

Hamlet of Tuktoyaktuk

Background Report for Water Licence Renewal (2015)

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Project Number:

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Date:

September, 2015

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September 15, 2015

Terry Testart
Senior Administrative Officer
Hamlet of Tuktoyaktuk
P.O. Box 120
Tuktoyaktuk NT X0E 1C0

Dear Mr. Testart:

Project No: 60439290

Regarding: Background Report for Water Licence Renewal (2015)

AECOM is please to submit the Background Report for Water Licence Renewal (2015) for the Hamlet of Tuktoyaktuk. Copies of this report have also been submitted to the NWT Water Board to assist the Board in its review of the Hamlet's application for water licence renewal.

If you have any questions, please contact me at 867-873-6316 x22.

Sincerely,
AECOM Canada Ltd.



Michel Lanteigne, P.Eng.
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cc: Executive Director, NWT Water Board

Distribution List

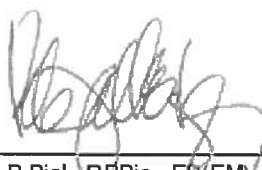
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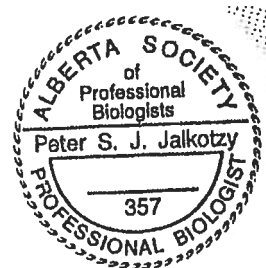
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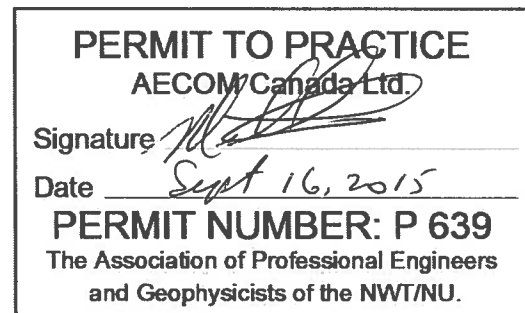


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1. Introduction

In support of the Hamlet of Tuktoyaktuk's application for renewal of its water licence, AECOM has prepared this background report to provide an overview of the water and waste infrastructure within the community based upon the compilation of existing information. In addition, this report will serve as a communication tool for the community to address questions and concerns raised by the mayor, council, senior administration, residents, and other potential stakeholders of the community's water and waste infrastructure.

The scope of the report includes background information on water supply and distribution, sewage collection and treatment, and solid waste management. The report summarizes most recent Annual Reports and Aboriginal Affairs and Northern Development Canada (AANDC) Inspection Reports to provide an overview of past issues and improvements to the systems. This report also acknowledges recent improvements to the Hamlet's water and waste infrastructure.

The information review is presented through a combination of figures and text to provide a complete understanding of the community's current infrastructure. The water and waste systems are illustrated in regional maps and aerial photos, and tables are used throughout the report to summarize information. This variety of presentation techniques makes the information clear and convenient for the various stakeholders to review within the application process.

2. Community Brief

The Hamlet of Tuktoyaktuk (or Tuktuujaartuq, “looks like a caribou”) is located on Kugmallit Bay near the Mackenzie River Delta. Tuktoyaktuk is accessible by plane, or seasonally by ice-road. The 137 kilometre (km) all season Inuvik-Tuktoyaktuk Highway (ITH) is currently under construction and is scheduled for completion in 2017-2018.

Tuktoyaktuk is the most northern community on Canada's mainland. Prior to 1900, the area was home to many Inuit whalers, but this original population was badly hit by years of influenza epidemics brought by American whalers. Eventually Alaskan Dene people and inhabitants of Herschel Island settled in the area. A Hudson's Bay trading post was built in 1928, and in the 1950s Tuktoyaktuk became a supply base for the Cold War DEW Line. Today, many community residents work in transportation with the Northern Transportation Company Ltd., support local tourism or Arctic research or practice traditional economic activities such as hunting and trapping.

