



# Appendix F

## Quality Assurance / Quality Control Plan



Hamlet of Cambridge Bay

## **Quality Assurance and Control Plan – Lagoon and Landfill**

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November, 2013

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# 1. Introduction

This Quality Assurance and Control Plan is intended to provide operating principles for the activities involved in the Hamlet of Cambridge Bay's Monitoring Program, specifically those required for the lagoon and landfill only. These operating principles will ensure that the samples collected for the Monitoring Program are reliable and of high quality.

Please note that this Quality Assurance and Control Plan is specific to Water License #3BM-CAM0914, issued April 30<sup>th</sup>, 2009. The Quality Assurance and Control Plan must be updated to meet the requirements of subsequent Water Licenses.

## 2. Sample Collection

### 2.1 Location

As per the Water License, the following Monitoring Program Stations will be utilized. Please refer to Figure 7.1 located in the Landfill Operations & Maintenance Manual for a map showing the approximate locations of CAM-4, CAM-5 and CAM-6.

**Table 2.1. Monitoring Program Stations**

Monitoring Program Station Number	Description
<b>CAM-1</b>	Raw water supply intake at Water Lake
<b>CAM-4</b>	Effluent from the eastern-most control pond in the Modified Solid Waste Disposal Facilities being discharged to the Retention Sewage Lagoon
<b>CAM-5</b>	Final Discharge Point for effluent from the Retention Sewage Lagoon to the Sewage Wetland
<b>CAM-6</b>	Outfall area for the Sewage Wetland

The Water License stipulates that CAM-4 is located at the sump in the Modified Solid Waste Disposal Facilities (landfill); however, this sump was not constructed. Instead, several control ponds were built in the ditches surrounding the landfill. All of these control ponds shall be designated as CAM-4, with the intent being that whichever of the control ponds are being pumped out shall be sampled. The control ponds are approximately 500 mm deep and should be pumped out to the lagoon (pending receipt of acceptable analytical results) when the depth of water in the ponds is about 300 mm or greater.

At the present time, the sampling locations shown on Figure 7-1 (located in the Landfill Operations & Maintenance Manual) are approximate – it is anticipated that sign posts will be installed during the next construction season. The co-ordinates of the sign posts (latitude and longitude) will be determined using GPS, and this Plan will be updated to include the new sign posts co-ordinates.

### 2.2 Sampling Parameters

Parameters of interest for each sampling station are shown in the Table below.

**Table 2.2. Sampling Station Parameters**

Parameter	Analytical Test Category	Monitoring Program Station		
		CAM-4	CAM-5	CAM-6
<b>Alkalinity (Total)</b>	Routine		X	X
<b>Aluminum</b>	Metals	X		
<b>Ammonia Nitrogen</b>	Nutrients		X	X
<b>Arsenic</b>	Metals	X	X	X
<b>Barium</b>	Metals	X		
<b>Biochemical Oxygen Demand</b>	Nutrients	X	X	X
<b>Calcium</b>	Routine		X	X
<b>Cadmium</b>	Metals	X	X	X
<b>Chlorides</b>	Routine	X	X	X

Parameter	Analytical Test Category	Monitoring Program Station		
Chromium	Metals	X	X	X
Cobalt	Metals		X	X
Conductivity	Routine		X	X
Copper	Metals	X	X	X
Cyanide	Cyanide (Special Request)	X		
Fecal Coliforms	Sterile		X	X
Fluoride	Routine	X		
Hardness	Routine		X	X
Lead	Metals	X	X	X
Iron	Metals	X	X	X
Magnesium	Routine		X	X
Manganese	Metals		X	X
Mercury	Metals	X	X	X
Nickel	Metals	X	X	X
Nitrate-Nitrite	Routine		X	X
Oil & Grease	Hexane Extractable Material	X	X	X
pH Range	Routine	X	X	X
Phenolic Compounds	Phenol (Special Request)	X		
Phosphorus	Nutrients	X		
Potassium	Routine		X	X
Silver	Metals	X		
Sodium	Routine		X	X
Sulphates	Routine	X	X	X
Sulphides	Sulphides (Special Request)	X		
Suspended Solids	Nutrients	X	X	X
Tin	Metals	X		
Total Organic Carbon (TOC)	Nutrients		X	X
Zinc	Metals	X	X	X

For CAM-1, the Hamlet is required only to measure and record the monthly and annual quantities of water pumped at that location.

