

# Hamlet of Pangnirtung

## Water Reservoir Operations and Maintenance Manual

**Type of Document:**

FINAL Rev 1

**Project Name:**

Hamlet of Pangnirtung Water Licence Renewal

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**Date Submitted:**

2018-05-28



## Legal Notification

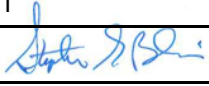

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exp Quality System Checks	
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## **Executive Summary**

In 2017, the Hamlet of Pangnirtung, NU, had to renew its Water Licence. One condition arising from the process was the requirement to provide an Operations and Maintenance Manual for the Water Supply System (an O&M Manual for the Water Treatment Plant/Truck-Fill Station is provided under a separate cover). The Water Supply System consists of the water intake (at the Duval River) and the storage reservoir.

This O&M Manual aids in the establishment of standardized maintenance methods.

The maintenance schedule for the reservoir/water intake piping is as follows:

- Annual maintenance as described below.
- Five-year cleaning of the reservoir.

A detailed description of the maintenance requirements is contained herein, including the contact information for individuals that may need to be called upon.

# 1 **Introduction**

As a condition for the renewal of the Hamlet of Pangnirtung's Water License, the Water Supply System (Water Reservoir and Intake Piping) are required to have an Operations and Maintenance Manual. The O&M Manual for the Truck-Fill Station is under a separate cover.

The ongoing improvements that are being undertaken for the operation of the water reservoir in Pangnirtung include following recommendations of best practices for operation water reservoirs from a variety of published sources and industry practices. This includes the information that is referenced by the American Water Workers Association (AWWA), the Good Engineering Practices for Northern Water and Sewer Systems (NT) and other referenced guidelines.

## 2 Construction

The water reservoir servicing the Hamlet of Pangnirtung was originally constructed in the mid-1980's. The reservoir (N66°08.97' and W65°40.70') is located just to the east of the Duval River, the primary water source for the Hamlet. The reservoir has a nominal capacity of 120,000 m<sup>3</sup>; current annual water use is in the order of 55,000 to 60,000 m<sup>3</sup>.

The reservoir is 40m X 140m along the bottom and 125m X 225m along the top. The 10m depth includes an ice allowance of 1.8m which reduces the effective storage to about 71,000 m<sup>3</sup> for the ten-month period of ice cover.

Water is drawn from the Duval River (refer to Fig. 1, Appendix 1) via a wheel-mounted pump and a 200mm diameter high density polyethylene (HDPE) fill pipe (refer to Fig. 2, Appendix 1). The pump and pump-suction intake are only in place during the duration of the reservoir filling (filling is generally completed prior to the end of August). The pump and pump suction are then drained, winterized and returned to storage.

The truck-fill station is located on the east side (refer to Fig. 2; operation and maintenance guidelines of this facility are under a separate cover).

The construction of the reservoir also included two (2) drainage diversion ditches along the southeast side to prevent contamination. The first ditch intercepts all the runoff from a nearby hill and directs it around the reservoir. The second ditch, downslope from the first, is to control runoff from the cut-off berm constructed as part of the first diversion ditch.

The inside and outside slopes of the reservoir are 4:1.

The liner is 80 mil HDPE overlain with protective layers of fine and coarse gravel. This polyethylene liner is designed specifically for flexible geomembrane applications. It contains approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers. HDPE Liners have outstanding chemical resistance, mechanical properties, environmental stress crack resistance, dimensional stability and thermal aging characteristics. This liner material has excellent resistance to UV radiation and is suitable for exposed conditions.

A sub-drain system was installed to control the effect groundwater could have on the liner (i.e., lifting of the liner). This drainage system consists of perforated 200mm polyethylene piping (laterals) placed under the reservoir in both across and length-wise in a 20m X 25m grid.

## 3 Operation and Maintenance

### 3.1 General

Operation of the reservoir consists of the annual filling operation. A diesel-powered pump (rated at 31.67 L/s) is used to fill the reservoir through the 200mm fill pipe. The pump is located to the southwest of the reservoir adjacent to the Duval River (refer to Fig. 2).

