1 PROJECT TITLE

OPERATION AND MAINTENANCE MANUAL
VOLUME 1
FOR THE WATER TREATMENT PLANT
AT
TALOYOAK, NUNAVUT

Set No. _____ of _____

Year of Completion: 2011

Original Scope: Work of this Contract comprises general construction, located at Taloyoak, Nunavut; and further identified as:

- Supply of all materials and construction of the access road and truck turn around pad.
- Supply and installation of HDPE intake casing pipes.
- Supply and installation of bedding and riprap protection for the intake casing pipes.
- Supply and installation of intake screens.
- Supply and installation of HDPE intake line and pump system including heat trace system.
- Construction of earthworks and steel skid foundation for the water treatment plant.
- Supply and construction of building for the water treatment plant.
- Supply and installation of water treatment plant including cartridge filtration system, chlorination system, water storage, waste water storage and truck fill station.
- Supply and installation of mechanical, electrical and control and instrumentation systems.
- Supply and installation of HVAC system including but not limited to the furnace system and air handling systems.
- Coordinate and pay for the installation of the power supply from the existing grid to the water treatment facility.
- Coordinate and pay for the supply of telephone service to the facility.
- Supply and installation of alternative energy systems including but not limited to the solar voltaic collectors, wind generator, battery storage, and inverters.

Chapter 1 INTRODUCTION
Chapter 2 TABLE OF CONTENTS
Chapter 3 BACKGROUND DESIGN
Chapter 4 SCHEMATIC FUNCTIONAL DATA
Chapter 5 COMPONENT DETAILS
Chapter 6 OPERATING PROCEDURES
1. OPERATION CHART
2. OPERATION PROCEDURE
3. EA TALOYOAK COMPONENT MAINTENANCE & OPERATIONS GUIDE
Chapter 7 MAINTENANCE PROCEDURES
1. MAINTENANCE CHART
2. MAINTENANCE PROCEDURE
3. EA TALOYOAK COMPONENT MAINTENANCE & OPERATIONS GUIDE
Chapter 8 TESTING AND CERTIFICATION
1. TESTING AND CERTIFICATION
i Dillon Cylinder Results
ii Moeller MCC 3000
iii System Component Acceptance Test Report
iv HDPE Hydrostatic Test Report
v EA Testing Procedure
vi Unigy Test
vii Xantrax UL Test Data 12-911-56-391
viii Xantrax UL Test Data 2-251904-161
ix Xantrax UL Test Data 2-2515-20-01
x Xantrax UL Test Data 2-255-07-004

2. WARRANTY STATEMENTS
i ASCO Auto Transfer Switch
ii Beckett Oil Burner Warranty
iii Belimo Actuator Warranty
iv Bray electric Actuator Warranty
v Carrier Oil Furnace Warranty
vi DigiTrace 920 Warranty
vii Dynamix Warranty
viii Franklin Electric Submersible Motor Warranty
ix Frontier Gen Set Warranty
x Goulds 320L 7242 Warranty
xi Greencheck BSQ-70-4 Warranty
xii Hach 2100 Warranty
xiii Harmsco Cartridge Warranty

xiv Harmsco Swingbolt Warranty
xv Hyrdromatic SV40 Warranty
xvi Johnson Controls Warranty
xvii Lennox HRV Warranty
xviii Maple Systems Warranty
xix Moeller MCC 3000 Warranty
xx Morrison Bros Warranty
xxi Norwesco Water Storage Tank Warranty
xxii Oliver MacLeod HT Chimney Warranty
xxiii PetroClear Warranty
xxiv Rheem Water Heater Warranty
xxv Ritepro Coupling Warranty
xxvi Sharp NT-175-UC1 Warranty
xxvii SHURflow Park Model Pump Warranty
xxviii Southwest Wind Whisper Warranty
xxix Totaline Easy Thermostat
xxx Tramont Day Tank Warranty
xxxi Unigy II Battery Warranty
xxxii Valmatic Combo Air Release Vacuum Warranty
xxxiii Vulcain Warranty
xxxiv Wattsun Solar Tracker System Warranty
xxxv Wika Warranty
xxxvi Xantrex AGS Warranty
xxxvii Xantrex Inverter Warranty
xxxviii Xantrex MPPT Charge Controller Warranty
xxxix Xantrex SCP Warranty
xl Yaskawa F7 Drive Warranty