Sampling frequency for each Monitoring Program Station is shown below.

**Table 2.3. Monitoring Program Station Sampling Frequency**

Monitoring Program Station	Sampling Frequency
CAM-4	Prior to discharge
CAM-5	Once at beginning of discharge, once during middle of discharge, and once near end of discharge
CAM-6	Monthly, during periods of observed flow

As noted above, for CAM-1, the Hamlet is required to measure and record pumped water quantities on a monthly and annual basis.

## **2.3 Sampling Equipment**

### **2.3.1 Flow Measurement – CAM-1**

Only volumes/flowrates are measured at the Monitoring Program Station CAM-1. The flow meter used (with totalizer) must be inspected and calibrated regularly as per the manufacturer's guidelines.

As mentioned in Section 1, this QA/QC plan is only for the lagoon and landfill. It is anticipated that the raw water intake flow meter will be maintained as part of activities related to providing potable water for the Hamlet of Cambridge Bay.

### **2.3.2 Water Quality Samples – CAM-4, CAM-5 and CAM-6**

For water quality samples, it is anticipated that the only equipment needed will be the sample bottles and coolers. For the Monitoring Program Stations CAM-4, CAM-5 and CAM-6, sample bottles will be ordered from the analytical laboratory prior to testing, for each testing event. The sample bottles ordered will be specific to the tests requested, and will be of the type recommended by the analytical laboratory. Sample analysis will be performed by the same analytical laboratory.

As filtration does not appear to be required for any of the specified water quality samples, the Hamlet does not require filtration equipment. Moreover, there is not anticipated to be any need for specific stream sampling equipment, as the Monitoring Program Stations are either still water bodies or shallow streams and thus Hamlet staff should be able to obtain samples from the bank.

Since the Monitoring Program Stations CAM-4, CAM-5 and CAM-6 are anticipated to be sampled only a few times per year, re-use of sample bottles is not recommended. It may be difficult for the Hamlet to allocate the facilities and man hours necessary to properly wash sample bottles, and storage space is likely limited.

## **2.4 Sampling Methods**

As mentioned above, stream water samples will be collected by Hamlet staff, and flown to an outside analytical laboratory for analysis. Samples will be obtained in accordance with the analytical laboratory's sampling instructions (Appendix G).

To ensure that samples arriving at the laboratory accurately reflect the site conditions, these general precautions must be taken:

- Obtain sample bottles and de-ionized water from the ISO accredited laboratory which will be performing the testing, and follow all instructions regarding their storage and usage
- Wear gloves when taking samples
- Avoid contaminating clean containers
- Determine the allowable headspace (air) in the sample container: most samples should fill the bottle, but some analyses (such as for volatile organic parameters) require absolutely no headspace, whereas a sample for

coliform counts should have two (2) centimeters of headspace. To check for the presence or absence of headspace, tilt the closed sample container upside-down and check for bubbles or large airspaces.

- Keep samples cool, but do not allow them to freeze. 4°C is recommended for most samples; if the temperature of the water is allowed to drop below zero, a sample may freeze and break the container (if glass). Thus, keep the samples in a cooler with ice, but do not leave the cooler outside for a long period of time during cold weather.
- If ice is used in the sample cooler, use additional packaging such as bubble wrap for glass containers, so that when the ice melts, the containers are still supported and cannot damage each other.
- Send samples to the laboratory as soon as possible. Some analyses have an allowable hold time as short as 24-48 hours. While samples can be analyzed past the hold time, the results are less reliable.
- Collect replicates and field blanks at the same time as samples.