The time to fill the reservoir (based on 55,000 m<sup>3</sup> volume change) would be in the order of 20 days pumping at 24h per day. After the reservoir is cleaned (every 5 years), the time to fill the reservoir (120,000 m<sup>3</sup>) would be in the order of 44 days (pumping at 24h per day).

Maintenance of the reservoir and intake pipe primarily consists of inspecting the various components of each. The GN Municipal Engineer and Public Works Foreman are to conduct an annual inspection that would include:

- Fence/gates
- Berm surface and slopes
- Liner (signs of erosion and liner exposure)
- Piping
- Ditching

Any deficiencies are to be noted and brought to the attention of the Hamlet SAO. The extent of any repairs required will determine the timeline to have the repairs done.

**NOTE: Given the importance of the Water Reservoir to the Hamlet, when working in the area with mechanical equipment, care must be taken regarding fuels and lubricating oils. DO NOT refuel any mobile equipment near the reservoir. Spill kits must be available when working around the reservoir with mobile equipment.**

### 3.2 Sub-Drainage System

The sub-drain system connects to a header pipe which drains under the north berm (via a manhole) to a ditch. In the event that the outfall freezes, the manhole is equipped with a sump to allow the system to be drained using a portable pump.

The system laterals are accessible from the top of the reservoir berms for cleaning or thawing. In the event of a blockage, a pressure sewer flusher can be used to remove the blockage.

### 3.3 Five-Year Reservoir Clean

Every five (5) years, the reservoir is to be drained, cleaned of any sedimentation build-up, any required repairs (to either the reservoir and truck-fill station intake piping that are below

the water level) are completed, and the reservoir refilled. The time to complete this work could be in the order of 10-13 weeks, broken down as follows:

- Draining reservoir: 2-3 weeks;
- Clean reservoir: 1-2 weeks (could be longer if repairs to the liner or liner protection are required);
- Fill reservoir (120,000 m<sup>3</sup>): 6-7 weeks;
- Time allowance to allow suspended sediments to settle: 1 week.

A “temporary” water supply will be required during this period with the Duval River as the source. It will be necessary to chlorinate each truckload of water prior to delivery.

With the extent of the work involved, and where time is of the essence, the Hamlet will be contracting out the work required to clean the reservoir. The procedures to be undertaken to retain a contractor to complete this work are as follows:

- Early in the year (Year 4) prior to the year designated as a cleaning year (Year 5), start the planning process and develop a Request for Proposals for cleaning (the timing is to catch the sealift for any equipment required – equipment to be shipped in Year 4);
- Contractor mobilizes in Year 5;
- A month prior to the Contractor beginning, notify residents of the timelines and the need to reduce water consumption;
- Before truck-fill is unserviceable, fill all the water tanks in town;
- Cleaning the reservoir occurs, make any repairs required, refill;
- After filling, wait 5-7 days to allow any sediment to settle; and
- Truck-fill station returns to operation.
- Actions taken, including repairs, are compiled in a report and presented to the Hamlet.

### 3.4 River Intake Piping/Diesel Pump

The river intake piping (pump suction) and the diesel pump are brought out of storage and used during the filling of the reservoir. The intake piping is to be inspected for cracks and leaks and to confirm any gaskets are present and properly seated. The strainer/check valve is inspected for blockages and to confirm the check valve is operational. **NOTE: If fish are present in the Duval River, the strainer sizing is to meet the requirements of the DFO publication “Freshwater Intake End-of-Pipe Fish Screen Guideline” (Fs 23-270/1995E).**

The diesel pump is inspected and serviced prior to being put into operation (refer to the manufacturer’s servicing instructions). Care must be taken when refueling the pump. Spill prevention and best practices for refueling must be observed for this facility.