Chapter 9 MANUFACTURER DATA & SERVICE INFORMATION

1. PREFABRICATED BUILDING COMPONENTS, SKIDS & FOUNDATIONS
i Pump House
ii Taloyoak Building Details
iii AES Electrical Layout

2. BUILDING UTILITIES
i Beckett Oil Burner
ii Belimo Damper Actuator
iii Carrier 58 CMA Multipoise Oil Furnace
iv Carrier Electronic Fan Timer
v Devoe Devthane Pipe Paint
vi Price Diffusers
vii Price Louvers DE635

viii Greencheck BSQ70-4 Centrifugal in line Fan
ix Lennox HRV 3-150 Heat Recovery Ventilator
x Thernon 202 Heat Trace
xi Honeywell Electronic Oil Primary Control
xii Oliver MacLeod Chimney HT6000
xiii Tamco 9000 ECT Damper
xiv Totaline Easy 1H/1C and 2H/1C Thermostat

3. FILTERS
i Harmsco Swing Bolt Water Filter
ii Harmsco Hurricane Cartridges
iii Hayward Simplex Basket Strainer
iv Madison Chlorine Tank Level Switch
v Petro Clear 40510W & 40530W Fuel Filter

4. PUMPS & TANKS
i Dynamix Agitator IOM MMX
ii Goulds 320L Installation Manual
iii Grundfos Alldos DDI 209 Chemical Metering Pump
iv Hydromatic SKV40 Waste Pump & Tank
v Morrison Spill Container
vi Norwesco Model 41862 378L Water Storage Tank VT0100-28
vii Norwesco Model 40215 1136 Wastewater Storage Tank VT0300-35
viii Plastic Mart Treated Water Storage VT0100-28
ix Plastic Mart Waste Water Storage Tank VT0300-35
x SHURflo 2088-492-144 Treated Water Pump
xi Zeebest Calcium Hypochlorite Mixing and Solution Tank

5. MOTORS
i Franklin Electric Submersible motors
ii Hydromatic SKV 40 Sewage Ejector Pump
iii Yaskawa AC Induction Motor Drive

6. VALVES & SWITCHES
i Blocked Vent Shut Off Valve
ii Bray R4 electric Actuator
iii Bray Butterfly Valve Series 30/31
iv Burkert Solenoid Valve
v Crane Swing Check Valve
vi Crane Gate Valve
vii Crane Glove Valve
viii Crane Ball Valve
ix Grundfos Foot Valve with switch

x Meridian 3 way Ball Valve
xi Morrison External Emergency Valve
xii Morrison Foot Valve
xiii PetroClear
xiv Praher PVC S6 Drainage Valve
xv Val-matic Swing Flex Valve
xvi Val-Matic Air/Vacuum Release valve

7. AES SYSTEM
i EA Taloyoak Component Maintenance & Operations Guide
ii KD Ketchen & Associates Solar Support
iii Kohler Power Systems Float Equalize Battery Charger
iv Sharp Solar Panels
v Solar Array Galvanized Piles
vi Southwest Windpower Inc. Whisper 500 Wind Generator
vii Unigy II Battery Rack
viii Watsun Solar Tracker
ix Wind Turbine Foundation Drawing
x Xantrex Automatic Generator Start
xi Xantrex Inverter AC DC Breaker Boxes
xii Xantrex XW Inverter Manual
xiii Xantrex XW Solar Charge Controller
xiv Xantrex XW Power System
xv Xantrex XW Control Panel

8. CONTROL PANEL
i ASCO 7000 Automatic Transfer Switch
ii Barnett Engineering Pro Talk Plus Autodialer
iii Carlo Gavazzi Power Supply
iv Control Systems SCADAPack 32 Remote Control System
v GenMaster GM250 Generator Controller
vi Maple HMI5000
vii Moeller MCC3000 Motor Control Center
viii Moeller MCC 3000 Sump pump Breaker
ix Schneider GFI & Circuit Breakers
x Xantrex Distribution Panel/Conduit Box

