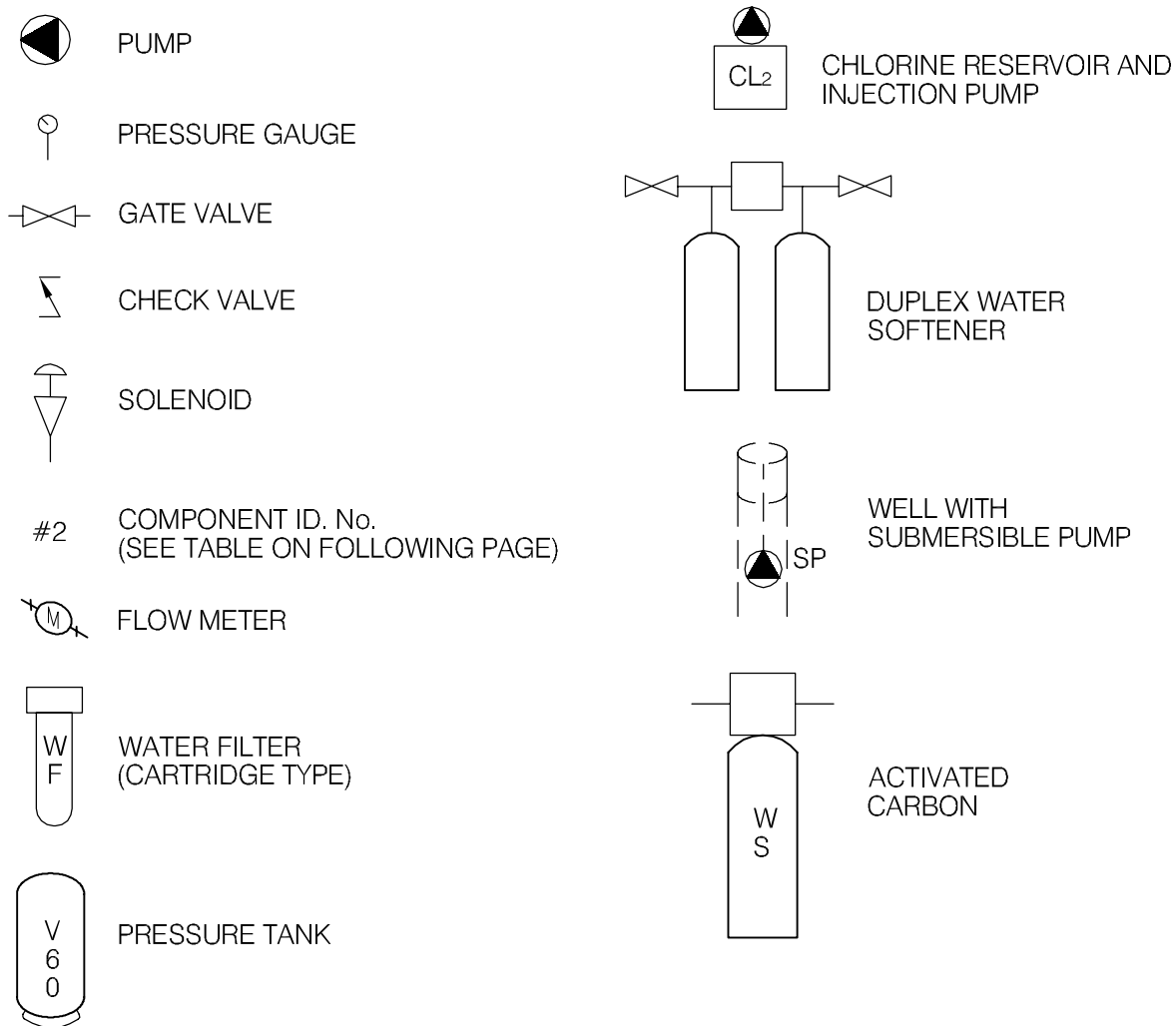


Photo 0151: 6522 Fueling Station

Photo 0018: 6522 Pressure Tank (left) and Water Heater (right)



LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

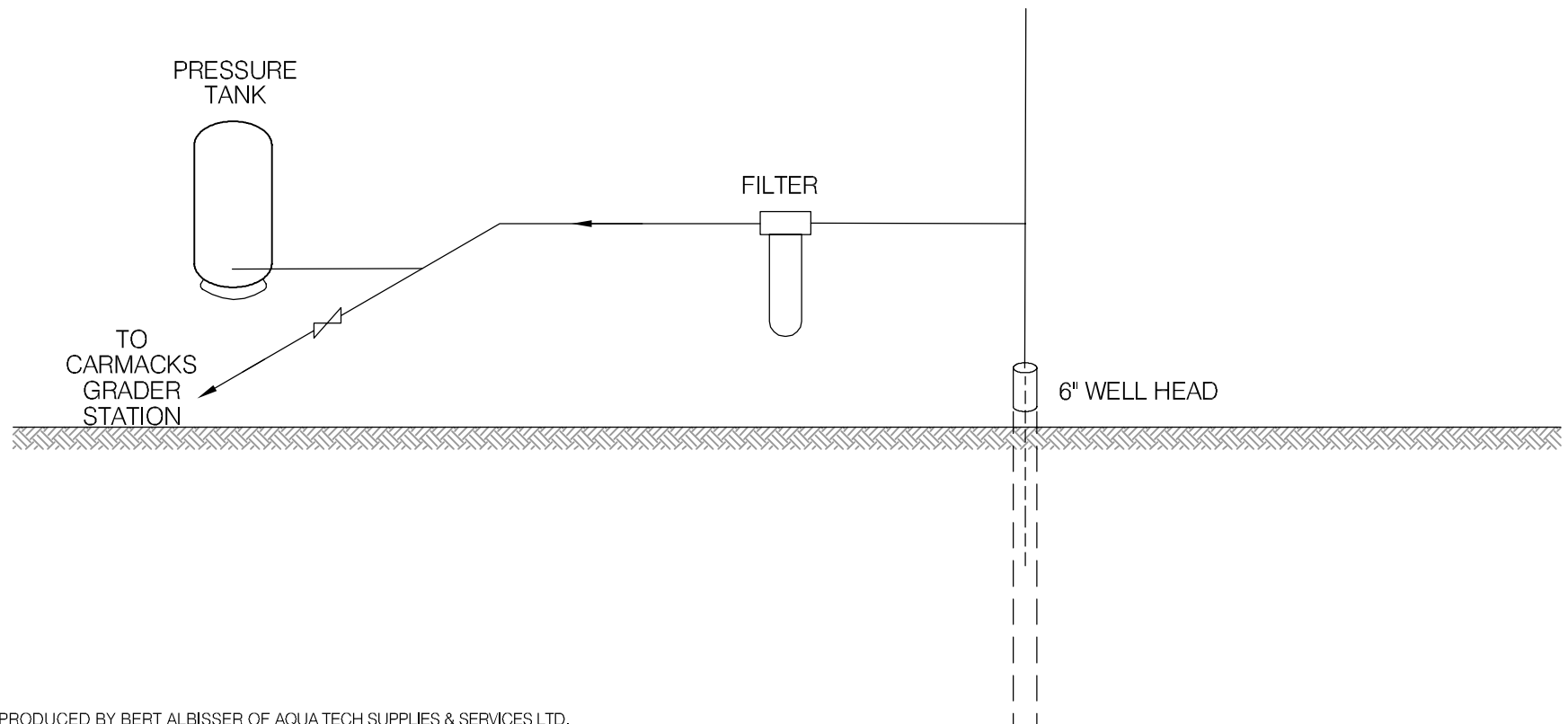
DATE APRIL 2006

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 WHITEHORSE REGION					
CLIENT  Yukon Highways and Public Works Property Management Branch				TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 6512 CARMACKS GRADER STATION					
DATE APRIL 2006		DWN. JSB		CHKD. RMM		FILE NO. 1260002.001		DWG.: FIGURE 6512B	

TABLE 6512 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6512	Grader Station	1	May 05	no	0/1	no	25-May-05	no



Table 6512-2: Water Quality Results

SOURCE:		Building 6512 - Carmacks Grader Station		GCDWQ Criteria		
Location/ Resident		Carmacks				
Address		Lot 10 Group 10				
Treatment		Filtration				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location			Washroom Tap			
Date Sampled		5-Oct-04	25-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CL)		5				15
Conductivity (uS/cm)		381				
Total Dissolved Solids		286				500
Hardness CaCO3		261		AO >200 = poor, > 500 unacceptable ^A		
pH		8.0		6.5		8.5
Turbidity (NTU)		1.0			1	5
UV Absorbance			<0.0010			
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3		244				
Chloride Cl		5				250
Fluoride F		0.21			1.5	
Sulphate SO4		32.6				500
Nitrate Nitrogen N		<0.1			10	
Nitrite Nitrogen N		<0.05			1	
Ammonia Nitrogen N						
Total Metals (ALS)						
Aluminum T-Al		<0.02			0.1	
Antimony T-Sb		0.0007			0.006	
Arsenic T-As		0.0034			0.025	
Barium T-Ba		0.0655			1	
Boron T-B		<0.02			5	
Cadmium T-Cd		<0.0002			0.005	
Calcium T-Ca		72.4				
Chromium T-Cr		0.0018			0.05	
Copper T-Cu		0.003			1	
Iron T-Fe		0.25				0.3
Lead T-Pb		0.0002			0.01	
Magnesium T-Mg		19				
Manganese T-Mn		0.067				0.05
Mercury T-Hg		<0.0002			0.001	
Potassium T-K		2.8				
Selenium T-Se		<0.0004			0.01	
Sodium T-Na		7				200
Uranium T-U		0.0017			0.02	
Zinc T-Zn		0.008				5
Dissolved Metals						
Iron D-Fe			<0.030			0.3
Manganese D-Mn			0.0649			0.05
Polycyclic Aromatic Hydrocarbons						
Acenaphthene			<0.000050			
Acenaphthylene			<0.000050			
Acridine			<0.000050			
Anthracene			<0.000050			
Benz(a)anthracene			<0.000050			
Benzo(a)pyrene			<0.000010			
Benzo(b)fluoranthene			<0.000050			
Benzo(g,h,i)perylene			<0.000050			
Benzo(k)fluoranthene			<0.000050			
Chrysene			<0.000050			
Dibenz(a,h)anthracene			<0.000050			
Fluoranthene			<0.000050			
Fluorene			<0.000050			
Indeno(1,2,3-c,d)pyrene			<0.000050			
Naphthalene			<0.000050			
Phenanthrene			<0.000050			
Pyrene			<0.000050			
Quinoline			<0.000050			
Extractable Hydrocarbons						
EPH10-19			<0.30			
EPH19-32			<1.0			
LEPH			<0.30			
HEPH			<1.0			
Field Chemistry (EBA)						
pH			8.06	6.5		8.5
TDS			225			500
EC (uS/cm)			450			
Temperature			13.0			
Free Available Chlorine						250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6512-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6512	Carmacks Grader Station	Carmacks	6884956	433308	532

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	?	Yes	54.86	No, sand and gravel	13.420 (may be wires, uncertain)	3/4hp submersible pump Size of pump meets needs	5.800

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.3	Split Cap Gasket	?	No	Inside building

**Table 6512-4: Potential Contaminant Sources
Building 6512 – Carmacks Grader Station**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1600 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	1000 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 15 m		
Septic fields	Biological, Organic, and Inorganic parameters.	20 m	6884950	433333
Gas stations	Organic and Inorganic parameters.	150 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	2 at 25 m and 1 at 60 m		
Used Oil Tank	Organic parameters.	30 m		
Used Solvent Drum	Organic parameters.	30 m		
Used Antifreeze Drums	Inorganic parameters.	30 m and 70 m		
Salt Storage	Inorganic parameters.	80 m		
Asphalt pile	Organic and Inorganic parameters.	70 m		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Luke Lebel

Date May 25, 2005

WELL ID #	Owner	Location Description
6512	YTS	Carmacks Grader Station

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Freegold road, Carmacks

c. GPS location: 433308 Easting, 6884956 Northing 532m elevation $\pm 7m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many Carmacks Grader Station

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

f. Nearest building, specify Located inside small addition to the Grader Station

g. Distance from well to building ~2m

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

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

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

(
5800^m - S.L. OF WATER
13.420^m - SOMETHING! MAY BE TOP OF PUMP
)

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k. 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 waste from grader station effluent and floor grease, flows into the septic tank/rock pit that is ~20m away

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

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

n. 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
located inside locked building

Entrance by animals? ☐ Yes ☒ No

Some evidence of mouse droppings. Entrance can be easily gained by animals. There are spaces between the walls of the wellhouse and dike and the grader station, as well as cracks in the cement floor

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

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

q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely/unknown

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 1+2; Distance from well to Potential Source 1: ~25m

Potential Source 2: AST 3; Distance from well to Potential Source 2: ~60m

Potential Source 3: waste oil/solvent/antifreeze; Distance from well to Potential Source 3: ~30m

Potential Source 4: Salt storage; Distance from well to Potential Source 4: ~80m
Asphalt pile ~40m; parking ~5m

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

How many? _____ ☐ in use ☐ abandoned ☐ 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 15 cm Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: 54.86m ^{possibly} ☐ measured (if possible) ☐ reported ☒ from log
- h. Static water level below ground: 5.800 m
☒ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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 addition off from the grader station
☐ 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 No ~ 0.3 m above 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
The well is inside semi insulated addition, there are however major cracks in concrete floor and spaces between addition and grade str walls
- iv. Any evidence of rodents? Specify Access is possible, some mouse droppings
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
split seal cap
If no, describe condition _____

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...) filtration only

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 _____

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- d. Date installed: _____ By: _____
- e. For submersible pump, depth of setting below surface 13.40 m - something, may be top of pump
- 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
tap on line after filter but before pressure tank
- j. Is there a water meter on the system? ☐ Yes ☒ No
- k. Is the pump and piping protected from freezing? ☐ Yes ☐ No
Well head is located inside building. There is no door between heated grader station and wellhouse addition. No heat trace, large void spaces
If yes, describe: between walls of addition and exterior grader station walls.
- l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

The effluent field 20m away does not only take in domestic waste from the grader station, but also hydrocarbon/solvent waste from the drainage inside the garage. The effluent field therefore doubles as a rock pit as all of the waste coming directly from the grader station drains into it.

b. Recommendations: See report



Driller's Report 109010039

Page 1 of 1

Carmacks Grader Station

Location: YTG Grader Station Well Lot 10 Group 10 CRMK

NAD 83 Zone 8 Easting 433293.45 Northing 6884939.6 Elevation ASL 1 m.

Location Accuracy: Horizontal 30-100 (topo)
Vertical unknown or unreliable

Purpose of well: Commercial - not fabrication or manufacturing

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	3.05 m.		SAND, fine		
2	3.05	5.49 m.		GRAVEL		
3	5.49	7.32 m.		GRAVEL till		
4	7.32	9.14 m.		SAND		
5	9.14	14.94 m.		fine SAND		
6	14.94	16.15 m.		GRAVEL		
7	16.15	54.86 m.		fine SAND		

WELL CONSTRUCTION

Well No. 1090100391 Completion date [] Drilling method [] Well type []

Casing: OS Diameter [] mm. Material [] Wall thickness [] mm. Depth to [] m.

Comments []

Surface/Env'l seal: Material [] Diameter [] mm. Depth from [] to [] m. Volume [] cu. m.

Gravel Pack ? ☐ Material [] Diameter [] mm. Depth from [] to []

Well Screen Information

OS Diameter [] Material [] Screen Type [] Comments []

Screen Sections

Section	From	to	Slot size/ perforation diameter
1	[]	[]	[]

WELL DEVELOPMENT AND STATUS

Well ID 1090100391 Developed by [] Wellhead completion [] Adapter depth [] m. Static water level [] m. Yield Estimate [] Lps Estimate method []

Final Status New, in use for intended purpose

No

GROUNDWATER QUALITY

Well No. 1090100391 Field Measurement Date 10-Dec-02

Electrical Conductivity 485 μ S
pH 7.56
Temperature 3.9 $^{\circ}$ C

Groundwater Type []
Turbidity/sand content []

Well disinfection
Was the well disinfected on completion of pump installation? ☐

Bacterial testing done? ☐ Lab [] Date []
Chemical testing done? ☐ Lab [] Date []

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PART B: EBA Site Inspection

Inspector:

MARK ROBINSON / AQUATECH.

Date

MAY 25/05

3/4 H.P. 230V SUBM. PUMP ON 1 1/4" POLY PIPE

WELL ID #	Owner	Location Description
<u>6512 6512</u>	<u>YTG</u>	<u>Carmacks</u>

6. Water Treatment

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

☐ chlorination ☐ iron and or manganese removal ☐ other

ALL TAPED UP. DID NOT OPEN
1 1/2 BIG BLUE FILTER AT WELL HEAD BEFORE PRESSURE TANK.

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 ROTTEN EGGS

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- d. Is there an unpleasant taste? ☒ Yes ☐ No ☐ brackish ☐ Other Do Not Drink, Haul H₂O From Home IN 20L Jug.
- 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 NOT DAILY - TESTING DONE BY PROPERTY MANAGEMENT (MONTHLY?)

TANK AND PIPING DETAILS

Tank Room

Is there a water tank? Yes ☒ No Details:

Where is it located?

Comments: WELL 6" CASING INSIDE A 8'X8'X10' ROOM ADDED TO SIDE OF GARAGE

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: DOOR REMOVED FROM WELL HOUSE TO SHOP. FLOOR RAISED FROM GARAGE (6")

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: CONCRETE CRACKED AROUND WELL CASING, FILLED WITH COLD MIX (PAVEMENT)

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

8. Conclusions

a. Comments on overall installation:

b. Recommendations:

- ① REPAIR CRACKS IN CONCRETE FLOOR IN WELL HOUSE.
- ② RAISE CASING - CASING IS ONLY 7" ABOVE WELL HOUSE FLOOR AND IS APP. 13" ABOVE FLOOR OF SHOP.
- ③ TO CLEAN WELL (REDEVELOP) YOU WOULD HAVE TO REMOVE ROOF OR REMOVE THE WHOLE ADD ON WELL ROOM BUILDING, IN ORDER TO GET EQUIPMENT OVER HOLE.



Driller's Report 109010039

Page 1 of 1

Location: YTG Grader Station Well Lot 10 Group 10 CRMK

NAD 83 Zone 8 Easting 433293.45 Northing 6884939.6 Elevation ASL 1 m.

 Location Accuracy: Horizontal 30-100 (topo) Purpose of well: Commercial - not fabrication or manufacturing
 Vertical unknown or unreliable

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	3.05 m.		SAND, fine		
2	3.05	5.49 m.		GRAVEL		
3	5.49	7.32 m.		GRAVEL till		
4	7.32	9.14 m.		SAND		
5	9.14	14.94 m.		fine SAND		
6	14.94	16.15 m.		GRAVEL		
7	16.15	54.86 m.		fine SAND		

WELL CONSTRUCTION

Well No. 1090100391 Completion date Drilling method Well type

Casing: OS Diameter mm. Material Wall thickness mm. Depth to m.

Comments

Surface/Env'l seal: Material Diameter mm. Depth from to m. Volume cu. m.

Gravel Pack? Material Diameter mm. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Screen Sections

Section	From	to	Slot size/ perforation diameter
1			

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

1090100391 m. m. Lps

Final Status New, in use for intended purpose

No

GROUNDWATER QUALITY

Well No. 1090100391 Field Measurement Date 10-Dec-02

Electrical Conductivity 485 μ S

pH 7.56

Temperature 3.9 $^{\circ}$ C

Groundwater Type

Turbidity/sand content

Well disinfection

Was the well disinfected on completion of pump installation?

Bacterial testing done? ☐

Lab

Date

Chemical testing done? ☐

Lab

Date



Photo 0196: 6512 Carmacks Grader Station and Well house Addition (back), Parking (front)



Photo 0197: 6512 Wellhead (center) and Filter (left)



Photo 0205: 6512 Septic Field and Rock Pit (left), Carmacks Grader Station (back right)



Photo 0202: 6512 Above Ground Fuel Storage Tanks (2) and Carmacks Grader Station (behind)



Photo 0204: 6512 Used Oil Tank, Used Antifreeze Drum and Used Solvent Drum, Carmacks Grader Station (behind)



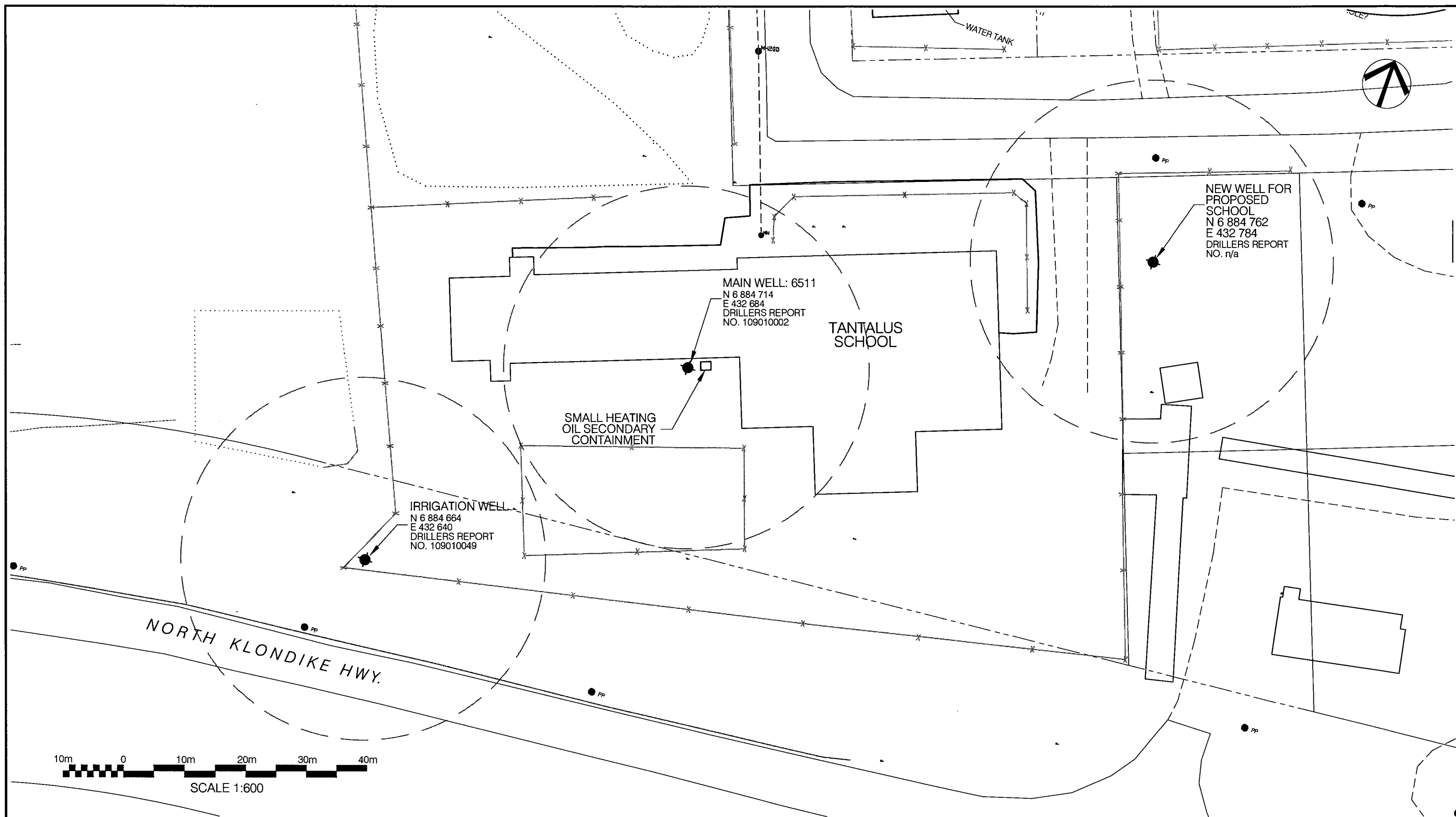
Photo 0203: 6512 Salt Storage



Photo 0200: 6512 Ash Fault Pile



Photo 0198: 6512 Pressure Tank



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: JUNE 2005
SCALE: AS SHOWN
PROJECT No.: 1260002.001
ACAD FILENAME: 001-WHITEHORSE REGION

CLIENT:



Highways and Public Works
Property Management Branch

**SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION**

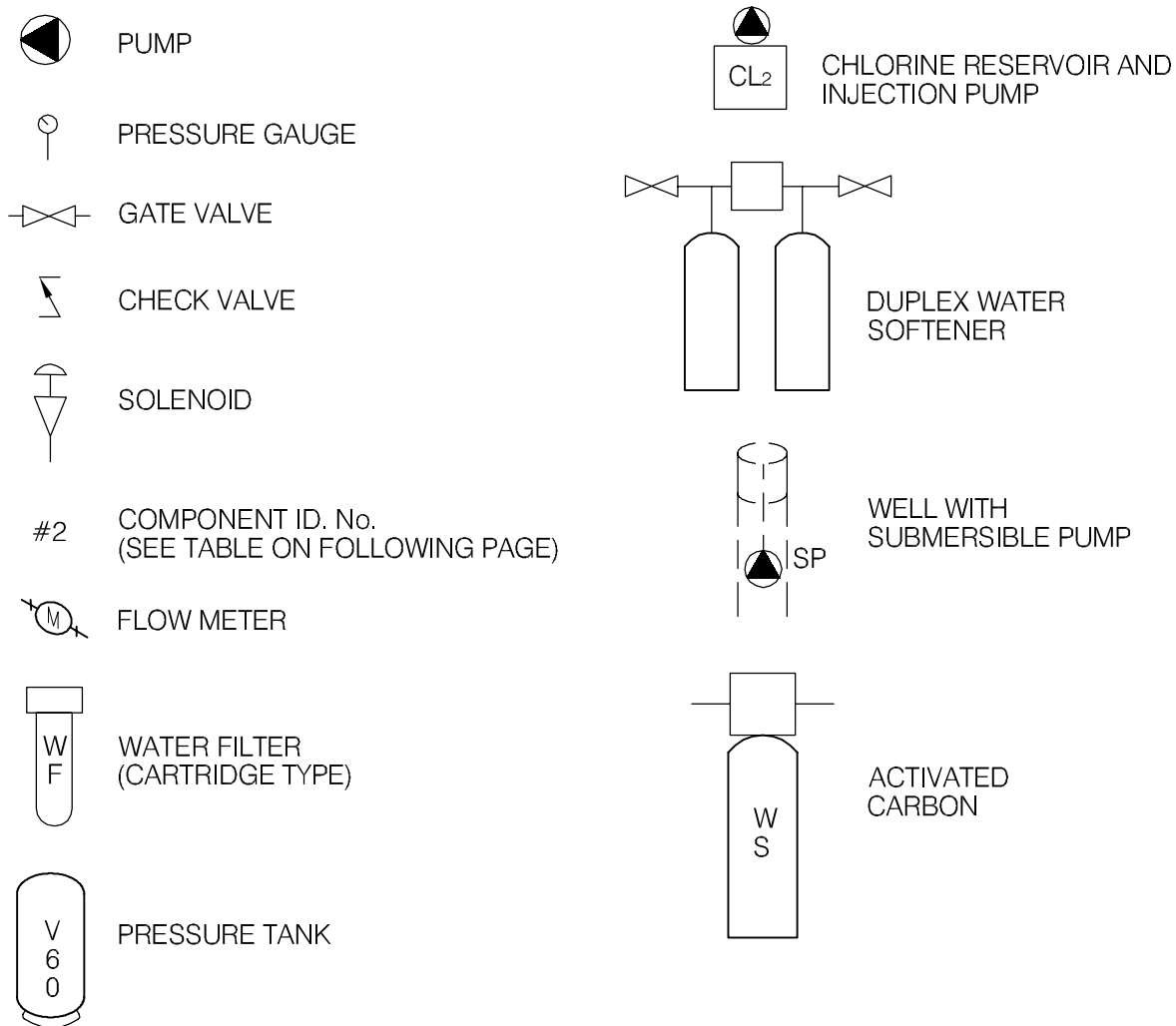
**GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS**

**TANTALUS SCHOOL
BUILDING 6511
SITE LOCATION DIAGRAM
WELL ID: 6511**

REVISION ISSUE
0

DRAWING No.
FIGURE 6511A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

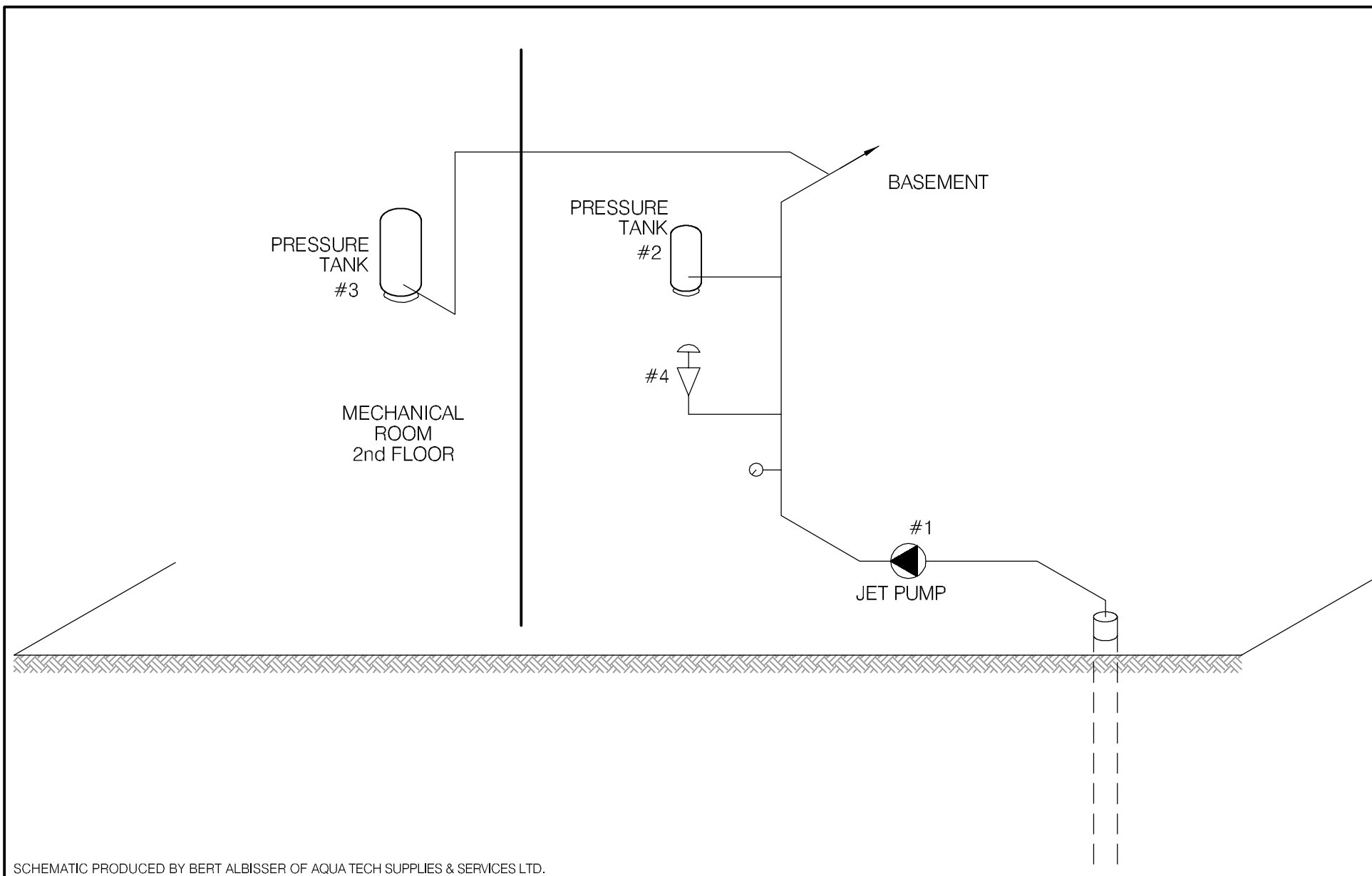
CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND



 EBA Engineering Consultants Ltd.			PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION		
CLIENT  Yukon Highways and Public Works Property Management Branch			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 6511 TANTALUS SCHOOL - CARMACKS, YT.		
DATE	APRIL 2006	DWN.	JSB	CHKD.	RMM
FILE NO.	1260002.001	DWG.:	FIGURE 6511B		

**Whitehorse Region – Tantalus School
Building # 6511**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	JET Pump	GRUNDFOS	JPF-4A.			1" X 1 HP.
2	PRESSURE TANK #1	WELLXTROL	WX-102			3/4" 4.56AL.
3	PRESSURE TANK #2	WELLXTROL	WX-600-1			
4	PRESSURE CONTROL	HONEYWELL				1/4 FIPT.
5	WATER FILTER	CUNO	NO INFORMATION ON PIPING SCHEMATIC			
6						
7						
8						
9						
10						

TABLE 6511 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
6511	Tantalus School	8	Sept-04 to Mar-05	no	0/8	no	2-Mar-05	no



Table 6511-2: Water Quality Results

SOURCE:		Building 6511 - Tantalus School		GCDWQ Criteria		
Location/ Resident		Carmacks				
Address		Lot 12-6 Group 903				
Treatment		Filtration				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location		Home Ec. Room				
Date Sampled		5-Oct-04	13-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)		5				15
Conductivity (uS/cm)		333				
Total Dissolved Solids		223				500
Hardness CaCO3		208		AO >200 = poor, > 500 unacceptable ^A		
pH		7.9		6.5		8.5
Turbidity (NTU)		0.3			1	5
UV Absorbance			<0.0010			
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3		197				
Chloride Cl		2				250
Fluoride F		0.21			1.5	
Sulphate SO4		20.6				500
Nitrate Nitrogen N		<0.1			10	
Nitrite Nitrogen N		<0.05			1	
Total Metals (ALS)						
Aluminum T-Al		<0.02			0.1	
Antimony T-Sb		0.0007			0.006	
Arsenic T-As		<0.0004			0.025	
Barium T-Ba		0.0634			1	
Boron T-B		<0.02			5	
Cadmium T-Cd		<0.0002			0.005	
Calcium T-Ca		60.1				
Chromium T-Cr		<0.0008			0.05	
Copper T-Cu		0.052			1	
Iron T-Fe		0.022				0.3
Lead T-Pb		0.0004			0.01	
Magnesium T-Mg		13.2				
Manganese T-Mn		0.013				0.05
Mercury T-Hg		<0.0002			0.001	
Potassium T-K		2.3				
Selenium T-Se		<0.0004			0.01	
Sodium T-Na		6				200
Uranium T-U		0.0012			0.02	
Zinc T-Zn		<0.004				5
Polycyclic Aromatic Hydrocarbons						
Acenaphthene			<0.000050			
Acenaphthylene			<0.000050			
Acridine			<0.000050			
Anthracene			<0.000050			
Benz(a)anthracene			<0.000050			
Benzo(a)pyrene			<0.000010			
Benzo(b)fluoranthene			<0.000050			
Benzo(g,h,i)perylene			<0.000050			
Benzo(k)fluoranthene			<0.000050			
Chrysene			<0.000050			
Dibenz(a,h)anthracene			<0.000050			
Fluoranthene			<0.000050			
Fluorene			<0.000050			
Indeno(1,2,3-c,d)pyrene			<0.000050			
Naphthalene			<0.000050			
Phenanthrene			<0.000050			
Pyrene			<0.000050			
Quinoline			<0.000050			
Extractable Hydrocarbons						
EPH10-19			<0.30			
EPH19-32			<1.0			
LEPH			<0.30			
HEPH			<1.0			
Field Chemistry (EBA)						
pH			7.83	6.5		8.5
TDS			191			500
EC (uS/cm)			375			
Temperature			11.0			

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 6511-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
6511	Tantalus School	Carmacks	6884714	432684	530

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	16.470	No	?	1hp jet pump Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.7 below grade	Split Cap Gasket	?	Unlikely	Inside building

**Table 6511-4: Potential Contaminant Sources
Building 6511 – Tantalus School**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1200 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	275 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
New Well	Biological and Inorganic parameters.	175	6884762	432784
Irrigation Well	Biological and Inorganic parameters.	61 m	6884664	432640
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	<30 m to service lines		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	225 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	1 m	6884714	432685
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Mandin
Luke LebelDate May 13, 2005

WELL ID #	Owner	Location Description
6511	YTG	Tantalus School

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Tantalus Schoolc. GPS location: 432684 Easting 6884714 Northing 530m elevation $\pm$ 9md. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
Serves Tantalus School in Carmacks☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify Located within Tantalus school off
of one of the mechanical rooms. Is underground outside, however.g. Distance from well to building 1kmh. If there is an effluent disposal field, is its location known? ☐ Yes ☒ No

i. Distance from well to nearest point of known field: _____

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

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k. 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

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

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

n. 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
well is located off of a mechanical room in the basement of the school there are no signs of animals

o. Is well site subject to flooding? ☐ Yes ☒ No
no evidence of water around well. It is within a concrete encasement

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

q. 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 _____

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

☐ Yes ☐ No Describe _____

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

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

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? 2 ☐ in use ☐ abandoned ☐ require proper sealing

1 in use for irrigation (6th), new not yet in use

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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 18cm Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: 14.770 ☒ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: Not possible - pump on - check others on property
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
well head is located off from a basement mechanical room
inside the school
☐ 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 The well head is 1.6m 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 apparent evidence
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition _____

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...) _____

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 _____

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d. ~~1~~ 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
Although these raw sample are filthy, Deep Brown coloration to the water due to sagrant pipe

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

k. Is the pump and piping protected from freezing? ☐ Yes ☐ No
No Heat trace. The well is off of a heated mechanical room.
No Insulation. The pump is in the mech room, concrete walls
If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
6511	YTC	TANTALUS SCHOOL

6. Water Treatment

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

☐ chlorination ☐ iron and or manganese removal ☒ other Automatic Backwash Filter
TYPE: ?