### **3.5 Reservoir Fill Piping**

The “permanent” intake (filler) pipe should have a constant grade as it travels up the slope to allow it to drain freely when not in use. The piping is to be inspected prior to use and upon completion of the reservoir filling. Repairs to the pipe would be “as required”.

### **3.6 Diversion Ditches/Culverts**

The diversion ditches are to be inspected for excessive erosion and/or siltation. Either conditions will require repairs using mechanical equipment (e.g. excavators).

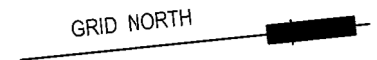
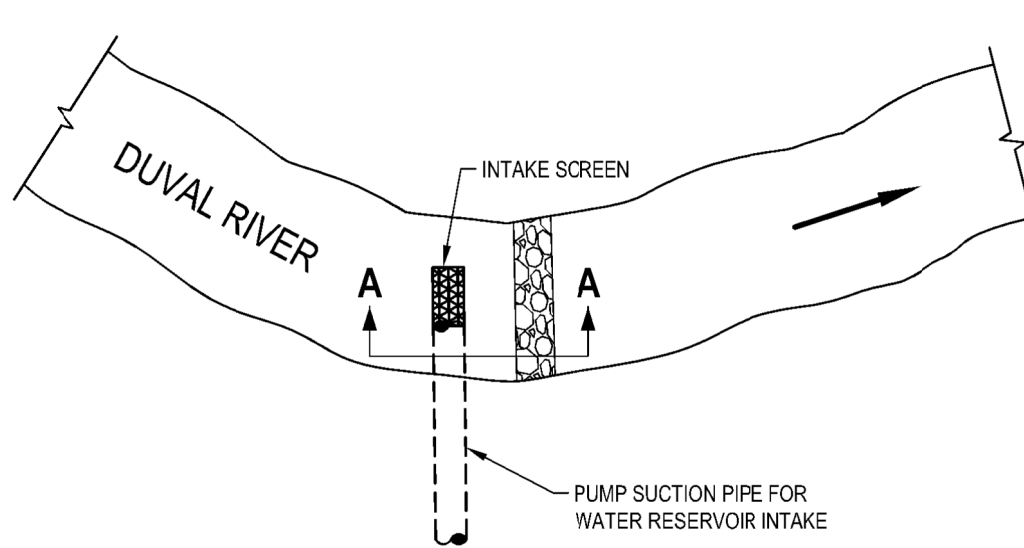
Culverts are to be inspected for blockages or excessive corrosion. Blockages are to be removed with high-pressure hoses or steam systems (depending on the blockage). Excessive corrosion will require the culvert be replaced.

## **4      Contact Information**

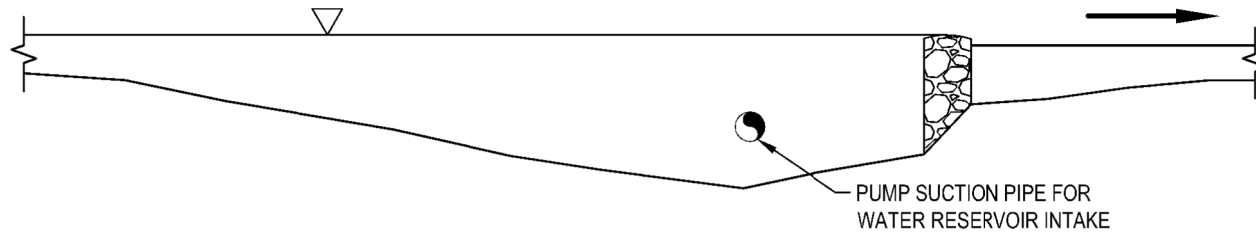
The following is a list of contacts that can be used to address any issues with the Water Supply System:

Bhabesh Roy	Municipal Planning Engineer, GN- CGS Ph.: 867 899 7314
Ron Ladd	Senior Administrative Officer Ph.: 867 473 8953
Jimmy Keenianak	Municipal Foreman Ph.: 867 473 8986
Daniel Mike	Water Treatment Plant Operator Ph.: 867 473 4036
Jonathan Mesher	Inspector, CIRNA Ph.: 867 975 4296

## **Appendix 1 – Figures 1 and 2**



**PLAN VIEW**  
N.T.S.



**SECTION A-A**  
N.T.S.

**PROJECT STATUS**

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Project Title

HAMLET OF PANGNIRTUNG, NU  
WATER SYSTEM SUPPLY

Dwg. Title:

**PUMP SUCTION PIPE  
LOCATION FOR WATER  
RESERVOIR INTAKE PIPE**

Drawn By:

Project No.

