

5.36 Old Crow - Water Supply System

Old Crow, the northernmost community in Yukon, is home to the Vuntut Gwitchin First Nation (VGFN) and has a population of about 221 people (Yukon Bureau of Statistics 2016). The community is served by a public drinking water system operated by Government of Yukon, Community Services Department. Water is supplied from two deep sub-permafrost groundwater wells completed in bedrock. The water wells were constructed in the 1980s with upgrades completed in 2012 prior to the construction of a new water treatment plant in 2013. Following iron and manganese removal, and disinfection treatment, water is delivered by bulk truck delivery to consumers. 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).

5.36.1 Data Compilation Methodology

Tetra Tech approached stakeholders including YG departments, water system operators and owners to let them know the project was in progress and to request their assistance in compiling the most complete data set possible. Through the process of compiling the data, Tetra Tech obtained data regarding the Old Crow Water Supply system from the following proponents:

- YG Community Services (the client) – YG CS provided data for the Old Crow Water Supply as this system is owned and operated by YG CS. The YG CS operator provided review comments and edits for the final summary to ensure completeness and accuracy.

5.36.2 Hydrogeology

Old Crow is located in a region of continuous permafrost. The Old Crow system is supported by two wells (WW 1 and WW 2) which allows for redundancy in the system to prevent loss of water supply should one well fail or be temporarily shut off for maintenance or repair. Both production wells are completed in a sub permafrost limestone bedrock aquifer. Permafrost in the Old Crow area was interpreted, during well drilling, to extend from near surface to approximately 63.5 m bgs.

Upon completion of drilling, the aquifer was found to be artesian and WW-1 flowed at approximately 6.1 L/s (80 IGPM) (Tetra Tech 1982). During inspection by Tetra Tech in March 2010, WW-1 was found to have about 5 psi of artesian pressure and to flow at about 2.2 L/s (29 IGPM) under artesian conditions. The artesian head at the well is similar to that observed when drilled, indicating that the aquifer is not being “mined” or depleted with time based on the current demand. The reduction in observed flow is attributed to the fact that the flow of 6.1 L/s (80 IGPM) was observed from top of casing, while when observed during the site visit in March 2010, the flow was from the overhead fill; thus, the water was overcoming a greater head which would result in reduced flow. The well adequately met the needs for water supply by trucked water delivery to the Old Crow community between 1982 and 2012.

Upon completion of WW-2 in 1982, artesian flows of approximately 2.3 L/s (30 IGPM) were observed. After completing well thawing on WW-2, Tetra Tech completed a pumping test in May 2012. Pumping test results clearly indicate a hydraulic connection between WW-1 and WW-2.

The Old Crow aquifer is considered to be highly confined, and both community wells are artesian. The nearest surface waterbody to the Old Crow wells is the Porcupine River, which, as the wells are highly artesian, cannot be hydraulically connected to the aquifer. Tetra Tech completed an analysis of the vulnerability of the Old Crow aquifer from the WW-1 well log in 2012 based on the semi-quantitative Intrinsic Susceptibility Index (ISI) (Ontario Ministry of Environment, 2001). The ISI value for the Old Crow aquifer was found to be 325, which suggests very low vulnerability to surface sources of contamination (Tetra Tech 2011a).

5.36.3 Summary of Wells

The Old Crow system is supported by two wells, WW-1 and WW 2 which creates redundancy in the system and prevents loss of water supply should one well fail or be temporarily shut off for maintenance or repair. Well logs for WW-1 and WW-2 are included in the associated GIS map and database.

Table 5-93: Old Crow Public Drinking Water Supply System, Well WW-1 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed in March 1982	Tetra Tech 1982
Total well depth	79 m bgs	
Casing	6" (152 mm) ID Steel Well Casing	
Casing depth	78 m bgs	
Well screen	No well screen present	
Static water level	approx. 8.0 m ags (March 2010)	Tetra Tech 2010
Sanitary seal	No sanitary seal is present	Tetra Tech 1982
Wellhead completion	Pitless Unit	Tetra Tech 2010
Wellhead stickup	1 m ags	
Well rated capacity	8.0 L/s (105.6 IGPM)	Tetra Tech 2010, 2011
Well GUDI status	Not assessed	
Well Construction Comments:	No sanitary seal is in place; however, artesian conditions with no flow around the wellhead during well shut in indicate a natural seal is present around the casing.	