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: PRESSURE TANK

Where is it located?

Comments: NEXT TO HUMP / ADDITIONAL IN MECH ROOM

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: _____

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

8. Conclusions

a. Comments on overall installation:

THE INSTALLATION MUST BE UPGRADED.
THE WELL HEAD MUST BE SEALED BETTER.
A DUPLEX PUMP SYSTEM FOR CONTINUOUS
WATER SUPPLY MUST BE PROVIDED.

b. Recommendations:

INSTALL A NEW DUPLEX WATER SUPPLY.
INSTALL FILTRATION AND PROPORTIONATE
CHLORINATION SYSTEM. CHECK THE
FILTER SYSTEM AND UP GRADE
AS NECESSARY.

TANTALUS IRRIGATION WELL



Driller's Report 109010049

Page 1 of 1

Location: Carmacks School Well Lot 12-6 CRMK

NAD 83 Zone 8 Easting 432650 Northing 6884726 Elevation ASL 1762 ft.

Location Accuracy: Horizontal 100-300 (topo)
Vertical 30.5 metres (100ft)

Purpose of well: Municipal - residences and other grouped structures

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	26 ft.		GRAVEL	Sand, Silt and Cobbles	
2	26	49 ft.		SILT	Gravel and Sand	
3	49	53 ft.		SILT		
4	53	59 ft.		SAND	Gravel with some Silt	
5	59	61 ft.		GRAVEL	Sand	

WELL CONSTRUCTION

Well No. 1090100491 Completion date 8/9/1991 Drilling method Air Rotary (conventional) Well type Overburden

Casing: OS Diameter 6 in. Material Steel Wall thickness Depth to 58 ft.

Comments

Surface/Env'l seal: Material Diameter Depth from to Volume

Gravel Pack ? Material Diameter Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Continuous Wire Wrap

Screen Sections

Section	From	to	Slot size/ perforation diameter
1	58	61 ft.	30 Thou.

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

1090100491 Air lifting None 13.5 ft. 30 gpm Air lifting

Final Status New, in use for intended purpose

No



Photo 0162: 6511-A Main School Wellhead (underneath panel at center) and Above Ground Fuel Storage Tank (right)



Photo 0160: 6511-A Wellhead

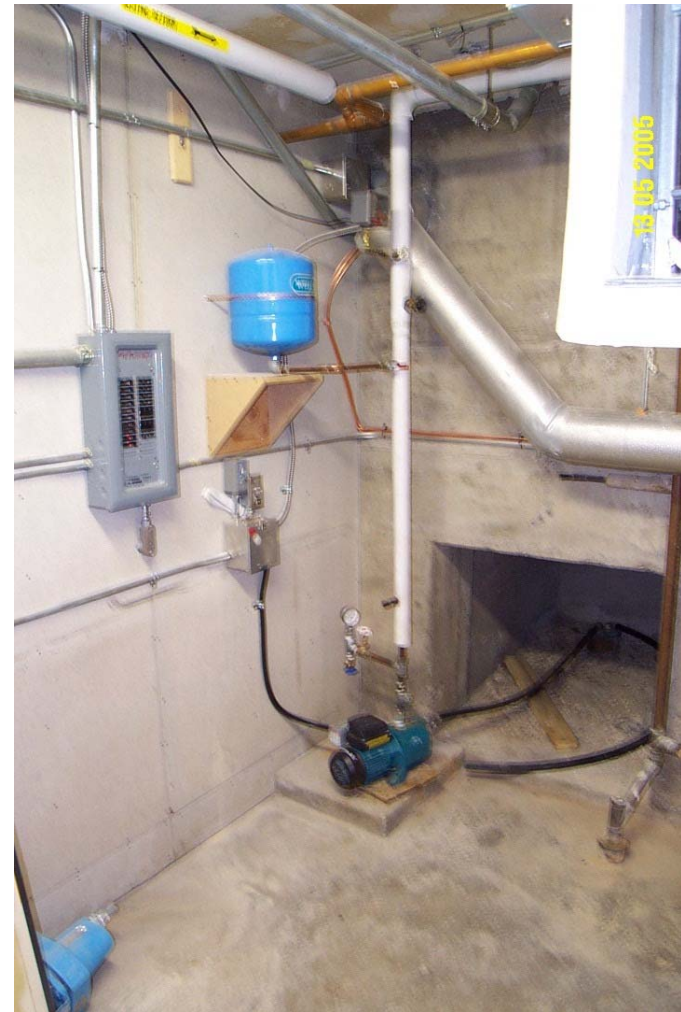


Photo 0161: 6511-A Jet Pump and Pressure Tank

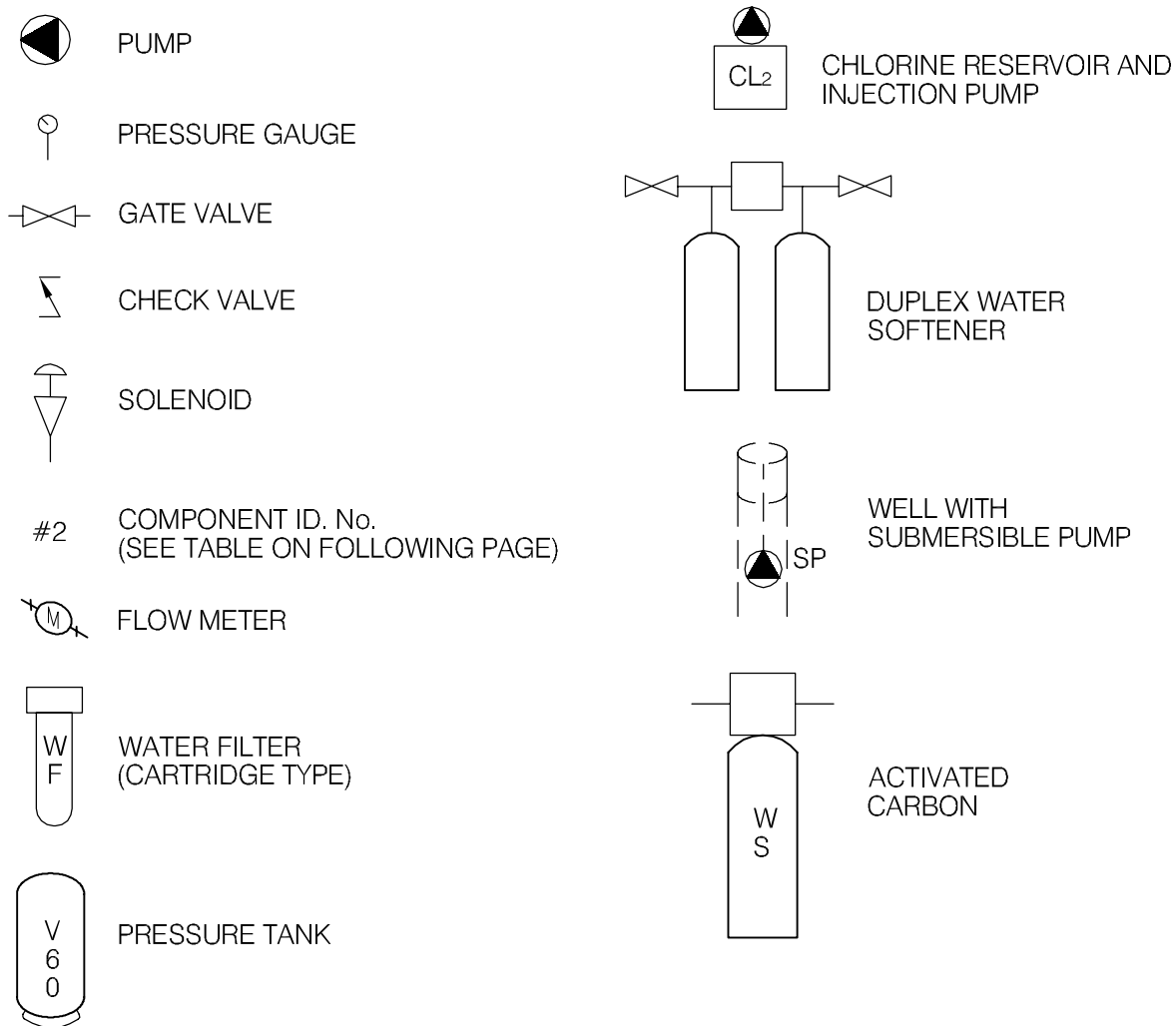


Photo 0159: 6511-C New Well Wellhead

Photo 0158: 6511-C Irrigation Well Wellhead



LEGEND



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

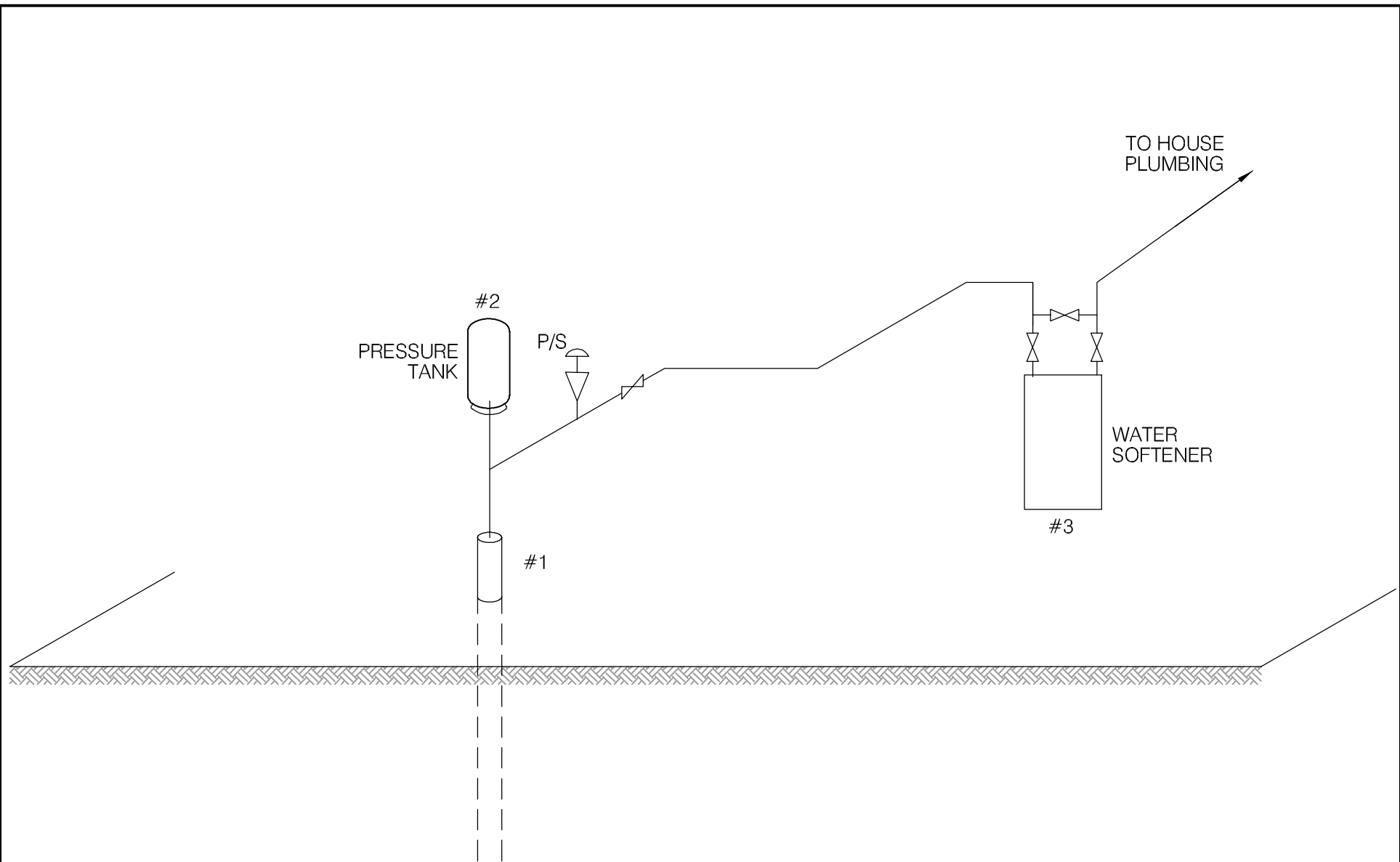
CHKD. RMM

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 WHITEHORSE REGION	
CLIENT 			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: M0201 RCMP HOUSING	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	FILE NO. 1260002.001	DWG.: FIGURE M0201B

Whitehorse Region – R.C.M.P. Housing
Building # MO201

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	SUB Pump 4"		ZWIRE			4" - 1/2 HP
2	P/TANK	CHALLENGER	JR25			3/4" 8.5 GAL.
3	SOFTENER	PETWA	C460MP-30MI			30K GRAN
4	PRESSURE SWITCH	SQ. D	FSG-2			1/4" FIPT
5						
6						
7						
8						
9						
10						

TABLE M0201 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
M0201	R.C.M.P Housing	7	Sept-04 to Mar-05	no	0/7	no	4-Mar-05	no



Table M0201-2: Water Quality Results

SOURCE:		Building M0201 - R.C.M.P. Housing			GCDWQ Criteria		
Location/ Resident		Carmacks					
Address		528 Rawlinson St					
Treatment		No					
Source of Water		On-Site Well					
Purpose of Sampling		Baseline	Additional Sampling	Baseline			
			Downstairs Laundry Tub Tap				
Sample Location		Kitchen Tap					
Date Sampled		5-Oct-04	13-May-05	6-Jul-06	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)		10		<5			15
Conductivity (uS/cm)		309		326			
Total Dissolved Solids		190		200			500
Hardness CaCO3		174		157	AO >200 = poor, > 500 unacceptable ^A		
pH		7.9		8.25	6.5		8.5
Turbidity (NTU)		1.5		2.30		1	5
UV Absorbance			<0.0010				
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3		171		178			
Chloride Cl		1		0.57			250
Fluoride F		0.21		0.173		1.5	
Sulphate SO4		14.8		14.3			500
Nitrate Nitrogen N		<0.1		<0.10		10	
Nitrite Nitrogen N		<0.05		<0.10		1	
Ammonia Nitrogen N							
Total Metals (ALS)							
Aluminum T-Al		<0.02		<0.010			
Antimony T-Sb		0.0007		<0.0005		0.006	
Arsenic T-As		0.0017		0.00198		0.025	
Barium T-Ba		0.0779		0.079		1	
Boron T-B		<0.02		<0.10		5	
Cadmium T-Cd		<0.0002		<0.0002		0.005	
Calcium T-Ca		52.5		47.4			
Chromium T-Cr		0.001		<0.0020		0.05	
Copper T-Cu		<0.001		0.0011		1	
Iron T-Fe		0.371		0.324			0.3
Lead T-Pb		<0.0001		<0.0010		0.01	
Magnesium T-Mg		10.9		9.29			
Manganese T-Mn		0.077		0.0643			0.05
Mercury T-Hg		<0.0002		<0.00020		0.001	
Potassium T-K		2.3		2.16			
Selenium T-Se		<0.0004		<0.0010		0.01	
Sodium T-Na		6		6.2			200
Uranium T-U		0.0009		0.00075		0.02	
Zinc T-Zn		0.026		0.054			5
Dissolved Metals							
Aluminum D-Al						0.1	
Antimony D-Sb						0.006	
Arsenic D-As						0.025	
Barium D-Ba						1.0	
Boron D-B						5	
Cadmium D-Cd						0.005	
Calcium D-Ca							
Chromium D-Cr						0.05	
Cobalt D-Co							
Copper D-Cu							1.0
Iron D-Fe			<0.030				0.3
Lead D-Pb						0.01	
Lithium D-Li							
Magnesium D-Mg							
Manganese D-Mn			0.0680				0.05
Mercury D-Hg						0.001	
Molybdenum D-Mo							
Nickel D-Ni							
Selenium D-Se						0.01	
Silver D-Ag							
Sodium D-Na							200
Uranium D-U						0.02	
Zinc D-Zn							5.0
Field Chemistry (EBA)							
pH			7.79		6.5		8.5
TDS			162				500
EC (uS/cm)			317				
Temperature			12.4				
Free Available Chlorine							

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading indicates exceedence of CDWQG MAC

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

< = Less than the detection limit indicated.

AO = Aesthetic Objective

MAC = Maximum Acceptable Concentration (Health Based)



**Table M0201-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
M0201	R.C.MP. Housing	Carmacks	6884996	432277	530

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	?	No, shallow well	?	1/2hp submersible pump Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.5 below grade	Split Cap Gasket	?	Unlikely	Inside building

**Table M0201-4: Potential Contaminant Sources
Building M0201 – RCMP Housing**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1800 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	400 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	<15 m to service lines and <30 m to main		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	600 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	3 m and 24 m	6884995 6885001	432274 432251
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	75 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

* No Well Log

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 13, 2005

WELL ID #	Owner	Location Description
MO207	RCMP	RCMP Housing Rawlinson st

1. Well Location and Potential Contaminant Sources

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

Carmarck

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

528 Rawlinson st

c. GPS location: 432277 Easting 6884996 Northing

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

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

Services 1 RCMP residence

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

f. Nearest building, specify Located directly beside residence with access from basement

g. Distance from well to building _____

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

i. Distance from well to nearest point of known field: _____

j. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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k. 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

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

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

n. 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
Can only be accessed through residence

Entrance by animals? ☐ Yes ☒ No
There are cobwebs and traces of mice present

o. Is well site subject to flooding? ☒ Yes ☐ No
There is some dampness and staining in the plywood

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

q. Is there a buried fuel tank on the property? ☐ Yes ☒ No very unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 1; Distance from well to Potential Source 1: ~3m

Potential Source 2: AST 2; Distance from well to Potential Source 2: ~24m

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

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

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

There is an adjacent well ~22m away

How many? _____ ☐ in use ☐ abandoned ☐ 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: ~40ft ☐ measured (if possible) ☐ reported ☐ from log
- *h. Static water level below ground: ~20ft *educated guess from based upon geology of the area and characteristics of surrounding wells*
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
Attached to basement of residence, enclosed w/ purl and non-purl and a tm casing on the top
☒ 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 Yes, ~0.5m below grade
- ii. Are there signs of ponding on the enclosure (e.g. water stains, etc.)? ☒ Yes ☐ No
There is some wetness and water stains near and on the ground. Rusting on wellhead
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
- iv. Any evidence of rodents? Specify There is some evidence of mouse droppings and cobwebs
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
split seal gasket
- If no, describe condition _____

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...) _____

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

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: Heat trace and is located within an insulated compartment off from a heated house

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
MO201	YTG.	RCHP CARNAKES Former Yukon Housing.

6. Water Treatment

- a. Is well water treated? ☐ Yes ☒ No; Type of treatment: SOFTNER - NO SALT
- ☐ 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: JR25 Pressure Tank.

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

8. Conclusions

a. Comments on overall installation:

THIS SYSTEM IS A BARELY ADEQUATE SETUP.
THE SOFTNER APPEARS TO BE NEGLECTED
AS THERE IS NO SALT IN THE BRINE
TANK. NO FILTRATION OR BACTERIAL
TREATMENT IS IN PLACE. THE PUMP
IS VERY NOISY AND MAY FAIL SOON

b. Recommendations:

SYSTEM SHOULD BE UPGRADED WITH
PROPER PUMP & PRESSURE TANK
INSTALLATION. THE SOFTNER SHOULD
BE PUT BACK IN SERVICE AND
A UV SYSTEM SHOULD BE INSTALLED.
THE WELL HEAD SHOULD BE UPGRADED
TO THE NEW REGS UP COMING.

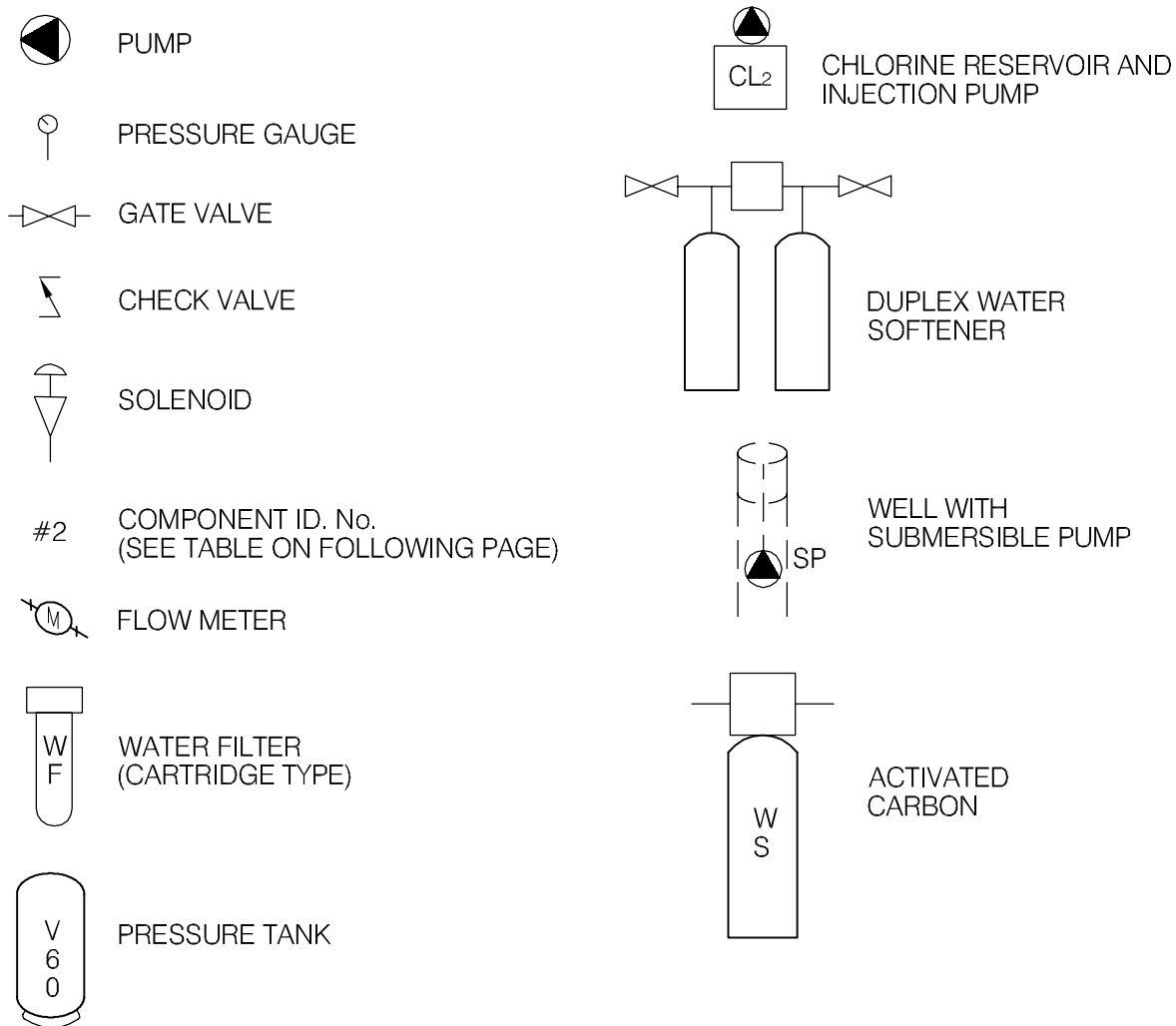


Photo 0166: M0201 Wellhead (front below paneling), R.C.M.P. Residence (behind) and Above Ground Storage Tank (center)

Photo 0167: M0201 Wellhead and Pressure Tank



LEGEND



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

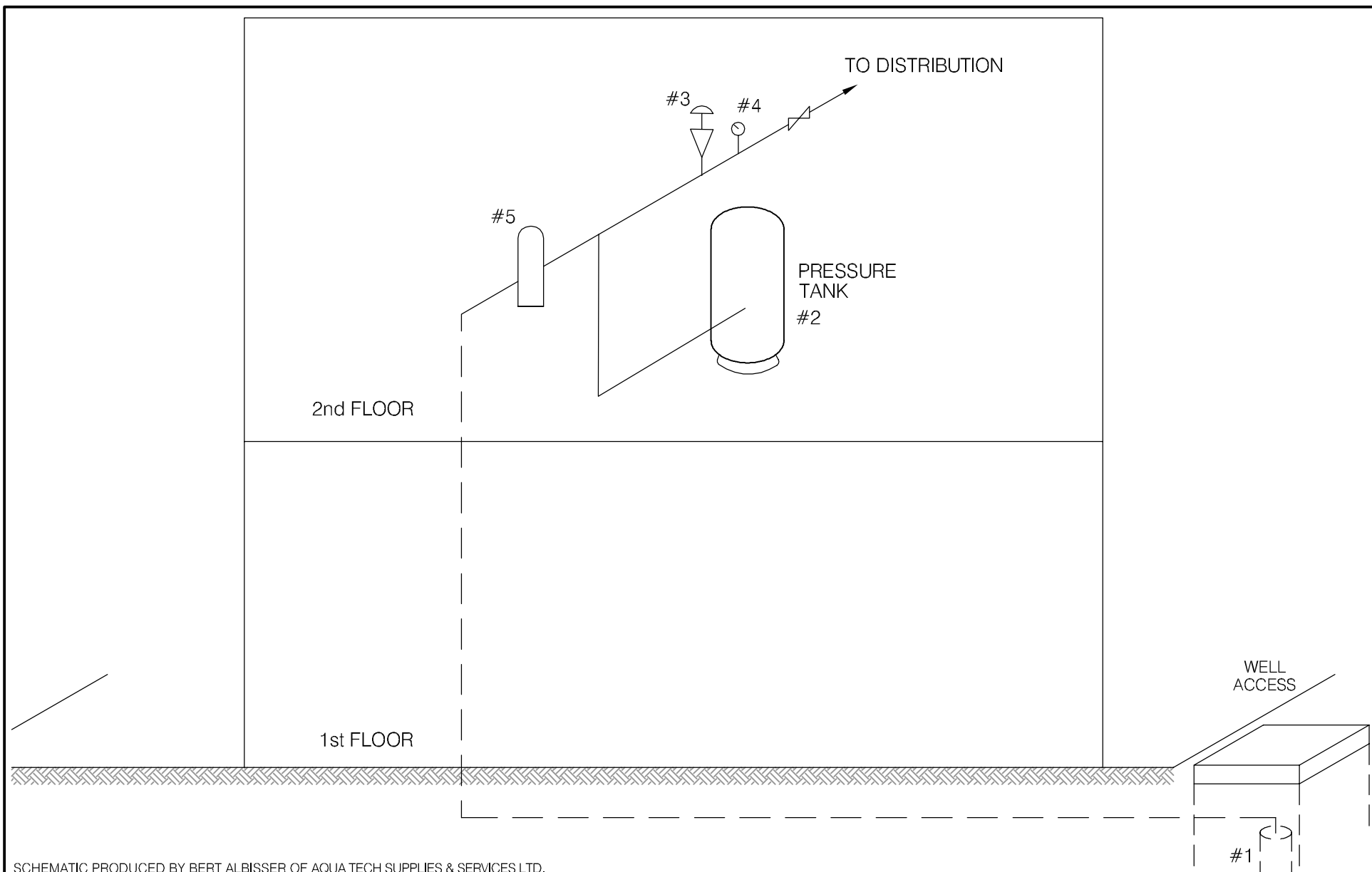
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: M0093
CARMACKS RCMP DETACHMENT WELL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE M0093B

**Whitehorse Region – R.C.M.P. Detachment
Building # MO093**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUBMERSIBLE	MYERS	3NFL72-12		0593	4" - 3/4 HP.
2	PRESSURE TANK	WELL RITE	WR26002			
3	PRESS SWITCH	SQ. D.	FSG-2			
4	PRESS GAUGE	MARSH	0-100			1/4" FIPT.
5	IN LINE STRAINER	SARCO				1" FIPT
6						
7						
8						
9						
10						

TABLE M0093 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
M0093	R.C.M.P. Detachment	7	Sept-04 to Mar-05	no	0/7	no	2-Mar-05	no



Table M0093-2: Water Quality Results

SOURCE:		Building M0093 - R.C.M.P. Detachment		GCDWQ Criteria		
Location/ Resident		Carmacks				
Address		Lot B-12				
Treatment		No				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location			Kitchen Sink			
Date Sampled		5-Oct-04	12-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour	(CU)	5				15
Conductivity	(uS/cm)	328				
Total Dissolved Solids		216				500
Hardness	CaCO3	201		AO >200 = poor, > 500 unacceptable ^A		
pH		7.9		6.5		8.5
Turbidity	(NTU)	0.25			1	5
UV Absorbance			<0.0010			
Dissolved Anions (ALS)						
Alkalinity-Total	CaCO3	188				
Chloride	Cl	3				250
Fluoride	F	0.21			1.5	
Sulphate	SO4	18.9				500
Nitrate Nitrogen	N	0.1			10	
Nitrite Nitrogen	N	<0.05			1	
Ammonia Nitrogen	N					
Total Metals (ALS)						
Aluminum	T-Al	<0.02				
Antimony	T-Sb	0.0007			0.006	
Arsenic	T-As	0.0004			0.025	
Barium	T-Ba	0.0583			1	
Boron	T-B	<0.02			5	
Cadmium	T-Cd	<0.0002			0.005	
Calcium	T-Ca	57.9				
Chromium	T-Cr	0.0016			0.05	
Copper	T-Cu	0.045			1	
Iron	T-Fe	0.052				0.3
Lead	T-Pb	0.0036			0.01	
Magnesium	T-Mg	12.1				
Manganese	T-Mn	<0.001				0.05
Mercury	T-Hg	<0.0002			0.001	
Potassium	T-K	2.2				
Selenium	T-Se	<0.0004			0.01	
Sodium	T-Na	7				200
Uranium	T-U	0.0011			0.02	
Zinc	T-Zn	0.008				5
Field Chemistry (EBA)						
pH			7.77	6.5		8.5
TDS			181			500
EC (uS/cm)			356			
Temperature			7.8			
Free Available Chlorine						250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 M0093-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
MOO93	R.C.M.P. Detachment	Carmacks	6884845	432680	528

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	16.080	No, shallow well	?	3/4hp submersible pump Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.14 below grade	Split Cap Gasket	?	Unlikely	No, ground is even

Table M0093-4: Potential Contaminant Sources
Building: M0093 - RCMP Detachment

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1300 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	350 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	<20 m to service lines and <30 to main		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	250 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	(2) 9 m and (2) 40 m	6884850 6884810	432688 432685
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	75 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Martin
Luke LebelDate May 12, 2005

WELL ID #	Owner	Location Description
M0093	RCMP	Carmacks RCMP Detachment

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Carmack RCMP Detachmentc. GPS location: 432680 Easting 6884845 Northing 528m elevation $\pm 11m$ d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____Carmacks RCMP Detachment only☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify Carmacks RCMP Detachmentg. Distance from well to building 2mh. If there is an effluent disposal field, is its location known? ☐ Yes ☒ No

i. Distance from well to nearest point of known field: _____

j. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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- k. 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

Sewage line within 30m

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

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

~1km away from solid waste dump

- n. Is the infrastructure protecting the wellhead, pump house, storage tank and/or water treatment plant designed and secured to prevent:

Unauthorized access by humans? ☐ Yes ☒ No

only a manhole cover, no lock. Can be accessed with a pick or crowbar

Entrance by animals? ☒ Yes ☐ No

Not completely (some traces of animals) but in concrete encasing w/ manhole cover

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

it's underground and there is evidence of water entering the well pit

- p. Is the well site well drained? ☒ Yes ☐ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 1 + AST 2; Distance from well to Potential Source 1: ~9m

Potential Source 2: AST 3 + AST 4; Distance from well to Potential Source 2: ~40m

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

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

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

How many? MOO 94 ☒ in use ☐ abandoned ☐ 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 61 cm ☐ No
Steel manhole cover
- f. Well casing: Diameter 15 cm Material: ☒ steel ☐ plastic ☐ concrete
- g. Depth of well: 14.940m ☐ measured (if possible) ☐ reported ☐ from log
bc
- *h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☒ in pit ☐ pitless adaptor ☐ in a building
concrete walls w/ steel manhole cover
☐ 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 114 cm below grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
There is some moisture and evidence of water seeping into the enclosure
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
The enclosure is filled with loose fiberglass insulation pieces
- iv. Any evidence of rodents? Specify very little
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition _____

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...) _____

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
unknown

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
There is heat trace and fibreglass insulation within the well enclosure
If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b.Recommendations: _____



M0093. RCMP DETACHMENT

Driller's Report 109010032

Page 1 of 1

Location: RCMP Detachment Well Lot B-12 CRMK

NAD 83 Zone 8 Easting 432679.74 Northing 6884827.8 Elevation ASL 1 m.