CB

FRE-00232735-A0

Dwg Standards

Ckd By:

Dwg. No.

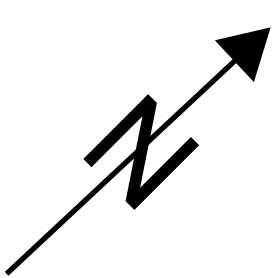
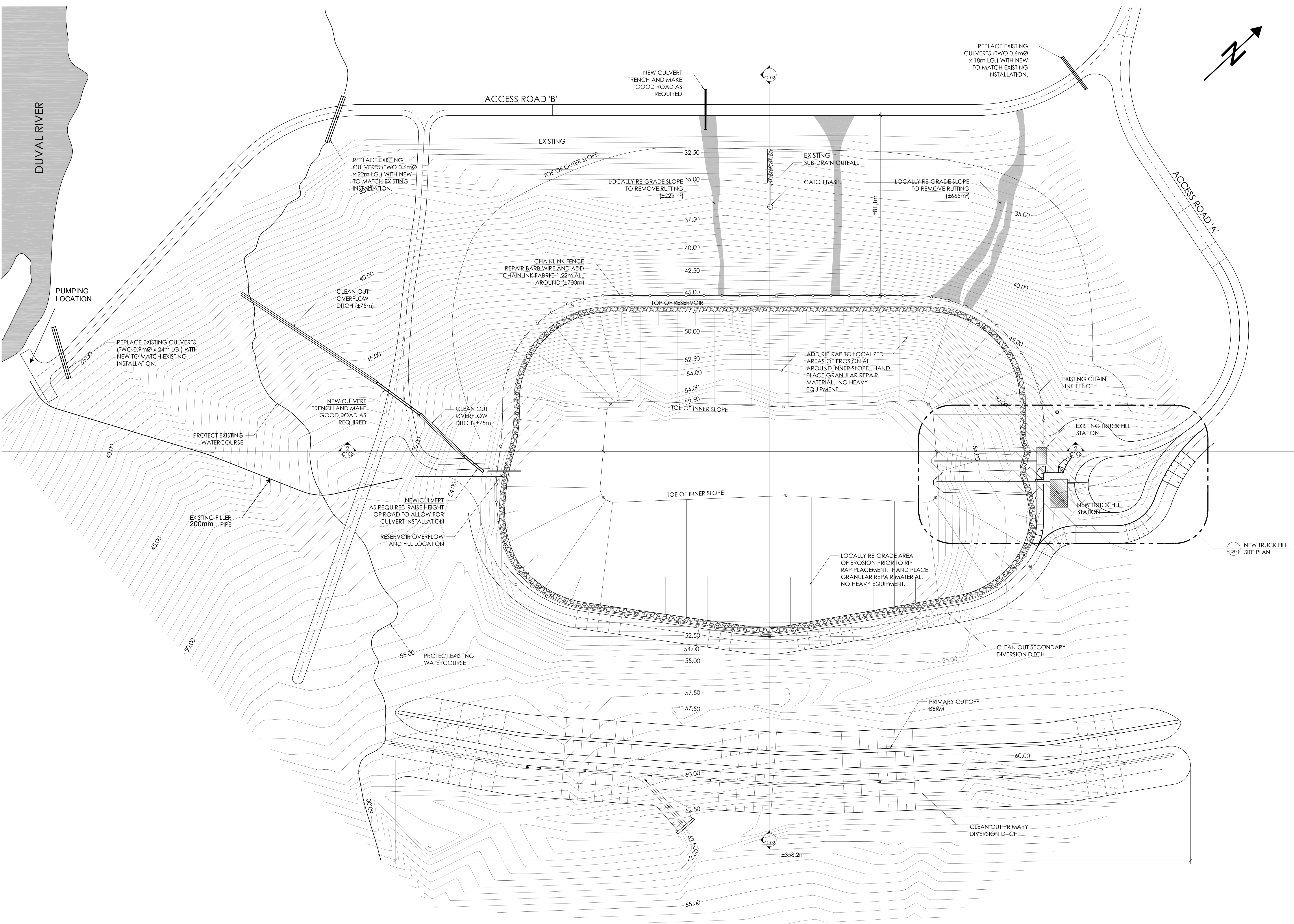
Rev. No.