9. INSTRUMENTATION
   i Anamet Conduit for RTD
   ii Digitrace 920 Heat Trace Controller
   iii Endress & Hauser Proline Promag Flow Sensor
   iv Johnson Controls Temperature Controller
   v KTech Fuel Level Sensor
   vi Vulcain Gas Transmitter VA301D
   vii Wika Tube Pressure Gauge

10. GENERATOR
   i Beckett Clean Cut Fuel Unit
   ii Frontier Genset Package
   iii John Deere Power Tech Diesel Engine
   iv Stamford Diesel Generator
   v Tramont Day Tank
   vi Westeel Fuel Vault

11. LAB EQUIPMENT
   i Calcium Hypochlorite Reagents/Chemicals
   ii Colorimeter Procedures Manual
   iii Hach Portable Turbidimeter
   iv Sentry Fire Extinguisher

12. LIGHTING
   i AdaptaBeacon 104 Flashing Halogen Lights
   ii Lumark Wall-Lite High pressure Sodium Dusk to Dawn wall light
   iii RAB Design FW4-2T8 Fluorescent Lighting
   iv Ready Lite CX5000 Exit Sign
   v Ready-Lite LDX Series Emergency Lighting System
   vi SceptaLight Outdoor Lighting

13. INTAKE SYSTEM
   i 100mm HDPE Piping
   ii Armtec Concrete Weights
   iii Armtec Concrete intake casing
   iv Intake/Casing Screen
   v Metal Works Skid Intake assembly
   vi Unified Alloy Intake Screen
   vii Urecon Pre Insulated Pipe
   viii Upper Termination Flanges

14. PLUMBING
   i MiFab F1000 Floor Drains

ii Rheem SP2412 Hot water tank
iii Ritepro Couplings
iv Wolverine Tubing

Chapter 10 APPENDIX

1. Photo Album

Distribution:

Set 1: Department of Community and Government Services, Government of Nunavut, Cambridge Bay Regional Main Office

Set 2: Department of Community and Government Services, Government of Nunavut, Headquarters Main Office

Set 3: Hamlet Office, Taloyoak, NU

Set 4: Water Treatment Plant, Taloyoak, NU

Set 5: Dillon Consulting Limited, Yellowknife, NT

2 REVISION DATA

This manual has been updated to include:

Date	Description of Change
Sept. 17, 2012	Addition Madison Chlorine Tank Level Switch – Filters Section

3 PROJECT REPRESENTATIVES

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APPENDIX A

SITE LOCATION

APPENDIX B

CANSO LAKE WATER QUALITY ANALYSIS

TABLE OF CONTENTS

Page No.

3 DESIGN DATA 2

3.1 GENERAL 2
3.2 BACKGROUND INFORMATION 2
3.3 SYSTEM DESCRIPTION 3
3.3.1 Overview 4
3.3.2 Raw Water Intake 4
3.3.3 Filtration System 4
3.3.4 Treated Water Truckfill System 5
3.3.5 Fire Flow/Bypass System 5
3.3.6 Disinfection System 6
3.3.7 Power and Heating Systems 6
3.3.8 System Backups and Redundancies 6
3.4 DESIGN DATA 6
3.4.1 Water Source 6
3.4.2 Chemical Analysis of Water Source 7
3.4.3 Population Projections 7
3.4.4 Water Consumption Data 7
3.4.5 Climate 8
3.5 SITE DEVELOPMENT 8
3.5.1 Intake Line 8
3.5.1.1 Heat Trace 9
3.5.2 Turn Access and Building Pad 9
3.5.3 Building Envelope 9
3.5.3.1 Water Treatment Plant 9
3.5.3.2 Chlorine Room 9
3.5.3.3 Furnace Room 9
3.5.3.4 Generator Room 10
3.5.4 Electrical and Power 10
3.5.5 Fuel Source 11
3.5.6 Building Heat and Ventilation 11
3.6 STANDBY POWER GENERATION 12
3.7 ACCEPTED RISKS 12
3.8 OVERLOAD AND EXPANSION CAPABILITY 13
3.9 EMERGENCY AND TROUBLE RESPONSE 13
3.9.1 Alarm System 13

FIGURES

Figure 3-1: Process Schematic 3

LIST OF TABLES

Table 1. Raw and Treated Water Design Parameters 7
Table 2. Design Climate Parameters 8

APPENDICES

Appendix A: Site Location
Appendix B: Water Quality Results for Canso Lake

3 DESIGN DATA

3.1 General

This section provides background information on Taloyoak. A description of the water treatment process, information on the water treatment process and building design as well as a description of the alarm systems in place within the water treatment plant.