Table 1 below presents a brief profile of the community including size, terrain, climate and socio-economic characteristics.

Table 1. Profile of Tuktoyaktuk

| Category | Description |
|-------------------------|--|
| Location: | 69° 27' N and 133° 02' W |
| Population: | 962 (2014 NWT Bureau of Statistics) |
| Residences: | 265 (2014 NWT Bureau of Statistics) |
| Proximity: | 137 km north of Inuvik, 1130 km northwest of Yellowknife |
| Weather: | Annual Daily Average = -10.2°C July Daily Average = 11.0°C and January Daily Average = -26.6°C (Canadian Climate Normals 1981-2010) |
| Precipitation: | 7.49 cm of rainfall and 10.31 cm of snowfall annually |
| Vegetation: | Surrounding vegetation consists of moss, peat, grasses, lichens, and small bushes of willow and Labrador Tea. Small flowering plants are common in summer (GNWT, 1982). |
| Transportation: | Accessible by air year-round, or by ice road from Inuvik or Aklavik in winter. All season road from Inuvik to Tuktoyaktuk is expected to be completed in 2017/18 winter season. |
| Economy: | Major industries include transportation, petroleum exploration, tourism and traditional trapping and hunting |
| Services: | Public School, Health Centre, RCMP Station, etc. |
| Geology/Terrain: | Terrain around Tuktoyaktuk is flat, barren tundra dotted with shallow lakes and pingos. Permafrost is continuous, with an active layer generally less than 0.5 m. The peninsula under the community is coarse sand, silt, clay and gravel with interbedded ice lenses, formed from erosion material. |

3. Infrastructure Descriptions

This section provides an overview of Tuktoyaktuk's water supply and waste disposal systems. See **Figure 1** for the locations of the water and waste management infrastructure described below.

3.1 Water Supply

The Hamlet's potable water supply system consists of the following elements:

- Seasonal raw water supply from Kudlak Lake,
- Raw water storage reservoir,
- Water treatment facility and truckfill station, and
- Trucked water delivery.

See **Figure 2** for the water supply site plan and **Figure 3** for water supply photographs.

3.1.1 Seasonal Raw Water Supply

Tuktoyaktuk's raw water comes from Kudlak Lake, a shallow lake located approximately 5.5 km east of the community centre and 4.5 km east of the raw water reservoir. Tuktoyaktuk's raw supply water is of good chemical quality for domestic use. The water is clear, moderately hard, well buffered, slightly alkaline, and has a moderate amount of dissolved solids.

In winter, the lake freezes deep enough that obtaining water from the lake is difficult and water quality is poor. The Hamlet uses a raw water storage reservoir to hold water for use during winter months.

The community obtains water from the lake via a high-density polyethylene pipeline. This intake line is partially submerged under Tuktoyaktuk Harbour and runs along the ground surface for the overland distance to the raw water reservoir. The intake line was replaced in October 2006 with a new 200 mm (8") diameter pipe after the old 100 mm diameter pipeline broke in the summer of 2006.

The water pump house at Kudlak Lake was relocated south of the previous location in April 2007.

3.1.2 Water Storage Reservoir

The water reservoir, built in 1984, is an earth structure with a capacity of approximately 90,300 m³. The reservoir characteristics are presented in **Table 2** below.

Table 2. Tuktoyaktuk Water Reservoir Characteristics

| Characteristic | Description |
|--|----------------------------|
| Maximum Reservoir Capacity | 94,300 m ³ |
| Usable Volume Under Ice | 53,100 m ³ |
| Maximum Water Depth | 7.0 m |
| Design Ice Thickness | 2.1 m |
| Dead Storage Depth | 0.5 m |
| Freeboard | 1.3 m |
| Full Reservoir Water Surface Dimension | 102 m in diameter |
| Inside Slope | 4:1 |
| Liner | 0.8 mm CPE with sand cover |