Designed By:

SGB

**FIG.1**

Design Checked  
By:



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**ARKTIS SOLUTIONS**  
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TEL: (867) 446-4129 Fax: (866) 475-1147

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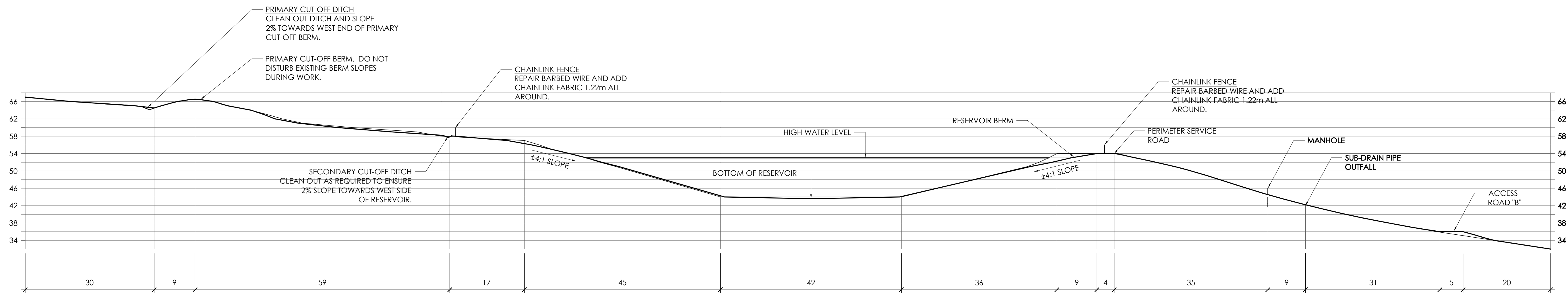
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PANGNIRTUNG, NUNAVUT

DRAWING NAME:  
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NEW TRUCK FILL LOCATION

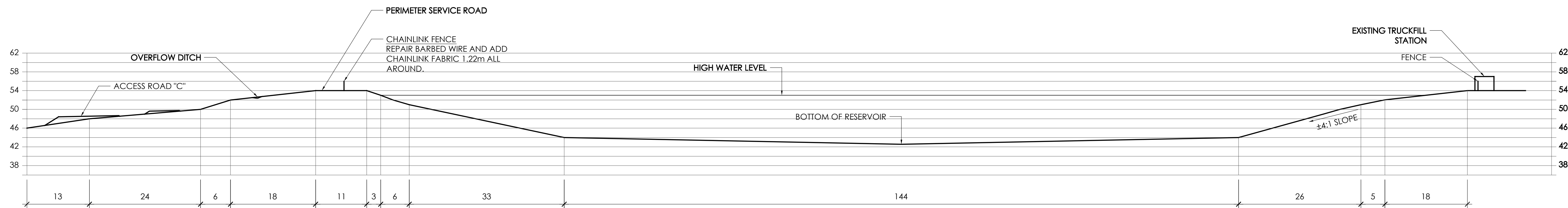
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Figure 2