Location Accuracy: Horizontal 30-100 (topo)

Vertical unknown or unreliable

Purpose of well: Commercial - not fabrication or manufacturing

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	4.88 m.		SAND and gravel		
2	4.88	5.49 m.		SILT, clay, sand		
3	5.49	8.84 m.		GRAVEL, sand		
4	8.84	14.94 m.		SILT		

WELL CONSTRUCTION

Well No. 1090100321 Completion date Drilling method Well type

Casing: OS Diameter mm. Material Wall thickness mm. Depth to m.

Comments

Surface/Env'l seal: Material Diameter mm. Depth from to m. Volume cu. m.

Gravel Pack ? Material Diameter mm. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Screen Sections

Section	From	to	Slot size/ perforation diameter
1			

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

1090100321 m. m. Lps

Final Status New, in use for intended purpose

No

GROUNDWATER QUALITY

Well No. 1090100321 Field Measurement Date 10-Dec-02

Electrical Conductivity 385 μ S

pH 7.35

Temperature 5.5 $^{\circ}$ C

Groundwater Type

Turbidity/sand content

Well disinfection

Was the well disinfected on completion of pump installation?

Bacterial testing done? ☐

Lab

Date

Chemical testing done? ☐

Lab

Date

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PART B: EBA Site Inspection

Inspector: _____

Date _____

WELL ID #	Owner	Location Description
M0093	YTG	CALMACICS DETACHMENT

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 _____

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 *N/A*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *N/A*
- 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: *BASEMENT*

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: _____

8. Conclusions

a. Comments on overall installation:

PROFESSIONAL INSTALLATION. NO DEFICIENCIES.

b. Recommendations:

INSTALL IRON SOFTENER & UV SYSTEM
CONSISTING OF PROPER PREFILTER
& UV SYSTEM.

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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

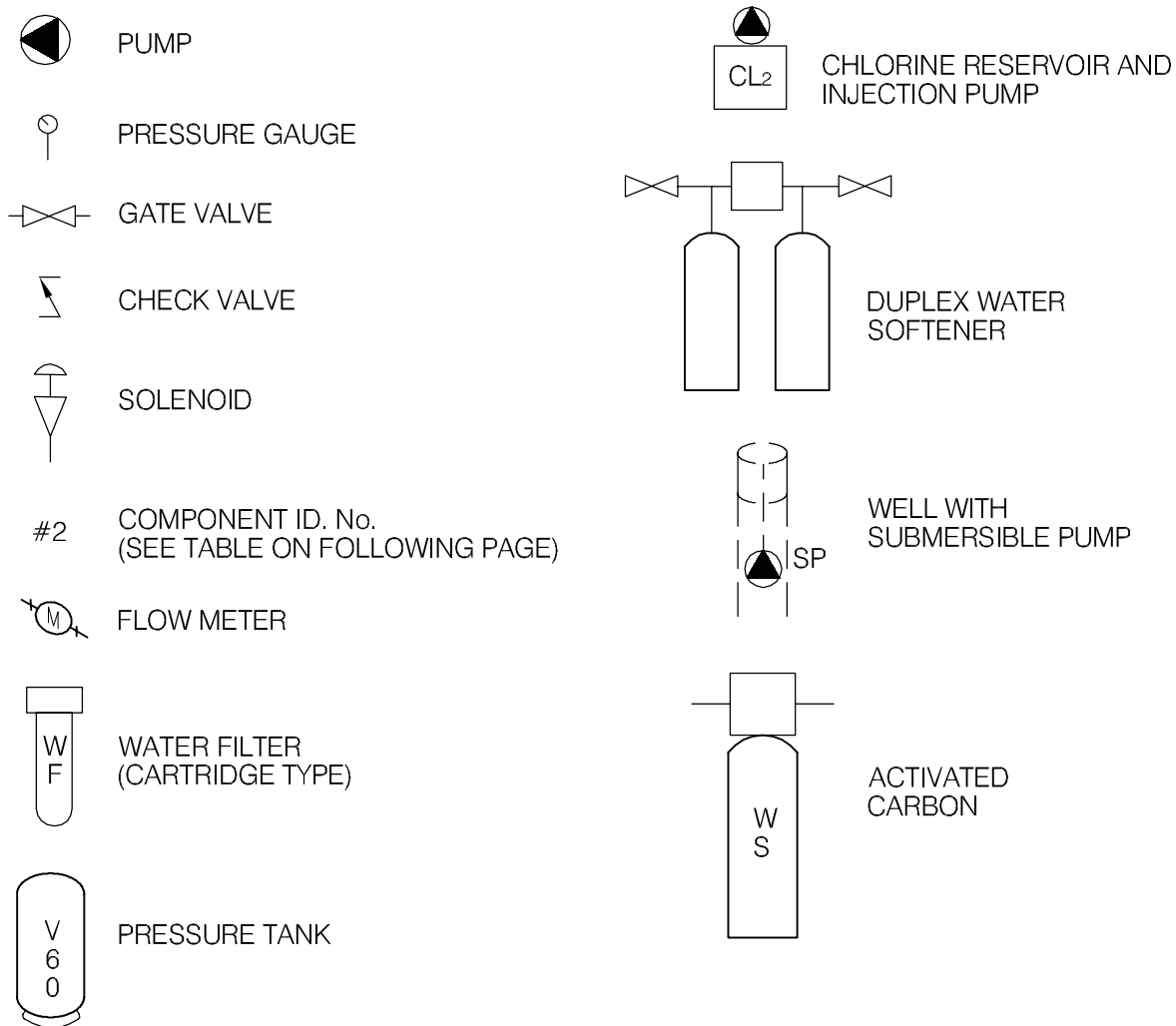
Have there been any bacteriological analyses conducted previously? YES NO

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

**Photo 0144:** M0093 Wellhead in Pit**Photo 0146:** M0093 Two Above Ground Storage Tanks**Photo 0008:** M0093 Pressure Tank**Photo 0010:** M0093 Pump Control Panel

LEGEND



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CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO.

1260002

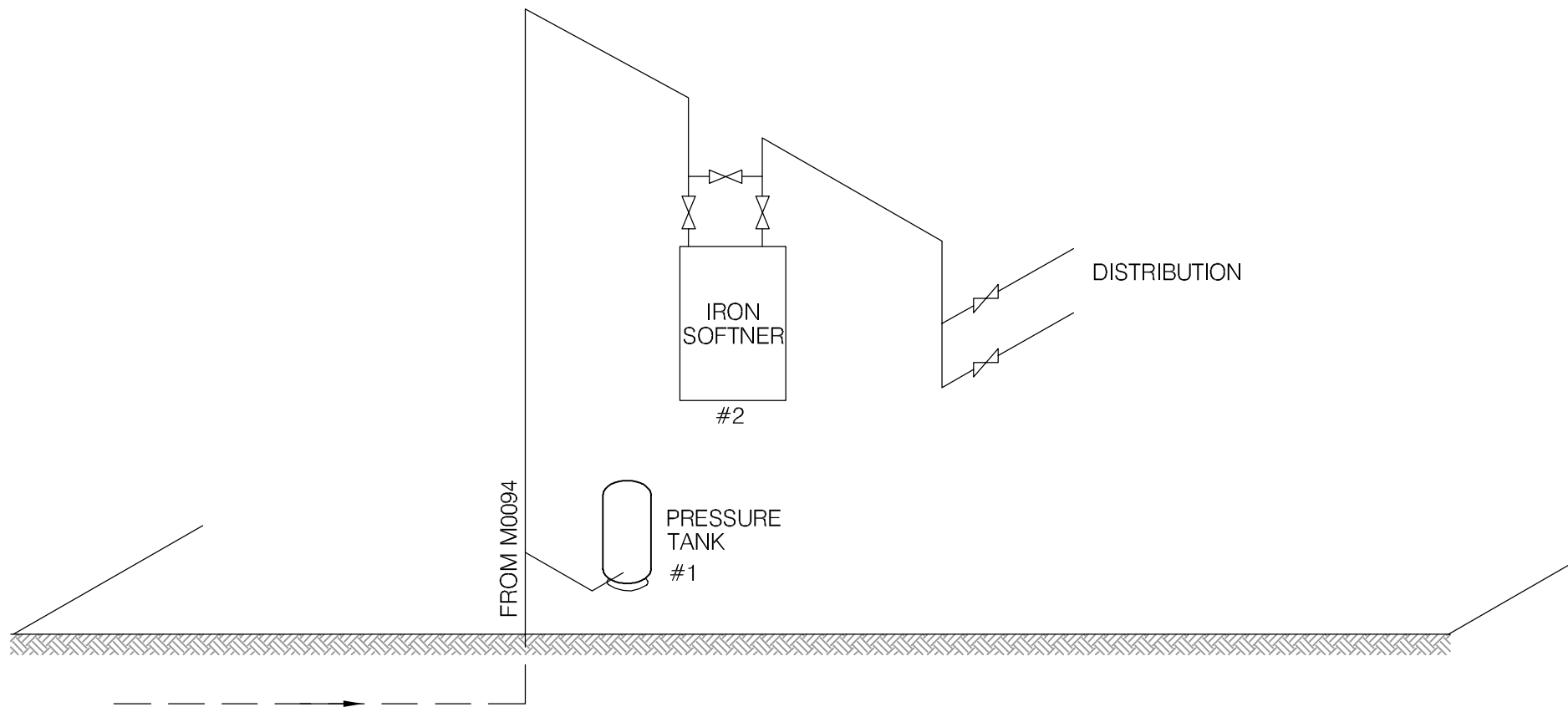
DRWG.

LEGEND

**Whitehorse Region – R.C.M.P. Housing
Building # MOO64**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUB. Pump.					4" - 1/2 HD.
2	HOLDING TANK		1250 V.			1250 GALLONS
3	~~DET~~ Pump	DURO	CONVEIRBLE			3/4 HD.
4	PRESS TANK.	AQUA FLO	AF 2665			307 L
5	WATER SOFTENER	MYERS	NISF30IN		1192	
6	PRESSURE SWITCH	SO. D	FGS-2			1/4" FIPT
7						
8						
9						
10						



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

 EBA Engineering Consultants Ltd.			PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION						
CLIENT  Yukon Highways and Public Works Property Management Branch			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: M0094 CARMACKS RCMP DETACHMENT						
DATE	APRIL 2006	DWN.	JSB	CHKD.	RMM	FILE NO.	1260002.001	DWG.:	FIGURE M0094B

Whitehorse Region – R.C.M.P. Housing
Building # ~~M0084~~ M0094

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	PRESSURE TANK	WELL RITE	WR260-02			
2	IRON SOFTNER	MYERS	MISF301N		1192	
3						
4						
5						
6						
7						
8						
9						
10						

TABLE M0064 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
M0064	R.C.M.P Housing	9	Oct-04 to Mar-05	yes	3/9	no	11-Mar-05	no
M0094	R.C.M.P Housing	12	Sept-04 to Mar-05	yes	2/12	no	11-Mar-05	no



Table M0064-2: Water Quality Results

SOURCE:	Building M0064 - R.C.M.P. Housing		Building M0094 - R.C.M.P. Housing		GCDWQ Criteria		
Location/ Resident	Carmacks		Carmacks				
Address	Lot B-12		Lot B-12				
Treatment	No, Water Softener Only		No, Water Softener Only				
Source of Water	On-Site Well, Shares with		On-Site Well, Shares with				
Purpose of Sampling	Baseline	Additional Sampling	Baseline	Additional Sampling			
Sample Location		Downstairs Laundry Tub Tap		Kitchen Tap			
Date Sampled	8-Oct-04	12-May-05	5-Oct-04	12-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)	5		5				15
Conductivity (uS/cm)	373		481				
Total Dissolved Solids	231		284				500
Hardness CaCO3	214		4		AO >200 = poor, > 500 unacceptable ^A		
pH	8.0		8.3		6.5		8.5
Turbidity (NTU)	0.15		0.3			1	5
UV Absorbance		<0.0010		<0.0010			
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3	201		215				
Chloride Cl	3		3				250
Fluoride F	0.2		0.2			1.5	
Sulphate SO4	21.4		21.8				500
Nitrate Nitrogen N	0.1		0.1			10	
Nitrite Nitrogen N	<0.05		<0.05			1	
Total Metals (ALS)							
Aluminum T-Al	<0.02						
Antimony T-Sb	0.0006		<0.02			0.006	
Arsenic T-As	<0.0004		0.0008			0.025	
Barium T-Ba	0.0643		<0.0004			1	
Boron T-B	<0.02		0.0009			5	
Cadmium T-Cd	<0.0002		<0.02			0.005	
Calcium T-Ca	63.9		<0.0002				
Chromium T-Cr	<0.0008		1.2			0.05	
Copper T-Cu	0.07	0.0116	0.0015			1	
Iron T-Fe	0.009		0.068				0.3
Lead T-Pb	0.0005		0.031			0.01	
Magnesium T-Mg	13.4		0.0002				
Manganese T-Mn	0.001		0.1				0.05
Mercury T-Hg	<0.0002		<0.001			0.001	
Potassium T-K	2.3		<0.0002				
Selenium T-Se	<0.0004		48.6			0.01	
Sodium T-Na	7		<0.0004				200
Uranium T-U	0.0011		81			0.02	
Zinc T-Zn	0.007		0.0009				5
			0.007				
Dissolved Metals							
Copper D-Cu		0.0078					1.0
Field Chemistry (EBA)							
pH		8.08		8.10	6.5		8.5
TDS		194		199			500
EC (uS/cm)		383		392			
Temperature		13.1		15.0			
Free Available Chlorine							250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 M0064-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
M0064 M0094	R.C.M.P. Housing	Carmacks	6884798	432697	526

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	?	No, shallow well	?	1/2hp submersible pump (shared between 2 residences) Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
?	Split Cap Gasket	?	Unlikely	Inside building

**Table M0064-4: Potential Contaminant Sources
Building M0064 – RCMP Housing**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	1250 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	350 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	<15 m to service lines and <30 to main		
Septic fields	Biological and Inorganic parameters.	>150 m		
Gas stations	Organic and Inorganic parameters.	200 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	18 m	6884810	432685
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>100 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 12, 2005

WELL ID #	Owner	Location Description
<u>M0094 + M0064</u> <u>(1 well)</u>	<u>RCMP</u>	<u>RCMP Housing</u>

1. Well Location and Potential Contaminant Sources

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

Carmacks

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

Carmacks RCMP Detachment Housing

c. GPS location: 432697 Easting 6884798 Northing 526m elev. $\pm 14m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

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

Services 2 RCMP Housing Houses

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

f. Nearest building, specify _____

g. Distance from well to building _____

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

i. Distance from well to nearest point of known field: _____

j. Well location relative to field: ☐ upslope ☐ downslope ☐ lateral

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- k. 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

There is a sewer line 30 m away

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

There is a solid waste dump ~1 km away

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

- n. 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

- o. Is well site subject to flooding? ☐ Yes ☐ No

- p. Is the well site well drained? ☐ Yes ☐ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 3 + 4; Distance from well to Potential Source 1: 18 m

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

- s. Are there other wells on this property? ☐ Yes ☐ No

How many? _____ ☐ in use ☐ abandoned ☐ 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 _____ Material: ☐ steel ☐ plastic ☐ concrete
- *g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- *h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☐ in pit ☐ pitless adaptor ☐ in a building
☐ 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 _____
 - 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 _____
 - v. Does the well casing have a proper seal cap? ☐ Yes ☐ No
- If no, describe condition _____

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...) water softeners for both homes

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

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: _____

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 ALBISSEN

Date MAY 12-05

WELL ID #	Owner	Location Description
<u>M0064</u>	<u>YTG</u>	<u>CARMACIES REMP RES.</u> <u>TAN HOUSE</u>

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 _____

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 *N/A*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *N/A*
- 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:

Pressure Basement

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:

INSTALLATION IS OF GOOD QUALITY &
WORKMANSHIP.
WELL CASING IS PRONE TOO FLOODING.

b. Recommendations:

INSTALL PITLESS ADAPTER & EXTEND CASING
18" ABOVE GRADE.

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PART B: EBA Site Inspection

Inspector: BERT ALBISSEN

Date May 12-05

WELL ID #	Owner	Location Description
M009A	YTG	CARMACKS - RCMP

WHITE House

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 _____

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 *N/A*
- f. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete *N/A*
- 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:

Basement

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:

INSTALLATION IS OF GOOD QUALITY
MATERIAL & WORKMANSHIP.

b. Recommendations:

ADD UV SYSTEM & FILTRATION



Photo 0015: M0064 Water System



Photo 0147: M0064 and M0094 Above Ground Heating Fuel Storage Tank

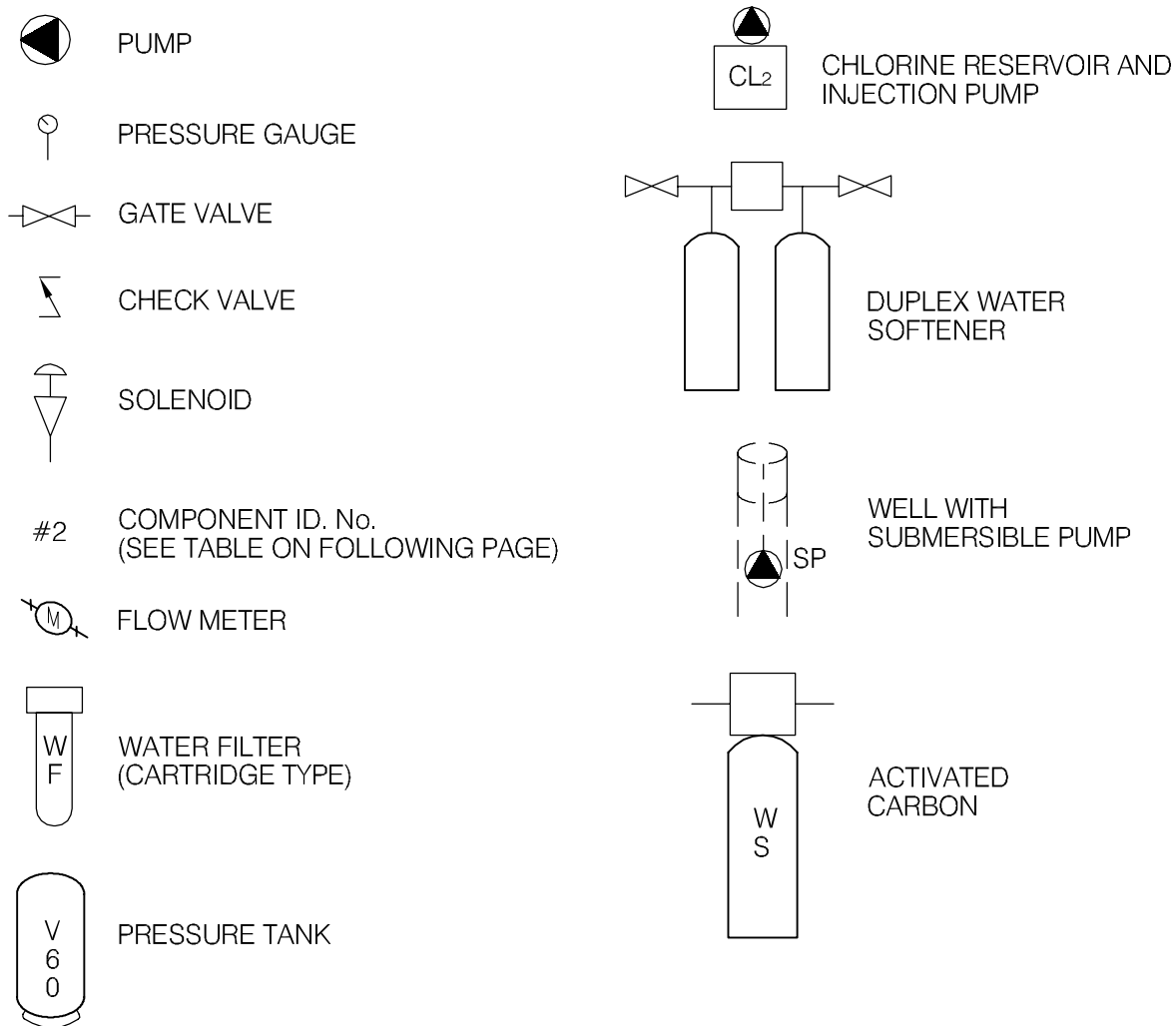


Photo 0011: M0094 Water Softener (left) and Pressure Tank (right)



Photo 0012: M0064 Water Softener

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

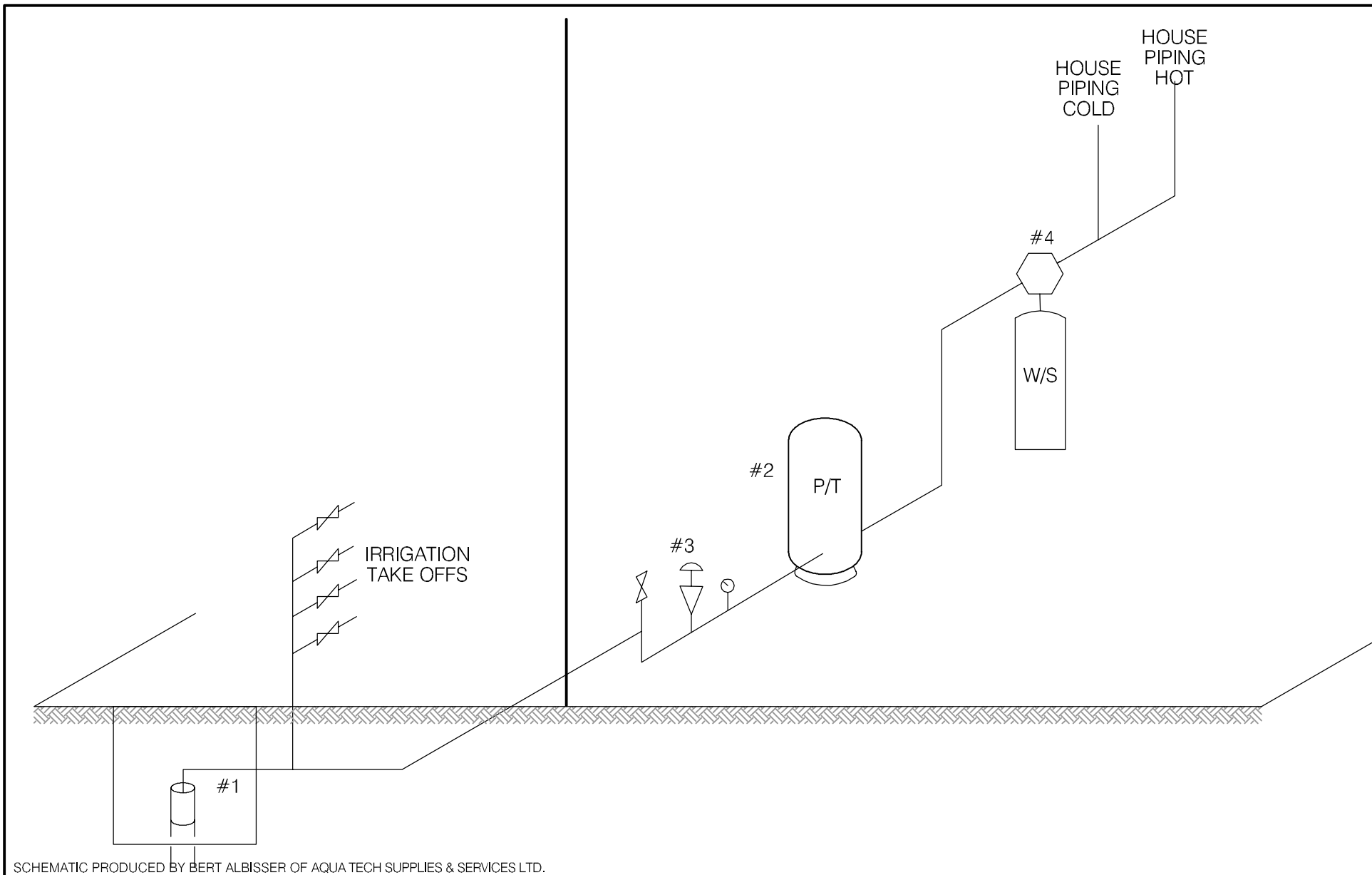
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



 EBA Engineering Consultants Ltd.		PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
CLIENT  Yukon Highways and Public Works Property Management Branch		TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: YWP A YUKON WILDLIFE PRESERVE - MAIN WELL	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	FILE NO. 1260002.001
		DWG.: FIGURE YWP-A	

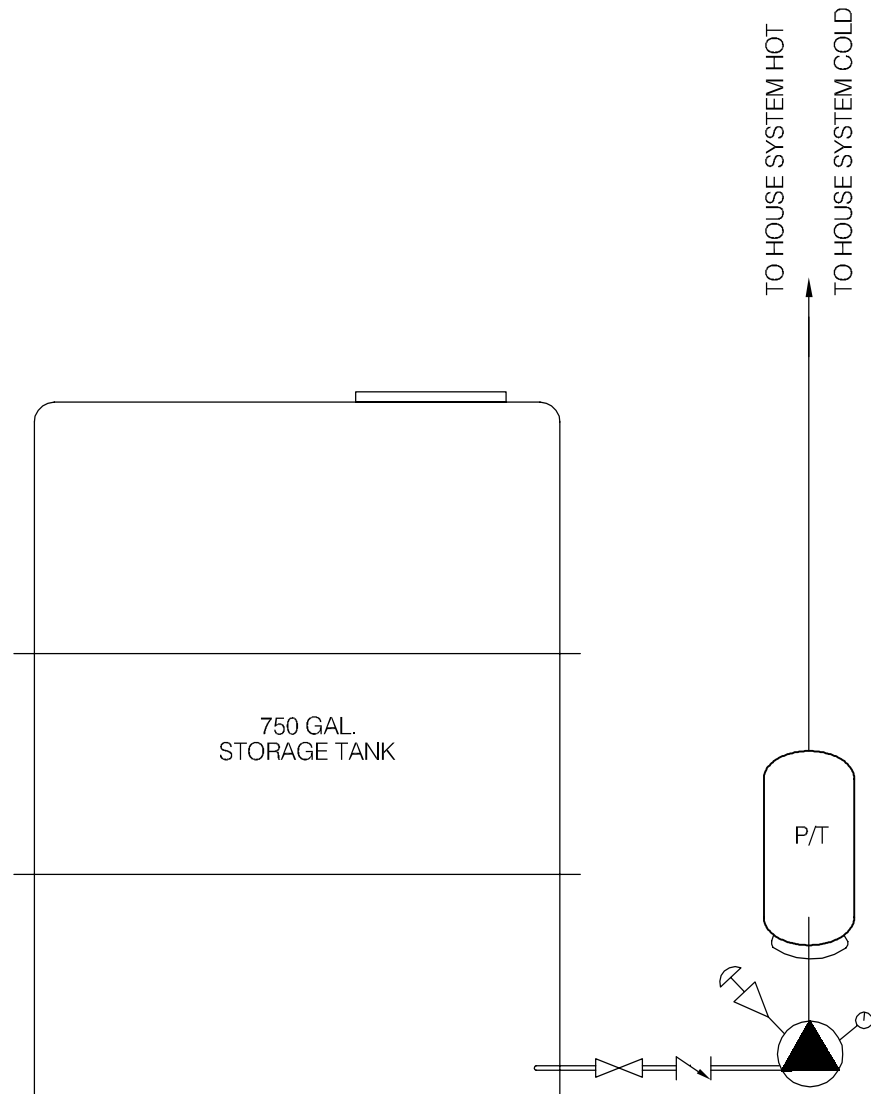
Whitehorse Region - ~~Carmacks Grader Station~~~~Building # 0512~~

WILDLIFE PRESERVE MAIN WELL

DISTRIBUTION & TREATMENT SYSTEM DATA

YWP A

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUBMERSIBLE					4" - 5 HP.
2	PRESSURE TANK	CHALLENGER	PC 366			
3	PRESSURE SWITCH	SCP D	FSG-2			2 HP 1/4" FIPT
4	IRON SOFTENER	ELITE	7836-1	EIS-45MI	228426	45000 GRAIN
5	PRESSURE GAUGE	MARCH	0-100 PSI			1/4" FIPT
6						
7						
8						
9						
10						



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: YWP B
YUKON WILDLIFE PRESERVE - STAFF HOUSE