Figure 1. Facility Locations

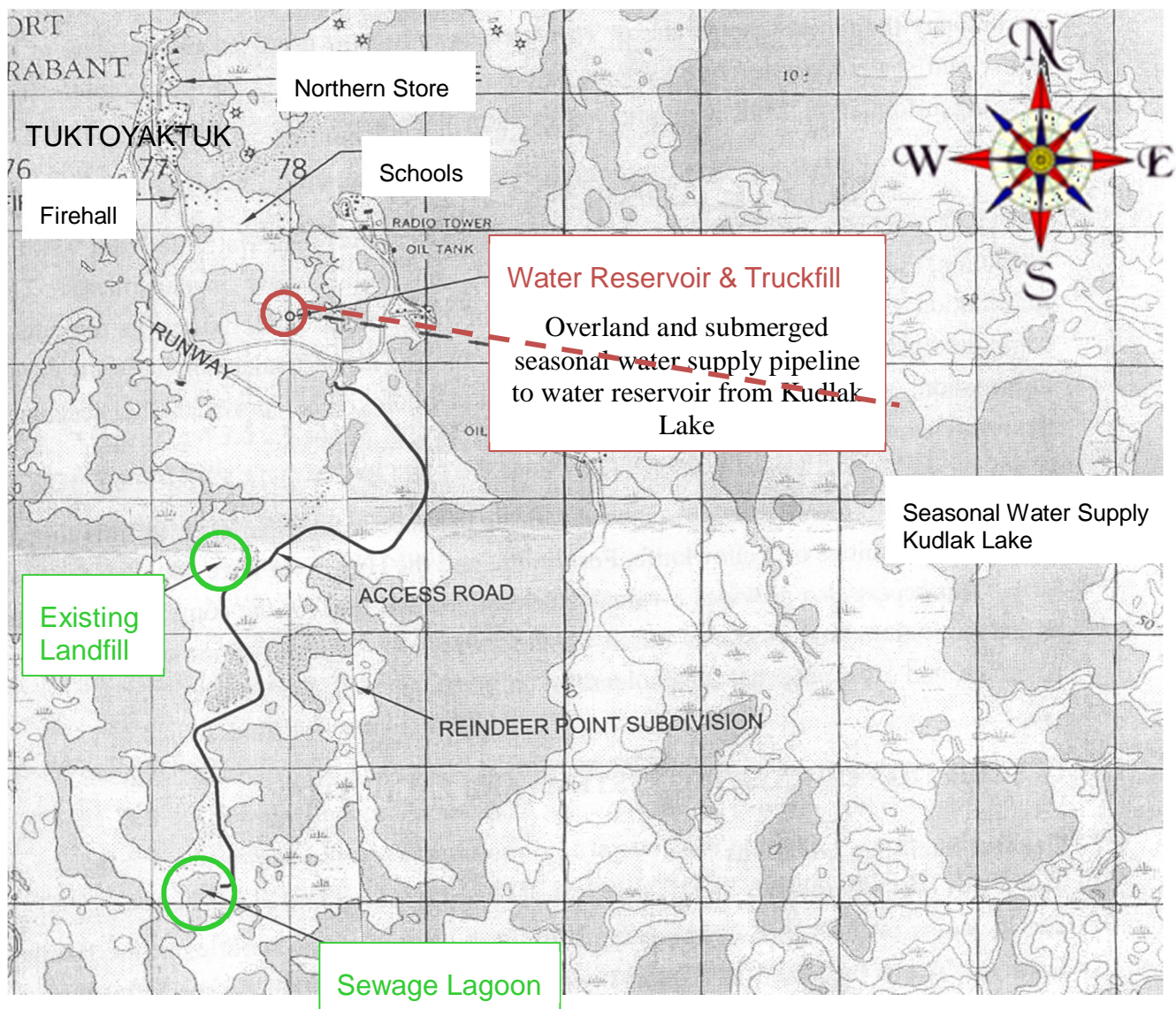



Figure 2. Water Supply Site Plan



Figure 3. Water Supply PhotographsNorth
South
**Water Reservoir****Truckfill Inlet Piping and Pumphouse
(without new building)****Water Treatment Plant and Truckfill Building****Old Pipeline from Kudlak Lake**

The design capacity of the water reservoir is equivalent to consumption by 1,900 community residents and 250 camp residents.