3.2 Background Information

Taloyoak, the northernmost community on the Canadian mainland, is a traditional northern community. It is located 69°32´ north latitude and 93°3´ west longitude, approximately 460 km east of Cambridge Bay and 1224 km northeast of Yellowknife, sitting 26 m above sea level on the Boothia Peninsula on Stanners Harbour. The Hamlet is accessible all year round by aircraft and by barge during the summer.

Taloyoak is located within a continuous permafrost zone, which consists of bedrock terrain that is covered with a thin layer of tundra vegetation. Despite poor soil quality, various types of lichen, moss, willow, heather and wildflowers grow in the area. Wildlife in the area consists of ground squirrels, lemmings, weasels, arctic hares, arctic foxes, ringed seals and numerous species of birds and fish.

Climate for Taloyoak consists of reasonably cool summers and extremely cold winters, which is typical climate for the northern arctic. The average mean temperatures for January and July are about -30.6°C and 11.8°C, respectively. Taloyoak receives approximately on average 128.4 cm of rainfall and 141 cm of snowfall that accumulates to a mean precipitation of 223.4 mm per year.

3.3 System Description

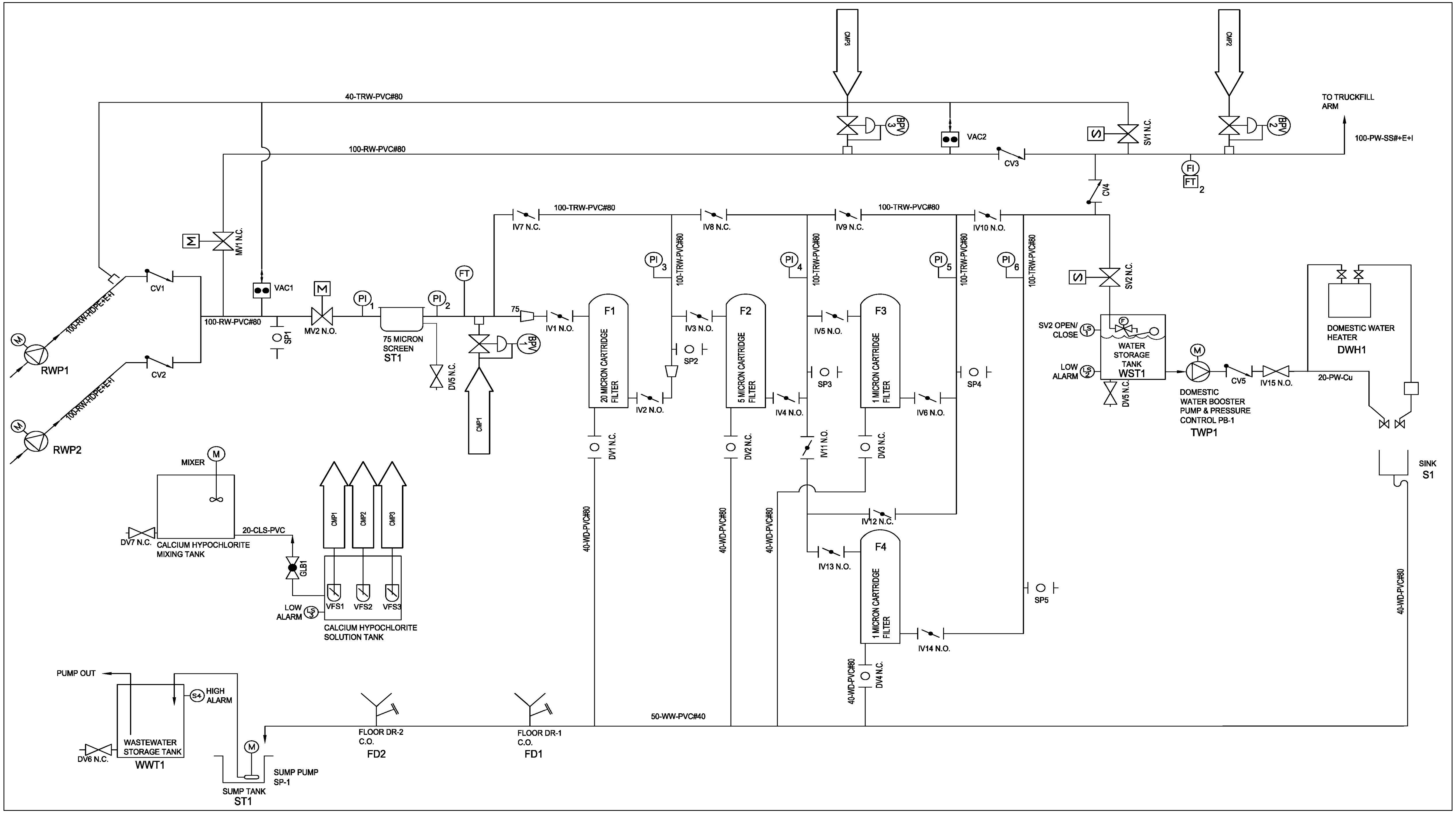


Figure 3-1: Process Schematic

3.3.1 Overview

Construction of the Water Treatment Plant (WTP) in Taloyoak, Nunavut began on 26 April, 2010.

Canso Lake was chosen as the raw water source for the community, a change from the previous source, Water Lake. This change was made due to the proximity of Water Lake to the community which presents a higher risk of contamination.

The cartridge filtration system consists of steel filter housings that contain different sizes of filter cartridges. Water disinfection is done through chlorination using powdered calcium hypochlorite.

There are two control panels: the Main Control Panel (MCP) is located in the building by the plant's operator station, the Truckfill Panel (TFP) is located outside on the truck fill arm. Treated water is transferred to the water truck following activation of a switch at the truckfill arm by the truck driver. Fire flow or bypass operation is initiated manually by the plant operator.

