2003 Cambridge Bay Annual Water Licence Report

Prepared for:
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1.0 INTRODUCTION

In 2003, the community infrastructure systems providing water, sewage and solid waste management to the residents of the Hamlet of Cambridge Bay were successfully operated and maintained by the community. **Figure 1** and **Figure 2** provide an overview of the location of the source water and wastewater lagoon with respect to the community.

2.0 WATER USE

The raw water source is Water Supply Lake, approximately 3 kilometers north of the community. The catchments area for the Lake is 231 hectares (571 acres). The summer storage of Water Supply Lake is approximately 1,738,000 m^3 and winter storage volume is about 544,000 m^3 with 2.5 meters of ice. The water source is not near any human activities and, as such, is relatively free from potential contamination.

The intake facilities extend 20 meters into Water Supply Lake to a depth of approximately 4 meters below the surface. The intake pump discharge line consists of a 100mm diameter HDPE pipe. This pipeline is coupled to a submersible pump at the intake pumphouse and rests with a HDPE intake shaft or casing pipe. The water is chlorinated at the intake pumphouse prior to pumping to the distribution pumphouse.

A 2,900 meters water supply pipeline runs from the intake facilities to the distribution pumphouse at the centre of community. The 150 mm waterline is freeze protected with insulation and a 50 mm recirculation waterline.

Water is then distributed by water trucks from the truckfill station in the community center to the water tanks within each residence in the community. Water delivery is provided to the residents by the Hamlet using 12,000 litre water trucks. There is a 260 m^3 storage tank located beside the distribution pumphouse. **Figure 3** shows the location of the intake area, pipeline, and distribution pumphouse. **Figure 4** shows the water distribution pumphouse.

3.0 WASTEWATER DISCHARGE

Sewage is collected from the community by sewage trucks to the sewage lagoon system, located approximately 1.5 km northeast of the community and adjacent to the existing Waste Metal Disposal Site. The system consists of several natural ponds connected in series (Pond 1, Pond 2, Pond 3, Pond 4, Pond 5 and Pond 6) as shown in **Figure 5**. Based on the normal water level in the lagoon ponds, the lagoon volume was estimated to be 72,000 m^3 by IEG Environmental Consultants.

The sewage is discharged into Pond 1 of the lagoon by tanker trucks at truck discharge site. The treated sewage by the lagoon is channeled into Cambridge Bay. Currently, there is no discharge control structure in the lagoon. The existing lagoon is, therefore, seasonally flooded due to spring runoff flowing into the lagoon from the surrounding watershed. The sewage effluent from the lagoon is discharged to Cambridge Bay continually.

4.0 WATER AND WASTEWATER QUANTITIES

Water consumption quantities are not available for this report. As such, water consumption was estimated as 140 litres per capita per day. The population for Cambridge Bay was estimated as 1,374 based on the Statistics Canada reported population of 1,309 in 2001 and an assumed 2.44% annual growth rate.

As such, water consumptions are estimated per month below.

Month	Total Water Use (Litres)
January	5,963,160
February	5,386,080
March	5,963,160
April	5,770,800
May	5,963,160
June	5,770,800
July	5,963,160
August	5,963,160
September	5,770,800
October	5,963,160
November	5,770,800
December	5,963,160
Total	70,211,400

5.0 SYSTEM MODIFICATIONS, MAINTENANCE AND LICENCE AMENDMENTS

The water use and waste disposal in the Hamlet of Cambridge Bay is regulated by a Type B Water Licence. The water licence for the Hamlet of Cambridge Bay, number NWB3CAM0207, was issued on September 1, 2002 and expires on August 31, 2007.

There are no records of any system modifications, maintenance and licence amendments in Cambridge Bay in 2003.

6.0 SURVEILLANCE NETWORK PROGRAM MONITORING

The location of three surveillance network program stations was identified by a water resources officer: the Water Supply Intake (CAM-1); the Solid Waste Disposal Facility Seepage (CAM-2, N69°07'26.2'W105°01'43.6'); and, located after the metal dump runoff and sewage lagoon effluent, the Sewage Lagoon Discharge (CAM-3, N69°07'19.5'W105°02'15.1').

There are thee points from which wastewater samples were obtained from the sewage lagoon system as indicated in **Figure 6**; the sewage lagoon pond "lagoon", the outlet of the pond adjacent to the metal disposal site "pond", and the ocean discharge point "outlet". Wastewater sampling was undertaken in 1998 and 2003, and the results of which are presented below. The analysis of the 2003 wastewater quality will be prepared by IEG Environment Consulting Limited. The "lagoon" sampling point was not included in the 2003 sampling program.