The raw water storage reservoir is filled to capacity in the late summer of each year. This filling procedure usually takes about a week of continuous pumping of water from Kudlak Lake.

3.1.3 Water Treatment and Truckfill Station

Prior to 2009, water was treated by chlorinating with calcium hypochlorite (powdered form of chlorine) during truckfill.

A new water treatment plant and truckfill station was constructed in 2009 by Corix Water Systems. The new water treatment process includes 50 micron cartridge filters, a pressure filter, UV reactors applying a 40 mJ/cm² dose, and a chlorine contact chamber.

3.1.4 Distribution

Water is distributed throughout the community using water trucks operated by a private contractor. Two trucks operate seven days per week, filling individual building water tanks. Most of the existing houses have small tanks that are filled daily. Each truck has a capacity of 15,890 L. Water deliveries are metered at the truck.

3.2 Sanitary Sewage Facility

Tuktoyaktuk's sewage is collected using trucked pumpout services. The sewage is treated at a sewage lagoon, shown in **Figures 4 and 5**, which is located approximately 3.9 km due south of the Airport Terminal Building.

3.2.1 Trucked Sewage Pumpout

Sewage is collected by a local contractor using 15,890 L vacuum trucks. Two trucks operate seven days per week. The sewage is transferred from holding tanks in each building to a retention lagoon approximately 5 km south of the community via an all-weather gravel road.

3.2.2 Lagoon Access Road and Sewage Truck Discharge Area

The access road to the sewage lagoon is an all-weather gravel road which exits the Reindeer Point subdivision access road. The access road leads to the truck discharge area at the north end of the lagoon. A seasonal access road extends to the south end of the lagoon.

Figure 4. Sewage Lagoon Site Plan

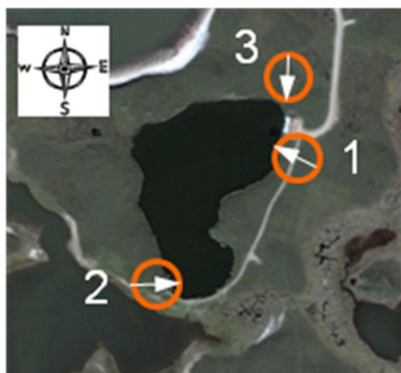
Base Image from GoogleEarthPro, © 2009 DigitalGlobe

Figure 5a. Sewage Lagoon Photographs**View 1****View 2**

Figure 5b. Sewage Lagoon Photographs



View 3 – Discharge Structure in 2009



The truck discharge area consists of a gravel area with two gravel ramps leading to a steel chute and pipe system for the discharge from the vacuum trucks. The vacuum trucks discharge by elevating the tank at the front end of the truck, and opening a valve at the back of the truck.

The dispersion structures at the sewage lagoon consist of a timber retaining wall and a metal ramp from the base of the retaining wall into the lagoon. The metal ramp provides a means of effluent dispersion into the lagoon and provides erosion protection to the retaining wall.

3.2.3 Sewage Lagoon

The Hamlet's sewage lagoon is located approximately 5.8 km due south from the Hamlet Office, or 3.9 km south of the Airport Terminal Building, and 1.5 km southwest of the Reindeer Point subdivision.

The sewage retention lagoon provides 365-day retention to treat the sanitary sewage generated by the community. This is a secondary sewage treatment facility. The facility is a 5.9 hectare natural lake that has been modified with a perimeter berm at the south edge to provide the necessary retention capacity. The lagoon has sufficient capacity for a population of 1,900 community residents and 250 camp residents, assuming only domestic use.