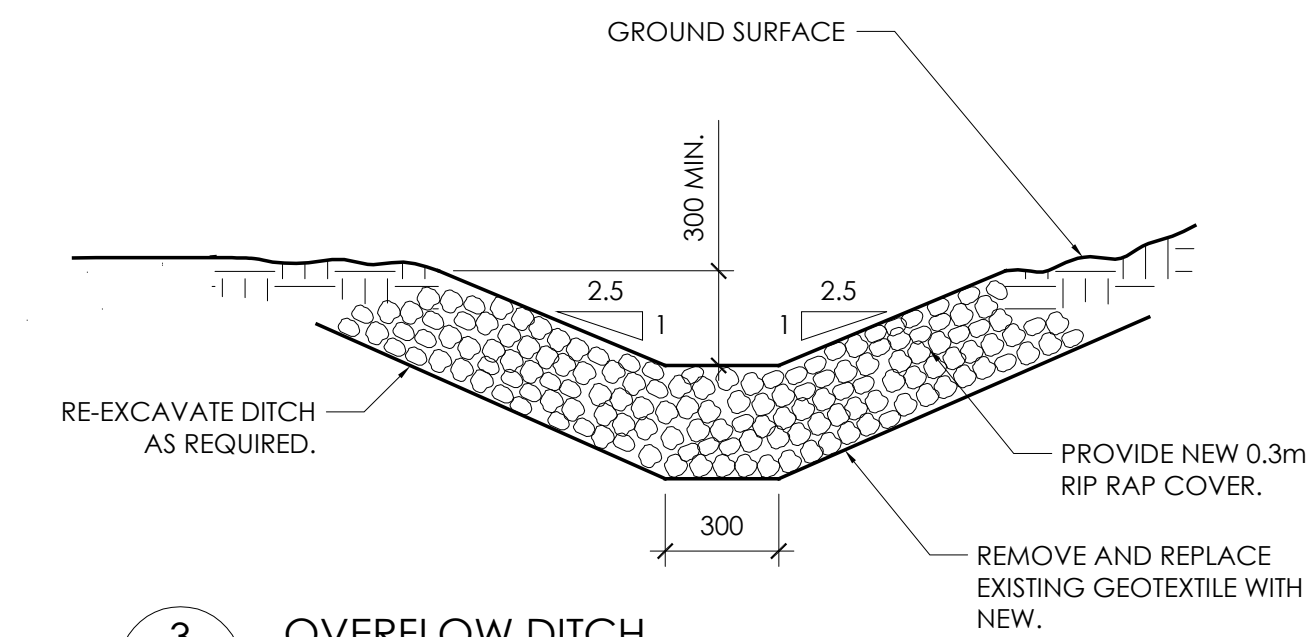




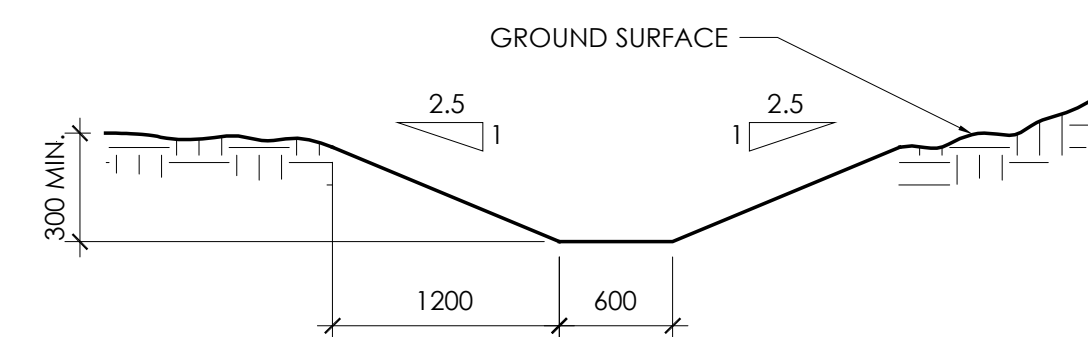
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