More detailed descriptions of all systems are shown below.

3.3.2 Raw Water Intake

Raw water is pumped from Canso Lake into the water treatment plant using a 20 hp submersible raw water pump (RWP1) rated at 28L/s (please refer to Appendix A at the end of this chapter for location). In the event that the main raw water pump fails, the system will automatically switch to the second intake pump (RWP2).

3.3.3 Filtration System

A 75 micron pre-filter screen is installed prior to raw water entering the filtration train. The screen is made up of stainless steel mesh strainer baskets, which remove dirt and debris so as to extend the operational life of filters.

The filtration stream consists of four swing bolt filter cartridge housings. The housings contain three 20 micron and five 5 micron cartridges in series, followed by two 1 micron absolute cartridges in parallel. The 1 micron absolute cartridges can be operated in series or in parallel. The 20 micron cartridge filter removes sand, silt, rust and loose scale. The 5 micron cartridge filter removes extra fine dirt, dust and particulates. Lastly, the 1 micron absolute filters provide three-log removal of Cryptosporidium and Giardia cysts and other cyst-sized particles from raw water.

Filtration System:

Nominal Flow Rate:	1,350 L/min
Operational Flow Rate:	1,000 L/min
Inflow Design Rate:	950 L/min
Filter Housing Material:	Stainless steel
Temperature Rating:	60°C (140°F)
Pressure Rating:	150 psi

All filter housings have drains that remove water from the filter; this is manual operation.

Pressure gauges are located between each filter to monitor pressure drops which will help determine if there are any upsets during any time of operation. As well, there are sampling ports along the system where samples can be taken which will assist with the monitoring of water quality during each stage of the process.

3.3.4 Treated Water Truckfill System

When there is a demand for water from the community, the solenoid valve (SV1) will open to initiate the flow of water stored in the water storage tank into the truck fill arm which fills the water distribution truck. This action is started when the water truck driver pushes the On/Off button located on the Truck Fill Panel.

