

5.49 Watson Lake - Town of Watson Lake Water Supply System

The Town of Watson Lake is located at km 1,022 on the Alaska Highway and is served by a community water system. Water for the community water system is sourced from groundwater supply wells (Well 4 and Well 5), is treated at a water treatment plant (constructed in 2013), and delivered via a piped water distribution system. The water system is owned and operated by the municipality. The Watson Lake water supply system serves a population of approximately 790 people (Yukon Bureau of Statistics 2016) and 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).

5.49.1 Data Compilation Methodology

Tetra Tech approached stakeholders including water system operators and owners, governing bodies and regulators to let them know the project was in progress and to request their assistance in compiling the most complete data set possible. The following stakeholders were contacted to provide information regarding the Town of Watson Lake water supply system:

- Town of Watson Lake – Town of Watson Lake water system operator provided review comments and information regarding the new water treatment system and the local hydrology.
- YG Community Services (the client) – YG CS provided data for Watson Lake regarding the water system upgrades when the other proponents contacted were not able to find the documents.
- YG Environmental Health – YG EHS was contacted and assisted with the provision of data for Watson Lake water treatment.

5.49.2 Hydrogeology

The Town of Watson Lake is underlain by glaciofluvial deposits consisting of sands and gravels. The thickness of the overburden underlying Watson Lake is unknown, but wells drilled in the well field area as deep as 32 m have not encountered bedrock. The glaciofluvial deposits are heterogeneous with varying composition, including cobbles, gravels, sands and silts. Wells in the Watson Lake municipal well field are completed in these glaciofluvial deposits.

The nearest surface water body to the Watson Lake wells is Wye Lake. Wye Lake has limited surface water inflow and discharge and is thought to primarily recharge and discharge through shallow groundwater flow.

Wells 4 and 5 both encountered similar lithology during drilling. Materials encountered were coarse and permeable from surface to the well completion depths with sands and gravels encountered above the target aquifer. The target aquifer is comprised of sand and gravel and was encountered at 23.0 m bgs in Well 4 and at 20.8 m bgs in Well 5. At both well locations, the aquifer consists of sand and gravel to the drilling completion depth of about 29.5 m bgs. The lack of a fine-grained confining layer means this aquifer is vulnerable to surface sources of contamination.

As part of the completion of Well 4, MH completed a semi-quantitative analysis of the aquifer vulnerability based on the methodology presented in the Technical Terms of Reference for Groundwater Studies (Ontario Ministry of Environment 2001). The intrinsic susceptibility of the aquifer at Well 4 was calculated to be 5.56. The ISI method defines aquifers with ISI scores of less than 30 to have high susceptibility to surface sources of contamination, and the score here indicates the Watson Lake aquifer is highly vulnerable to surface sources of contamination. The ISI value for Well 4 is similar to the value of 5 calculated for Well 1 (which is completed in the same area and is no longer in use) in 2012 (Tetra Tech 2012). This suggests that the ISI value for the aquifer is likely similar throughout the area.

5.49.3 Summary of Wells

The well logs for the Town of Watson public supply wells are included in the GIS map and database portion of this project. The following tables summarize the completion characteristics of the Watson Lake wells.

Table 5-125: Watson Lake Public Water Supply System, Well 4 Summary		
Well Construction Parameters	Details	Source
Date of construction	Well was completed by Midnight Sun Drilling Inc. in April 2012	MH 2012
Total well depth	28.3 m bgs	
Casing	12" (305 mm) ID Steel Well Casing	
Casing depth	25.2 m bgs	
Well screen	3.1 m 60 slot (1.52 mm) v-wire well screen from 25.2 m bgs to 28.3 m bgs.	
Static water level	5.6 m bgs (measured on April 25, 2012)	
Sanitary seal	Bentonite gout seal to 4.9 m bgs	
Wellhead completion	Pitless Unit	
Wellhead stickup	0.69 m ags	
Well rated capacity	30 L/s (396 IGPM)	
Well GUDI status	Non-GUDI	Golder Associates Ltd.2015
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

