

## 5.45 Takhini Subdivision – Champagne and Aishihik First Nation Water Supply System

Champagne Aishihik First Nation (CAFN) owns and operates a public drinking water system in the Takhini River Subdivision (TRS), located at km 1470.2 on the Alaska Highway in Yukon. The system consists of two deep drilled groundwater wells, Potable Water Well 1 (PW Well 1, called Well 1 in previous reports) and Potable Water Well 2 (PW Well 2, called Well 3 in previous reports). One other groundwater well, Geoexchange Well 1 (GE Well 1, called Well 2 in previous reports) was drilled in 2005 but, due to low flow was not used as a production well and was instead incorporated into a geoexchange heating system. Both drinking water wells are located next to the water treatment building. The system is classified as a Large Public Drinking Water Supply System under the Yukon Drinking Water Regulations – Guidelines for Part I – Large Public Drinking Water Systems (YG 2007).

### 5.45.1 Data Compilation Methodology

Tetra Tech approached all the stakeholders, water system operators and owners that we could contact to let them know the project was in progress and to request their assistance in compiling the most complete data set possible. Many of the stakeholder groups contacted were able to provide data and received the project positively. Through the process of compiling the data, Tetra Tech has had communication with the following parties regarding the CAFN Takhini River Subdivision Water System:

- Champagne Aishihik First Nation – CAFN provided approval to use Tetra Tech data and review comments for this system summary.
- Indigenous and Northern Affairs Canada – Was contacted at the project outset and provided some direction on available information and contacts.

### 5.45.2 Hydrogeology

According to the driller's well log, PW Well 1 is completed in a confined sand and gravel overburden aquifer which is separated from the surface by a thick layer of low permeability silt and clay sediments. Surficial geology mapping in the area of the TRS and inferred well capture zone indicates that the overburden in the area is comprised primarily of glaciolacustrine deposits likely deposited in the historical Glacial Lake Champagne. Deposits are composed of silt and clay with some sand and gravel lenses based on the lithology encountered at PW Well 1 and GE Well 1 and information in Morison and Klassen (1991). Bedrock geology mapping in the development area indicates that the quaternary overburden deposits are underlain by early Jurassic aged granite and granodiorite from the Long Lake Plutonic Suite (Gordey 2008).

PW Well 1 is located approximately 660 m from the Takhini River and the nearest surface water is greater than 300 m from the well completion location (Tetra Tech 2012).

Results of a pumping test conducted on PW Well 1 in 2008 indicated that the aquifer behaved differently in early and late pumping stages (EBA 2008). The late pumping test transmissivity was higher than the early transmissivity, which suggests that the well is completed in a 'leaky, confined aquifer' as reported by Gartner Lee Limited (2001) and Summit Environmental (2010). Using the 2008 results which gave an aquifer transmissivity of  $6 \times 10^{-5} \text{ m}^2/\text{s}$  and an aquifer thickness of 1.2 m, the hydraulic conductivity of this aquifer is estimated to be  $5 \times 10^{-5} \text{ m/s}$ .

The vulnerability of the aquifer encountered by PW Well 1 was assessed using the semi-quantitative ISI method suggested by the Ontario Ministry of Environment. The ISI method result of 764 indicated that the aquifer underlying the site has a low vulnerability to potential surface-based contamination due to the thick low permeability silt and clay over a deep confined aquifer (Tetra Tech 2012).

### 5.45.3 Summary of Wells

Well logs for CAFN PW Well 1 and PW Well 2 serving the Takhini River Subdivision Public Water Supply System are included in the GIS map and database portion of this project. The well log for CAFN GE Well 1 was not available for review. The following tables summarize the completion characteristics of CAFN PW Well 1, PW Well 2, and GE Well 1.

Table 5-115: CAFN TRS Public Drinking Water System, Potable Water Well 1 Summary		
Well Construction Parameters	Details	Source
Date of construction	Well was completed by Fredelana Enterprises Ltd. in May 1995	Well log
Total well depth	130.5 m bgs	
Casing	6" (152 mm) OD Steel Well Casing	
Casing depth	129.3 m bgs	
Well screen	1.2 m 10 slot (0.254 mm) stainless steel well screen from 129.3 m bgs to 130.5 m bgs (by Cathway Water Resources in 2008)	Tetra Tech 2008
Static water level	20.0 m bgs (May 2005); 21.7 m bgs (November 2010)	Well log and Tetra Tech 2012
Sanitary seal	No record of sanitary seal installation. Based on the depth of the well and the thickness of low permeability sediment between the surface and the screened depth, the lack of surface seal does not pose risk to the groundwater source (Summit 2010).	Summit 2010
Wellhead completion	The wellhead is completed in an insulated metal clad enclosure with heat trace extending into the well to prevent freezing.	Tetra Tech 2012
Wellhead stickup	1.14 m ags (measured July 2011)	
Well rated capacity	0.94 L/s (12.4 IGPM)	
Well GUDI status	Non-GUDI	Summit 2010
Well Construction Comments:	Well was not constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

**Table 5-116: CAFN TRS Public Drinking Water System, Potable Water Well 2 Summary**

Well Construction Parameters	Details	Source
Date of construction	Well was completed in November 2014	Tetra Tech 2014
Total well depth	129.4 m bgs	
Casing	6" (150 mm) ID steel well casing	
Casing depth	128.2 m bgs	
Well screen	1.2 m of 10-slot (0.25 mm) v-wire stainless steel well screen from 128.2 m bgs to 129.4 m bgs	
Static water level	20.5 m bgs (November 18, 2014)	
Sanitary seal	Bentonite seal to 6 m bgs	
Wellhead completion	Pitless Unit	
Wellhead stickup	1.0 m ags	
Well rated capacity	1.3 L/s (17 IGPM)	
Well GUDI status	Non-GUDI	
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