Table 5-94: Old Crow Public Drinking Water Supply System, Well WW-2 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed in March 1982	Tetra Tech 1982
Total well depth	121.9 m bgs	
Casing	6" (155 mm) ID Steel Well Casing	
Casing depth	97 m bgs	
Well screen	Open borehole	
Static water level	Artesian	
Sanitary seal	No sanitary seal	Tetra Tech 2012b
Wellhead completion	Split gasket cap	
Wellhead stickup	1 m ags	
Well rated capacity	15.2 L/s (201 IGPM)	

Table 5-94: Old Crow Public Drinking Water Supply System, Well WW-2 Summary

Well Construction Parameters	Details	Source
Well GUDI status	Not assessed	
Well Construction Comments:	No sanitary seal is in place, however artesian conditions with no flow around the wellhead during well shut in indicate a natural seal is present around the casing. Well is partially blocked by rock and well seal plate approximately 105.5 m bgs (Tetra Tech 2012)	

5.36.4 Source Water Quality

The water supplied from the two Old Crow wells has been shown to be sourced from the same artesian, confined aquifer. As part of the Old Crow LPDWSA in 2012, Tetra Tech completed a review of available water quality data. From this review of groundwater chemistry from WW-1, Tetra Tech made the following observations:

- The source water from the well is hard to very hard ranging from 167 mg/L to 214 mg/L (as CaCO₃) on the dates sampled. According to Health Canada, “hard water causes incrustation in distribution systems and excessive soap consumption. Public acceptability of the degree of hardness may vary considerably from community to community depending on local conditions. Therefore, a maximum acceptable level for hardness is not specified by Health Canada. Waters with hardness levels in excess of 200 mg/L are considered poor but have been tolerated by consumers;”
- Manganese concentrations were above the GCDWQ AO for all sample results. Manganese concentrations were highest (0.589 mg/L) in July 2009; all other results fluctuated between 0.14 mg/L to 0.16 mg/L; and,
- The water from both wells can be classified as calcium-bicarbonate type water.

Tetra Tech did not review recent water quality data but understands water chemistry analysis is completed at this system annually and bacteriological monitoring is completed on a regular basis with results sent to YG EHS for review.

5.36.5 Water Treatment and Distribution

Table 5-95: Old Crow Public Drinking Water Supply System Treatment and Distribution Details

Item	Details	Source
Owner/Operator	Yukon Government Community Services	
Water source	Groundwater	Tetra Tech 2012
Wells serving the system	WW-1 and WW-2	
Treatment type	Manganese-iron removal filtration, disinfection	Stantec 2013
Number of people served	221	Yukon Bureau of Statistics 2016
Delivery method	Trucked bulk delivery	YES 2012

Table 5-95: Old Crow Public Drinking Water Supply System Treatment and Distribution Details		
Item	Details	Source
Age of system/last known update	Well WW-2 was brought online in 2012. New water treatment plant was completed in 2013.	Tetra Tech 2012 Stantec 2013

5.36.6 Source Water Protection Planning

Tetra Tech was not able to find any record of a SWPP/AWPP or GUDI assessment for the Old Crow community water supply wells or aquifer. An aquifer vulnerability assessment was completed in 2011 and found that the aquifer is well protected from surface sources of contamination (Tetra Tech 2011a). Given this water source is the key water supply for the remote community, source water protection planning for this groundwater source may provide a valuable tool for identifying, monitoring and managing risks to the well and aquifer.

Potential sources of contamination in the vicinity of the wells that were identified include the following:

- Industrial activity, which in Old Crow is limited to community services including operation of a diesel generator and public services for septic and solid waste disposal.
- The nearest surface waterbody to the Old Crow wells is the Porcupine River, which as the wells are highly artesian, cannot be directly hydraulically connected to the aquifer.

5.36.7 Water Supply Information Data Gaps

Tetra Tech has contacted YG CS water system operator as well as the VGFN public services manager, and to our knowledge, the data compiled here is complete with the exceptions of the following data gaps:

- Tetra Tech notes that Source Water Protection Planning has not been completed for the Old Crow community water supply system.