Table 1 "Lagoon" Sampling Results

Effluent Discharge Parameter	Unit	"Lagoon" Sampling Point	MWWE Guideline[1]
		1998 Sample (Average)	
pH		8.88	6.5 - 8.5[2]
Total Suspended Solids	mg/L	63	180
BOD_5	mg/L	88	120
Ammonium	mg/L	NA	--
Kjeldahl Nitrogen	mg/L	NA	--
Organic Carbon	mg/L	NA	--
Faecal Coliforms	CFU/100 mL	NA	--
Total Dissolved Solids	mg/L	NA	--

Table 2 "Pond" Sampling Results

Parameter	Units	"Pond" Sample Results		MWWE Guidelines [1]
		1998 Sample (Average)	October 2003 Sample	
pH		8.73	NA	6.5-8.5
Total Suspended Solids	mg/L	8.73	40	180
BOD5	mg/L	70.3	11	120
Fecal Coliforms	CFU/dL	65.6	NA	--
Silver, Ag	mg/L	0.00019	<0.0050	0.1
Aluminum, Al	mg/L	NA	0.280	2.0
Arsenic, As	mg/L	NA	NA	0.05
Boron, B	mg/L	NA	0.500	5.0*
Barium, Ba	mg/L	NA	0.068	1.0*
Beryllium, Be	mg/L	NA	<0.0020	--
Bismuth, Bi	mg/L	NA	<0.001	--
Calcium, Ca	mg/L	NA	66.1	--
Cadmium, Cd	mg/L	0.00011	<0.00100	0.005*
Cobalt, Co	mg/L	0.0004	<0.002	0.1*
Chromium, Cr	mg/L	0.0033	<0.0050	0.1
Copper, Cu	mg/L	0.0067	0.010	0.2*
Iron (total), Fe	mg/L	2.5214	2.81	--
Potassium, K	mg/L	NA	28.4	--
Magnesium, Mg	mg/L	NA	74.1	--
Manganese, Mn	mg/L	0.0188	**0.162**	0.05*
Molybdenum, Mo	mg/L	NA	<0.005	0.2
Sodium, Na	mg/L	NA	193.0	--
Nickel, Ni	mg/L	0.0019	0.0050	0.3*

Parameter	Units	"Pond" Sample Results		MWWE Guidelines [1]
		1998 Sample (Average)	October 2003 Sample	
Lead, Pb	mg/L	0.0027	<0.0050	0.05*
Tin, Sn	mg/L	NA	<0.050	5.0
Strontium, Sr	mg/L	NA	0.1170	--
Titanium, Ti	mg/L	NA	0.0100	--
Thallium, Tl	mg/L	NA	<0.05000	--
Vanadium, V	mg/L	NA	0.003	--
Zinc, Zn	mg/L	0.0225	0.028	0.50

Notes:

1. 1998 sample results are obtained from a report titled "Environmental Audit & Site Contamination Assessment of Cambridge Bay Waste Disposal Sites, 2000".
2. These results are converted into mg/L as originally reported as µg/L.
3. NA - Not analyzed/data not available.
4. -- - No applicable guideline.
5. October 2003 Sample Report is obtained from IEG Report "Cambridge Bay Municipal Sewage Lagoon and Waste Facilities Assessment, October 2005".
6. October 2006 Sample Report is based upon samples collected by Earth Tech and Analyzed by Norwest Labs, Edmonton.
7. [1] Guidelines for the Discharge of Treated Municipal Wastewater in the NWT, 1992 (Season: Summer, 150-600 Lcd) (Receiving Env: Marine/Bay).
8. * Dissolved.