3.2.4 Lagoon Effluent Discharge

The sewage lagoon is discharged in the early fall of each year to a saltwater inlet. Fall discharge ensures that the sewage receives the maximum possible natural aerobic treatment within the lagoon provided by sunlight, warm temperatures, and wind in the summer.

The seasonal discharge point is located on the constructed berm at the south edge of the lagoon, 3.0 km directly southeast from the open ocean of Kugmallit Bay and approximately 6.5 km from the ocean by way of the inlet channels. Discharge is accomplished by pumping effluent over the berm.

Over the recent water licence term, the Hamlet has collected samples from the sewage lagoon (SNP 0714-2) and the run-off lagoon at the landfill (SNP 0714-3) during summer and fall months. Data is available from Taiga labs for the number of samples shown in **Table 3**.

Table 3. Lagoon Effluent Sampling Summary

| SNP Sampling Location | Number of Samples with Available Data | | |
|---|---------------------------------------|------|------|
| | 2008 | 2011 | 2012 |
| 0714-2 (Sewage Lagoon) | 1 | 2 | 1 |
| 0714-3 (Runoff Lagoon at Landfill) | 0 | 0 | 1 |

The following tables show the average sample results for the sewage lagoon and solid waste lagoon, along with the operating parameter requirements of the Hamlet's Water Licence.

Table 4. Results of Sewage Lagoon Effluent Sampling

| Parameter | Units | Licence Requirement | Average Sample Result |
|---------------------------|-----------|---------------------|-----------------------|
| BOD₅ | mg/L | 120 (MAC) | 28 |
| TSS | mg/L | 180 (MAC) | 92 |
| pH | | 6 to 9 | 7.93 |
| Oil / Grease Sheen | | none visible | none visible |
| Fecal Coliforms | CFU/100mL | no requirements | 11000 |

Table 5. Results of Solid Waste Run-off Lagoon Effluent Sampling

| Parameter | Units | Licence Requirement | Sample Result (2012) |
|---|-----------|---------------------|----------------------|
| BOD₅ | mg/L | 120 (MAC) | 10 |
| TSS | mg/L | 180 (MAC) | 6 |
| Polychlorinated Biphenyls (PCBs) | µg/L | 25 (MAC) | <0.1 |
| pH | | | 8.36 |
| Fecal Coliforms | CFU/100mL | | 55 |
| Cadmium | µg/L | | <0.05 |
| Cobalt | µg/L | | <0.01 |
| Chromium | µg/L | | 0.8 |
| Copper | µg/L | | <0.02 |
| Iron | µg/L | | 391 |
| Mercury | µg/L | | <0.01 |
| Manganese | µg/L | | 7.4 |
| Nickel | µg/L | | 2.2 |
| Lead | µg/L | | <0.01 |
| Zinc | µg/L | | 6.6 |

3.3 Solid Waste Facility

Tuktoyaktuk's solid waste is collected by truck and transported to the solid waste landfill, approximately 3 km south of the Hamlet. The landfill site consists of the following components:

- Perimeter fence and access roads to landfill areas
- Active municipal waste disposal area (east area)
- Bulky waste disposal area (south area)
- Remediated disposal areas
- On-site drainage retention system.

See **Figure 6** for the facility layout and **Figure 7** for site photographs.

3.3.1 Solid Waste Collection and Site Access

Solid waste collection is done by truck throughout the community under contract to the Hamlet. Collection currently involves two trucks operating seven days per week.

The Solid Waste Disposal site is accessed from a gate along the all-weather road to Reindeer Point. This entrance provides access to the bulky waste area, the hazardous waste storage area, and a storage shed for the Hamlet's Caterpillar tractor. The gate is normally closed to provide security for the Caterpillar tractor.

The landfill site is surrounded by a 1200 m perimeter fence on the inland side of the site. The ocean-facing side of the landfill, to the west, is not fenced.