#### 2.4.1 Replicates and Field Blanks

The Hamlet should occasionally send a duplicate sample (taken at the same time, from the same location as the first sample) to the laboratory to check that consistent sampling is being done. To ensure sampling integrity, a duplicate sample should be taken once every ten (10) samples for wastewater samples from CAM-5 and CAM-6.

Likewise, a field blank should be collected at least once per sampling event for both CAM-5 and CAM-6. A field blank is a sample of distilled/deionized water that treated in same manner as samples, and is therefore taken to the field and handled identically

It is anticipated that CAM-4 events will be very infrequent, i.e., less than annually. It is recommended that for CAM-4 sampling events, complete sampling suites (all required tests) be performed on duplicates (either replicates or splits) and blanks for every sampling event.

## 3. Sample Handling

### 3.1 Preservation

Samples may need to be chemically preserved or kept at a certain temperature during storage and transportation to the laboratory. Samples must also arrive at the laboratory and be tested within a certain time frame (hold time), the length of which depends on the type of analysis to be performed. These requirements depend on the type of analysis that will be done; refer to *Standard Methods* and the laboratory guidelines. Taiga Environmental Laboratory's requirements are included in Appendix G.

For those samples requiring chemical preservation, preservative(s) will be added at the time of sample collection. Typically, these preservatives are provided along with the sample bottles and thus the amount of preservatives and concentration is determined by the analytical laboratory providing the sample bottles.

### 3.2 Sample Identification

Samples should be properly labeled to avoid confusion and inaccurate Monitoring Program reporting. The label on each sample needs to include:

- Sampling date and time
- Sample number (i.e. CAM-4.1).
- Monitoring Program station or other location
- Name of the sample collector
- Sample type (i.e. if the sample is for metals or routine analysis)
- Any preservative used
- Any other identifying label required by the laboratory (for example "Metals" if intended for metals analysis)
- Any other information that is important for identifying the sample.

It is anticipated that sample bottles will be supplied with labels that the sample collector can fill in. These labels must be filled in using a water resistant, non-smearing felt pen or grease pencil. In addition, it is recommended that the sample number, sampling date and sampling time be marked on the lid of each sample.

The Hamlet should keep a logbook for sampling events. This logbook should include the date and time of sampling event, sampling locations, number of samples, and time that samples were shipped out for analysis.

### 3.3 Sample Transportation

It is anticipated that the timing of sampling events will be chosen to coincide with scheduled flights to Yellowknife. Hamlet staff responsible for sample collection should conduct the sampling event such that samples are all collected and delivered to the airport several hours before the flight to Yellowknife is scheduled to leave.

The Hamlet should follow the analytical laboratory's shipping instructions. It is likely that samples will be shipped in coolers. Samples should be stored upright in the coolers, with cold packs and/or bubble wrap in between sample containers to reduce the possibility of sample containers breaking during transport. The use of cold packs or ice (cold packs are preferred) is recommended to maintain refrigeration for samples that require it. It may be advisable to secure the cooler lids with packing tape to ensure that the coolers remain closed during transportation and handling.

## 4. Laboratory Analysis

All analyses will be conducted by Taiga Environmental Laboratory, with the exception of cyanide, sulphides and phenolic compounds, which are subcontracted to a private analytical laboratory (also with CALA accreditation). Taiga's accreditation, methods used for analyses and detection limits for these analyses can be found in Appendix G.