Table 3 "Outlet" Sampling Results

Parameter	Units	"Outlet" Sampling Point		MWWE Guidelines [1]
		1998 Sample (Average)	October 2003 Sample	
pH		7.74	NA	6.50 - 8.50[2]
TSS	mg/L	11.50	**189**	180.0
BOD_5	mg/L	6.33	**156**	120.0
Fecal Coliforms, FC	CFU/dL	154	NA	--
Silver, Ag	mg/L	0.0001	<0.005	0.10
Aluminum, Al	mg/L	NA	**2.75**	2.0
Arsenic, As	mg/L	NA	0.0012	0.05
Boron, B	mg/L	NA	0.39	5.0*
Barium, Ba	mg/L	NA	0.037	1.0*
Beryllium, Be	mg/L	NA	<0.002	--
Calcium, Ca	mg/L	NA	32.70	--
Cadmium, Cd	mg/L	0.0001	<0.001	0.005*
Cobalt, Co	mg/L	0.0007	<0.002	0.1*
Chromium, Cr	mg/L	0.0030	<0.005	0.1
Copper, Cu	mg/L	0.0030	0.149	0.2*
Iron, Fe	mg/L	NA	1.69	0.3*
Potassium, K	mg/L	NA	18.10	--
Magnesium, Mg	mg/L	NA	25.60	--
Manganese, Mn	mg/L	NA	**0.054**	0.05*
Mercury, Hg	mg/L	0.00001	<0.0002	0.0006
Molybdenum, Mo	mg/L	NA	<0.005	0.2

Parameter	Units	"Outlet" Sampling Point		MWWE Guidelines [1]
		1998 Sample (Average)	October 2003 Sample	
Selenium, Se	mg/L	NA	0.002	0.05
Sodium, Na	mg/L	NA	89	--
Nickel, Ni	mg/L	0.0018	0.004	0.3*
Lead, Pb	mg/L	0.0013	<0.005	0.05*
Tin, Sn	mg/L	NA	<0.05	5.0
Strontium, Sr	mg/L	NA	0.053	--
Titanium, Ti	mg/L	NA	0.044	--
Thallium, Tl	mg/L	NA	<0.05	--
Vanadium, V	mg/L	NA	0.003	--
Zinc, Zn	mg/L	0.0096	0.081	0.5

Notes:
1. 1998 sample results are obtained from a report titled "Environmental Audit & Site Contamination Assessment of Cambridge Bay Waste Disposal Sites, 2000".
2. October 2003 Sample Report is obtained from IEG Report "Cambridge Bay Municipal Sewage Lagoon and Waste Facilities Assessment, October 2005".
3. October 2006 Sample Report is based upon samples collected by Earth Tech and measured by Norwest Labs, Edmonton.
4. [1] Guidelines for the Discharge of Treated Municipal Wastewater in the NWT, 1992 (Season: Summer, 150-600 Lcd) (Receiving Env: Marine/Bay).
5. [2] Water License requirement.
6. # Result is not reliable because of equipment error as reported by the Norwest Labs.
7. * Dissolved content.
9. -- No applicable Regulation.
10. NA – Sample not analyzed/data not available.

In 2003, to the best of the community's knowledge, based upon feedback from the community's operating staff and the limited water sample data, the community infrastructure systems were operating within the criteria of the water licence with the exception of the estimated annual removal of approximately 70,211 m^3 of water from the Water Lake. The current water license allows for the removal of 70,000 m^3 of water from Water Lake annually. The outfall sampling in 2003 saw exceedences of the Guidelines for the Discharge of Treated Municipal Wastewater in the NWT for total suspended solids, BOD_5, aluminum and manganese.

7.0 SYSTEM ABANDONMENT AND RESTORATION WORK

The water and sewer systems serving the Hamlet of Cambridge Bay did not have any system abandonment or restoration work completed in 2003.

8.0 SYSTEM STUDIES AND INSPECTIONS

Indian and Northern Affairs Canada (INAC) completed an inspection of the Cambridge Bay facilities on August 4, 2003. These inspections are typically done annually to ensure that facilities are in compliance with the terms of their water license. The 2003 inspection found that all aspects of the water supply system were acceptable.

The inspector did report on disposal of industrial waste oil, solvent and fuel at the metal dump. The SAO has been informed and the Hamlet was instructed to stop this practice from continuing and to ensure removal of the drums and to restrict access to the dump. The inspector recommended the installation of a water meter at the Water Intake Facility to better estimate water consumption. The inspector also recommended a berm be installed at the water intake facility for the fuel tank.

The inspector reported that the Water Intake Facility is well maintained, with the chlorination pump in good condition and appropriate spill response measures in place. The Water Treatment plant was also reported to be in good condition.

The Operation and Maintenance (O&M) Manual for the Hamlet of Cambridge Bay was found to be out of date. The Hamlet was directed to produce a new O&M Manual to the Water Board

9.0 TRAINING AND COMMUNICATION EXERCISES

There are no records of the staff of the Hamlet of Cambridge Bay attending any conferences or workshops in 2003.