During normal operation, the lead RWP will be energized on initiation. Motorized Valve 1 (MV1) is closed and Motorized Valve 2 (MV2) is open. Chlorine (as calcium hypochlorite solution) is also injected into the water entering the truck fill arm. After every truck filling, SV1 opens to allow excess water to flow back into the intake pipe casing. This removes water from the climate-exposed truck fill arm, thereby protecting the treated water from freezing in the arm.

3.3.5 Fire Flow/Bypass System

Under fire flow operation, or anytime that the plant operator wants to by-pass the filter train, the plant operator will select the “By-Pass” mode on the MCP. The by-pass mode will open MV1 and close MV2. Operation from the TFP will be the same as normal operation.

Drain water from the truckfill line and the by-pass line will be returned to the intake pipe casing by the overflow line. Solenoid Valve 1 (SV1) will open, allowing the water to drain back to the intake pipe casing after each fill cycle.

3.3.6 Disinfection System

Water disinfection is done through chlorination using powdered calcium hypochlorite. Pre-chlorination is done before and after water goes through the filtration train. Chlorine is also injected prior to the water entering the truck fill arm and storage tank. Treated water is stored in a water storage tank, goes through to the truck fill arm for the distribution of potable water using water trucks.
When the truckfill system is started, Flow Switch 1 (FS1) initiates Chemical Metering Pump 1 (CMP1) to inject chlorine into the water prior to the filtration train. When water passes through the filtration train and enters the truck fill arm, Flow Switch 2 (FS2) will initiate Chemical Metering Pump 2 (CMP2) to introduce chlorine into the water. The treated water leaves the filtration train and enters the water storage tank.

3.3.7 Power and Heating Systems

Power requirements for the Water Treatment Plant building and treatment processes will be supplied by the Alternative Energy System (AES). The AES consists of photovoltaic (PV) modules and a wind turbine, with batteries to store additional energy. Where power demands are greater than what can be produced by the AES, power provided by the Nunavut Power Corporation (NPC) via power transmission lines and/or the standby diesel generator will be used.

Heating in the WTP comes from an oil furnace and a Heat Recovery Ventilator (HRV). Heating in the AES building is supplied by oil-fired fan type heaters, heat generated from the photovoltaic system and the wind turbine generator.

3.3.8 System Backups and Redundancies

The Water Treatment Plant is designed with automatic backups for power and pumps. If one fails, the duplicate component is put into operation. The systems are designed to recover from freezing with no major damage and minimal interruptions to the operation of the Water Treatment Plant. The intake and truck fill lines are protected from freezing through the use of heat cables, which are controlled automatically.

Shelf spares are available in the Water Treatment Plant for all critical components of the treatment system in order to prevent extended plant shutdown due to component failure that requires a replacement part.

3.4 Design Data

3.4.1 Water Source

Raw water will be drawn from Canso Lake, situated northwest of the community. Refer to Appendix A for location of water source in comparison to community centre.

3.4.2 Chemical Analysis of Water Source

Water samples were taken in Canso Lake on August 8th, 2007 and October 8th, 2007. The water quality analysis revealed several exceedances to the Guidelines for Canadian Drinking Water Quality (GCDWQ), as shown below:

- Turbidity: 0.5 to 0.6 NTU;
- E.coli: < 1 MPN/100mL;
- Total Coliforms: 22 MPN/100mL

The GCDWQ limit for turbidity is 0.3 NTU for conventional treatment. The raw water is slightly exceeding the turbidity requirement for drinking water. The small presence of E.coli and total coliforms suggests an exceedance to the GCDWQ, where the limit for E.coli is 0 MPN/100mL. There is no limit presented for total coliforms. Based on this information, it was found that treatment will be required for turbidity and microbiological components. The treatment required will consist of filtration and disinfection.

The complete results of the raw water quality analysis are included in Appendix B.

3.4.3 Population Projections

The population of Taloyoak in 2007 was reported to be approximately 850 people (communicated by Stephen King, SAO Taloyoak). The average growth rate was estimated to be 2.4% over a 20-year period. This information was extrapolated to determine the population of the community in 2033 (25 year design horizon), where it is expected that the population of Taloyoak will be approximately 1761 people.