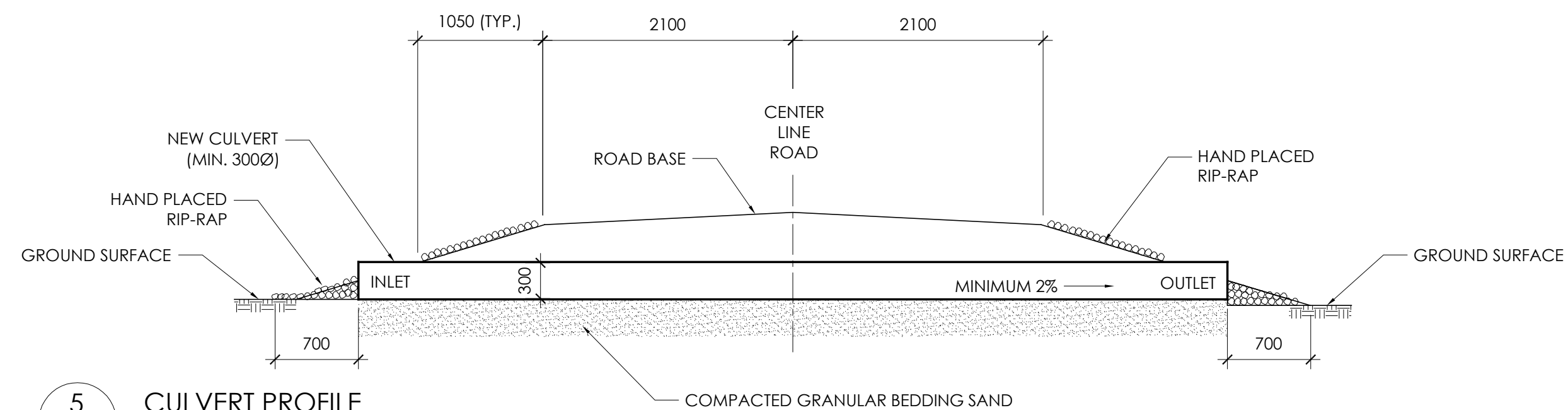
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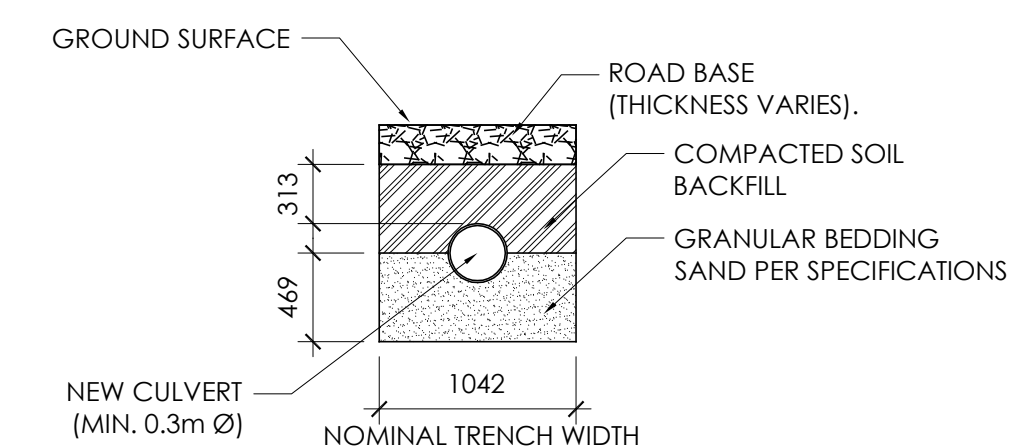
3 OVERFLOW DITCH  
SCALE 1:20