10.0 SYSTEM DISCHARGES

Sewage enters into Pond 1 at the truck discharge site. Sewage travels through the six lagoon ponds identified in **Figure 4.** The wastewater will enter a series of natural lakes and wetlands before ultimately discharging into Cambridge Bay approximately 450 metres east of the community. Effluent from the sewage lagoon discharges during spring, summer and fall. Effluent does not discharge during winter due to freezing.

11.0 SYSTEM EXCAVATIONS

In 2003, there were no recorded trench or sump excavations associated with the Hamlet's water, sewer and solid waste management systems.

12.0 LAGOON SLUDGE

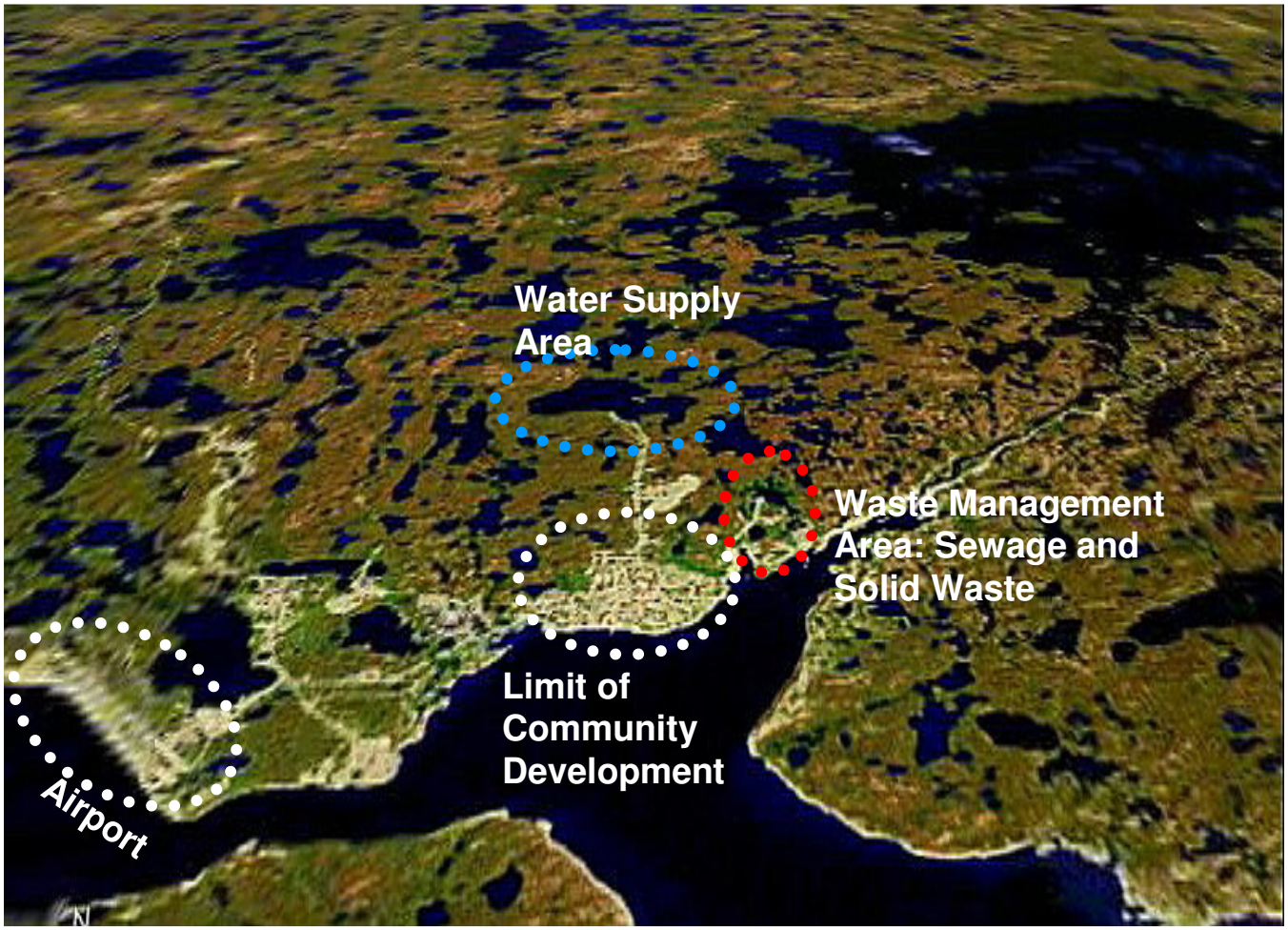
In 2003, there was no removal of solid waste or sludge from the sewage lagoon.