Table 5-126: Watson Lake Public Water Supply System, Well 5 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed by Midnight Sun Drilling Inc. in May 2015	MH 2015
Total well depth	26.8 m bgs	
Casing	12" (305 mm) ID Steel Well Casing	
Casing depth	23.1 m bgs	
Well screen	3.05 m of 60 slot (1.52 mm) exposed from 23.8 m bgs to 26.8 m bgs	
Static water level	5.6 m bgs (measured on May 14, 2015)	
Sanitary seal	Bentonite grout surface seal to 4.9 m bgs	
Wellhead completion	Pitless Unit	
Wellhead stickup	0.7 m ags	
Well rated capacity	11.5 L/s (152 IGPM)	
Well GUDI status	Non-GUDI	
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

5.49.4 Source Water Quality

Upon completion of the two water supply wells in 2012 and 2015, water samples were collected to characterize the water quality and potability. From the water quality results and summaries provided in the well completion reports (MH 2012, MH 2015):

- The water provided from both the wells is calcium-bicarbonate type with a pH of approximately 8.1 and is considered hard to very hard with a measured hardness of 156 mg/L in Well 4 and 209 mg/L in Well 5;
- Measureable nitrite and ammonia concentrations were detected in the water, but are likely attributable to the organic sediments found in the aquifer soils rather than anthropogenic effects;
- The total iron concentration measured in the two wells was between 0.408 mg/L and 0.697 mg/L, which exceeded the GCDWQ AO of 0.3 mg/L;
- The total manganese concentration measured in the wells was between 0.139 mg/L and 0.148 mg/L, which exceeded the GCDWQ AO of 0.05 mg/L;
- The wells were tested for petroleum hydrocarbons including VOC and PAH. All hydrocarbon parameters analyzed were below the detection limits;
- Testing for potential formation of THM and HAA through chlorination treatment found that the results were below the GCDWQ and that THM and HAA formation associated with chlorination treatment process is not likely to occur from Wells 4 and 5; and

- The water quality from both wells met the GCDWQ MACs for all parameters tested (including radiological parameters from Well 4).

5.49.5 Water Treatment and Distribution

Item	Details	Source
Owner/Operator	Town of Watson Lake	Tetra Tech 2012
Water source	Groundwater	p.c. Alan Puckett 2016
Wells serving the system	Well 4 and Well 5	
Treatment type	Pre-chlorination, greensand filtration to remove iron and manganese, secondary chlorine disinfection with baffled tanks for chlorine contact time	Opus DaytonKnight 2014 p.c. Alan Puckett 2017
Population served	Approximately 790	Yukon Bureau of Statistics 2016
Delivery method	Piped	p.c. Alan Puckett 2016
Age of system/last known update	New Water Treatment Plant completed in 2013.	

5.49.6 Source Water Protection Planning

Tetra Tech was not able to find any record that a SWPP/AWPP has been developed for the Town of Watson Lake community water supply system and both YG CS and the system operator were not aware of any such plans. Given that the system supplies the residents of Watson Lake with potable drinking water and is classed as a LPDWS, source water protection planning here is merited.

Watson Lake was established as an air base in 1941 and became an important stop on the military supply route to Alaska with the completion of the Alaska Highway in 1942 and later as an industrial supply route to mines accessed by the Robert Campbell Highway. Today, Watson Lake is a hub for transportation for goods transported from the south into the Yukon.

Potential sources of contamination to the Town of Watson Lake wells and aquifer were identified as part of the 2012 LPDWSA. Wells 4 and 5 were drilled in the same area as Wells 1 and 1a, therefore are in close proximity to the same identified potential sources of contamination. Potential sources of contamination in the vicinity of the Watson Lake supply wells that were identified in 2012 included:

- Above-ground storage tanks, all located >60 m from the wells;
- Wye Lake located approximately 100 m from the wells; and
- Sewer main located approximately 45 m from Well 5.

The nearest surface waterbody to the Watson Lake water supply wells is Wye Lake, which is about 100 m down-gradient of the nearest water well (Well 4).

5.49.7 Water Supply Information Data Gaps

Tetra Tech was not able to obtain all records for the updates to the water supply system since 2012, as a result some data gaps have been identified:

- No source water protection is in place for the system. Source water protection planning is an effective tool for maintaining the integrity of water supply systems and aquifers and is considered an essential part of best management practices for water supply systems. Source water protection for the Watson Lake well field would allow for increased protection of the unconfined, vulnerable groundwater aquifer; and.
- Wells 1, 1a, 2 and 3 have not been decommissioned. These wells should either be securely maintained in anticipation of future use, or, if they are no longer needed, should be decommissioned in accordance with best management practices to protect the groundwater supply.