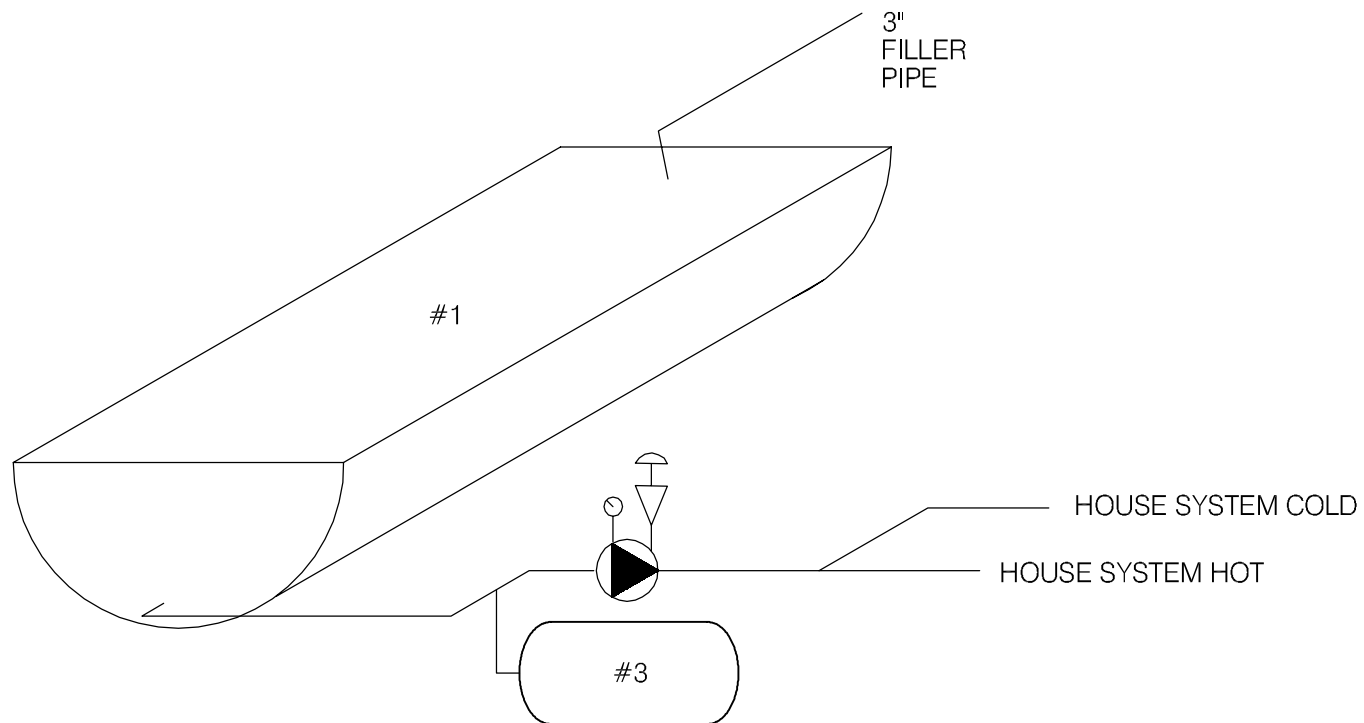
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE YWP-B



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

 EBA Engineering Consultants Ltd.			PROJECT SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
CLIENT  Yukon Highways and Public Works Property Management Branch			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: YWP-D PTARMIGAN TOWERS RESIDENCE	
DATE APRIL 2006	DWN. JSB	CHKD. RMM	FILE NO. 1260002.001	DWG.: FIGURE YWP-E

TABLE YWP - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
YWP-A	Yukon Wildlife Preserve Main Office	0	Jun-05 to Feb-06	yes	2/13	yes	28-Feb-06	no
YWP-B	Yukon Wildlife Preserve Kestrel Cottage	1	May-04	no	0/1	no	31-May-04	no



Table YWP-2: Water Quality Results

SOURCE:	Building YWP-A Yukon Wildlife Preserve Main Office		Building YWP-B Yukon Wildlife Preserve Staff Building		GCDWQ Criteria		
Location/ Resident	Takhini Hot Springs Road		Takhini Hot Springs Road				
Address							
Treatment	No, Water Softener Only		No				
Source of Water	On-Site Well		Delivery				
Purpose of Sampling	Additional Sampling	Baseline	Baseline (City of Whitehorse)	Additional Sampling			
Sample Location	Raw Water Tap from Kitchen		City of Whitehorse Waterhouse 3	Kitchen Tap			
Date Sampled	19-May-05	26-Jun-05	1-Dec-04	19-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)	<5.0	<5	<5				15
Conductivity (uS/cm)	1270	1220	252				
Total Dissolved Solids	904	950	160				500
Hardness CaCO3	688	658	116		AO >200 = poor, > 500 unacceptable ^A		
pH	8.18	7.96	7.86		6.5		8.5
Turbidity (NTU)	0.69	0.14	<0.1			1	5
UV Absorbance	0.022						
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3	286	292					
Chloride Cl	26.5	23.6					250
Fluoride F	0.185	0.12				1.5	
Sulphate SO4	35.9	394					500
Nitrate Nitrogen N	2.61	0.58				10	
Nitrite Nitrogen N	<0.10	0.50				1	
Ammonia Nitrogen N	-						
Total Metals (ALS)							
Aluminum T-Al	<0.020	<0.020					
Antimony T-Sb	<0.0010	<0.0010				0.006	
Arsenic T-As	0.00044	0.00048				0.025	
Barium T-Ba	<0.040	<0.040				1	
Boron T-B	<0.20	<0.20				5	
Cadmium T-Cd	<0.00040	<0.00040				0.005	
Calcium T-Ca	162	155					
Chromium T-Cr	<0.0040	<0.0040				0.05	
Copper T-Cu	0.0024	0.0032				1	
Iron T-Fe	<0.030	<0.030					0.3
Lead T-Pb	<0.0020	<0.0020				0.01	
Magnesium T-Mg	68.9	65.6					
Manganese T-Mn	<0.0040	0.0193					0.05
Mercury T-Hg	<0.00020	<0.00020				0.001	
Potassium T-K	2.83	2.51					
Selenium T-Se	<0.0020	<0.0020				0.01	
Sodium T-Na	51.5	39.8					200
Uranium T-U	0.00946	0.00854				0.02	
Zinc T-Zn	<0.10	<0.10					5
Trihalomethanes							
Bromodichloromethane							
Bromoform							
Chloroform							
Dibromochloromethane							
Total Trihalomethanes						0.1	
Haloacetic Acids							
Bromoacetic Acid							
Bromochloroacetic Acid							
Chloroacetic Acid							
Dibromoacetic Acid							
Dichloroacetic Acid							
Trichloroacetic Acid (TCA)							
Field Chemistry (EBA)							
pH	7.43				6.5		8.5
TDS	579						500
EC (uS/cm)	1134						
Temperature	9.2						
Free Available Chlorine							

Notes:

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

highlighting.

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Underline with Yellow shading 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 YWP-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
?	Yukon Wildlife Preverve Main Office	Takhini Hotsprings Road	6749184	481827	747
?	Yukon Wildlife Preverve Kestrel Cottage	Takhini Hotsprings Road	6748465	481835	721

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	?	Yes	102.8	Bedrock - 4m to 103m	?	?	?
150	Early 1970's	No	55.8	?	53.910	?	41.725

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.4m below grade	Split Cap Gasket	Open Hole Screen from 4.3m to 102.8m	No	No, but slopes away from pit
Approximately at grade (within 0.2m)	Split Cap Gasket	?	No	Inside building

**Table YWPA-4: Potential Contaminant Sources
Building YWPA – Yukon Wildlife Preserve Main Office**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Animal Pens	Biological parameters	12 m and 25 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 15 m		
Septic fields	Biological and Inorganic parameters.	Approx 40 m	6743231	481831
Gas stations	Organic and Inorganic parameters.	8 km		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	6 m	6749183	481834
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

**Table YWPB-4: Potential Contaminant Sources
Building YWPB –Yukon Wildlife Preserve Kestrel Cottage**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Animal Pens	Biological parameters	50 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 14 m		
Septic fields	Biological and Inorganic parameters.	15 m	6748482	481837
Gas stations	Organic and Inorganic parameters.	8 km		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	16 m and 30 m		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 19, 2005

WELL ID #	Owner	Location Description
	YTG	Yukon Wildlife Preserve well A

1. Well Location and Potential Contaminant Sources

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

Takhini Hot Springs Road

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

Yukon Wildlife Preserve, km 8 Takhini Hot Springs Road

c. GPS location: 481827 Easting 6749184 Northing 747m elevation ± 8m

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system?

If so how many _____

Services main office, and a hydrant that

can connect to animal

☐ 5 or more delivery sites on a trucked distribution system?

If so how many _____

f. Nearest building, specify Game Farm Main office

g. Distance from well to building ~1m

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

i. Distance from well to nearest point of known field: _____

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

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- k. 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

Septic tank ~20m away, downslope, septic tank begins >40m away, downslope

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

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

- n. 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

unfastened wooden lid

Entrance by animals? ☐ Yes ☒ No

Few traces of animals, access possible

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

some evidence of dampness and water staining

- p. Is the well site well drained? ☒ Yes ☐ No

- q. 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 _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST; Distance from well to Potential Source 1: ~6m

Potential Source 2: Baby, Musko's pen; Distance from well to Potential Source 2: ~12m

Potential Source 3: Musko's pen; Distance from well to Potential Source 3: 25m

Potential Source 4: wildlife compound; Distance from well to Potential Source 4: ~26m

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

How many? WB ☐ in use ☒ abandoned ☐ 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: _____ ☐ measured (if possible) ☐ reported ☐ from log

* h. Static water level below ground: _____

☐ 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 _____ slot size(s) _____

Location of screen: from _____ to _____ 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
wood-enclosed (hen-pwf) pit w/ styrofoam insulated walls

☒ 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 Yes, 1.4m below grade
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
water staining and dampness
- iii. Is the wellhead enclosed by fiberglass insulations? ☐ Yes ☒ No
There is styrofoam insulation in enclosure walls and
lid. No insulation directly inside enclosure
- iv. Any evidence of rodents? Specify No evidence, access is likely
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition only

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...) Water Softener only

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

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
hydrant for hoses to animal tanks

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

k. Is the pump and piping protected from freezing? ☐ Yes ☐ No
Heater in enclosure. No Heat trace. No insulation in pit. Pit walls
and lid have styrofoam insulation
If yes, describe: _____

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 ALBISSEZ

Date May 20/05

WELL ID #	Owner	Location Description
W.L.P. MAIN WELL	YTC	KIKON WILDLIFE PRESERVE

6. Water Treatment

a. Is well water treated? ☒ Yes ☒ No; Type of treatment: IRON SOFTENER

☐ 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: PRESSURE TANK PC-360

Where is it located?

Comments: Basement

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: YES

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Overall Tank No 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

8. Conclusions

a. Comments on overall installation:

System Needs To Be Completely Re-piped From Well To House TIE IN. SOFTNER IS ONLY SIZED FOR 4 PEOPLE MAXIMUM. A LARGER SOFTNER WILL HAVE TO BE INSTALLED TO GET UNINTERRUPTED SOFT WATER SUPPLY.

b. Recommendations:

INSTALL SURFACE SEAL ON WELL, EXTEND CASING ACCORDINGLY. REPIPE THE COMPLETE SYSTEM. INSTALL SUITABLE DUPLEX WATER CONDITIONER OF APPROPRIATE SIZE FOR NEW DEMAND. INSTALL UV SYSTEM AFTER SOFTNER FOLLOWED BY AUXILIARY CHLORINATION SYSTEM FOR PROTECTION OF THE PIPING SYSTEM. INSTALL FREEFLOW PREVENTION OF APPROPRIATE SIZE.



Driller's Report 204140152

Page 1 of 1

Takhini Hot Springs Rd.

Location: Yukon Game Farm Well Lot 1353, Yukon Game Farm ~~Game~~

NAD 83 Zone 8 Easting 482482 Northing 6749732 Elevation ASL 2414.7 ft.

Location Accuracy: Horizontal
Vertical

100-300 (topo)
30.5 metres (100ft)

Purpose of well: Domestic - household needs

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	4	ft.	SAND with Silt and Gravel		
2	4	5	ft.	BEDROCK		
3	5	12	ft.	SAND with Gravel		
4	12	335	ft.	BEDROCK		

WELL CONSTRUCTION

Well No. 2041401521 Completion date Drilling method Well type

Casing: OS Diameter 6 in. Material Wall thickness in. Depth to ft.

Comments

Surface/Env'l seal: Material Diameter in. Depth from to ft. Volume cu. ft.

Gravel Pack ? Material Diameter in. Depth from to

Well Screen Information

OS Diameter	Material	Screen Type	Comments
	Open Hole	Open Hole	Open Hole

Screen Sections

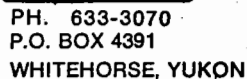
Section	From	to	Slot size/ perforation diameter
1	14	335	ft.

WELL DEVELOPMENT AND STATUS

Well ID	Developed by	Wellhead completion	Adapter depth	Static water level	Yield Estimate	Estimate method
2041401521			ft.	ft.	gpm	

Final Status New, in use for intended purpose

No



B-ID 204140152

Started.....MAY 16.....1983

Completed... MAY 25 19. 83

FORMATION LOG			DESCRIPTION OF WORK	TIME			
FROM	TO	FORMATION		DATE	FROM	TO	HOURS
			MOVE LOAD AT SHOP	MAY 18	8:00	10:00	
			TRAVEL TO SITE	"	10:15	10:45	
			SET UP WELD ON SHIP	"	10:45	12:00	
			UNLOAD FLAT DECK				
0'	4'	Silty	SAND & GRAVEL	"	12:00	1:00	
4'	5'	B.R.					
5'	12'	SAND & Gravel					
12'	165'	B.R.		"	1:00	5:00	7 hrs.
			TRAVEL	MAY 19	8:00	8:30	
165'	250'	BR	2 G.A.M. AT 224	"	8:30	5:00	
			TRAVEL	"	5:00	5:30	
			TRAVEL	MAY 20	8:00	8:30	
250'	295'	BR	~~PULLOUT~~ BIT	"	8:30	4:30	
			PULLOUT BIT		4:30	5:00	3.5
			TRAVEL	MAY 20	5:00	5:30	

Crd. of Casing & Pipe				Remarks:
Size	Type	Size	Type	
Feet	Inch	Feet	Inch	
				Static Level
				Ground Level
				Top Of Casing
				Total Rig Time
				Total Standby
				Drilling Mud

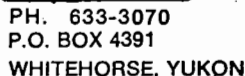
SIGNATURES

MIDNIGHT SUN.....

TITLE.....Kirk.....

CLIENT.....

TITLE.....



Started... MAY 1983

Completed... MAY 25 19.53

[illegible]

SIGNATURES

MIDNIGHT SUN.....

TITLE.....Kick.....

CLIENT.....

TITLE.....

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 19, 2005

WELL ID #	Owner	Location Description
	YTG	Yukon Wildlife Preserve well B Kestrel Cottage

1. Well Location and Potential Contaminant Sources

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

Takhini Hot Springs Road

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

Staff House, Yukon Wildlife Preserve, Takhini Hot Springs Road

c. GPS location: 481835E 6748465N 721m elev. ± 14m

d. Is there electric power? ☐ Yes ☒ No

e. Does the well system have:

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

The well has been abandoned due to water quality

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

f. Nearest building, specify Located inside the Yukon Wildlife Preserve staff building

g. Distance from well to building _____

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

i. Distance from well to nearest point of known field: ~15m

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

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- k. 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

septic tank and field ~16m away. Field does not work, must be pumped out regularly.

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

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

- n. 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

well is located inside a locked building

Entrance by animals? ☐ Yes ☒ No

evidence of rodents and insects in well room

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

some evidence of water staining

- p. Is the well site well drained? ☒ Yes ☐ No

- q. 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 _____

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

☐ Yes ☐ No Describe _____

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

Potential Source 1: AST 1; Distance from well to Potential Source 1: ~16m

Potential Source 2: AST 2; Distance from well to Potential Source 2: > 30m

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

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

- s. Are there other wells on this property? ☐ Yes ☐ No

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

early 1970's

- * 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: 7/ 55.8m ☒ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: 41.729 - MAY 19, 2005
☒ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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 room off from main building
☐ in a wooden enclosure other, describe Add-on.
- 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 The well head is approximately at grade level
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
There is some dampness; heavy rust on the well head
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
In the walls of the enclosure
- iv. Any evidence of rodents? Specify There is some evidence of mouse droppings
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No
Split cap seal, but heavily rusted
If no, describe condition _____

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...) well abandoned

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

5. Pump Installation:

- 41.725
- a. Is the well equipped with a pump? ☒ yes ☐ No
NOT CURRENTLY USED - ELECTRICAL DISCONNECTED
- 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 53.910 m
- f. Drop pipe for submersible pump: ☒ steel ☐ plastic
- g. Pump delivers water to: ☐ pressure tank ☐ elevated tank ☐ other N/A - nowhere
- 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 a building/add-on, but still reported to have frozen, no heat when door is closed
- 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 ALBISSEN

Date MAY 20/05

WELL ID #	Owner	Location Description
WLP STAFF	YTG	WILD LIFE PRESERVE

HOUSE (KESTREL COTTAGE)

6. Water Treatment

WELL NOT FUNCTIONAL

- a. Is well water treated? ☐ Yes ☒ No; Type of treatment:
STORAGE TANK (DELIVERED WATER)
☒ 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 .38 MG/L reading.
Tested at KITCHEN TAP (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: BASEMENT

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?

5' ~~Ø~~ x 6' H.

What material is the tank constructed of? FIBRE GLASS.

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 HEIGHT DOES NOT ALLOW CLEANING

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: SOME SEDIMENT

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:

THIS SYSTEM NEEDS TO BE REPLACED.
WELL S/B REDEVELOPED.

b. Recommendations:

REDEVELOP WATER WELL. BUILD NEW
ENCLOSURE FOR PUMP SYSTEM.
INSTALL APPROPRIATE TREATMENT.
DISINFECT THE COMPLETE HOUSE
SYSTEM & INSTALL UV IF POSSIBLE.

DISTRIBUTION & SYSTEM DATE

1. Pump System - MOWAT M75-33/JR 44H
JET PUMP SYSTEM.
2. WATER STORAGE TANK - 750 GALLON -
VERTICAL, SECTIONAL FIBRE GLASS TANK.

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PART B: EBA Site Inspection

Inspector: Brian Albers

Date MAY 20/05

WELL ID #	Owner	Location Description
WLP-UNIT D	YTG	WLP - PARMIGAN Tower

6. Water Treatment

DELIVERED WATER

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 _____

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: SITOP AREA.

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: YES

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Overall Tank

What are the tank size and dimensions?

6' ϕ HALF TANK X 14' L (APPROX 850 GALLONS)

What material is the tank constructed of? FIBRE GLASS.

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: TANK IS SEALED NO ACCESS.

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

Comments: NOT AVAILABLE

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:

NOT A SUITABLE WATER SYSTEM.

b. Recommendations:

REPLACE THE COMPLETE SYSTEM, INCLUDING THE STORAGE TANK. THERE IS ADEQUATE ROOM FOR A NEW SYSTEM IN THE SHOP AREA.



Photo 0174: YWP-A Main Office (left), Well Head Enclosure (center) and Baby Muskox Pen (back right)



Photo 0173: YWP-A Well Head



Photo 0175: YWP-A Septic Field (front) and Muskox Pen (Back)



Photo 0178: YWP-A Well Head Enclosure (front), Main Office (left) and Above ground Fuel Storage Tank (right)

**Photo 0176:** YWP-A Muskox Pen (back)**Photo 0177:** YWP-A Baby Muskox Pen (left), Animal Feed Storage Area (behind)**Photo 0004:** YWP-A Pressure Tank (left) and Water Softener (right)**Photo 0001:** YWP-A Piping in Building from Wellhead



Photo 0183: YWP-B Preserve Staff Building and Well House Addition



Photo 0006: YWP-B Trucked Water Storage Tank



Photo 0182: YWP-B Above Ground Fuel Storage Tank



Photo 0184: YWP-B Trucked Water Intake



Photo 0182: YWP-D Piping



Photo 0006: YWP-D Water Storage Tank



Photo 0184: YWP-D Jet Pump and Pressure Tank



Photo 0183: YWP-B Preserve Staff Building and Well House Addition



Photo 0006: YWP-B Trucked Water Storage Tank



Photo 0182: YWP-B Above Ground Fuel Storage Tank



Photo 0184: YWP-B Trucked Water Intake



Photo 0174: YWP-A Main Office (left), Well Head Enclosure (center) and Baby Muskox Pen (back right)



Photo 0173: YWP-A Well Head



Photo 0175: YWP-A Septic Field (front) and Muskox Pen (Back)



Photo 0178: YWP-A Well Head Enclosure (front), Main Office (left) and Above ground Fuel Storage Tank (right)

**Photo 0176:** YWP-A Muskox Pen (back)**Photo 0177:** YWP-A Baby Muskox Pen (left), Animal Feed Storage Area (behind)**Photo 0004:** YWP-A Pressure Tank (left) and Water Softener (right)**Photo 0001:** YWP-A Piping in Building from Wellhead



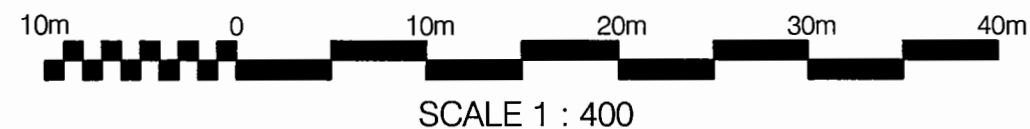
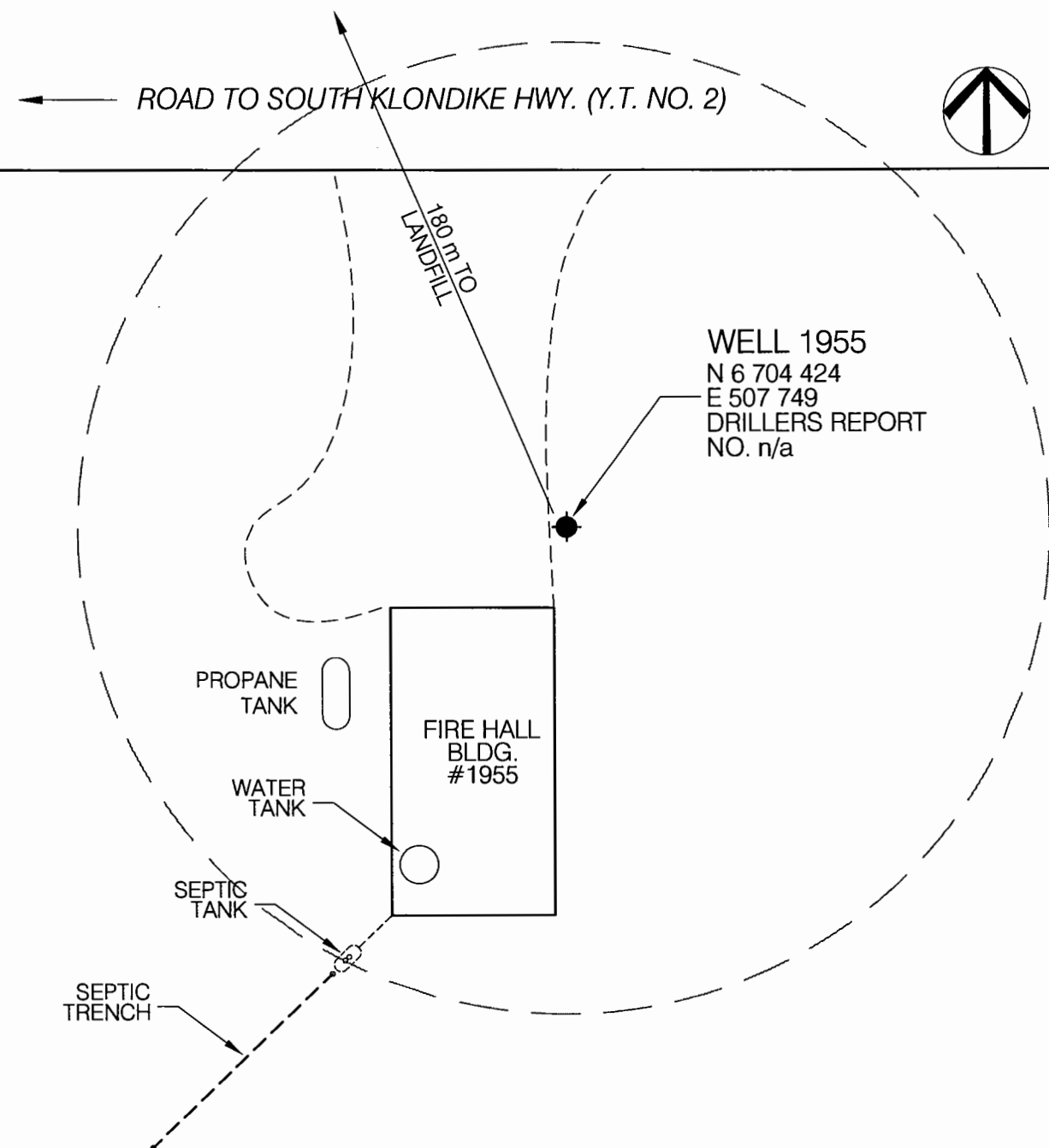
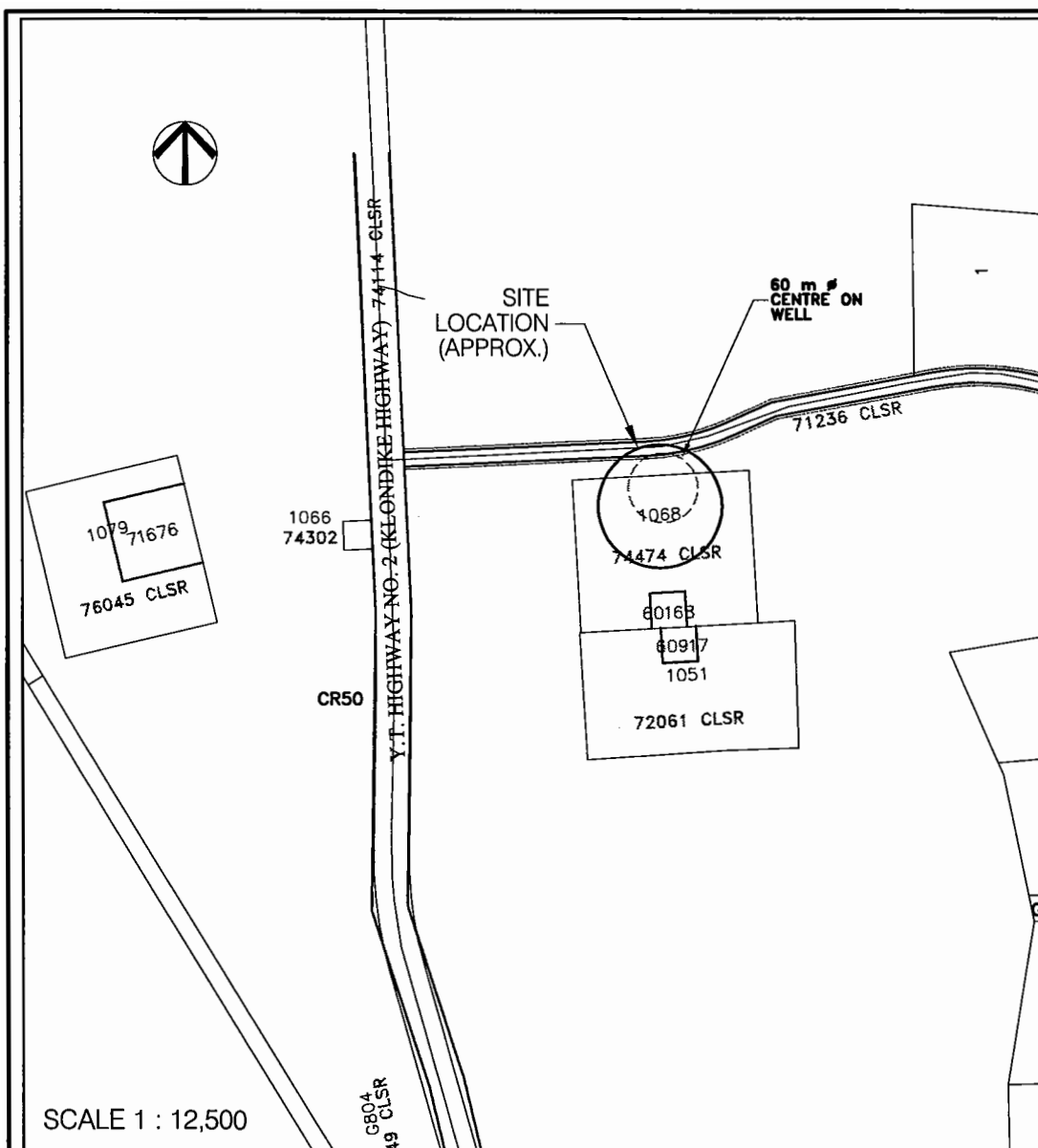
Photo 0182: YWP-D Piping



Photo 0006: YWP-D Water Storage Tank



Photo 0184: YWP-D Jet Pump and Pressure Tank



NOTES:

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



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

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



EBA Engineering Consultants Ltd.

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

CLIENT:

Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

MOUNT LORNE FIRE HALL
BUILDING 1955
SITE LOCATION DIAGRAM
WELL ID: 1955

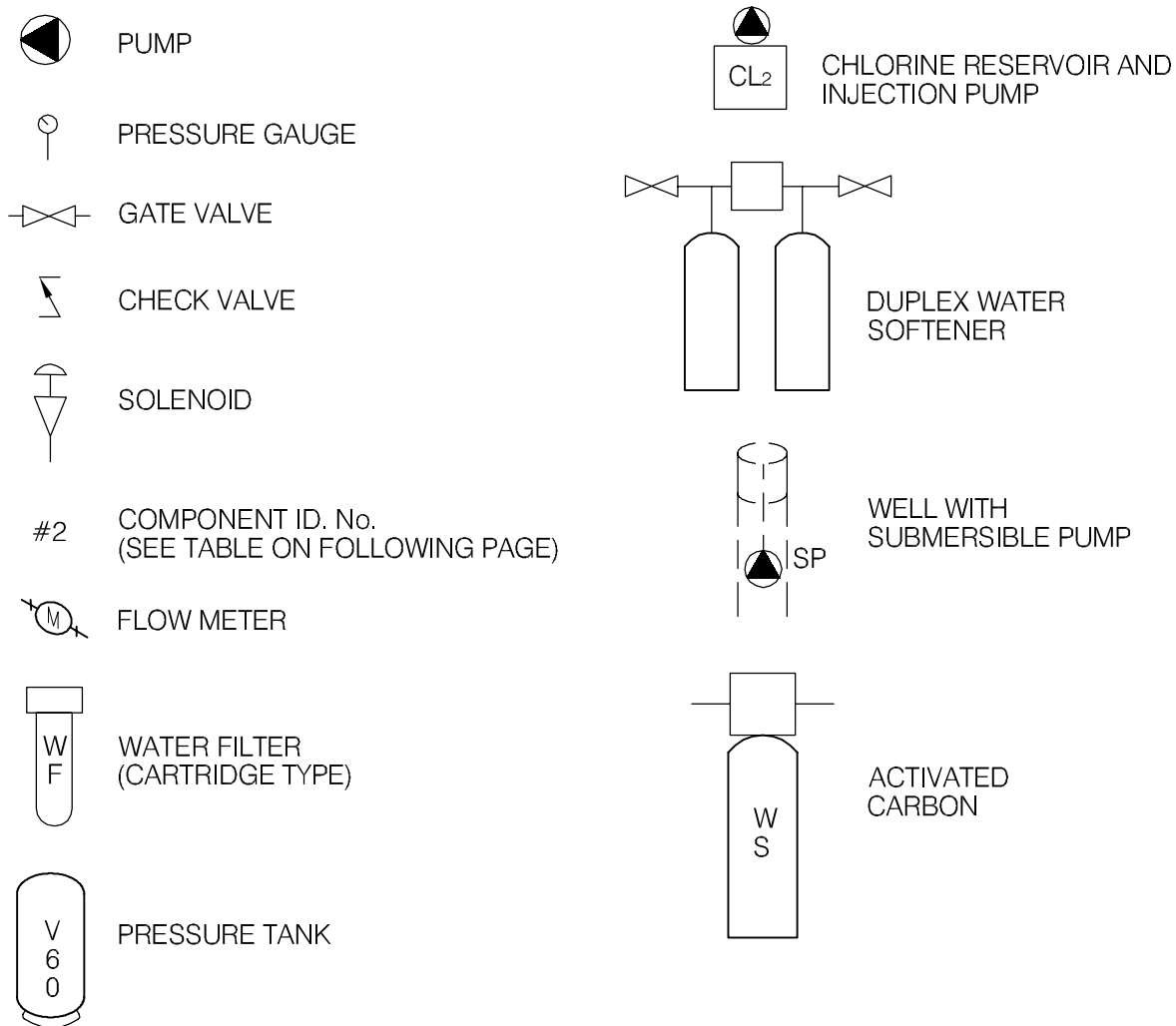
REVISION ISSUE

0

DRAWING No.