13.0 OPERATION AND MAINTENANCE PLANS

Operation and Maintenance (O&M) Manuals for the Hamlet of Cambridge Bay's solid and sewage waste treatment systems have been identified as a requirement for the renewal of the Hamlet's water licence by the Nunavut Water Board (NWB). As such O&M Manuals will be updated and submitted to the NWB for review.

14.0 REFERENCES

Bodykevich, Constantine, Water Resources Officer, INAC, Nunavut District: "August 4, 2003 Municipal Water Licence Report" August 20, 2003.



Hamlet of Cambridge Bay
Annual Report
Water Supply and Waste Sites

Figure 1

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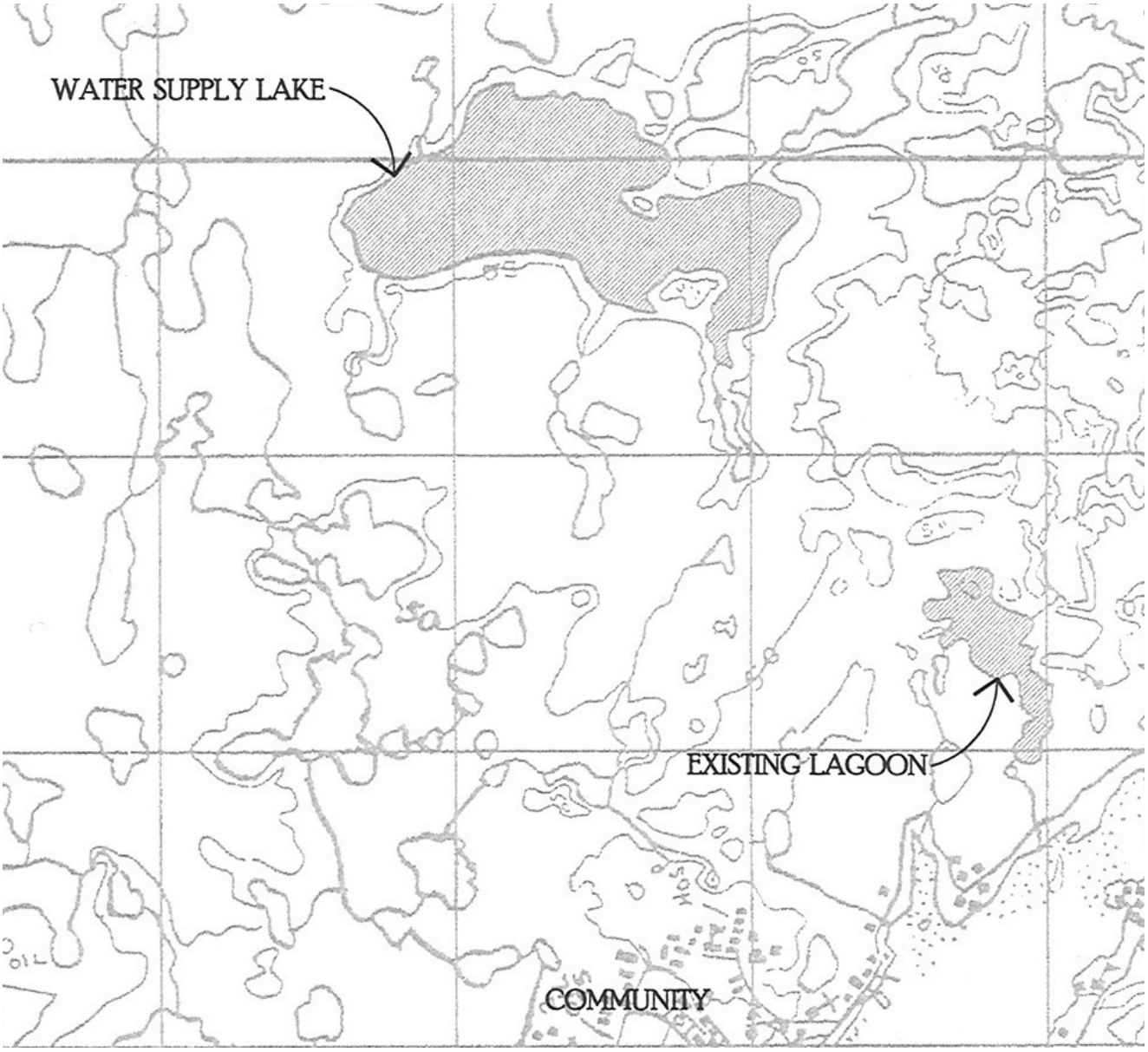
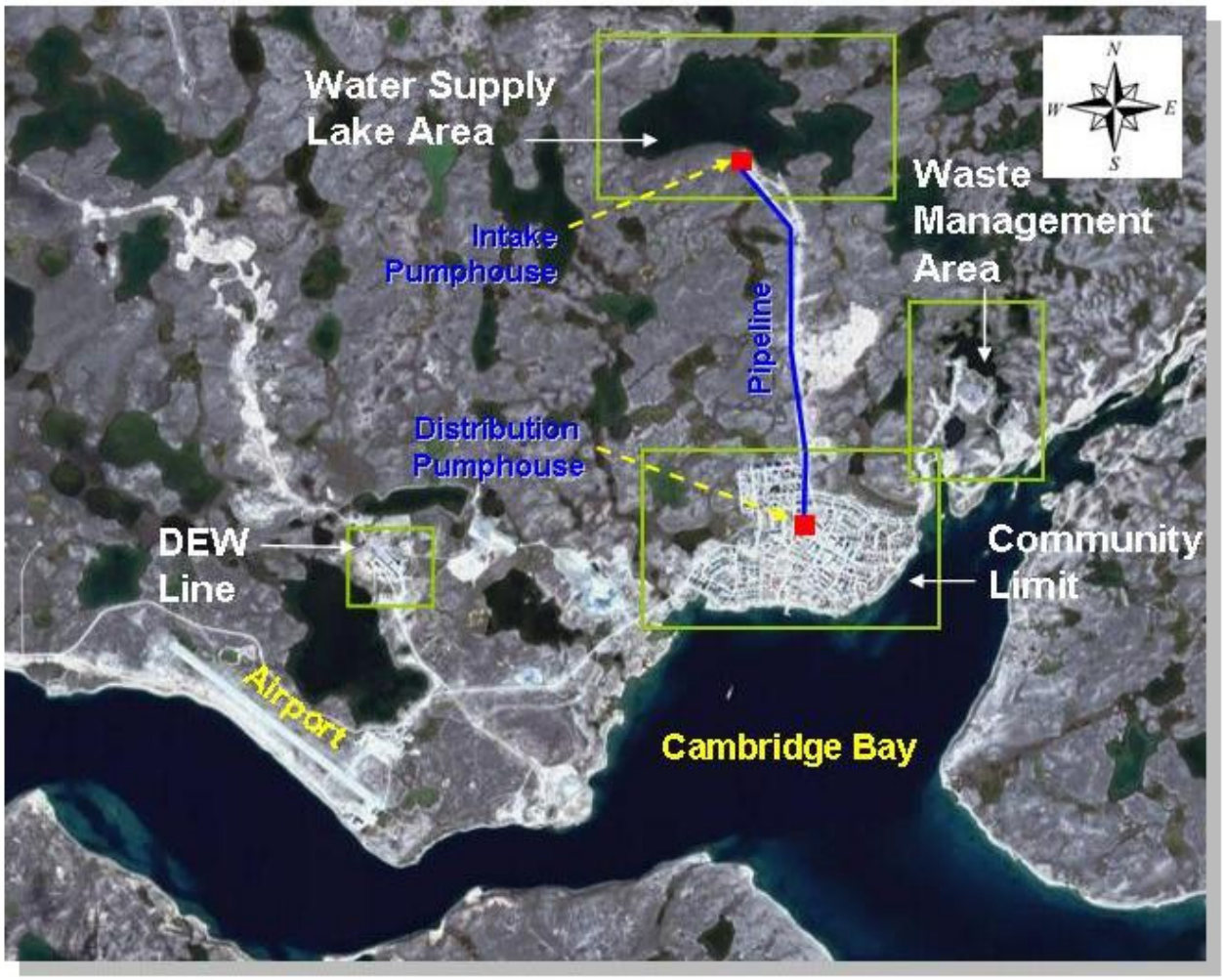