**Table 5-117: CAFN TRS Public Drinking Water System, GeoExchange Well 1 Summary**

Well Construction Parameters	Details	Source
Date of construction	Well was completed in 2003	Tetra Tech 2012
Total well depth	157 m bgs	
Casing	Unknown	
Casing depth	155 m bgs	
Well screen	2 m 30 slot (0.76 mm) stainless steel well screen from 155 m bgs to 157 m bgs	
Static water level	Unknown	
Sanitary seal	Unknown	
Wellhead completion	Unknown	
Wellhead stickup	Unknown	
Well rated capacity	very low yield (<1.1 IGPM), and not considered to be suitable for a back-up well	

**Table 5-117: CAFN TRS Public Drinking Water System, GeoExchange Well 1 Summary**

Well Construction Parameters	Details	Source
Well GUDI status	Non-GUDI	Summit 2010
Well Construction Comments:	Well was likely not constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

\*\*Tetra Tech understands this well is currently used as a heat source well in a geoechange heating system.

#### 5.45.4 Source Water Quality

In 2012, Tetra Tech reviewed water quality result from the Takhini River Subdivision PW Well 1 with results from 2008 and 2010. In addition to the 2012 water quality results from PW Well 1, Tetra Tech completed sampling and analysis as part of the well completion reporting for PW Well 2 in 2014. In general, the raw water from the CAFN TRS public water supply well meets the GCDWQ with the exception of total arsenic (Tetra Tech 2012). The key observations and comments noted in 2012 are:

- The groundwater source from PW Well 1 and PW Well 2 is a calcium-magnesium-bicarbonate type, with relatively low mineralization; and has a measured pH of 8.1 to 8.3;
- The water is considered medium hard with measured hardness ranging from 110 mg/L to 118 mg/L as CaCO<sub>3</sub>;
- The arsenic concentration in raw and treated samples from the Takhini River Subdivision well has been consistently higher than the GCDWQ MAC of 0.01 mg/L with measured concentrations ranging from 0.0142 mg/L to 0.0160 mg/L in the results reviewed; and
- The water met all other GCDWQ health-based criteria and aesthetic objectives for the parameters measured.

#### 5.45.5 Water Treatment and Distribution

**Table 5-118: CAFN TRS Public Drinking Water System Treatment and Distribution Details**

	Details	Source
Owner/Operator	Champagne Aishihik First Nation	Tetra Tech 2012
Water source	Groundwater	
Wells serving the system	PW Well 1 and PW Well 2	
Treatment type	Sand filter, filtration (10 microns and 1 micron stages), chlorination, arsenic removal	YES 2012 AdEdge 2012
Number of people served	30 delivery points (approximately 90 people)	
Delivery method	Bulk truck delivery	
Age of system/last known major work	New water well PW Well 2 completed in 2014 and connected in 2015	

### 5.45.6 Source Water Protection Planning

An AWPP was prepared by CAFN for the Takhini River Subdivision Water Supply System with technical input from Tetra Tech in 2014. The AWPP was prepared prior to the completion of PW Well 2. The Takhini River Subdivision Preliminary AWPP was developed based on Tetra Tech's risk based approach, which is adapted from British Columbia's Environment (BC MoE) Tool Kit.

Due to the uncertainty in the groundwater flow direction and to ensure that capture zones were conservatively estimated, Calculated Fixed Radius method was used for the inferred downgradient area of the capture zone (i.e., to the north and east), whereas the Theim Method was used for the inferred upgradient area of the capture zone (i.e., the west and south). The irregular capture zone shape is therefore a conservative hybrid of these two evaluation methods.

Key conclusions from the AWPP include:

- Though a contaminant release within the identified well capture zone will present a potential risk to the aquifer and the water quality from PW Well 1. The thick glaciolacustrine silt and clay unit overlying the aquifer provides significant protection against potential contaminants originating from surface sources.
- The highest risks to the community PW Well 1 are from potential releases and spills from above ground storage tanks (ASTs), leachate from septic fields, and a waste transfer station site to the west of the well.
- Old vehicles and other debris that were dumped in an area to the west of the well may also pose a potential risk. Most of the old vehicles have been removed from the site; however, no further assessment has been carried out to identify potential soil contamination in this area.

Tetra Tech recommended the following:

- Mitigation measures including replacement of some ASTs; public education and awareness initiatives; a hazardous waste minimization and collection; implementing an emergency response plan; and implementing regular tracking and monitoring of risks to the community wells.
- PW Well 2 is not included in the current AWPP, and Tetra Tech recommended updating the AWPP to include this well.

Tetra Tech understands that CAFN is in the process of implementing some of the recommendations from the AWPP and are planning to update the AWPP to include PW Well 2 in 2017.

### 5.45.7 Water Supply Information Data Gaps

Tetra Tech has reviewed available data in our database and communicated with CAFN and YG CS. From these reviews, we are not aware of any upgrades to the system outside of those captured in this summary. Tetra Tech has noted the following data gaps or areas where the protection of the water source could be improved:

- The AWPP currently does not include protection considerations for PW Well 2, and Tetra Tech understands this will be updated in the near future. The updated version of the AWPP should be included when it is available.