FIGURE 1955A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

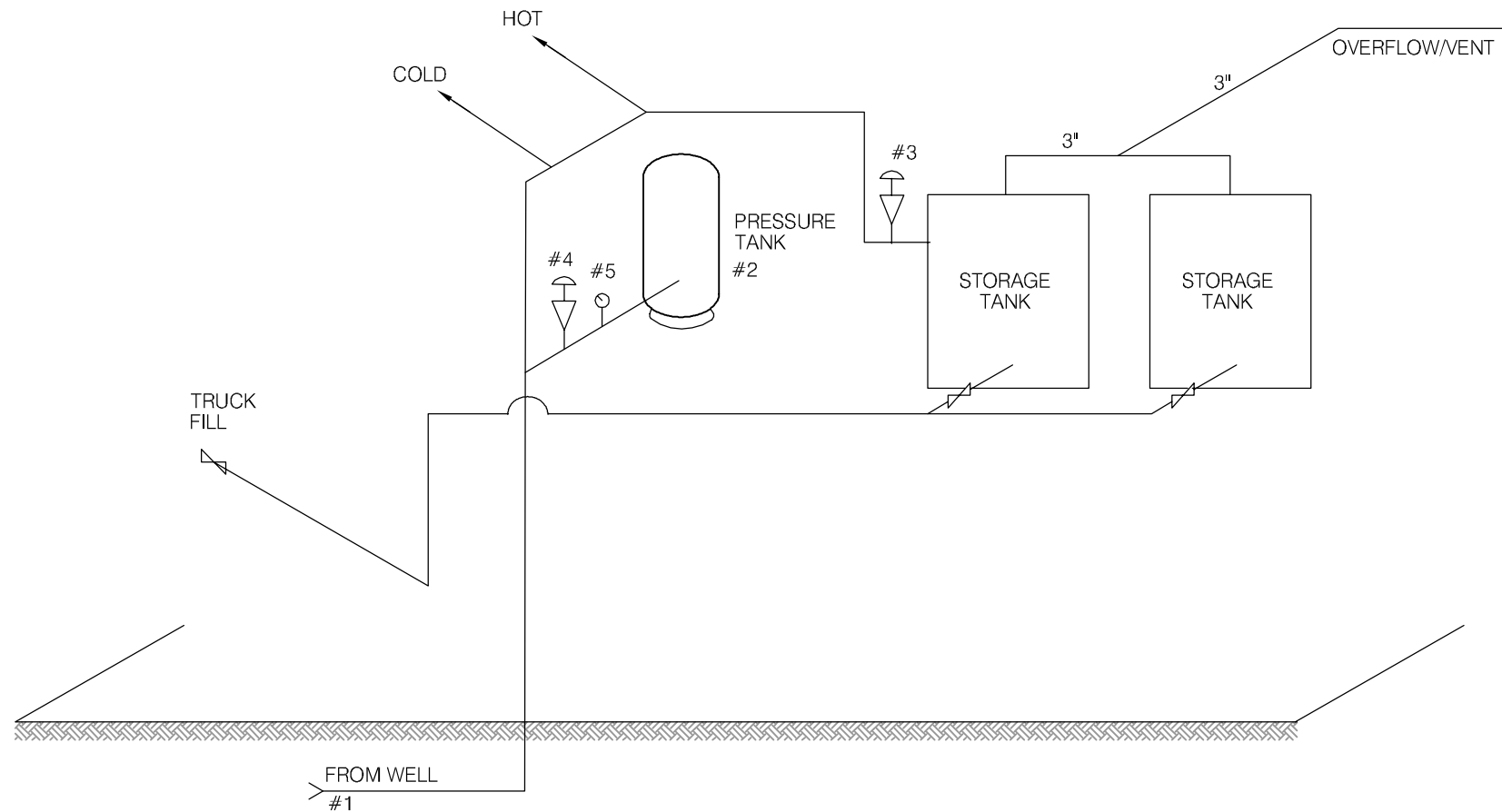
DATE APRIL 2006

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  Yukon Highways and Public Works Property Management Branch			TITLE WATER SYSTEM DISTRIBUTION/TREATMENT SCHEMATIC SYSTEM ID.: 1955 MOUNTE LORNE FIRE HALL - WELL ID.: 1955		
DATE JULY 2005	DWN. JSB	CHKD. RMM	FILE NO. 1260002.002	DWG.: FIGURE 1955B	

Whitehorse Region – Mount Lorne Firehall
Building # 1955

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUB. PUMP	?	?			4" - 2 HP.
2	PRESSURE TANK	CHALLENGER	PC266			
3	FLOAT CONTROL	MC CONNELL	# 21			3/4"
4	PRESSURE SWITCH	SQ. D.	FSG 2			1/4" FIPT
5	PRESSURE GAUGE	MARSH	O-100			1/4 HIPT
6						
7						
8						
9						
10						

TABLE 1955 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1955	Mount Lorne Firehall	6	Sept-04 to Mar-05	no	0/6	no	2-Feb-05	no



Table 1955-2: Water Quality Results

SOURCE:		Building 1955 - Mount Lorne Firehall		GCDWQ Criteria		
Location/ Resident		Mount Lorne				
Address						
Treatment		No				
Source of Water		On-Site Well				
Purpose of Sampling		Baseline	Additional Sampling			
Sample Location		Kitchen Tap	Kitchen Tap			
Date Sampled		4-Oct-04	19-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)		5				15
Conductivity (uS/cm)		301				
Total Dissolved Solids		220				500
Hardness CaCO3		206		AO >200 = poor, > 500 unacceptable ^A		
pH		8.0		6.5		8.5
Turbidity (NTU)		0.8			1	5
UV Absorbance			0.0073			
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3		177				
Chloride Cl		<1				250
Fluoride F		0.17			1.5	
Sulphate SO4		32				500
Nitrate Nitrogen N		0.1			10	
Nitrite Nitrogen N		0.11			1	
Ammonia Nitrogen N						
Total Metals (ALS)						
Aluminum T-Al		<0.02				
Antimony T-Sb		0.0008			0.006	
Arsenic T-As		<0.0004			0.025	
Barium T-Ba		0.0318			1	
Boron T-B		<0.02			5	
Cadmium T-Cd		<0.0002			0.005	
Calcium T-Ca		62.1				
Chromium T-Cr		<0.0008			0.05	
Copper T-Cu		0.016			1	
Iron T-Fe		0.131				0.3
Lead T-Pb		0.0012			0.01	
Magnesium T-Mg		9.6				
Manganese T-Mn		0.004				0.05
Mercury T-Hg		<0.0002			0.001	
Potassium T-K		1.3				
Selenium T-Se		<0.0004			0.01	
Sodium T-Na		4				200
Uranium T-U		0.0028			0.02	
Zinc T-Zn		0.019				5
Field Chemistry (EBA)						
pH			7.70	6.5		8.5
TDS			181			500
EC (uS/cm)			358			
Temperature			15.9			
Free Available Chlorine						250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1955-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1955	Mount Lorne Firehall	Robinson Subdivision	6704424	507749	784

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)
Unknown	?	No	?	?	?	?	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
Greater than 0.85m below ground	?	?	Unlikely	Slopes towards pit

**Table 1955-4: Potential Contaminant Sources
Building 1955 – Mount Lorne Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	180 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 26 m		
Septic fields	Biological and Inorganic parameters.	30 m	6704391	507729
Gas stations	Organic and Inorganic parameters.	>>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	N/A		
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan Martin
Luke LabelDate May 19, 2005

WELL ID #	Owner	Location Description
1965	YTG	Mount Lorne Firehall

1. Well Location and Potential Contaminant Sources

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

Robinson Subdivision

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

Mount Lorne Firehallc. GPS location: 507749 Easting 6704427 Northing 784m elevation $\pm$ 13md. Is there electric power? ☐ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
Mount Lorne Firehall☐ 5 or more delivery sites on a trucked distribution system? If so how many _____f. Nearest building, specify Mount Lorne Firehallg. Distance from well to building 4.5mh. If there is an effluent disposal field, is its location known? ☒ Yes ☐ Noi. Distance from well to nearest point of known field: ~30mj. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral123
180
240
283

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- k. 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

septic Tank ~ 30m away. Field begins ~ 2m after that

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

- m. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☐ No
solid waste dump 180m away

- n. 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
unfastened lid. No lock

Entrance by animals? ☐ Yes ☒ No
No evidence of animals. Access possible

- o. Is well site subject to flooding? ☒ Yes ☐ No
Extremely serious flooding well head is inaccessible due to sediment carried down by flooding

- p. Is the well site well drained? ☐ Yes ☒ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☒ No unlikely

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☐ Yes ☐ No Describe _____

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

Potential Source 1: Dump; Distance from well to Potential Source 1: 2180m refuse @ 123m

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ 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 _____ Material: ☐ steel ☐ plastic ☐ concrete
Unknown due to sediment and flood damage
- *g. Depth of well: _____ ☐ measured (if possible) ☐ reported ☐ from log
- *h. Static water level below ground: _____
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
Inside wood (puff exterior) and insulated pit.
☒ 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 > 85cm below grade, Inaccessible due to flood damage/sediment
- ii. Are there signs of ponding on the enclosure(e.g. water stains, etc.)? ☒ Yes ☐ No
Very very serious flood damage, sediment carried down by flooding enough to bury all piping and well head, then plywood insulation walls (non-pert). Evidence of water damage to insulation plywood interior
- iii. Is the wellhead enclosed by fiberglass insulations? ☒ Yes ☐ No
However, evidence that it is quite wet
- iv. Any evidence of rodents? Specify Unknown No evidence. May have been covered by flood damage
- v. Does the well casing have a proper seal cap? ☐ Yes ☐ No
unknown due to flood damage
- If no, describe condition _____

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...) _____

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

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
unknown due to flood damage

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
unknown

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

k. Is the pump and piping protected from freezing? ☐ Yes ☐ No
unknown due to flood damage

If yes, describe: _____

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: _____

Date May 31/05

WELL ID #	Owner	Location Description
<u>1955</u>	<u>VTG.</u>	<u>MOUNT LORENE FILLMAN</u>

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 _____

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: UPSTAIRS IN FIRE HALL

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?

2 x AG 1250 1250 Gallon EACH.

What material is the tank constructed of? FIBRE GLASS.

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 ABOVE TANK LID

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

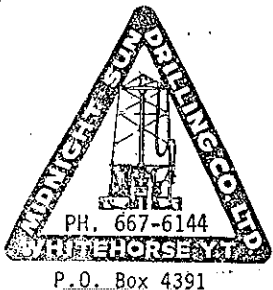
8. Conclusions

a. Comments on overall installation:

REASONABLY GOOD INSTALLATION.
TANK OVERFLOW IS ABOVE TANKS - TANKS
WILL OVERFLOW INTO BUILDING.

b. Recommendations:

INSTALL IN LINE COMMERCIAL FILTER
ON LINE FROM WELL PUMP. INSTALL
CHLORINATOR BETWEEN FILTER &
PRESSURE TANK.
LOWER OVERFLOW LINE TO TOP OF
TANK LEVEL, AND EXTEND OVERFLOW
LINE TO GROUND LEVEL. SCREEN
OVERFLOW PIPE



FIELD REPORT

W-1959

Started. Nov. 14... 1994

Completed. Nov. 18... 1994

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
Laywire Industrial Hampden	W/W	Fire Hall Robinson Subdiv.

FORMATION LOG			DESCRIPTION OF WORK	TIME			
FROM	TO	FORMATION		DATE	FROM	TO	HOURS
			MOVE				
			Loading	Nov. 14	8:00	9:00	1
			move on set up	"	9:00	11:30	2.5
2	7	silt		"	11:30	5:00	5.5
7	10	Gr. sand.					
0	22	fine sand					
2	46	fine sand some Gr.					
6	71	Gr. sand					
1	97	Gr. silt sand					
7	114	Gr. sand some silt					
			crew travel	"	5:00	6:00	1
			crew travel	Nov. 15	8:00	9:00	1
			set screen	"	9:00	10:30	1.5
			Develop	"	10:30	1:00	2.5
			move off to shop	"	1:00	2:30	1.5

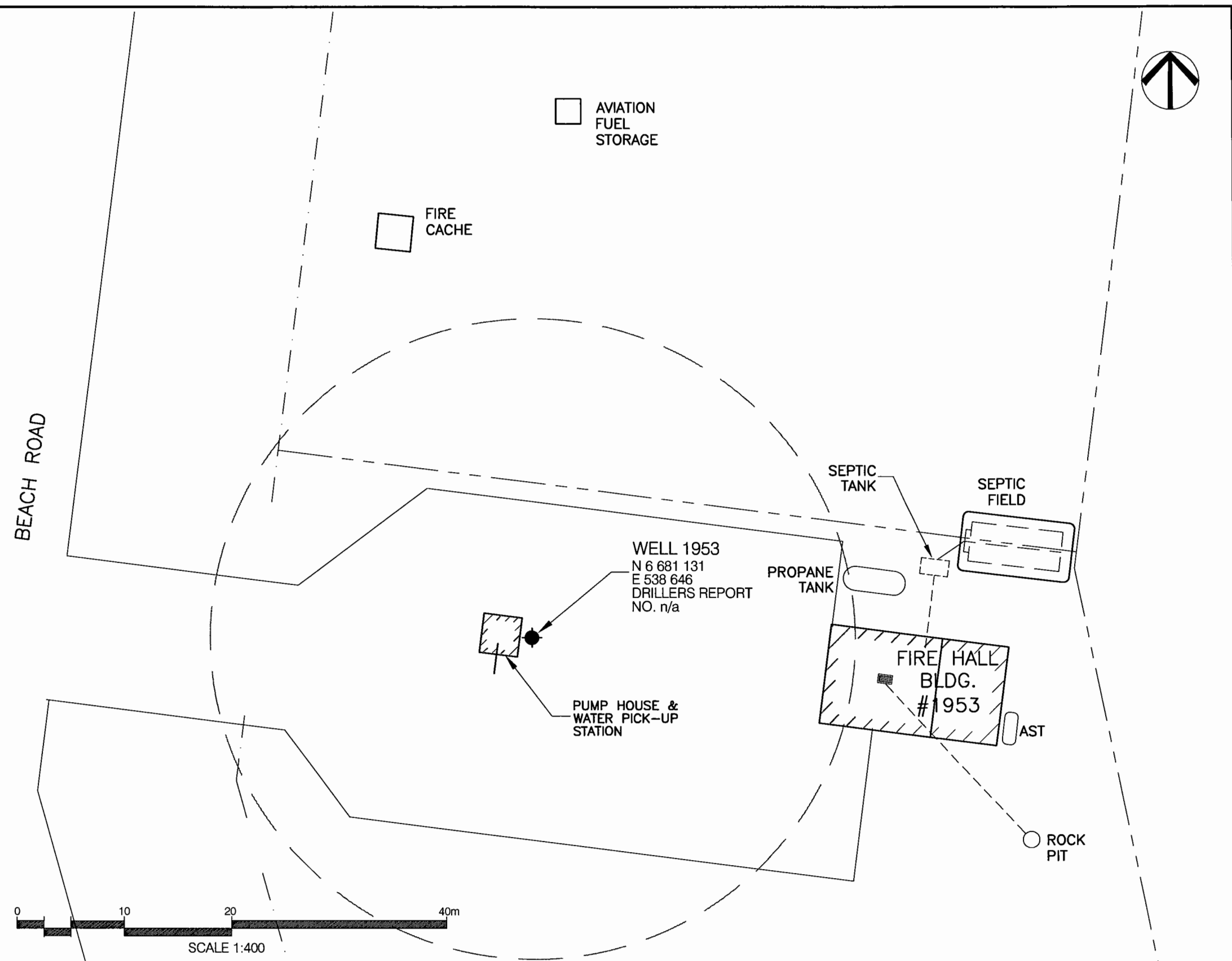
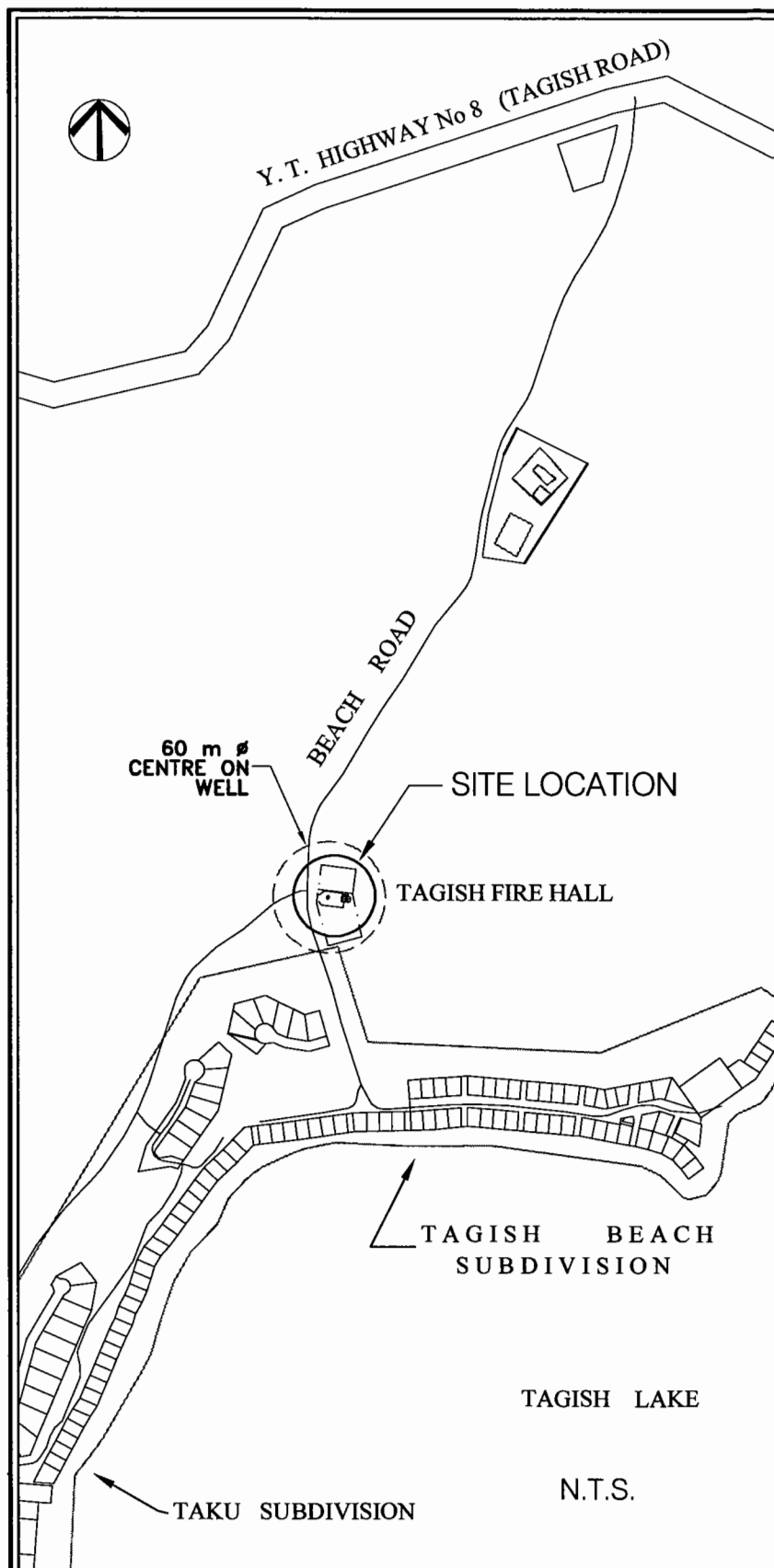
rd. of Casing & Pipe				Remarks:
Size	Type	Size	Type	
2	Inch	Feet	Inch	1- drive shoe
				20 slot screen
2				2' riser K Packer
				5 7/8" bit pin

SIGNATURES

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

**Photo 0192:** 1955 Well Head Enclosure**Photo 0191:** 1955 Well Head**Photo 0193:** 1955 180 Meters to Landfill Site**Photo 0194:** 1955 Septic Field

**Photo 0018:** 1955 Hot Water Tank (left) and Pressure Tank (right)**Photo 0021:** 1955 Water Storage Tanks**Photo 0020:** 1955 Fill Control**Photo 0022:** 1955 Storage Tank Piping



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.

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



EBA Engineering Consultants Ltd.

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

CLIENT:



Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION

GOVERNMENT OF YUKON
HIGHWAYS & PUBLIC WORKS

TAGISH FIRE HALL
BUILDING 1953
SITE LOCATION DIAGRAM
WELL ID: 1953

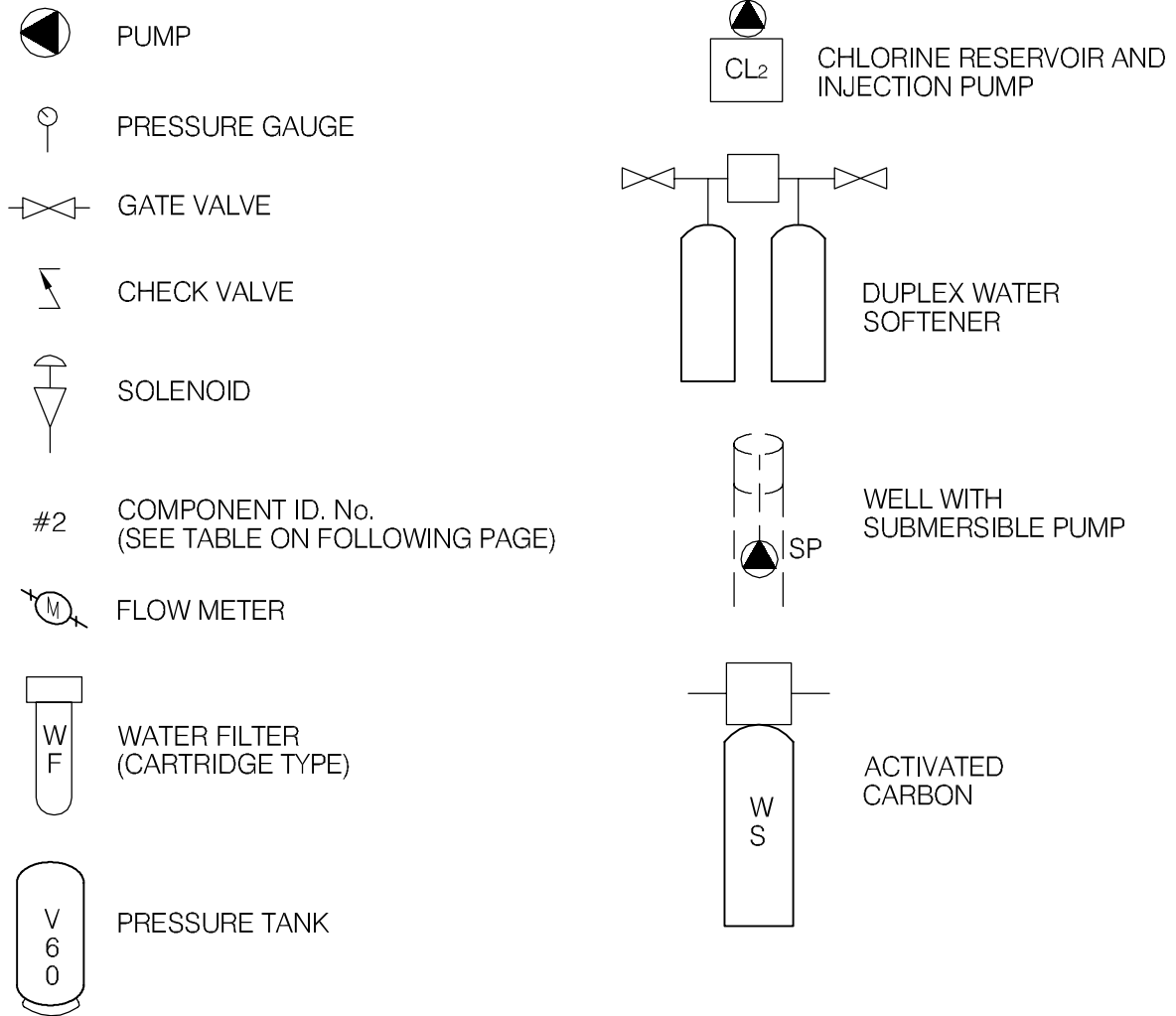
REVISION ISSUE

0

DRAWING No.

FIGURE 1953A

LEGEND



EBA Engineering Consultants Ltd.

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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

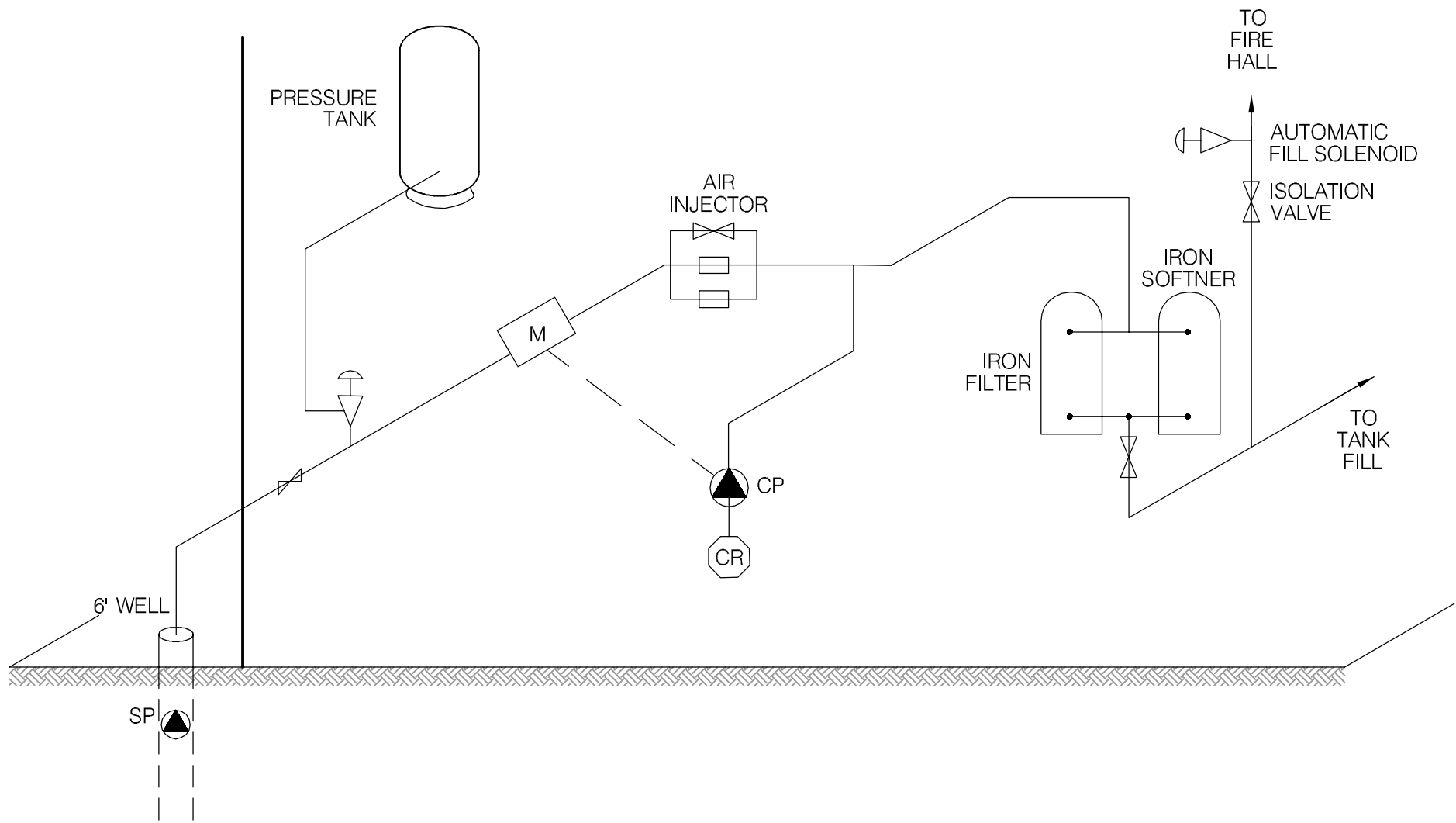
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1953
TAGISH FIRE HALL

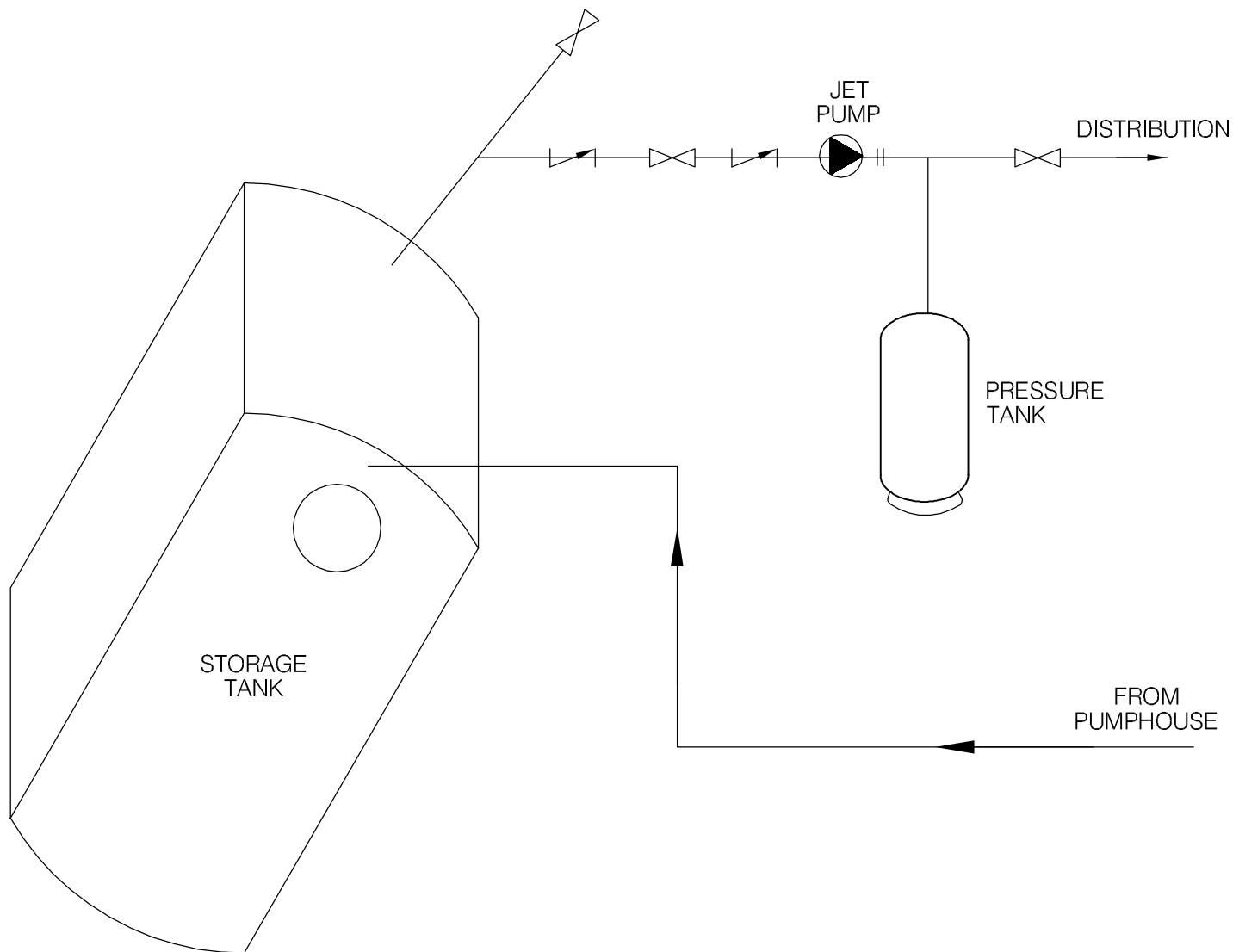
DATE APRIL 2006

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FILE NO. 1260002.001

DWG.: FIGURE 1953B



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DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1953C

Whitehorse Region – Tagish Firehall
Building # 1953

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUBMERSIBLE	RED JACKET	8 FC (175530 ^{GF} 1996.)			3 HP 2"
2	PRESSURE CONTROL	RED JACKET	HYDROSWANT			2"
3	Flow Meter Pulsar	LMI	RFP-020			2"
4	CHLORINE INJECTION	GRUNDFOSS	DME 8-10	96472847		
5	IRON FILTERS	WATERTECH	BTW-30 DUPLEX ~~REF 30T2~~			TANK 30x72 RING 1 1/2"
6	WATER METER	NEPTUNO	2" TRIDENT 10			2" FLANGED.
7	PRESSURE TANK	AMTROL	WX-30R			
8	SOL. FILL VALVE	KECO	2" BRONZE			2" FIPT
9	PRESS CONTROL	WATTS	U5BLP.			1/2" FIPT
10	AIR CHARGER	WATERTECH	30" DUPLEX			2x1" HYDRO CHARGER

TABLE 1953 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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
Building #	Building Name						
1953	Tagish Firehall (Fill Station)	9	Sept-04 to Mar-05	no	0/9	no	2-Mar-05