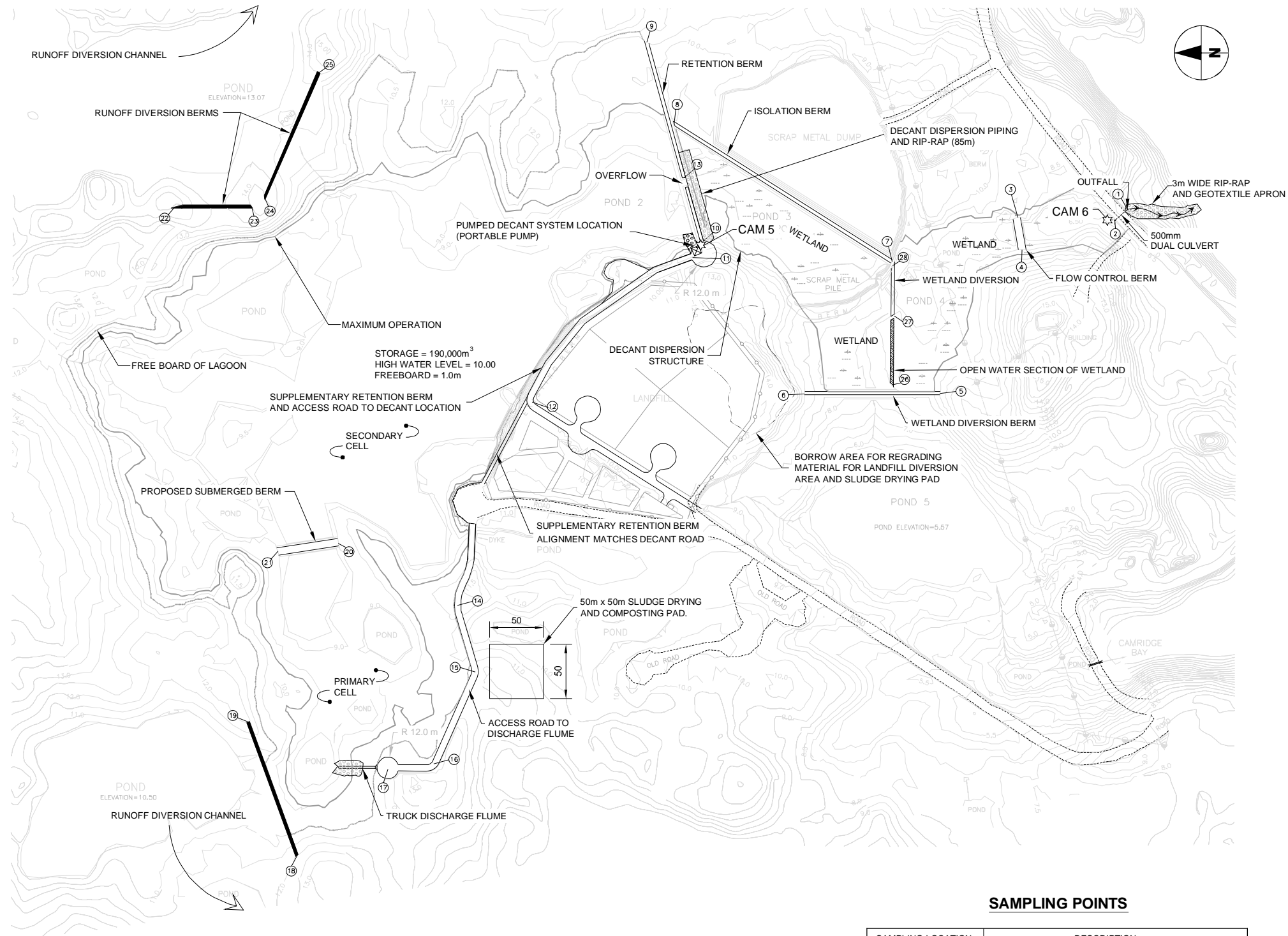
Methods and detection limits for the subcontracted analytical parameters can be seen in the Table below.