Hamlet of Cambridge Bay
Annual Report
Lagoon and Water Supply Locations

Figure 2

EarthTech



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Water Pumphouse and Pipeline Locations

Figure 3

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Hamlet of Cambridge Bay
Annual Report
Sewage Lagoon Pond Locations

Figure 4

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Figure 3 Water Distribution Pumphouse

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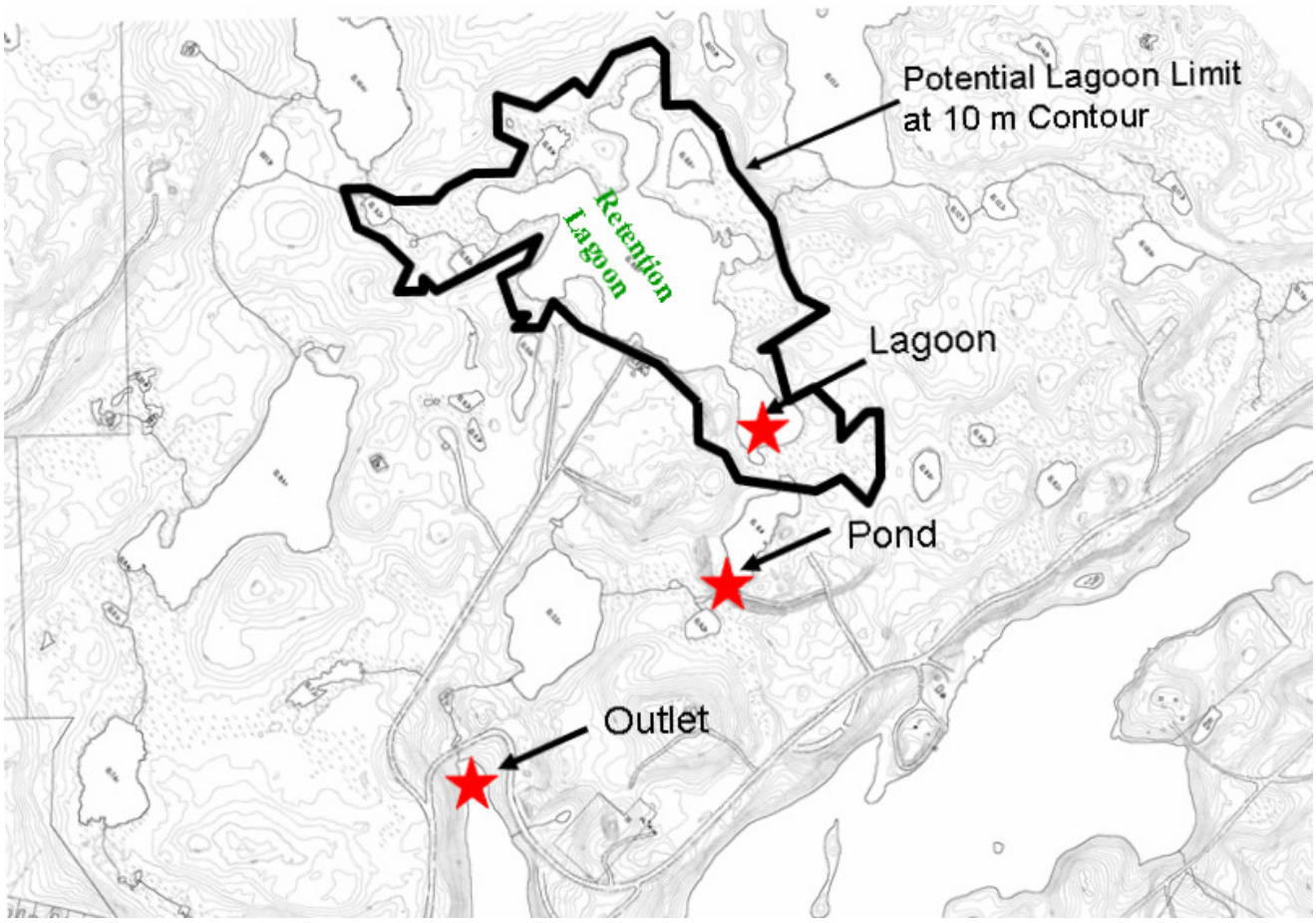
Annual Report
Water Distribution Pumphouse

Figure 5

EarthTech



Hamlet of Cambridge Bay
Annual Report
Sewage Lagoon Sampling Locations

Figure 6

EarthTech