Table 1953-2: Water Quality Results

SOURCE:	Building 1953 - Tagish Firehall (Fill Station)			GCDWQ Criteria		
Location/ Resident	Tagish					
Address						
Treatment	Chlorination					
Source of Water	On-Site Well					
Purpose of Sampling	Baseline	Baseline	Additional Sampling			
Sample Location			Kitchen Tap			
Date Sampled	15-Jun-04	4-Oct-04	9-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)				AO	MAC	AO
Colour (CU)	<5.0	<3				15
Conductivity (uS/cm)	533	335				
Total Dissolved Solids	309	242				500
Hardness CaCO3	263	228		AO >200 = poor, > 500 unacceptable ^A		
pH	8.23	8.1		6.5		8.5
Turbidity (NTU)	0.69	0.3			1	5
Dissolved Anions (ALS)						
Alkalinity-Total CaCO3	280	217				
Chloride Cl	3.36	1				250
Fluoride F	0.167	0.17			1.5	
Sulphate SO4	23.8	24.6				500
Nitrate Nitrogen N	<0.10	<0.1			10	
Nitrite Nitrogen N	<0.10	<0.05			1	
Total Metals (ALS)						
Aluminum T-Al	<0.010	<0.02				
Antimony T-Sb	<0.00050	0.0007			0.006	
Arsenic T-As	0.0017	0.0006			0.025	
Barium T-Ba	0.071	0.0646			1	
Boron T-B	<0.10	<0.02			5	
Cadmium T-Cd	<0.00020	<0.0002			0.005	
Calcium T-Ca	72.1	51.2				
Chromium T-Cr	<0.0020	<0.0008			0.05	
Copper T-Cu	<0.010	0.024			1	
Iron T-Fe	0.637	0.016				0.3
Lead T-Pb	<0.0010	0.0011			0.01	
Magnesium T-Mg	20.2	21.8				
Manganese T-Mn	0.0218	0.003				0.05
Mercury T-Hg	<0.00020	<0.0002			0.001	
Potassium T-K	2.69	2.6				
Selenium T-Se	<0.0010	<0.0004			0.01	
Sodium T-Na	8.5	7				200
Uranium T-U	0.00646	0.0065			0.02	
Zinc T-Zn	0.141	0.02				5
Trihalomethanes						
Bromodichloromethane			0.0023			
Bromoform			<0.0010			
Chloroform			0.0054			
Dibromochloromethane			<0.0010			
Total Trihalomethanes			0.0078		0.1	
Haloacetic Acids						
Bromoacetic Acid			<0.0020			
Bromochloroacetic Acid			<0.0020			
Chloroacetic Acid			<0.020			
Dibromoacetic Acid			<0.0020			
Dichloroacetic Acid			0.002			
Trichloroacetic Acid (TCA)			<0.0020			
Field Chemistry (EBA)						
pH			7.73	6.5		8.5
TDS			440			500
EC (uS/cm)			480			
Temperature						
Free Available Chlorine			0.02			250

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1953-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1953	Tagish Firehall	Tagish	6681131	538646	670

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	1990	Yes	48.8	Silt and Clay - 0m to 43m	?	3hp submersible pump Size of pump meets needs	7.8

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.20 above grade	Split Cap Gasket	Yes 0.9m	Unlikely	No, but slopes away from pit

**Table 1953-4: Potential Contaminant Sources:
Building 1953 – Tagish Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	Approximately 800 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	36 m		
Septic fields	Biological and Inorganic parameters.	40 m		
Gas stations	Organic and Inorganic parameters.	>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	N/A	6681117	538692
Aviation Fuel Drums	Organic parameters	48 m	6621185	538644
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

SMALL PUBLIC WATER SYSTEM ASSESSMENT**PART A: EBA Site Inspection**Inspector: Ryan MartinDate May 9, 2005Luke Lebel

WELL ID #	Owner	Location Description
1953	YTG	Tangish Fire Hall

1. Well Location and Potential Contaminant Sources

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

Taku Subdivision, Tangish

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

c. GPS location: 0538646 Easting ; 6681131 Northing 670m elevation
accuracy $\pm 8m$ d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____☒ 5 or more delivery sites on a trucked distribution system? If so how many _____?f. Nearest building, specify 1.7m to pump house.
27 m to fire hall garage

g. Distance from well to building _____

h. If there is an effluent disposal field, is its location known? ☒ Yes ☐ Noi. Distance from well to nearest point of known field: 40 m to tank, i start field.j. Well location relative to field: ☐ upslope ☐ downslope ☒ lateral

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Septic N-0538683 E 6681145 ELEV 670

k. 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

rock pit on west side bldg, septic system on east side bldg
(53m) (40m)

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

m. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No
cemetery is at start of road

n. 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
Buildings, well head all lockable Evidence of mice in well enclosure

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

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

q. Is there a buried fuel tank on the property? ☐ Yes ☐ No No evidence of UST

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: fire equip. cache; Distance from well to Potential Source 1: 30m

Potential Source 2: Av. gas; Distance from well to Potential Source 2: 48m

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

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information:

- a. When was well installed? Year 1990 Month July
- 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: 160 ft ☐ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: 25 ft at time of drilling
☐ 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 N/A
- k. If there is a well screen: length 3' slot size(s) 20 slot
Location of screen: from 157' to 160' 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 _____
- 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 Above grade - (0.2 m)
- 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 - styrofoam SM.
- iv. Any evidence of rodents? Specify Yes, mouse droppings.
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition SPLIT GASKET CAP -
NOTE MOUSE DROPPINGS ON TOP
OF CAP

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...) 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

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
→ IN WELL PUMPHOUSE

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: INSULATED & HEAT TRACE

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

- well enclosure accessible to rodents

b. Recommendations: _____
- design enclosure that is mouse proof
- consider raising casing slightly

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PART B: EBA Site Inspection

Inspector: _____

Date: _____

WELL ID #	Owner	Location Description
1953	VTG	TACISIT FIREHALL

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 PROPORTIONAL CHLORINE FEED (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 ☐ 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: FIREHALL

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: OVERFLOW NOT PRACTICAL

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Overall Tank

What are the tank size and dimensions?

AG 1500 OVAL TANK.

What material is the tank constructed of? FIBRE GLASS

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: SLIGHT

Is there any sediment or scum in bottom of tank? YES ☐ NO

Comments: SOME RUST SEDIMENT

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 OF GOOD QUALITY
& WORKMANSHIP.

b. Recommendations:

MOVE SOLENOID CONTROL VALVE FOR FIRE
WATER STORAGE FROM PUMP HOUSE TO
VICINITY OF TANK. PUMP DOMESTIC
WATER TAKE OFF UPSTREAM OF SOLENOID
VALVE. THIS WILL FEED TREATED,
CHLORINATED WATER TO THE JET PUMP,
SUPPLYING POTABLE WATER TO THE
BUILDING.

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PART C: Property Manager/ System Operator Questionnaire

Inspector: TERRY JACKSON Date APRIL 9/05
Property manager: Y.T.G.

1) Water Source:

- a. Is the well water the major source of drinking water? ☒ Yes ☐ No
b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year 1990 Month _____
b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
c. Is there a driller's log for the well?: ☒ Yes ☐ No
d. Do you know the depth of your well? If so, please indicate: 160' galvanized pipe
e. Who was the well constructed by?
Indicate contractor's name: Midnight sun Drilling
f. Are you, the owner ☒ Yes or other: Y.T.G.
g. Who maintains the well? Community Services Y.T.G.
h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
i. Is there a buried fuel tank on the property? ☐ Yes ☒ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? Midnight sun 1990
b. What type of pump do you have? 3 h.p. Red Jacket.
c. Pump delivers water to: ☒ pressure tank ☒ elevated tank ☐ other _____

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4) Water Treatment

a. Is your well water treated? ☒ Yes ☐ No

Type of treatment: ☒ chlorination ☒ iron and or manganese removal
other _____

5) Well Capacity:

a. Well capacity: User's opinion ☒ adequate ☐ inadequate

b. Are there any times of year when your well goes dry, or does not produce enough water?

c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

a. In general, do you like your water?: ☒ yes ☐ no

b. Does the water stain household plumbing? ☐ yes ☒ No ☒ slight ☐ severe

Type of stain: ☐ brown ☐ red ☐ black

c. Does the water contain sediment? ☐ Yes ☒ No ☐ occasional ☐ constant

d. Is there an unpleasant odour? ☐ Yes ☒ No

☐ Sulphur (rotten egg smell) ☐ Other _____

e. Is there an unpleasant taste? ☐ Yes ☒ No ☐ brackish ☐ Other _____

f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☒ no

g. Is water softener being used? ☐ Yes ☒ No

h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☐ No

If so, at what time intervals? 2 weeks

Who takes them? Community Services

i. Is there a history of bad bacterial analyses? ☐ Yes ☒ No

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

7) Do you have any overall comments or complaints about your water well system?

The tank that feeds the water truck tank should be cleaned
The piping should be changed, that feeds the domestic
water to the fireball 11/11



Field Report

PH. 633-3070 TELEX 036-8496
P.O. BOX 4391
WHITEHORSE, YUKON

Started July 30...1990

Completed July 31...1990

NAME AND ADDRESS OF CLIENT	DESCRIPTION OF WORK	LOCATION OF WORK
2000. TRANSPORTATION	W / W	Taku subdiv.
302 2703		Tagish.
✓ WHITEHORSE YUKON	90-1A-27	

FORMATION LOG			DESCRIPTION OF WORK	TIME			
FROM	TO	FORMATION		DATE	FROM	TO	HOURS
			MOVE				
			Loading	July 30	8:00	9:30	1.5
			crew Travel	"	9:30	11:00	1.5
			change over	"	11:00	1:00	2.
0	18	silt	fine sand.	"	1:00	7:00	6
8	120	silt	clay				
			crew Travel	"	7:00	8:00	1
			Loading	July 31	8:00	8:30	0.5
			crew Travel	"	8:30	10:00	1.5
20	192	silt	clay	"	10:00	1:30	3.5
22	197	fine	sand				
17	158	G.v.	sand				
8	160	sand	same silt				
			set screen	"	1:30	2:20	1
			Develop	"	2:30	4:30	2.
			Trip out move off.	"	4:30	5:30	1
			move Rig to well	"	5:30	7:00	1.5
			check crew to shop				

d. of Casing & Pipe

Size Type Size Type

6				1- olex shoe	SCREEN SUR 160 BOS
feet	Inch	Feet	Inch	5 7/8" bit pin	
157				20 slot	
				K Packer	
				30 GPM	

			Static Level	Total Rig Time	hrs.
			Ground Level 25'	Total Standby	hrs.
			Top Of Casing	Drilling Mud	sacks

SIGNATURES

MIDNIGHT SUN.....

CLIENT.....

TITLE.....

TITLE.....



Photo 0062: 1953 Well Enclosure (right) and Pumphouse



Photo 0059: 1953 Well Head



Photo 0061: 1953 45 gal. Aviation Fuel Drums (front), Pumphouse (back right), and Firehall (back left)



Photo 0060: 1953 Fire Equipment Cache (front), Pumphouse (back left)

**Photo 0063:** 1953 Fill Station**Photo 0067:** 1953 Pipe Hangar – Potential Location for Solenoid**Photo 0068:** 1953 Water Supply System, Pressure Tank (left), Iron Removal Tanks (right)**Photo 0066:** 1953 Firehall 1250gal Water Storage Tank

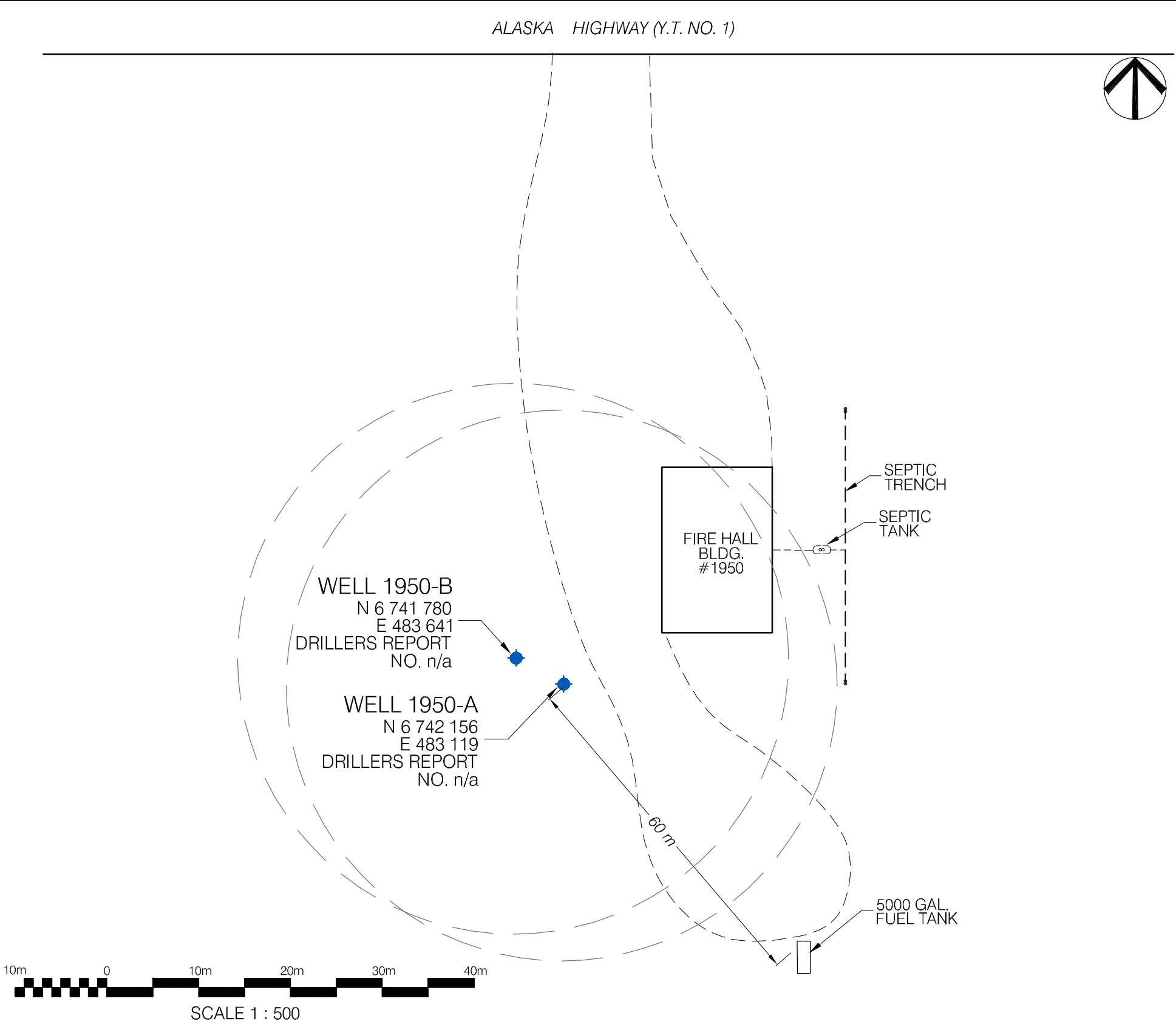
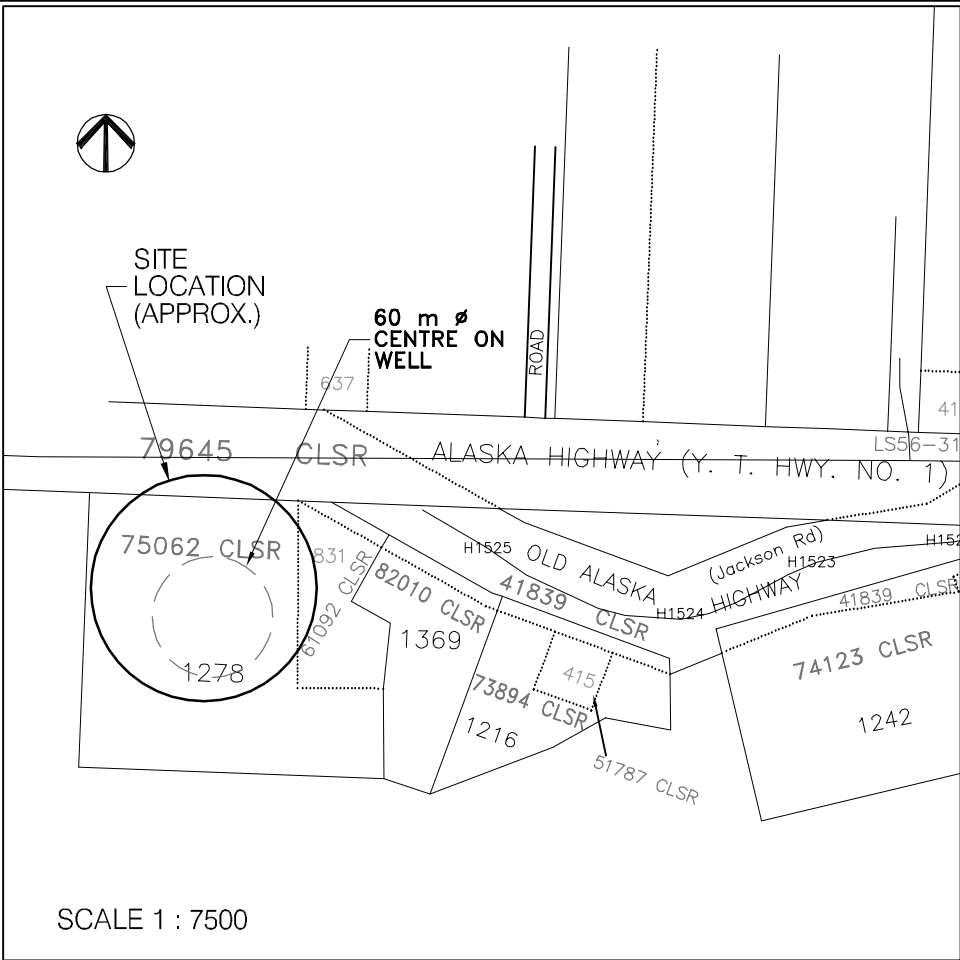


Photo 0069: 1953 Grundfos DME Chlorinator

Photo 0070: 1953 Pumphouse Iron Duplex Injection Chlorine System



Z:\0201Drawings\S\Klondike-Haines Junction Hwy\1260008 Ibox Valley Fire Hall Water Well\1260008 Ibox Overall Plan.dwg, 4/11/2006 8:40:46 AM, Adobe PDF, jbuyck



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

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

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

**EBA Engineering Consultants Ltd.**

DESIGNED BY:
DRAWN BY:
DATE:
SCALE:
PROJECT No.:
ACAD FILENAME: 001-WHITEHORSE REGION

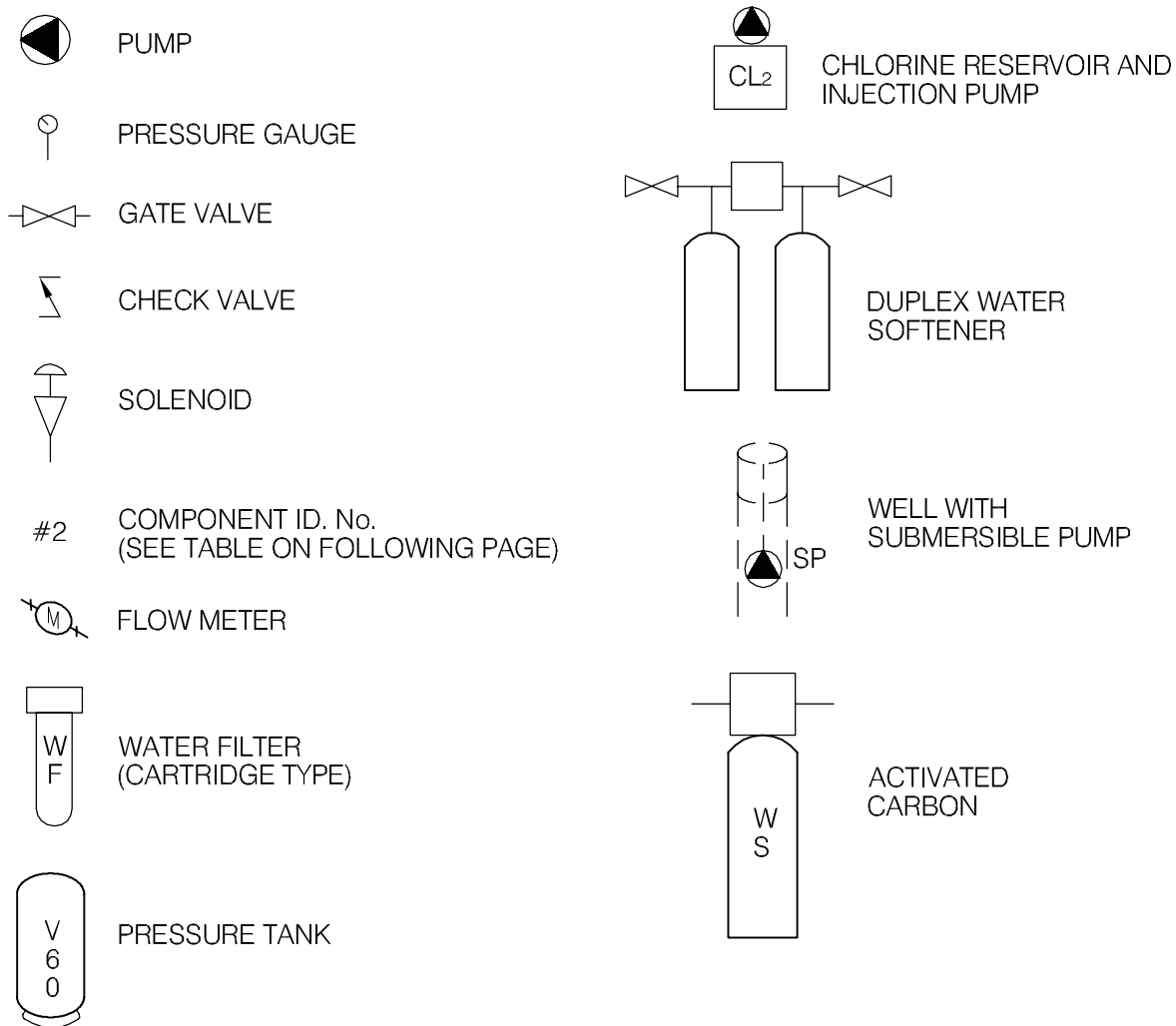
R. MARTIN
J. BUYCK
JUNE 2005
AS SHOWN
1260002.001

CLIENT:

**Yukon**
Highways and Public Works
Property Management Branch

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
IBEX FIRE HALL BUILDING 1950 SITE LOCATION DIAGRAM WELL ID: 1950	REVISION ISSUE 0 DRAWING No. FIGURE 1

LEGEND



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

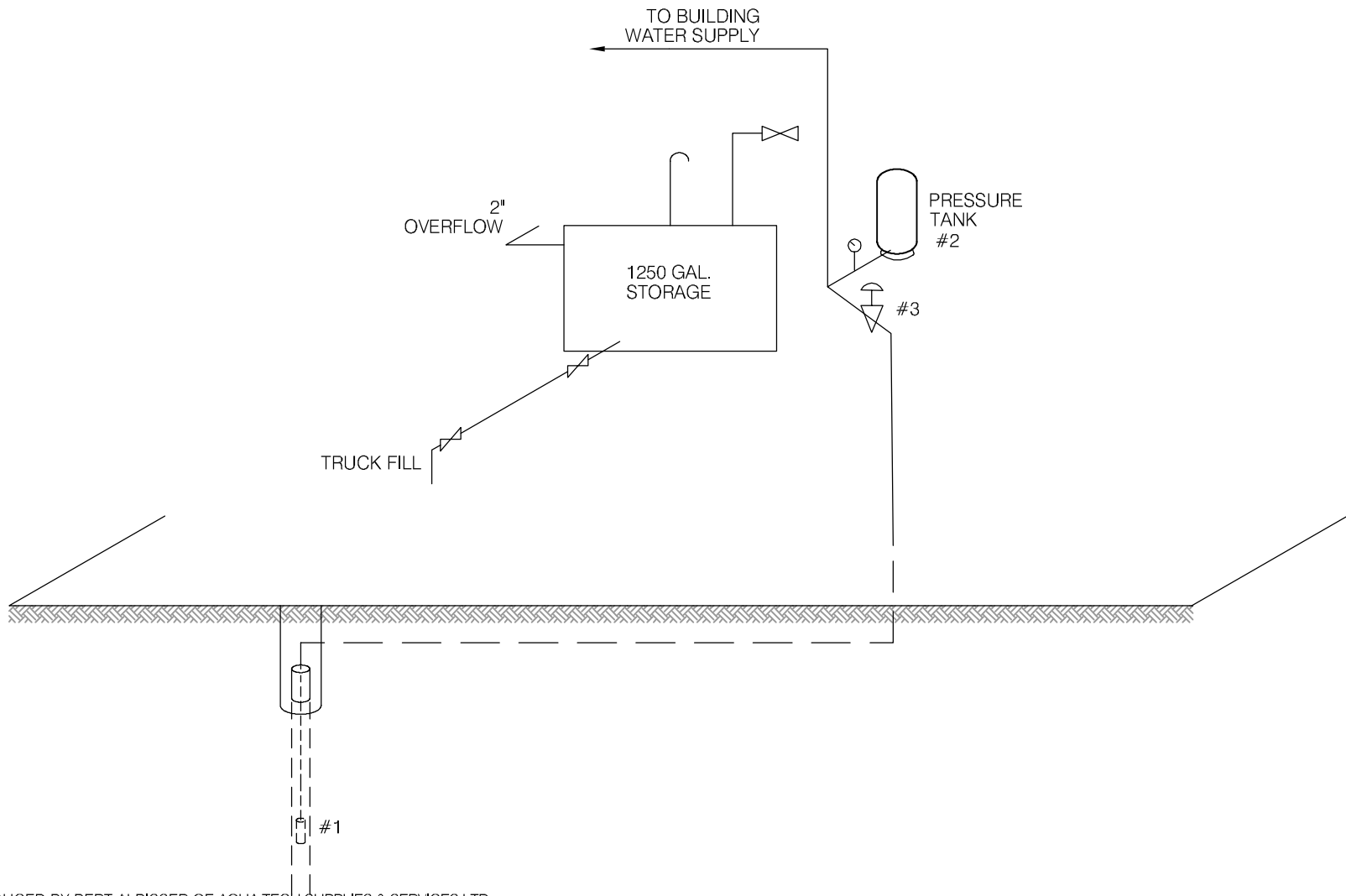
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



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Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1950
IBEX FIRE HALL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1950B

Whitehorse Region – Ibx Firehall
Building # 1950

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUB. PUMP	GOULDS				4" x 1/2 HP.
2	PRESSURE TANK	AQUA AIR	V140		A33	1 1/4 NPT.
3	SOLenoid Fill VALVE	~~ASSO~~ RAINBIRD	DV100			1" - 24V
4	FLOAT CONTROL	SJE	Pump-up			
5	PUMP TECH	FRANKLIN	PT58000			1/2 - 1 1/2 HP.
6						
7						
8						
9						
10						

TABLE 1950 - 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?
1950	Ibex Firehall	9	Sept-04 to Feb-06	yes	2/18	no	28-Feb-06	no



Table 1950-2: Water Quality Results

SOURCE:	Building 1950 - Ibex Valley Firehall		GCDWQ Criteria		
Location/ Resident	Ibex Valley				
Address					
Treatment	No				
Source of Water	On-Site Well				
Purpose of Sampling	Baseline	Additional Sampling			
Sample Location	Washroom Tap	Kitchen Tap			
Date Sampled	5-Oct-04	10-May-05	Lower Limit	Upper Limit	
Physical Tests (ALS)			AO	MAC	AO
Colour (CU)	5	<5.0			15
Conductivity (uS/cm)	512	847			
Total Dissolved Solids	304	579			500
Hardness CaCO3	265	392	AO >200 = poor, > 500 unacceptable ^A		
pH	7.8	8.21	6.5		8.5
Turbidity (NTU)	0.5	4.92		1	5
UV Absorbance		<0.0010			
Dissolved Anions (ALS)					
Alkalinity-Total CaCO3	190	230			
Chloride Cl	52	1.67			250
Fluoride F	0.23	1.05		1.5	
Sulphate SO4	23	109			500
Nitrate Nitrogen N	1.5	<0.10		10	
Nitrite Nitrogen N	<0.05	<0.10		1	
Ammonia Nitrogen N		0.075			
Total Metals (ALS)					
Aluminum T-Al	<0.02	<0.020			
Antimony T-Sb	0.0008	<0.0010		0.006	
Arsenic T-As	0.0037	0.00384		0.025	
Barium T-Ba	0.0928	0.13		1	
Boron T-B	<0.02	<0.20		5	
Cadmium T-Cd	<0.0002	<0.00040		0.005	
Calcium T-Ca	74.2	115			
Chromium T-Cr	0.0014	<0.0040		0.05	
Copper T-Cu	0.344	0.295		1	
Iron T-Fe	0.064	0.852			0.3
Lead T-Pb	0.0013	0.0041		0.01	
Magnesium T-Mg	17.7	25.4			
Manganese T-Mn	0.006	0.038			0.05
Mercury T-Hg	<0.0002	<0.00020		0.001	
Potassium T-K	1.6	1.75			
Selenium T-Se	0.0006	<0.0020		0.01	
Sodium T-Na	13	27.7			200
Uranium T-U	0.0058	0.00869		0.02	
Zinc T-Zn	0.04	<0.10			5
Field Chemistry (EBA)					
pH		7.50	6.5		8.5
TDS		393			500
EC (uS/cm)		773			
Temperature		12.8			

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1950-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1950	Ibex Fire Hall	Ibex Valley	6742155	483119	736

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	?	No	11.830	Unlikely, shallow well	?	1/2hp submersible pump Size of pump meets needs	8.605

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
1.75 below grade	Split Cap Gasket	Yes 0.2m	Unlikely	No, but slopes away from pit

**Table 1950-4: Potential Contaminant Sources
Building 1950 – Ibex Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 28 m	6742163	483152
Septic fields	Biological and Inorganic parameters.	30 m		
Fire fighting equipment fueling station	Organic and Inorganic parameters.	70 m	6742117	483168
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	>60 m	6742117	483168
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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* No well Log

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 10, 2005

WELL ID #	Owner	Location Description
1950	YTG	Ibex Valley Fire Hall

1. Well Location and Potential Contaminant Sources

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

Ibex Valley

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

Ibex Valley Fire Hall, Alaska Highway

c. GPS location: 483119 Easting; 6742155 Northing; 763m elevation; ±10m

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many Supplies the Fire Hall however, there is an outside hose bib that the public sometimes uses

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

f. Nearest building, specify Ibex Valley Fire Hall

g. Distance from well to building 11.6m

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

i. Distance from well to nearest point of known field: ~30m

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

0483152 Easting
6742163 Northing ± 5m
757m elevation

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- k. 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

The septic tank/effluent field is down the likely water-level gradient from the well

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

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

- n. 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

Only an unlocked, screwed on piece of port plywood is present

Entrance by animals? ☐ Yes ☒ No

Mouse droppings and cobwebs present

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

It is, however, underground in only a plywood enclosure, and since it is relatively new, evidence may not be present as of yet

- p. Is the well site well drained? ☒ Yes ☐ No

- q. Is there a buried fuel tank on the property? ☐ Yes ☐ No

No evidence observed

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

48368
674217
753m (16m) ← Potential Source 1: AST; Distance from well to Potential Source 1: >60m

Potential Source 2: _____; Distance from well to Potential Source 2: _____

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

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

- s. Are there other wells on this property? ☐ Yes ☐ No

No evidence observed

How many? _____ ☐ in use ☐ abandoned ☐ 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 _____
most likely
- *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 120 x 120 cm square ☐ No
- f. Well casing: Diameter 15 cm Material: ☐ steel ☒ plastic ☐ concrete
one piece plastic expansion cap
- g. Depth of well: 10.080 m ☒ measured (if possible) ☐ reported ☐ from log
below casing
- h. Static water level below ground: 8.605 m below casing
☒ measured (if possible) ☐ reported ☐ from log ☐ flowing
**Two capfulls of chlorine were added to the well after the measurements were taken*
- i. (If granular) Is the well completed: ☐ open end casing ☒ with a well screen
likely
☐ 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 0.38 m slot size(s) unknown
Location of screen: from 9.70 m to 10.08 m ☐ from log ☐ reported
bc bc measured
- l. Is there a sump below the screen? ☐ Yes ☐ No *unlikely*
- m. Is the well head: ☐ in pumphouse ☒ in pit ☐ pitless adaptor ☐ in a building
An insulated pit w/pwf exterior casing (plywood and 2x6 studs)
☒ 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 The well head is 1.75m 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 There is a little amount of mouse droppings in the upper section
- v. Does the well casing have a proper seal cap? ☐ Yes ☒ No

If no, describe condition Although there is a ^{plastic} cap, there are open holes for the heat trace and power lines to go down

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...) _____

4. Aquifer Supplying This Well:

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

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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e. For submersible pump, depth of setting below surface 9.70 m bc

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

i. Is there provision for taking water samples before water reaches storage? ☐ Yes ☐ No
Not easily - tap just above floor level @ pressure tank

k. Is the pump and piping protected from freezing? ☒ Yes ☐ No
There is insulation, an insulated compartment, heat trace, and a
If yes, describe: heater present.

1. Comments on pump installation: _____

a. Comments on overall installation:

Well in pit, well may be shallow

b. Recommendations: 1. The company should
2. The company should
3. The company should
4. The company should
5. The company should

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PART B: EBA Site Inspection

Inspector: Bert Allessen

Date _____

WELL ID #	Owner	Location Description
1950	VTG	IBEX FIREHAU

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 _____

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: FIRE HALL UPPER FLOOR.

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?