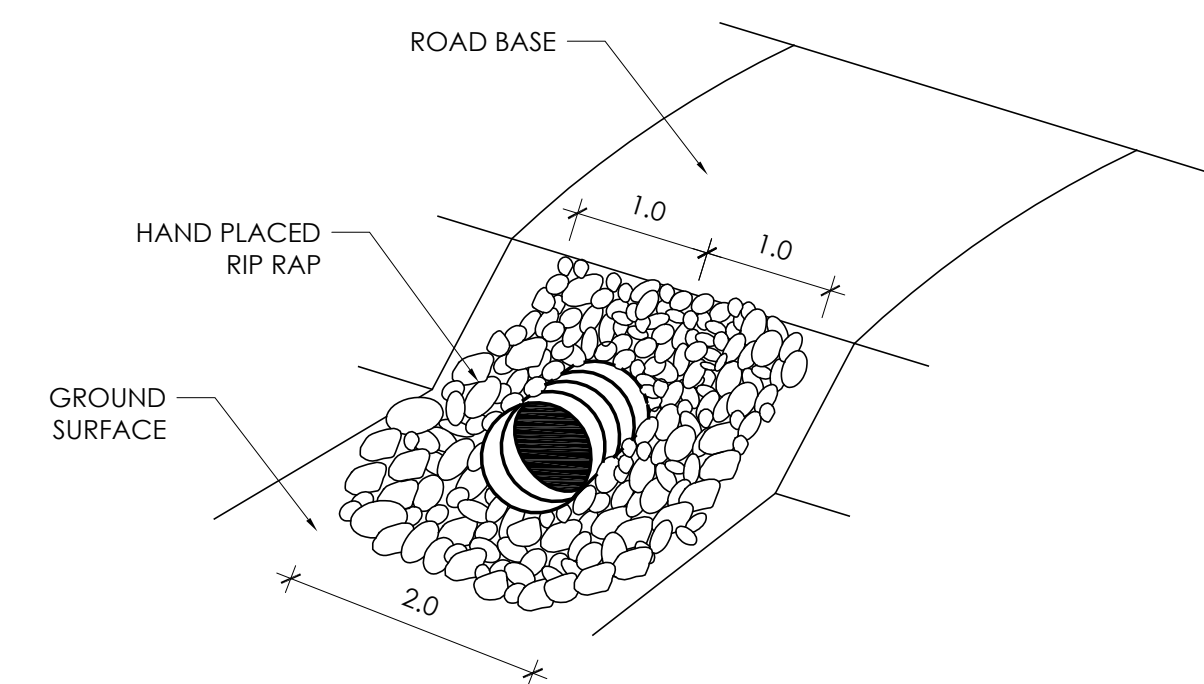
4 TYPICAL DITCH  
SCALE 1:40



5 CULVERT PROFILE  
SCALE 1:40



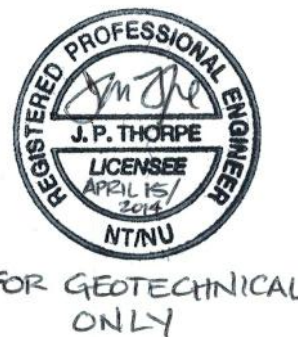
6 CULVERT SECTION SCALE  
SCALE 1:40



7 CULVERT ISOMETRIC  
NOT TO SCALE

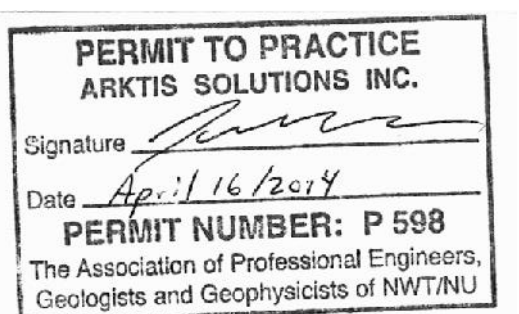


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SCALE:	AS NOTED	PLOT DATE:	04/15/14

PROJECT:

OPTIMIZATION OF  
DRINKING WATER  
SUPPLY

PANGNIRTUNG, NUNAVUT

DRAWING NAME:  
EARTH INFRASTRUCTURE  
REPAIRS  
SECTIONS AND DETAILS

DRAWING NO.:  
C102