Figure 6. Landfill Site Plan

Base Image from GoogleEarthPro, © 2009 DigitalGlobe

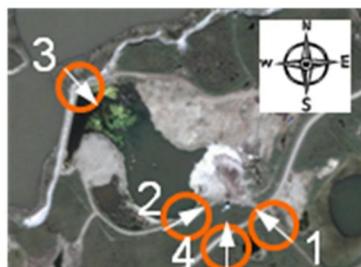
Figure 7a. Landfill Photographs**View 1: Entrance to Municipal Solid Waste (MSW) Area****View 2: Active Municipal Solid Waste (MSW) Area****View 3: Perimeter berm**

Figure 7b. Landfill Photographs**View 4: Active Municipal Solid Waste (MSW) Area in 2009**

3.3.2 Solid Waste Disposal Facility

The Tuktoyaktuk Solid Waste Disposal site is a large fenced-in facility, approximately 3 km south of the Hamlet. It has been in operation since the early 1970s as a replacement to the dump formerly located at the end of the community airstrip. The facility covers an area of approximately 20 hectares, but not all of the area is currently in use.

The municipal waste area occupies an area approximately 70 m wide and 50 m long. The landfill is operated with limited compaction and limited cover.

The domestic waste area has a limited area for household hazardous waste storage, and no designated areas for waste separation. The municipal waste area is used by both the community and the local industries with no direct fee charged. There is no permanent supervision of the site, and no records of the quantities and types of waste are kept.

The Hamlet was operating a bulky metal waste area approximately 100 m wide by 100 m long. This area was remediated with complete cover in 2004. There is no designated metal waste area currently at the site.

Several old landfill areas were remediated in the north, southwest and east portions of the landfill site. These areas have been covered, with limited vegetative cover in the north and southwest areas and substantial vegetative cover in the east area.

The existing landfill is scheduled for closure and is listed as a priority site by GNWT and AANDC. A new landfill site located approximately 17km southwest of the community has been designed and approved and construction was initiated in 2015. As of this writing, Phase 1, including a landfill cell and access road to the site, has been completed. Phase 2, including fencing, gate, and buildings is underway. Final operations will be contingent upon receipt of direct access to the new ITH.

3.3.3 Solid Waste Disposal Facility On-site Drainage Retention and Control Berm

Most of the surface area of the Solid Waste Disposal facility is covered by a lagoon containing surface runoff from the landfill. The surface runoff lagoon is retained by a 250 m long gravel and clay berm on the eastern edge of the landfill site.

The berm does not have any discharge control structure, so drainage continually accumulates. The perimeter berm also prevents the ingress of the ocean.

3.3.4 Water Pollution

The pollution factors associated with the landfill include surface water pollution, and subsurface water pollution. Surface water pollution is a concern which is managed with the on-site runoff collection within the landfill area.

3.3.5 Landfill Site Management

It has been recommended in the studies that the landfill site needs management improvements. The most significant of these improvements is that the municipal waste area requires management (signs and barricades) to limit the waste disposal area into a more manageable (smaller) area. As noted in Section 3.3.2, the existing landfill has been identified as a priority for closure by GNT and AANDC, and the new landfill site has been approved and is under construction (2015).

4. Water Licence Compliance Inspections and Annual Reports

This section summarizes the information from past AANDC inspection reports and the Hamlet's Annual Reports. No other studies or reports have been completed since 2005 on the Hamlet's water and waste systems, as far as AECOM is aware.

4.1 Water Licence and Amendments

The Hamlet of Tuktoyaktuk currently holds Water Licence N7L3-0714 from the NWT Water Board, for municipal water use up to 100,000 m³/year and municipal waste disposal. The Licence was first issued to the Hamlet in 1984 for water use up to 150,000 m³/year and waste disposal.