AG 1250

What material is the tank constructed of? FIBRE GLASS

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:

THE BASIC INSTALLATION IS GOOD. THE
TANK NEEDS TO BE CLEANED.

b. Recommendations:

WELL CASING TO BE EXTENDED ABOVE GROUND
LEVEL & SURFACE SEAL INSTALLED. INSTALL
PROPORTIONAL CHLORINATOR AND SURFACE RETENTION
TANK. POTABLE WATER IS TAKEN OFF BEFORE
FIRE STORAGE TANK.



Photo 0100: 1950 Well-Enclosure – Pit (front), Ibex Valley Firehall (back)



Photo 0099: 1950 Wellhead



Photo 0101: 1950 Well (front), Skating Rink and Above Ground Oil Storage Tank (back)



Photo 0102: 1950 Septic Field



Photo 0104: 1950 Outside Water Tap Accessable to Public for Water Pickup



Photo 0106: 1950 Pressure Tank

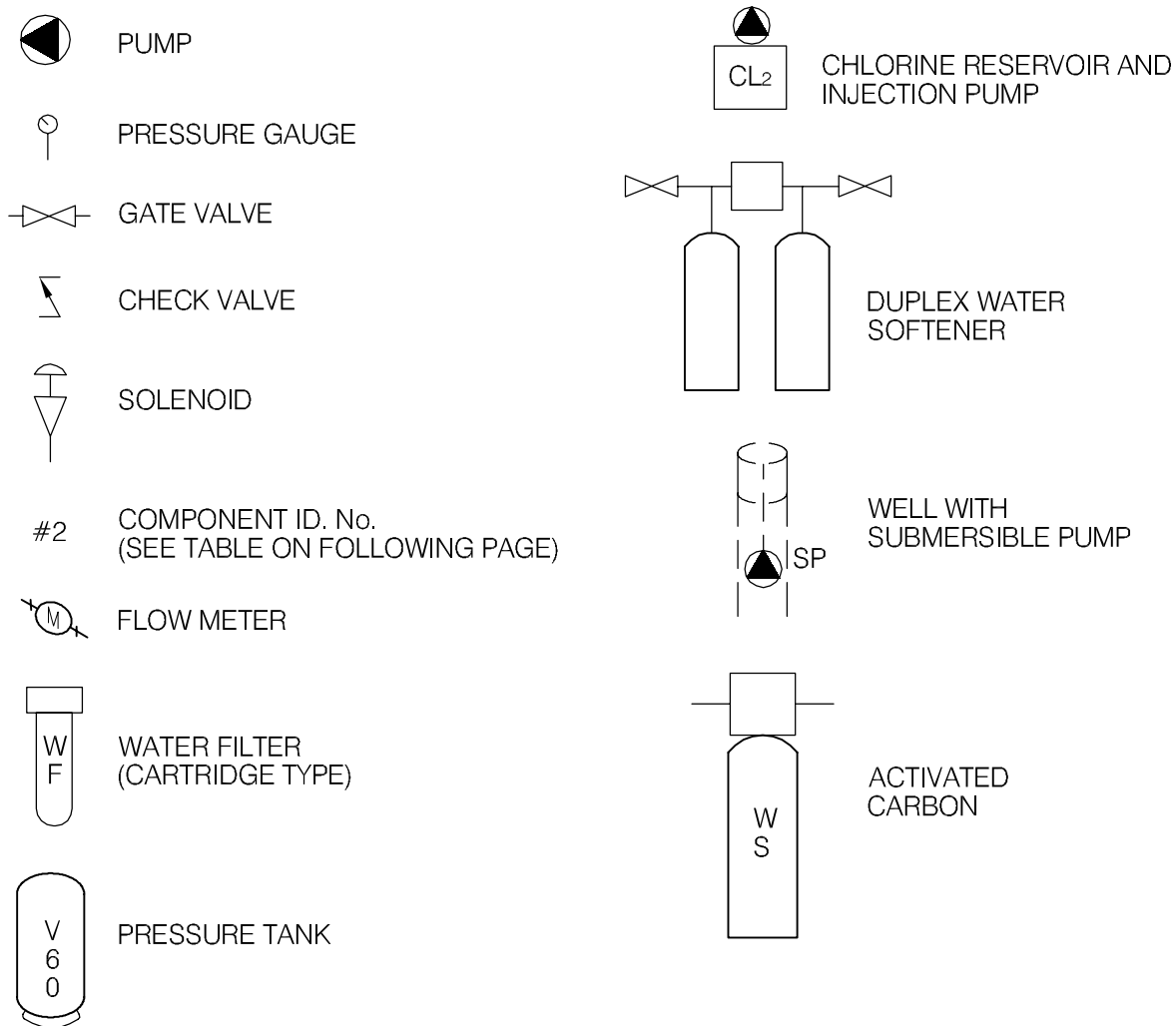


Photo 0107: 1950 Solenoid and Water Storage Tank



Photo 0105: 1950 Scum on Surface of Well Water Storage Tank

LEGEND



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

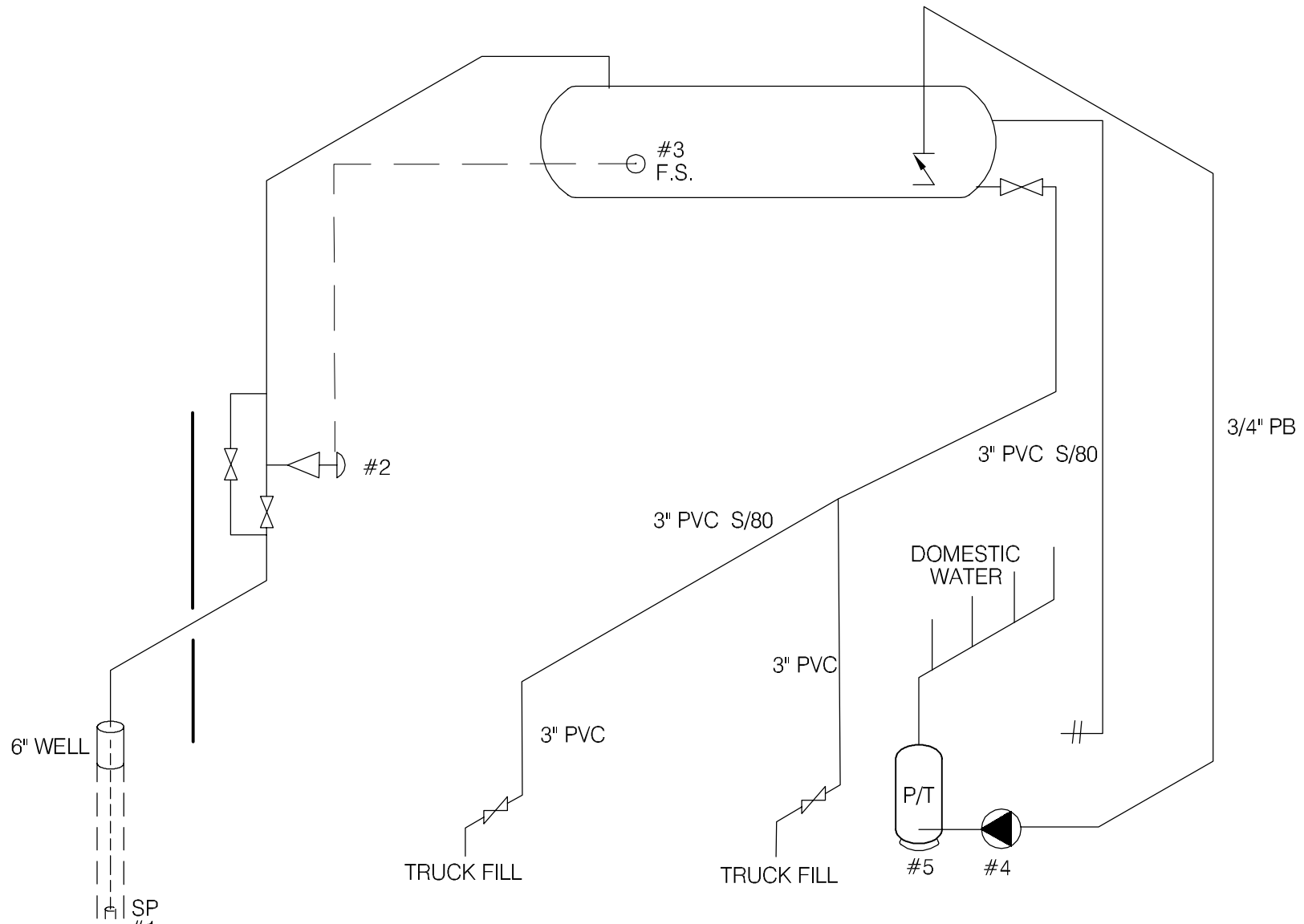
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT

Yukon
Highways and Public Works
Property Management Branch

PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1924
GOLDEN HORN FIRE HALL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1924B

**Whitehorse Region – Golden Horn Firehall
Building # 1924**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	4" SUB. PUMP	JACUZZI	35459P-52/c			4" x 1"
2	PUMP CONTROL VALVE	ASCO	8210G100		474225	2" FIPT
3	FLOAT CONTROL.	N/A	N/A			
4	DOMESTIC PUMP	S/R	SPLC-Z		10935	1/2 HP.
5	PRESSURE TANK	FUXCON	JR255'			8.5 GAL
6	F.G. TANK.	N/A	N/A.			36" x 72 x 102"
7						
8						
9						
10						

TABLE 1924 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1924	Golden Horn Firehall	6	Sept-04 to Mar-05	no	0/6	no	2-Feb-05	no



Table 1924-2: Water Quality Results

SOURCE: Building 1924 - Golden Horn Firehall		GCDWQ Criteria							
Location/ Resident							Golden Horn		
Address							Lot 189		
Treatment							No		
Source of Water							On-Site Well		
Purpose of Sampling		Baseline	Additional Sampling						
Sample Location									
Date Sampled		4-Oct-04	10-May-05	25-Jun-06	Lower Limit	Upper Limit			
Physical Tests (ALS)					AO	MAC	AO		
Colour (CU)		5		<5			15		
Conductivity (uS/cm)		567		640					
Total Dissolved Solids		389		412			500		
Hardness CaCO3		348		337	AO >200 = poor, > 500 unacceptable ^A				
pH		8.3		8.17	6.5		8.5		
Turbidity (NTU)		0.25		1.21		1	5		
UV Absorbance			<0.0010						
Dissolved Anions (ALS)									
Alkalinity-Total CaCO3		271		294					
Chloride Cl		2		1.27			250		
Fluoride F		0.47		0.406		1.5			
Sulphate SO4		98.5		101			500		
Nitrate Nitrogen N		0.1		0.11		10			
Nitrite Nitrogen N		<0.05		<0.10		1			
Ammonia Nitrogen N			-						
Total Metals (ALS)									
Aluminum T-Al		<0.02		<0.010					
Antimony T-Sb		0.0007		<0.0005		0.006			
Arsenic T-As		0.0345	0.0207	0.0290		0.025			
Barium T-Ba		0.0169		<0.020		1			
Boron T-B		0.04		<0.10		5			
Cadmium T-Cd		<0.0002		<0.0002		0.005			
Calcium T-Ca		45.9		49.1					
Chromium T-Cr		0.0016		<0.0020		0.05			
Copper T-Cu		0.04		0.0311		1			
Iron T-Fe		0.007		0.142			0.3		
Lead T-Pb		0.0013		0.0014		0.01			
Magnesium T-Mg		46.6		52.2					
Manganese T-Mn		0.005		0.036			0.05		
Mercury T-Hg		<0.0002		<0.0002		0.001			
Potassium T-K		3		2.93					
Selenium T-Se		<0.0004		<0.0010		0.01			
Sodium T-Na		17		18.6			200		
Uranium T-U		0.0024		0.00210		0.02			
Zinc T-Zn		0.066		<0.10			5		
Trihalomethanes									
Bromodichloromethane			-						
Bromoform			-						
Chloroform			-						
Dibromochloromethane			-						
Total Trihalomethanes			-			0.1			
Haloacetic Acids									
Bromoacetic Acid			-						
Bromochloroacetic Acid			-						
Chloroacetic Acid			-						
Dibromoacetic Acid			-						
Dichloroacetic Acid			-						
Trichloroacetic Acid (TCA)			-						
Field Chemistry (EBA)									
pH					6.5		8.5		
TDS							500		
EC (uS/cm)									
Temperature									
Free Available Chlorine									

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1924-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS**

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1924	Golden Horn Fire Hall	Golden Horn	6718089	506919	738

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	?	Yes	32.9	Silt and Clay - 4m to 29m Bedrock - 30m to 33m	?	Complaints about the well capacity - too slow for fire hall	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.46 above grade	Split Cap Gasket	Yes 1.5m	Unlikely	No, ground is even

**Table 1924-4: Potential Contaminant Sources
Building 1924 – Golden Horn Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological ¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 20 m		
Septic fields	Biological and Inorganic parameters.	Unknown, Approx. 19 m to 40 m	6718071	506916
Gas stations	Organic and Inorganic parameters.	~400 m		
Underground Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	22 m	6718073	506932
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 10, 2005

WELL ID #	Owner	Location Description
1924	YTG	Golden Horn Fire Hall

1. Well Location and Potential Contaminant Sources

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

Golden Horn

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

Golden Horn Fire Hall

c. GPS location: 6718089 Northing; 0506919 Easting; 738 elevation $\pm 6m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

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

Fills only one elevated tank in the fire hall

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

f. Nearest building, specify Golden Horn Fire Hall

g. Distance from well to building 2.1 m

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

i. Distance from well to nearest point of known field: Tank @ 19m, end of field ~ 40m
Field likely starts at 3m

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

GPS of septic:

0506916 Easting

6718071 Northing $\pm 6m$

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- k. 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

Tank @ 19 m, end of field @ ~40 m, field may start before 30 m, likely starts within 30 m

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

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

- n. 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
There are only screws in place
not locked

Entrance by animals? ☒ Yes ☐ No
There is only evidence of
a few ants, no more evidence

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

- p. Is the well site well drained? ☒ Yes ☐ No

-relatively flat

- q. 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 _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: Floating Oil Tank; Distance from well to Potential Source 1: 22 m photo

Potential Source 2: Alaska Highway; Distance from well to Potential Source 2: 70 m

Potential Source 3: 2 Jerry Cans; Distance from well to Potential Source 3: ~10 m photo

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

0506932
6718073

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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 25cm ☐ No
↳ TIN ENCLOSURE
- f. Well casing: Diameter 15 cm Material: ☒ steel ☐ plastic ☐ concrete
(6")
- g. Depth of well: 108ft ☐ measured (if possible) ☐ reported ☒ from log
- h. Static water level below ground: cannot access / 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 5ft slot size(s) 30 slot
Location of screen: from 103ft to 108ft from log reported
- l. Is there a sump below the screen? ☐ Yes ☐ No unlikely
- m. Is the well head: ☐ in pumphouse ☐ in pit ☐ pitless adaptor ☐ in a building
☐ in a wooden enclosure other, describe In a tin enclosure
- 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 no, it is 0.56m above 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 evidence of rodents
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition _____

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...) _____

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

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 108 ft

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

1 inch (by Terry)

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

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

The pump, however, is presently shut down

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: There is heat trace and both styrofoam and fiberglass insulation

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 ALBISSEZ

Date MAY 10/05

WELL ID #	Owner	Location Description
<u>1924</u>	<u>YTC</u>	<u>GOLDEN HORN FIRE HALL</u>

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 _____

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: FIBREGLASS TANK

Where is it located?

Comments: INSIDE - ON ELEVATED PLATFORM

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: OVERHEAD ELECTRIC HEATER

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?

30" x 72" x 102

What material is the tank constructed of? FIBREGUSS

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:

OVERALL INSTALLATION IS ACCEPTABLE IN ALL ASPECTS (MATERIAL & WORKMANSHIP) EXCEPT THE DRAIN DOES NOT GO TO A PROPER DISPOSAL SITE.

DOMESTIC WATER SUPPLY IS UNTREATED. THE WATER SUPPLY IS INADEQUATE FOR FIRE FIGHTING PURPOSES.

b. Recommendations:

DRILL A NEW WELL WITH A YIELD OF AT LEAST 25 GPM.

INSTALL A PUMP SYSTEM TO SUIT.

RE-AMP DOMESTIC WATER SYSTEM TO FACILITATE PROPER TREATMENT TO MEET CDWG. PARAMETERS.

INITIATE TESTING PROCEDURE AS REQUIRED. MODIFY TANK TO ALLOW ACCESS FOR CLEANING.

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PART C: Property Manager/ System Operator Questionnaire

Inspector: TERRY JACKSON Date April 10/05
Property manager: VTG.

1) Water Source:

- a. Is the well water the major source of drinking water? ☒ Yes ☐ No
b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year 1991 Month _____
b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
c. Is there a driller's log for the well?: ☐ Yes ☐ No
d. Do you know the depth of your well? If so, please indicate: 102 ft
e. Who was the well constructed by?
Indicate contractor's name: Tom BURKE
f. Are you, the owner ☐ Yes or other: VTG.
g. Who maintains the well? VTG.
h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
i. Is there a buried fuel tank on the property? ☐ Yes ☒ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? Tom BURKE. 1991
b. What type of pump do you have? JACUZZI pump 1/2 hp.
c. Pump delivers water to: ☐ pressure tank ☒ elevated tank ☐ other _____

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4) Water Treatment

- a. Is your well water treated? ☐ Yes ☒ No

Type of treatment: ☐ chlorination ☐ iron and or manganese removal
other _____

5) Well Capacity:

- a. Well capacity: User's opinion ☒ adequate ☐ inadequate
b. Are there any times of year when your well goes dry, or does not produce enough water?

c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

- a. In general, do you like your water?: ☒ yes ☐ no
b. Does the water stain household plumbing? ☐ yes ☒ No ☐ slight ☐ severe
Type of stain: ☐ brown ☐ red ☐ black
c. Does the water contain sediment? ☐ Yes ☒ No ☐ occasional ☐ constant
d. Is there an unpleasant odour? ☐ Yes ☒ No
☐ Sulphur (rotten egg smell) ☐ Other _____
e. Is there an unpleasant taste? ☐ Yes ☒ No ☐ brackish ☐ Other _____
f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☒ no
g. Is water softener being used? ☐ Yes ☒ No
h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☒ No
If so, at what time intervals? _____
Who takes them? _____
i. Is there a history of bad bacterial analyses? ☐ Yes ☐ No
j. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete

7) Do you have any overall comments or complaints about your water well system?

*In high demand situation pump would not be
high enough. No protection from drinking water
and fire tank water*



Driller's Report 204100474

Page 1 of 1

Location: Golden Horn Firehall Well Lot 189, Golden Horn GOLD

NAD 83 Zone 8 Easting 506931 Northing 6718080 Elevation ASL 2401.6 ft.

Location Accuracy: Horizontal 30-100 (topo)
Vertical 3.05 metres (10ft)

Purpose of well: Domestic - household needs

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	5 ft.		SAND with Gravel and Silt		
2	5	14 ft.		FINE SAND		
3	14	28 ft.		SILT		
4	28	96 ft.		CLAY with Silt		
5	96	98 ft.		GRAVEL with Fine Sand and Silt		
6	98	350 ft.		BEDROCK		

WELL CONSTRUCTION

Well No. 2041004741 Completion date Drilling method Well type

Casing: OS Diameter 6 in. Material Wall thickness in. Depth to ft.

Comments

Surface/Env'l seal: Material Diameter in. Depth from to ft. Volume cu. ft.

Gravel Pack ? Material Diameter in. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments
30 Slot Screen Continuous Wire Wrap 30 Slot Screen

Screen Sections

Section	From	to	Slot size/ perforation diameter
1	103	108 ft.	30 Thou.

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method
2041004741 ft. ft. gpm

Final Status New, in use for intended purpose

No



Driller's Report 204100458

Page 1 of 2

Location: Golden Horn Well Dunkin Street WHSE

NAD 83 Zone 8 Easting 507002 Northing 6718754 Elevation ASL 1 m.

Location Accuracy: Horizontal 30-100 (topo)

Vertical unknown or unreliable

Purpose of well: Commercial - not fabrication or manufacturing

Permafrost encountered? No

LOG OF OVERBURDEN AND BEDROCK MATERIALS

Layer	From	To	General Colour	Most Common Material	Secondary Material	General Description
1	0	1.4 m.		GRAVEL, silt cobbles		
2	1.4	137.19 m.		BEDROCK		

WELL CONSTRUCTION

Well No. 2041004582 Completion date Drilling method Well type

Casing: OS Diameter 15.24 mm. Material Wall thickness mm. Depth to m.

Comments

Surface/Env'l seal: Material Diameter mm. Depth from to m. Volume cu. m.

Gravel Pack ? Material Diameter mm. Depth from to

Well Screen Information

OS Diameter Material Screen Type Comments

Screen Sections

Section	From	to	Slot size/ perforation diameter
1			

WELL DEVELOPMENT AND STATUS

Well ID Developed by Wellhead completion Adapter depth Static water level Yield Estimate Estimate method

2041004582 Unknown m. m. Lps

Final Status Unknown

No

GROUNDWATER QUALITY

Well No. 2041004581 Field Measurement Date 25-Mar-03

Electrical Conductivity μS

pH

Temperature $^{\circ}\text{C}$

Groundwater Type

Turbidity/sand content

Well disinfection

Was the well disinfected on completion of pump installation?

Bacterial testing done?

Lab

Date

Chemical testing done?

Lab

Date

Select Borehole

204100474

Add Borehole

Select Monitor

2041004741

Add Monitor



Wa

Borehole Data

204100474		All units for this borehole are		Imperial		NB: the system will determine units for ALL related fields as specified on the manual input form, consistent with this selection. Convert numbers as required before entry.	
A1 Well Name		Golden Horn Firehall Well					
A2 Drilled for		UMA/YTG					
A3 Address		Lot 189, Golden Horn					
A4 Town		GOLD - Golden Horn		Add Town		NTS 105D/10	
A5 83		8		506931		6718080	
NAD		Zone		Easting		Northing	
A6 2400		3.05 metres (10ft)		Good - Complete well data.		30-100 (topo)	
Well elevn.		Vertical Accuracy		Data quality			
A8 Purpose		Domestic - household needs				Add Purpose	
B8 ☐ Permafrost?		From		to			
H1 Driller		Midnight Sun Drilling Comp		Add Driller		H2 Name(s)	
H3 Driller Add							
I1 Cons.				I2 Cons. Add			
I3 Ref.				Add Reference		Date Submitted	

Dov



Photo 0078: 1924 Wellhead (front), Golden Horn Firehall (left) and Septic Field (back)



Photo 0079: 1924 Wellhead



Photo 0080: 1924 Septic Field (fron), Golden Horn Firehall (back)



Photo 0077: Above Ground Fuel Storage Tank



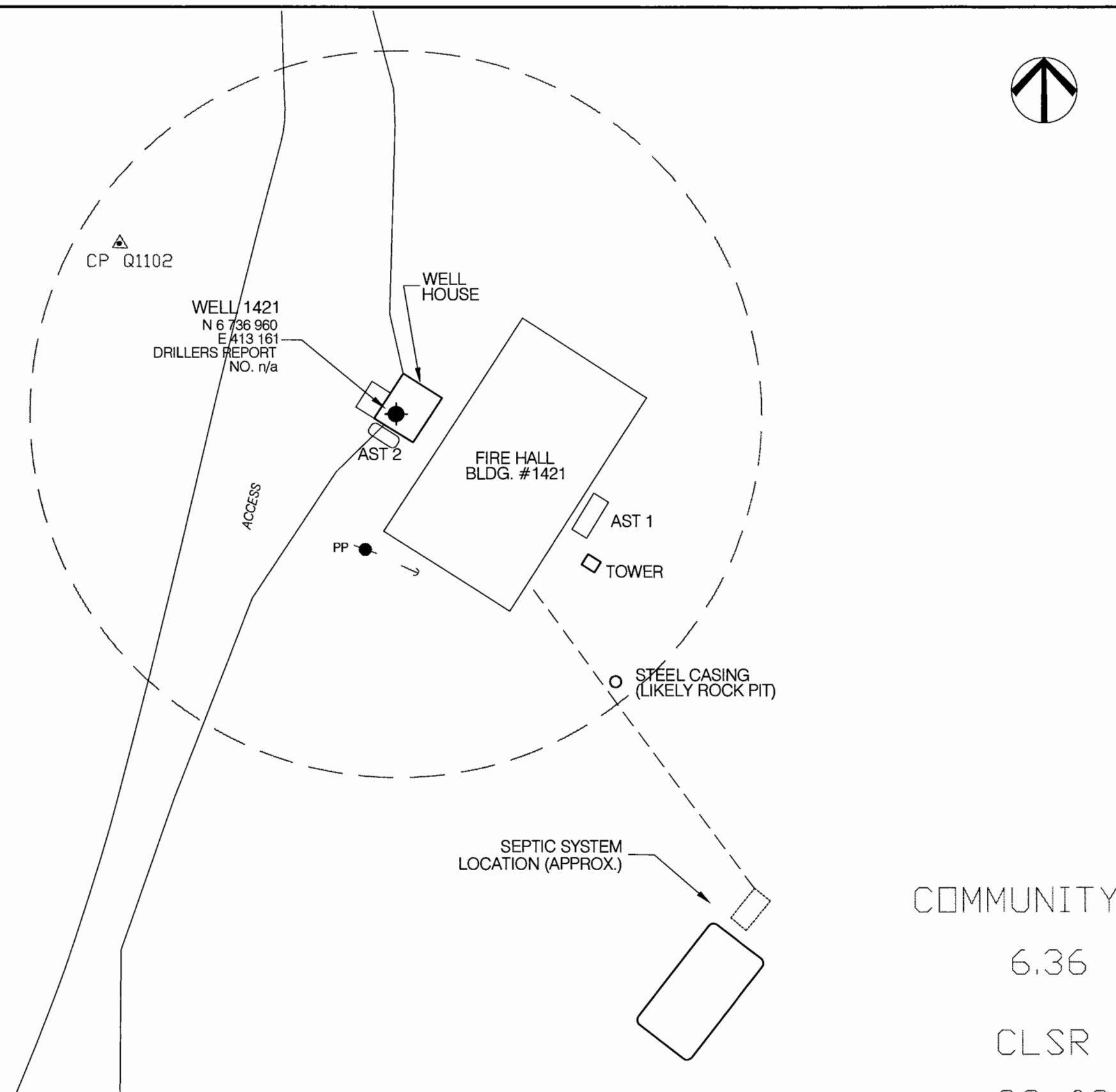
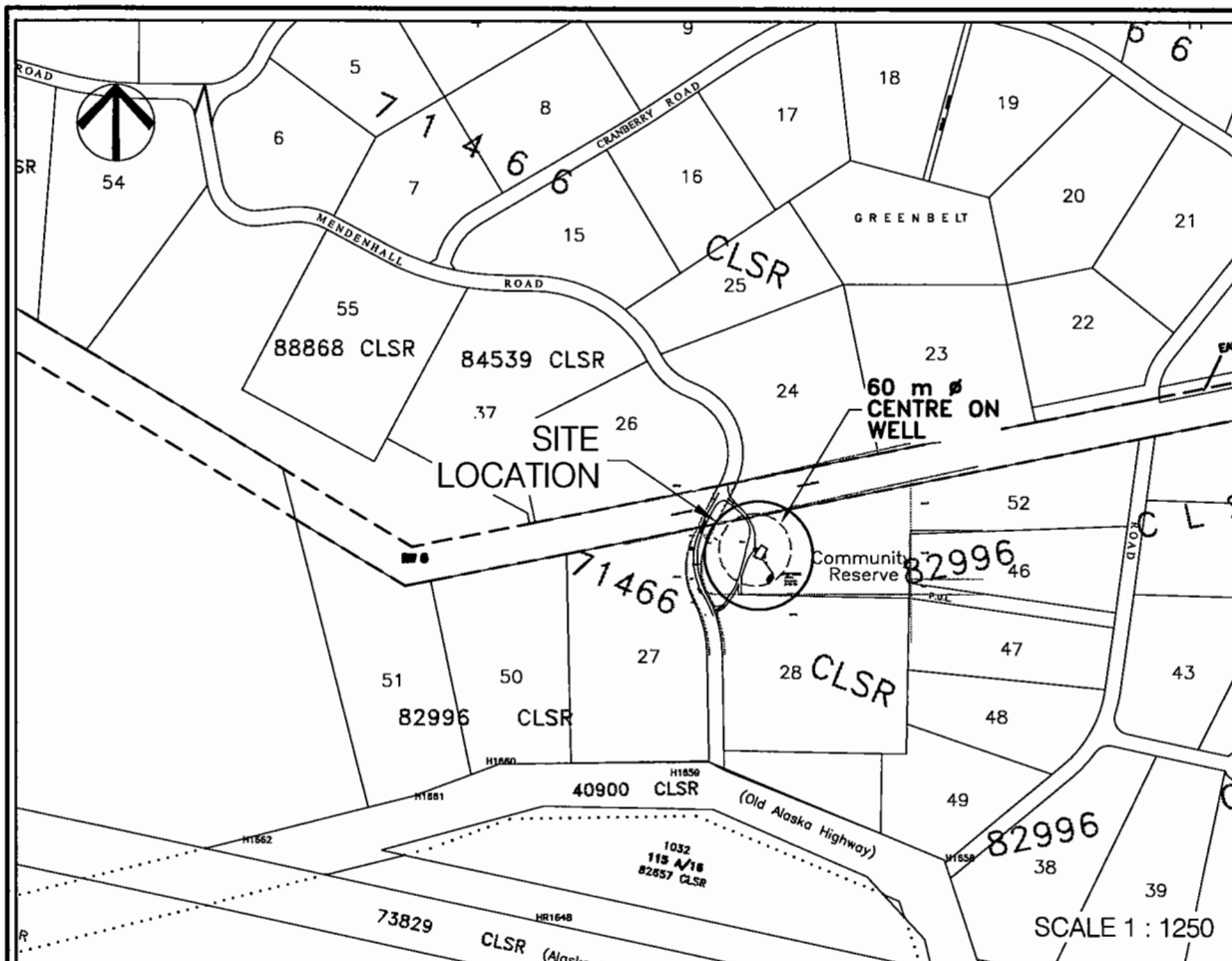
Photo 0469: 1924 Pump System



Photo 0470: 1924 Water Storage Tank



Photo 0465: 1924 Tank Fill Solenoid Valve and Bypass



NOTES:
1. UTM COORDINATES OBTAINED WITH A HAND HELD GPS USING NAD83 SYSTEM AND ARE CONSIDERED TO BE ACCURATE TO 10.0 m, APPROXIMATELY.

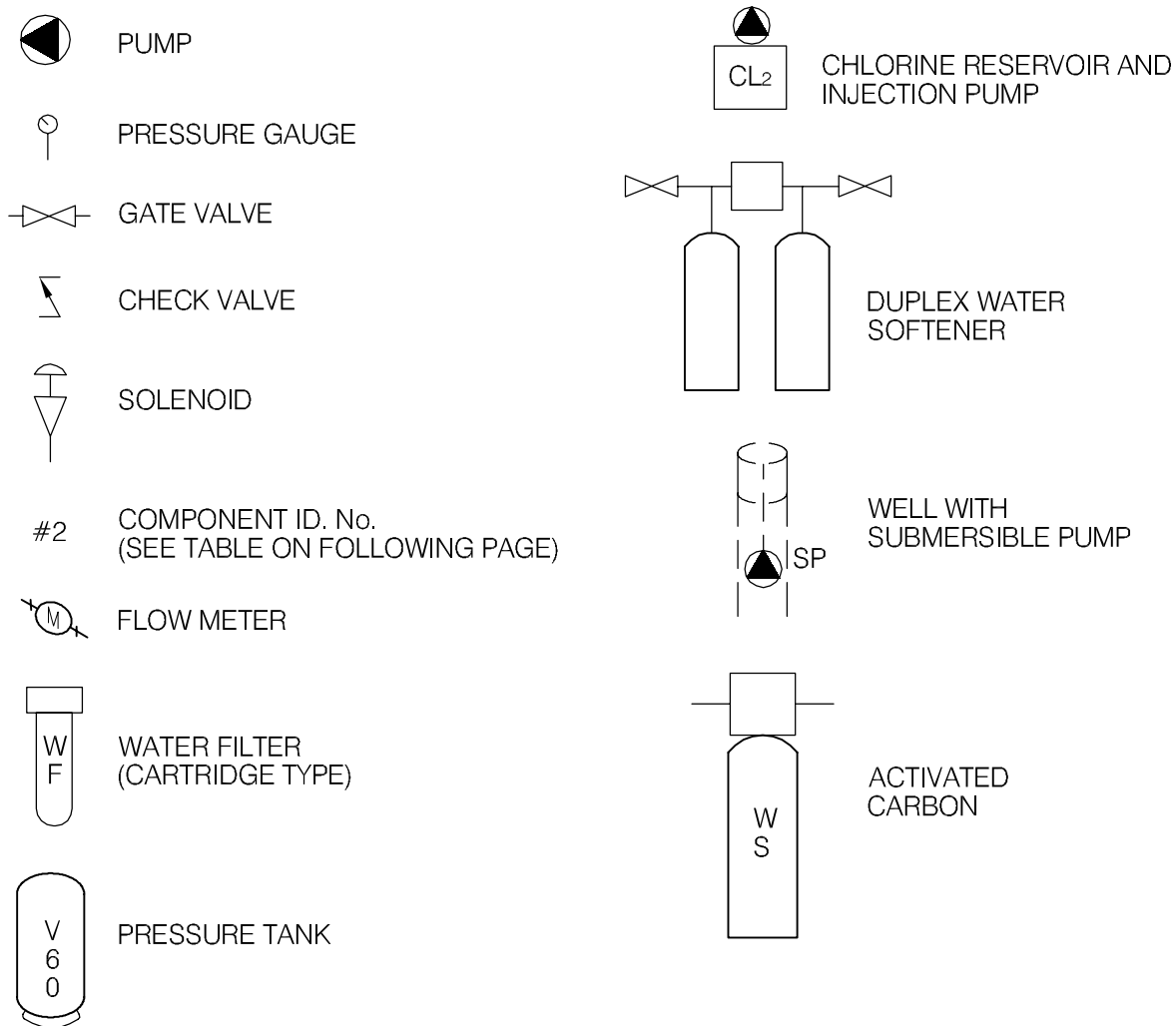
30 m RADIUS FROM WATER WELL FOR CONSIDERATION OF PROXIMITY TO POTENTIAL CONTAMINANT SOURCES.