3.4.4 Water Consumption Data

It was calculated that 247.5 m^3/day of water will be required in 2033 to meet the community's needs, as per the water consumption equation provided by MACA. In addition to daily domestic demand, water will be required for emergency situations, such as a fire. The Fire Marshal of Nunavut recommended the design fire flow rate to be 1,000 L/min or 1440 m^3/day.

Table 1 shows the design flowrates for raw and treated water as well as the maximum supply pipeline pressure:

Table 1. Raw and Treated Water Design Parameters

Raw Water/Intake Pump Flow Rate	950 L/min
Fire Flow/By-Pass Flow Rate	1,000 L/min
Truckfill Arm Fill Rate	1,000 L/min
Process Flow Rate	1,000 L/min
100 mm HDPE Water Supply Pipe Line Max Pressure	100 psi

3.4.5 Climate

Climate conditions used in the design are as follows:

Table 2. Design Climate Parameters

Design Minimum Temperature		-45°C (-43°C)
Degree Days (below 18°C)		12037(11693)
Design Water Tank Storage Temperature		5.0°C
Design Operation Room Temperature		10.0°C
Design Incoming Water Temperature		0.5°C
Design Generator Room Temperature		10.0°C
Snow Load	S_S S_R	1.5 kPa(1.9 kPa) 0.1 kPa (0.1 kPa)
Wind Pressures		0.39 kPa (0.62 kPa)
Seismic	Za Zv	2 1

Source: Supplement to the National Building Code of Canada 2005, Third Edition. Cambridge Bay data used, Arctic Bay data is in brackets.

3.5 Site Development

3.5.1 Intake Line

The intake line specifications are:

- Submerged section of intake is approximately 5 m.
- The top of the intake screen is set at an elevation of approximately 17 m above sea level.
- Intake is installed within an insulated casing pipe.
- Intake pump is housed within a steel skid that allows for pump extraction.
- The skid has a steel cable attached, which leads to the off take pipe. The cable is used to extract the pump for maintenance and repairs.
- The off take pipe from the pump is 100 mm HDPE DR 17 pipe.
- The casing pipe is HDPE DR 17 300 mm diameter.
- The casing pipe consists of 63.5 mm of rigid polyurethane foam insulation and an outer jacket of 50 mm black (UV-inhibited) HDPE.
- Two heat traces are installed in the casing pipe, next to the 100 mm pipe in a copper tube.
- All heat traces are installed with controllers.

3.5.1.1 Heat Trace

A heat trace system is installed on the intake casings and pipes to prevent water from freezing. A total of four power-limiting cables will be installed, two per intake casing/pipeline. Only one heat trace cable on each intake will be operational during normal operation. The heat trace will be activated by Resistance Temperature Detectors (RTDs). A combined temperature sensor and thermostat will monitor and control the temperature of the heat trace cables. The following illustrates the heat trace set points:

Primary Cable:
- Temperature low point: 5°C
- Temperature high point: 8°C

Secondary Cable:
- Temperature low point: 3°C
- Temperature high point: 6°C

3.5.2 Turn Access and Building Pad

The truck turning access pad and building pad makes up the overall foundation for the building.

Building pad dimensions are 12.2 m X 4.5 m, grading is at a 2:1 slope throughout the perimeter.

The truck turn around pad has a radius of 15 m so that standard water distribution trucks can be used in the future. The side slopes of the building pad and turn around pad are be 3:1 (H:V). 150 mm of Type II granular material is placed on top of 500 mm Type I material. Granular materials are compacted to 95% standard proxy density.

3.5.3 Building Envelope

3.5.3.1 Water Treatment Plant

Pre-manufactured, skid-mounted building is constructed which is able to provide an insulation value of RSI 5.4 (nominal R-32).

3.5.3.2 Chlorine Room

Interior partition walls and an interior door separates the chlorine storage and mixing area from the rest of the Plant. The Chlorine Room is 1.2m by 1.6 m.

3.5.3.3 Furnace Room

The furnace is partitioned by walls to separate the furnace from the treatment system. The partitions measure approximately 2 meters.

3.5.3.4 Generator Room

The Generator Room is enclosed from the treatment section of the Water Treatment Plant by partition walls. Access for this room is from a separate entrance from the outside of the Plant.