**Table 4.1. Detection Limits and Analysis Methods for Analytical Parameters**

Parameter	Detection Limit	Analysis Method
Total Cyanide	0.002 mg/L	EPA 335.3
Cyanide – weak acid dissociable	0.004 mg/L	SM 4500-CN:I
Cyanide – strong acid dissociable	0.002 mg/L	APHA 4500-CN-C
Total Phenol	0.002 mg/L	APHA 5530D
Sulphide	0.005 mg/L	SM 4500-S2-E

## **5. Documentation and Records**

Results from the Monitoring Program must be included in the Annual Water License Report prepared by the Hamlet. Therefore, organized records should be kept of all laboratory analysis results, AANDC inspection reports, and field observations (for instance the presence of oil and grease on the lagoon surface, or lagoon colour).



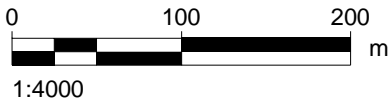
<b><u>LEGEND</u></b>	
EDGE OF ROAD (ELEV. 10.0m)	
DRAINAGE ROUTE	
RIP-RAP	
SEWAGE LAGOON/WETLAND BERM	
RUNOFF DIVERSION BERM	
OPEN WATER SECTION OF WETLAND	
FREE BOARD	
MAX OPERATION WATER LEVEL	
OPEN WATER SECTION	
SAMPLE POINT	

**NOTES:**  
ELEVATIONS ARE EXPRESSED IN METER OR DECIMALS THEREOF.

BERM POINTS	NORTHING	EASTING
1	7667952.67	498928.34
2	7667964.75	498917.18
3	7668055.83	498919.56
4	7668050.75	498889.87
5	7668126.82	499757.16
6	7668252.15	498757.16
7	7668170.48	498878.77
8	7668372.90	499006.76
9	7668397.97	499082.42
10	7668347.00	498898.03
11	7668357.13	498883.20
12	7668505.96	498748.79
13	7668363.63	498956.63
14	7668573.61	498560.76
15	7668557.39	498499.29
16	7668597.34	498411.69
17	7668638.10	498410.28
18	7668722.31	498329.19
19	7668767.59	498452.94
20	7668684.04	498619.15
21	7668740.07	498610.20
22	7668835.17	498930.79
23	7668764.43	498930.23
24	7668752.28	498938.93
25	7668702.41	499054.24
26	7668171.72	498764.31
27	7668171.12	498829.37
28	7668170.48	498878.77
29	7667956.60	498915.42
30	7667970.84	498901.51

## **SAMPLING POINTS**

SAMPLING LOCATION	DESCRIPTION
CAM 4	EFFLUENT FROM MODIFIED SOLID WASTE DISPOSAL FACILITIES BEING DISCHARGED TO THE RETENTION SEWAGE LAGOON
CAM 5	FINAL DISCHARGE POINT FOR EFFLUENT FROM THE RETENTION SEWAGE LAGOON TO THE SEWAGE WETLAND
CAM 6	OUTFALL AREA FOR THE SEWAGE WETLAND





Aboriginal Affairs and  
Northern Development Canada

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*Files :*

License # #3BM-CAM0914

November 22, 2013

Ms Maureen Nakonechny  
Water/Wastewater Engineer  
AECOM  
17203-103 Avenue  
Edmonton, AB T5S 1J4

Dear Ms Nakonechny :

**Re:           Quality Assurance/Quality Control Plan  
              Hamlet of Cambridge Bay  
              Water Board License #3BM-CAM0914  
              Kitikmeot, NUNAVUT**

**Submitted: November 7, 2013**

**Reviewed : November 8 and November 21, 2013**

Thank you for the submission of the updated Quality Assurance and Quality Control Plan you have prepared for Hamlet of Cambridge Bay as per the Surveillance Monitoring Program outlined in the Nunavut Water Board issued Water License #3BM-CAM0914.

The license regulates the use of water and disposal of waste for the Hamlet of Cambridge Bay, located within the Kitikmeot Region, Nunavut.

Upon review, it has been found that the QAQC Plan is complete. Approval of the Plan is hereby granted. Should you require further information, please do not hesitate to contact me at (867) 669-2781.

Sincerely,

Angelique Ruzindana, M.Sc., Ph.D

Analyst Under the *Northwest Territories and Nunavut Waters Act*