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

EBA Engineering Consultants Ltd.	CLIENT:
DESIGNED BY: R. MARTIN	 Highways and Public Works Property Management Branch
DRAWN BY: J. BUYCK	
DATE: JUNE 2005	
SCALE: AS SHOWN	
PROJECT No.: 1260002.001	
ACAD FILENAME: 001-WHITEHORSE REGION	

SMALL PUBLIC WATER SYSTEMS ASSESSMENT WHITEHORSE REGION	
GOVERNMENT OF YUKON HIGHWAYS & PUBLIC WORKS	
MENDENHALL FIRE HALL BUILDING 1421 SITE LOCATION DIAGRAM WELL ID: 1421	REVISION ISSUE 0 DRAWING No. FIGURE 1421A

LEGEND



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

DATE APRIL 2006

DWN. JSB

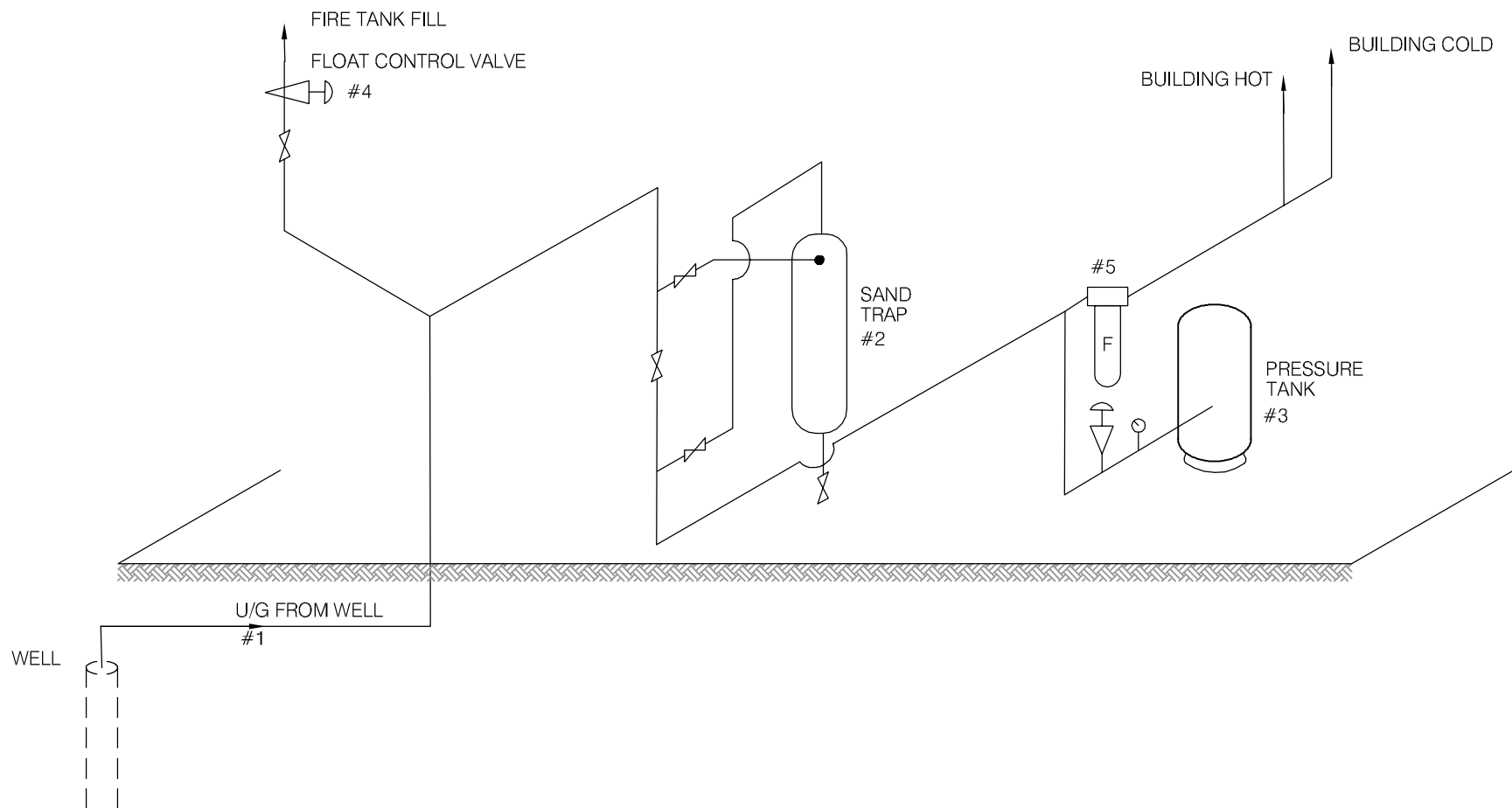
CHKD. RMM

FILE NO.

1260002

DRWG.

LEGEND



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



EBA Engineering Consultants Ltd.

CLIENT



PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1391
HOOTALINQUA FIRE HALL

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.001

DWG.: FIGURE 1391B

**Whitehorse Region – Mendenhall Firehall
Building # 1421**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	WELL HOUSE STORAGE TANK		2000 VERT			2000 GAL
2	FIRE HALL STORAGE TANKS		1250 AG			1250 GAL
3	FIRE HALL STORAGE TANKS		1250 AG			1250 GAL
4	WELL PUMP 1/2 HP					4" x 1"
5	JET PUMP 1 HP	MYERS	MJ100S-K			1 1/4 x 1"
6	PRESSURE TANK	WELL RITE	WR250R			322 L
7	FILL CONTROL VALVE	ASCO				1" FIPT.
8						
9						
10						

TABLE 1421 - 1: SUMMARY OF BACTERIOLOGICAL RESULTS

		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?
Building #	Building Name							
1421	Mendenhall Firehall	2	Apr-05 to May-05	no	0/2	no	May 05	no



Table 1421-2: Water Quality Results

SOURCE:		Building 1421 - Mendenhall Firehall			GCDWQ Criteria		
Location/ Resident		Mendenhall Subdivision					
Address							
Treatment		No					
Source of Water		On-Site Well					
Purpose of Sampling		Baseline	Additional Sampling	Baseline			
Sample Location		Mendenhall Community Association (ASL)					
Date Sampled		13-Mar-00	10-May-05	15-Jun-05	Lower Limit	Upper Limit	
Physical Tests (ALS)					AO	MAC	AO
Colour (CU)		<5	<5.0	<5			15
Conductivity (uS/cm)		563	575	579			
Total Dissolved Solids		347	355	353			500
Hardness CaCO3		240	259	275	AO >200 = poor, > 500 unacceptable ^A		
pH		7.87	8.22	7.87	6.5		8.5
Turbidity (NTU)		<0.1	1.78	9.26		1	5
UV Absorbance			<0.0010				
Dissolved Anions (ALS)							
Alkalinity-Total CaCO3		239	246	251			
Chloride Cl		2.4	4.69	4.85			250
Fluoride F		0.33	0.435	0.409		1.5	
Sulphate SO4		65	71.8	67.9			500
Nitrate Nitrogen N		0.2	0.24	0.22		10	
Nitrite Nitrogen N		<0.1	<0.10	<0.10		1	
Ammonia Nitrogen N			0.042				
Total Metals (ALS)							
Aluminum T-Al		0.008	<0.010	<0.010			
Antimony T-Sb			<0.00050	<0.0005		0.006	
Arsenic T-As		0.0001	0.00018	0.00012		0.025	
Barium T-Ba		0.037	0.043	0.041		1	
Boron T-B		<0.05	<0.10	<0.10		5	
Cadmium T-Cd		<0.0002	<0.00020	<0.0002		0.005	
Calcium T-Ca		68.8	72.6	77.7			
Chromium T-Cr		0.002	<0.0020	<0.0020		0.05	
Copper T-Cu		0.006	0.558	0.709		1	
Iron T-Fe		<0.03	0.757	0.697			0.3
Lead T-Pb		0.002	0.0034	0.0032		0.01	
Magnesium T-Mg		16.6	18.8	19.7			
Manganese T-Mn		<0.001	<0.0020	<0.0020			0.05
Mercury T-Hg		<0.00005	<0.00020	<0.0002		0.001	
Potassium T-K		3.63	3.4	3.31			
Selenium T-Se		0.002	0.0025	0.0019		0.01	
Sodium T-Na		24.7	24.6	23.2			200
Uranium T-U		0.0622	0.0554	0.0578		0.02	
Zinc T-Zn		0.019	0.091	0.091			5
Trihalomethanes							
Bromodichloromethane			-				
Bromoform			-				
Chloroform			-				
Dibromochloromethane			-				
Total Trihalomethanes			-			0.1	
Haloacetic Acids							
Bromoacetic Acid			-				
Bromochloroacetic Acid			-				
Chloroacetic Acid			-				
Dibromoacetic Acid			-				
Dichloroacetic Acid			-				
Trichloroacetic Acid (TCA)			-				
Field Chemistry (EBA)							
pH			7.76		6.5		8.5
TDS			276				500
EC (uS/cm)			535				
Temperature			17.4				
Free Available Chlorine							

Notes:

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

Shading indicates exceedence of Proposed MAC guideline (arsenic).

Bold Underline with Yellow shading 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 1421-3: Summary of Well Assessment Results
SMALL PUBLIC DRINKING WATER SYSTEMS

Well Identification and Location					
Building #	Building Name	Location	Northing (+/- 10 m)	Easting (+/- 10 m)	Grade Elevation (+/- 10 m)
1421	Mendenhall Fire Hall	Mendenhall	6736960	436161	714

Well Details							
Well Casing Diameter (mm)	Year Well Installed	Well Log?	Well Depth (m bg)	Reported Low Permeabilty Protective Layer?	Pump Setting (m bg)	Well Capacity - Tested, or Reported by User	Static Water Level Below Ground (m-btwc)
150	?	No	43.2	Likely Bedrock from ~4m to ~43m	?	1/2hp submersible pump Size of pump meets needs	?

Well Construction Details				
Wellhead Above ground (m)	Well Cap	Well Screen	Surface Seal	Apron Grading
0.43 above grade	Split Cap Gasket	?	Unlikely	Inside building

**Table 1421-4: Potential Contaminant Source
Building 1421 – Mendenhall Fire Hall**

Potential Contaminant Source	Potential Contaminants	Distance from Water Source	Northing	Easting
Dump or Landfill	Organic and inorganic chemicals.	>>120 m		
Cemetery	Biological¹ , inorganic ² and organic parameters.	>>120 m		
Sewage lagoon	Biological , inorganic and organic parameters.	>>300 m		
Sewage lines, tanks and lift stations	Biological , inorganic and organic parameters.	Approx. 20 m		
Septic fields	Biological and Inorganic parameters.	Approx 50 m	6736913	436185
Gas stations	Organic and Inorganic parameters.	>>30 m		
Undergrounds Fuel Storage Tanks (USTs)	Organic parameters.	>>30 m		
Above ground storage tanks (ASTs)	Organic parameters.	1 m, 20 m	6736960 6736956	436161 436175
Naturally occurring sources of contamination	Radionuclides, Bacteria and Viruses from surfacewater sources.	>150 m		

Notes:

Bold highlighting of distances indicates non-compliance with proposed guidelines

1- Biological parameters include: bacteria, viruses, protozoa (parasitic organisms), helminthes (intestinal worms), and bio aerosols (inhalable moulds and fungi).

2 – Inorganic contaminants could include arsenic in embalming chemicals (prior to early 1900's), and heavy metals in caskets.

Required Setback Distances Draft Guidelines for Part III – Small Public Drinking Water Systems:

300 m (1,000 ft) from a sewage lagoon or pit and manure heaps

120 m (400 ft) from a solid waste dump or a cemetery

30 m (100 ft) from any other potential source of contamination

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*No Log must fill in Missing Information at a later time

SMALL PUBLIC WATER SYSTEM ASSESSMENT

PART A: EBA Site Inspection

Inspector: Ryan Martin
Luke Lebel

Date May 10, 2005

WELL ID #	Owner	Location Description
1421	YTG	Mendenhall Fire Hall

1. Well Location and Potential Contaminant Sources

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

Mendenhall

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

Mendenhall Fire Hall, Mendenhall drive

c. GPS location: 0436161 Easting; 6736960 Northing; elev: 714m; $\pm 10m$

d. Is there electric power? ☒ Yes ☐ No

e. Does the well system have:

☐ 15 or more service connections to a piped distribution system? If so how many _____
There is a public filling station and a fire hall supplied from the well

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

f. Nearest building, specify Mendenhall Fire Hall

g. Distance from well to building 7m to fire hall

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

i. Distance from well to nearest point of known field: ~60m

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

GPS Septic Tank/effluent field

0436183 Easting
6736913 Northing
721m Elevation

$\pm 5m$

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- k. 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

Effluent field/septic tank 50m away

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

- m. Is the well located within 120 m from a solid waste site or dump, cemetery? ☐ Yes ☒ No
There is, however, a small recycling depot

- n. 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
The well is located inside a locked wellhouse with a cement floor

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

- p. Is the well site well drained? ☒ Yes ☐ No
It is unlikely that any surface water will enter the well house

- q. 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 _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: ASTZ; Distance from well to Potential Source 1: adjacent to well house ~1m

Potential Source 2: AST1; Distance from well to Potential Source 2: 20m

Potential Source 3: _____; Distance from well to Potential Source 3: 20m

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

- s. Are there other wells on this property? ☒ Yes ☒ No

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

436165
6736956
724m
±11m

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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
Yet to be found
- d. Is there a surface seal to 6 m ☐ Yes ☐ No ☐ unknown ☒ unlikely
- e. Surface casing: ☐ Yes Diameter _____ ☒ No
The well head is within only a well house
- f. Well casing: Diameter 15cm Material: ☒ steel ☐ plastic ☐ concrete
(6")
- g. Depth of well: 240' ☐ measured (if possible) ☒ reported ☐ from log
- * h. Static water level below ground: cannot access
☐ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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
Heated and well insulated pumphouse
☐ 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 No, 43cm above grade, 26cm above concrete floor
- 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
The well house is well insulated and heated
- iv. Any evidence of rodents? Specify There is no evidence, however it appears that the wellhouse is regularly cleaned, No mouse traps
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition _____

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...) _____

4. Aquifer Supplying This Well:

- * a. The aquifer is: ☐ bedrock ☐ granular sediment ☒ unknown
likely bedrock based on well log information from other wells in the area that are of similar depth.
- b. Does water level and/or well capacity show seasonal fluctuation? ☐ Yes ☒ No

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: It is all contained within a well insulated and heated well-house

l. Comments on pump installation: _____

6. Conclusions

a. Comments on overall installation:

see report

b. Recommendations: see report

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PART B: EBA Site Inspection

Inspector: BERT ALBISSEER

Date MAY 10/05

WELL ID #	Owner	Location Description
1421	VTG	MENDEN HALL SUBDIVISION

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 _____

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: 1-2000 GAL IN WALK HOUSE / 2-1250 GAL IN FIRE HALL

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?

2000 GAL / 84" x 115" / 1250 AG.

What material is the tank constructed of? 2000 PE / 1250 FG.

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 FG / YES / PE

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:

PE TANK IN WELLHOUSE IS NOT SUITABLE FOR
STORAGE OF DRINKING WATER.
NO TREATMENT IS IN PLACE.
TANK ACCESS IS NOT SUITABLE FOR CLEANING.

b. Recommendations:

REPLACE TANK IN WELL HOUSE WITH A TANK SIZE
THAT IS ACCESSABLE FOR CLEANING. INITIATE
REGULAR CLEANING SCHEDULE. INSTALL LIQUID
CHLORINATION SYSTEM AND SCHEDULE REGULAR
CHLORINE RESIDUAL ~~TESTING~~ TESTING.

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PART C: Property Manager/ System Operator Questionnaire

Inspector: TERRY JACKSON Date May 10/05

Property manager: ITG. Meridenhall fire hall

1) Water Source:

- a. Is the well water the major source of drinking water? ☒ Yes ☐ No
- b. Is the well water used for other non-drinking purposes? ☒ Yes ☐ No

2) Well information:

- a. When was your well installed? Year _____ Month _____
- b. Type: ☒ drilled ☐ dug ☐ sand point ☐ other _____
- c. Is there a driller's log for the well?: ☒ Yes ☐ No
- d. Do you know the depth of your well? If so, please indicate: 240
- e. Who was the well constructed by?
Indicate contractor's name: _____
- f. Are you, the owner ☐ Yes or other: ITG
- g. Who maintains the well? _____
- h. Are there other wells on this property? ☐ Yes ☒ No
How many? ____; Are they: ☐ in use ☐ abandoned ☐ require proper sealing
- i. Is there a buried fuel tank on the property? ☐ Yes ☒ No
If yes, is it ☐ in use ☐ abandoned
Is the location known? _____
How was it abandoned? _____

3) Pump Installation

- a. Who installed your pump, and when did they install it? _____
- b. What type of pump do you have? _____
- c. Pump delivers water to: ☐ pressure tank ☒ elevated tank ☐ other _____

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4) Water Treatment

- a. Is your well water treated? ☐ Yes ☒ No

Type of treatment: ☐ chlorination ☐ iron and or manganese removal
other _____

5) Well Capacity:

- a. Well capacity: User's opinion ☒ adequate ☐ inadequate
- b. Are there any times of year when your well goes dry, or does not produce enough water?

- c. Has well capacity decreased since it was installed? ☐ Yes ☒ No

6) Water Quality:

- a. In general, do you like your water?: ☒ yes ☐ no
- b. Does the water stain household plumbing? ☐ yes ☒ No ☐ slight ☐ severe
- Type of stain: ☐ brown ☐ red ☐ black
- c. Does the water contain sediment? ☐ Yes ☒ No ☐ occasional ☐ constant
- d. Is there an unpleasant odour? ☐ Yes ☒ No
- ☐ Sulphur (rotten egg smell) ☐ Other _____
- e. Is there an unpleasant taste? ☐ Yes ☒ No ☐ brackish ☐ Other _____
- f. Hardness: Is it hard to lather with soap?: ☐ yes, very ☐ moderate ☒ no
- g. Is water softener being used? ☐ Yes ☒ No
- h. Are samples for bacterial analysis (coliforms) taken regularly? ☐ Yes ☐ No
If so, at what time intervals? _____
Who takes them? _____
- i. Is there a history of bad bacterial analyses? ☐ Yes ☐ No
- j. Is there a chemical analysis? ☐ Yes ☐ No ☐ adequate ☐ incomplete

7) Do you have any overall comments or complaints about your water well system?



Photo 0091: 1421 Well house, Above Ground Storage Tank and Water-Pickup (front) and Mendenhall Firehall (back)



Photo 0087: 1421 Wellhead



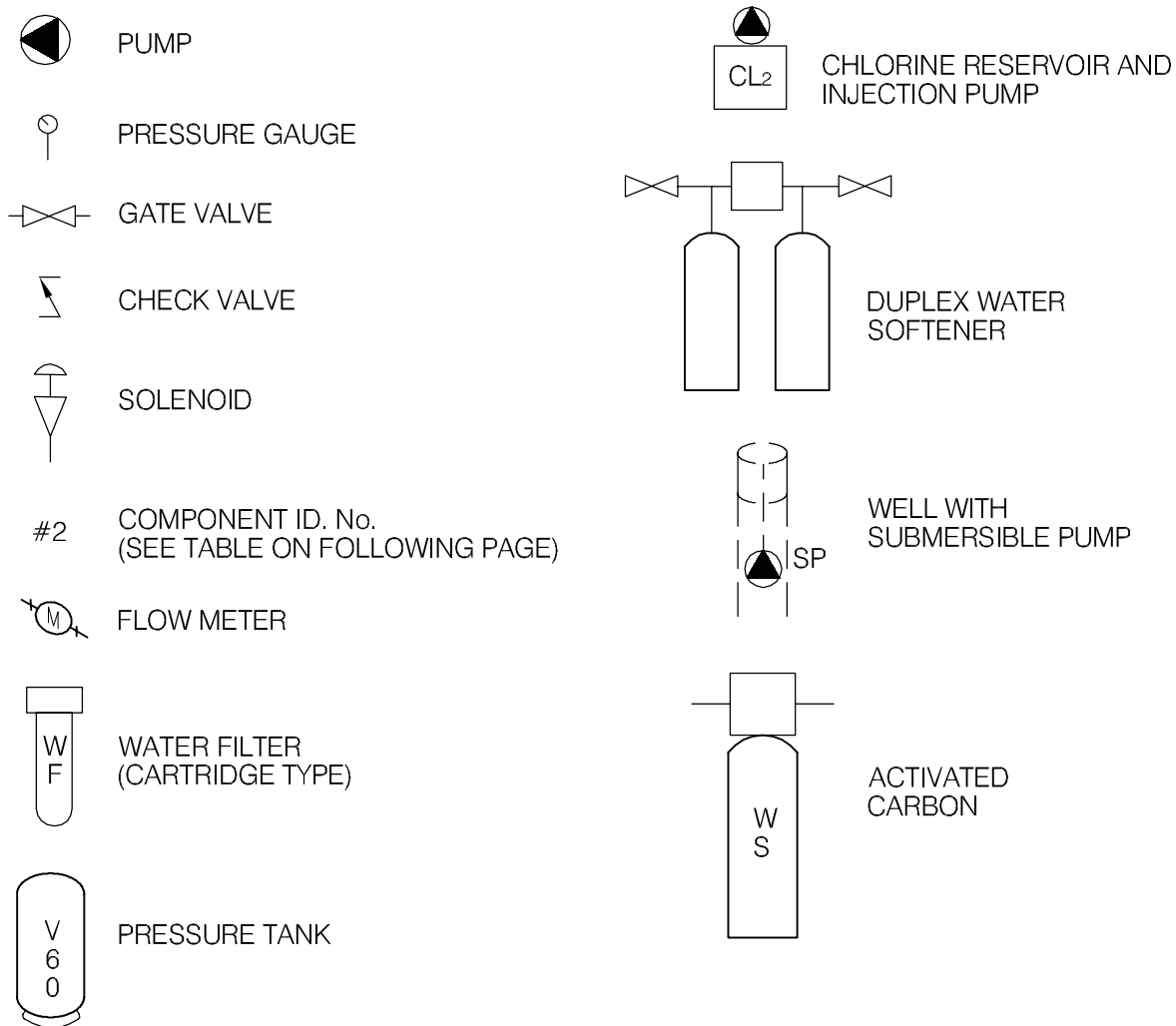
Photo 0093: 1421 Above Ground Storage Tank



Photo 0094: 1421 Septic Field (front) and Mendenhall Firehall (back)

**Photo 0089:** 1421 Water-Pickup**Photo 0098:** 1421 Pressure Tank and System**Photo 0088:** 1421 Water Reservoir (in wellhouse)**Photo 0097:** 1421 Water Storage Tanks (in firehall)

LEGEND



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PROJECT

SMALL PUBLIC WATER SYSTEMS ASSESSMENT
WHITEHORSE REGION

TITLE

SCHEMATIC SYSTEM
LEGEND

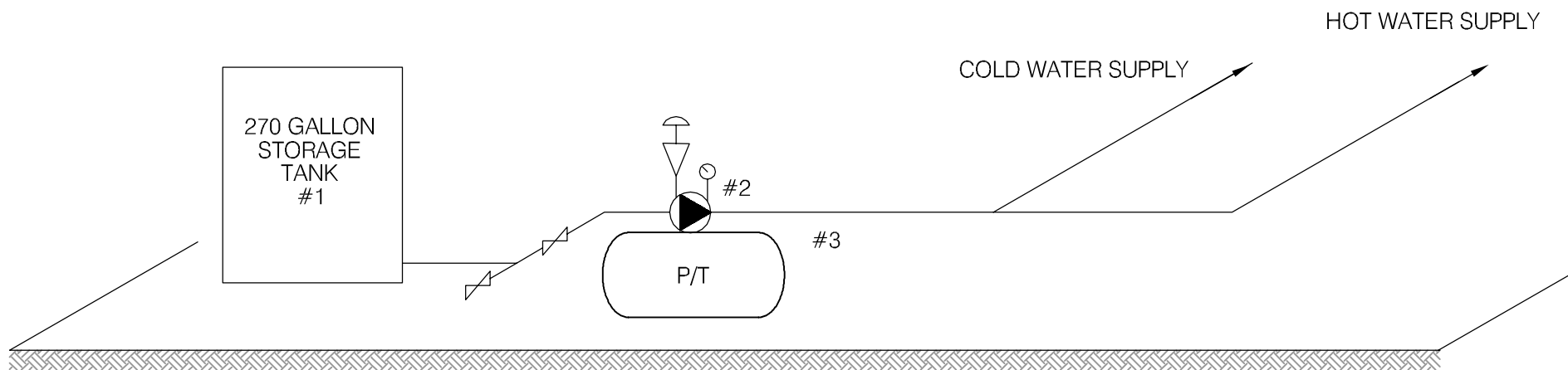
DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002

DRWG. LEGEND



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



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CLIENT



PROJECT

ADDITIONAL ASSESSMENT
EASTERN REGION

TITLE

WATER SYSTEM DISTRIBUTION/TREATMENT
SCHEMATIC SYSTEM ID.: 1131
CARCROSS SEARCH & RESCUE BUILDING

DATE APRIL 2006

DWN. JSB

CHKD. RMM

FILE NO. 1260002.005

DWG.: FIGURE 1131-B

**Whitehorse Region – Carcross Search and Rescue
Building # 1131**

DISTRIBUTION & TREATMENT SYSTEM DATA

Item	Description	Manufacturer	Model	Part No.	Serial No.	Size
1	Polyethylene Storage Tank		270			Upright 270 Gallon
2	Jet Pump	R.G.Ray	SPLC-2H		C95G	½ HP – 115 V.
3	Pressure Tank	Con Air	SCA15H		1A95N	4.5 Gallon
4						
5						
6						
7						
8						
9						
10						

Table 1131-2: Water Quality Results

	Building 1131- Carcross Search and Rescue	GCDWQ Criteria		
SOURCE:				
Location/ Resident	Carcross			
Address				
Treatment	Filtration			
Disinfection	Chlorination			
Source of Water				
Purpose of Sampling	Additional Sampling			
Sample Location	10-Aug-05			
Date Sampled		Lower	Upper Limit	
Physical Tests (ALS)		AO	MAC	AO
Colour (CU)				15
Conductivity (uS/cm)				
Total Dissolved Solids				500
Hardness CaCO3		AO >200 = poor, > 500 unacceptable ^A		
pH		6.5		8.5
Turbidity (NTU)			1	5
UV Absorbance	0.270			
% UV Transmittance				
Organic Parameters				
Tannin and Lignin	<0.10			
Total Organic Carbon C	1.55			
Field Chemistry (EBA)				
pH	8.16	6.5		8.5
TDS (ppm)	41			500
EC (uS/cm)	80			
Temperature (°C)	21.0			
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: Luke LebelDate August 10, 2005

WELL ID #	Owner	Location Description
1131	YTG	Carcross Search and Rescue Office

1. Well Location and Potential Contaminant Sources

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

Carcross

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

Carcross Roadc. GPS location: N 6670005 E 516351 elev 663m ± 12md. Is there electric power? ☒ Yes ☐ Noe. 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 _____Search and Rescue Building☐ 5 or more delivery sites on a trucked distribution system? If so how many _____g. Nearest building, specify located in addition to Search and Rescue Building

h. Distance from well to building _____

i. If there is an effluent disposal field, is its location known? ☒ Yes ☐ Noj. Distance from well to nearest point of known field: ~ 12mk. 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

Septic tank + Effluent field

- 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
located in locked building

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 *unlikely*

If yes, is it ☐ in use ☐ abandoned

Is the location known? ☐ Yes ☐ No

Distance from the well to known buried tank _____

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

☒ Yes ☐ No Describe _____

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

Potential Source 1: AST 1; Distance from well to Potential Source 1: ~14m

Potential Source 2: ...; Distance from well to Potential Source 2: _____

Potential Source 3: AST 2+3; Distance from well to Potential Source 3: ~81m

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

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

How many? _____ ☐ in use ☐ abandoned ☐ require proper sealing

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2. Well and Wellhead information: *Abandoned*

- 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: 760m ☒ measured (if possible) ☐ reported ☐ from log
- h. Static water level below ground: 3.780m bc
☒ 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 _____ slot size(s) _____
Location of screen: from _____ to _____ 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 addition to building
- 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 No, ~60cm above 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 likely in walls of enclosure
- iv. Any evidence of rodents? Specify Yes, mouse droppings
- v. Does the well casing have a proper seal cap? ☒ Yes ☐ No

If no, describe condition Split gasket cap

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 well abandoned

Explain (filtration, disinfection etc...) _____

4. Aquifer Supplying This Well:

- a. The aquifer is: ☐ bedrock ☒ granular sediment ☐ unknown
likely
- b. Does water level and/or well capacity show seasonal fluctuation? ☐ Yes ☐ No w/c

5. Pump Installation:

- a. Is the well equipped with a pump? ☒ yes ☐ No
- b. Type of pump: ☐ hand ☒ electric submersible ☐ jet no longer in use, but still in place
- ☐ 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 n/a
- h. Are there automatic pump controls: ☐ Yes ☐ No n/a
- i. Is there provision for taking water samples before water reaches storage? ☐ Yes ☐ No n/a
- j. Is there a water meter on the system? ☐ Yes ☐ No n/a
- k. Is the pump and piping protected from freezing? ☒ Yes ☐ No n/a

If yes, describe: _____

- l. Comments on pump installation: _____

6. Conclusions

- a. Comments on overall installation:

There is a well at this site, but it is no longer in use.
This water system uses water from a delivered source.
The fill pipe and vent is ABS piping and there is no
vermin screen

- b. Recommendations: _____

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PART B: EBA Site Inspection

Inspector: MARK ROBINSON AQUA TECH

Date AUG 10/05

WELL ID #	Owner	Location Description
1131		SEARCH AND RESCUE CANCROSS.

6. Water Treatment

a. Is well water treated? ☐ Yes

☒ No; Type of treatment: NO TREATMENT ON SITE. TREATED BY DELIVERY

☐ 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 0.01 reading.

Tested at OFFICE SINK TAP (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: 8' X 10' ROOM WITH HOT WATER TANK, JET PUMP, ELECTRICAL PANEL, SHELVES

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: INSULATED STORAGE ROOM, HEATED WHEN DOOR IS LEFT OPEN

Are there windows in the add-on that may allow direct sunlight onto the water holding tank? ☒ YES

NO

Comments: 5' X 3' WINDOW RIGHT BESIDE TOP 2' OF UPRIGHT POLY TANK.

Are there other heat sources near the tank? ☒ YES ☐ NO

Comments: TOYO STOVE. ROOM BESIDE STORAGE ROOM.

Is there waterproof flooring with a sealed base to contain spills? ☒ YES ☐ NO

Comments: CONCRETE FLOOR, 2" BELOW ROOM NEXT TO IT.

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Overall Tank

What are the tank size and dimensions?

270 IMP. GALS / 1227 LITRES 7' HIGH 3' ROUND 15" LID ON TOP

What material is the tank constructed of? Poly

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: 1/2" PVC + 1" POLY TUBING FOR SUCTION TO JET PUMP

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) OVERFLOW PRUSED OFF.

Is the water tank drain accessible? (YES) NO BUT 2" OFF BOTTOM

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: COULD NOT SEE INTO TANK.

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)

ONLY 10" BETWEEN TOP OF TANK (LID) AND CEILING.

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8. Conclusions

a. Comments on overall installation:

STATION IS ON WATER DELIVERY INTO A 270 IMP. GAL UPRIGHT POLY TANK.
THE WATER IS DRAFTED FROM THE TANK WITH A $\frac{1}{2}$ HP., 115V JET PUMP WITH
1" POLY TUBING FOR SUCTION AND 1" POLY TUBING (DISCHARGE) TIED INTO POLY B
MANIFOLD.

b. Recommendations:

**Photo 141:** 1131 Water storage tank.**Photo 027:** 1131 Abandoned well.**Photo 029:** 1131 Carcross search and rescue building (former grader station).**Photo 028:** 1131 Abandoned wellhead enclosure.