Table 6. Summary of Water Licence Periods

| Effective Date | Expiry Date | Licence # |
|---------------------------|-------------------|-----------------------|
| November 19, 2013 | June 30, 2014 | N7L3-0714 (renewal) |
| April 23, 2010 | November 20, 2013 | N7L3-0714 (renewal) |
| June 28, 2005 | June 27, 2009 | N7L3-0714 (renewal) |
| April 30, 2002 | April 29, 2005 | N7L3-0714 (renewal) |
| March 1, 2000 | April 29, 2002 | N7L3-0714 (extension) |
| March 1, 2000 | February 28, 2002 | N7L3-0714 |
| January 1, 1997 | February 29, 2000 | N7L3-0714 (extension) |
| September 11, 1997 | December 31, 1999 | N7L3-0714 (amendment) |
| January 1, 1997 | December 31, 1999 | N7L3-0714 |
| March 1, 1994 | February 28, 1997 | N7L3-0714 |
| March 1, 1984 | February 28, 1994 | N7L4-0714 |

4.2 Water Licence Annual Reports

The Hamlet did submit annual reports during the years 2008, 2011, and 2012.

The Hamlet's average water use from 2008 to 2012 was 48,053 m³ per year, or 145 litres per capita per day.

SNP sampling results, as summarized in the annual reports, indicate that the sewage lagoon and solid waste disposal run-off lagoon are operating within the water licence parameters.

4.3 Water Licence Compliance Inspection Report 2013

A Water Licence inspection was done in 2013 by inspectors from Indian and Northern Affairs Canada (INAC).

4.3.1 Water Supply

Water supply facilities were generally acceptable. There were no violations identified during the course of inspection (August 27, 2013).

Table 7 presents a summary of comments from the 2013 Inspection Report on the Hamlet's Water Supply.

Table 7. Summary of INAC Inspections (Water Supply)

| Inspection | Concerns | Notes/Comments |
|-----------------|-------------|--|
| August 27, 2013 | No concerns | Oil and waste containers on site. Ensure these are properly disposed of prior to securing the site Propane tanks left on site as a source of fuel for water pumping operations, since in the past there have been issues with diesel fuel leaking at the site |

4.3.2 Waste Disposal

Table 8 presents a summary of comments from the 2013 Inspection Report on the Hamlet's Waste Disposal Facilities.

Table 8. Summary of INAC Inspections (Waste Facilities)

| Inspection Date | Concerns | Notes |
|-----------------|---|--|
| August 27, 2013 | Ground access by ATV down the bank to the intake facility/pumping station was disturbing the ground | The stated concern can be addressed by staff walking to the pump station after parking ATV at top of bank. |

4.3.3 Surveillance Network Program

Table 9 presents a summary of comments from the 2013 Inspection Report regarding the Hamlet's Surveillance Network Program (SNP) and records and reporting requirements.

Table 9. Summary of INAC Inspections (SNP and Reporting)

| Inspection Date | Records & Reporting | SNP |
|-----------------|---------------------|--|
| August 27, 2013 | No Concerns | Records and reporting were not inspected |

5. Recent and Planned Improvements

Some modifications to the water licence infrastructure since the last water licence renewal (November 2013) include:

- A new solid waste landfill has been approved by the EISC in 2014 and construction initiated in 2015.
- The new landfill will commence operations upon receipt of permission to access the ITH.

6. Conclusions and Recommendations

Over the most recent term of its Water Licence, the Hamlet of Tuktoyaktuk has not had any material non-compliance issues. The Hamlet did not submit water licence reports annually as required by the licence; however, reports for 2013 and 2014 were filed and an inspection in 2013 found no non-compliance.

As noted, the community will begin operations at a new landfill site approved in 2014 which will improve the overall circumstances related to the current facilities.

Tuktoyaktuk's water and waste facilities have served the community successfully, and should continue to do so in the future.

7. References

NWT Bureau of Statistics, *Tuktoyaktuk Statistical Profile*. <http://www.statsnwt.ca/community-data/Profile-PDF/Tuktoyaktuk.pdf> accessed online September 2015.

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