3.5.4 Electrical and Power

Power sources for the water treatment plant come from the Alternative Energy System (which consists of a wind turbine, a photovoltaic (PV) system and batteries), the utility provider and the standby diesel generator. The wind turbine and PV system will be used as the major source of power. When power demand is low, energy is stored in batteries which will be used when power demands increase. In the event that power demands in the WTP cannot be met by the Alternative Energy System, grid power provided by the Nunavut Power Corp. will be used. If there is a grid power failure and the Alternative Energy System is insufficient to meet the power demand, the standby diesel generator will commence operation.

The Alternative Energy System (AES) consists of photovoltaic (PV) modules and a wind turbine. Under normal operation, majority of the power requirements can be supplied by either the PV modules and wind generator, or both. Any additional energy supplied by the system will be stored in batteries to be used at a later time. Therefore, during times when the power demand is greater than what can be supplied by the AES, the remaining power requirements will be supplied by energy stored in batteries, utility power and/or the backup diesel generator installed in the Water Treatment Plant. Daily energy consumption is calculated to be 60 kW-hr and system peak demand is expected to reach 20 kW.

The following depicts the specifications of different components of the Alternative Energy System:

Photovoltaic Modules:

Make & Model:	Sharp NT-175UC1
Material:	Crystal silicon
Max. Power:	175 W
Max. Power Voltage:	35.4 V
Output:	48V, 500 amp-hours
Type of Cell:	Monocrystalline silicon
Cell configuration:	72 in series

Wind Turbine Generator:

Make & Model:	Whisper 500
Rotor diameter:	4.5 m
Input:	48V DC
Rated Power:	3000 W @ 24 mph (10.5 m/s)
Frequency:	60Hz
Survival wind speed:	120 mph (55 m/s)
Blade specifications:	Carbon-reinforced fiberglass

Batteries:

Make & Model:	Unigy AVR95-27
Min no. of batteries:	48
Output:	48V, 6300 amp-hours
Autonomy days:	3.5 days @ 80% max. depth of discharge
	3 days @ 68% max. depth of discharge
	2.2 days @ 50% max. depth of discharge

Inverter:

Make & Model:	Xantrex XW Hybrid
Input:	48V DC
Output:	2 @ 3 x 3.6 kW ± 2%
Voltage:	120/240V
Configuration:	1-phase, 3-wire
Frequency:	60Hz

3.5.5 Fuel Source

Main fuel source for the furnace and standby generator will be arctic grade diesel. Fuel is stored in a fuel tank, and is transferred to a day tank for use in furnace/generator. The day tank pumps fuel at the required rate to run the furnace/generator.

Fuel Tank:

Make & Model:	Westeel Fuel-Vault HFV-C;conforms to ULC-S601-07
Capacity:	4540 litres
Material:	Mild Steel

Day Tank:

Make & Model:	Tramont TRS Series
Motor Specifications:	1/3 hp, 115 VAC, 60 Hz, thermally protected
Pump Specifications:	2 gpm, high lift gear pump
Capacity:	40 litres
Material:	Heavy gauge steel

3.5.6 Building Heat and Ventilation

The water treatment process building is heated by an oil furnace, oil-fired fan-type unit heaters, and a Heat Recovery Ventilator (HRV). The HRV provides fresh air into the building while exhausting an equal amount of stale air. During the cold seasons, incoming cold fresh air is warmed by using the heat recovered from the stale air before it is exhausted to the environment. Heating in the AES building is supplied from oil-fired fan type heaters, heat generated from the photovoltaic system and the wind turbine generator.

The following illustrates the heating and ventilation set points for the building:

Heat Recovery Ventilator:

Make & Model:	Lennox HRV 200-3
Max Efficiency:	69%
Voltage:	120V
Configuration:	1-phase
Frequency:	60Hz

Furnace:

Make & Model:	Beckett
Firing Rate Range:	0.40 - 3.00 GPH
Input:	56,000 – 420, 000 BTU/h
Voltage:	120V
Frequency:	60Hz
Configuration:	1-phase
Motor:	1/7 hp, 3450 rpm, NEMA 48M frame

3.6 Standby Power Generation

If there is a disruption in the power transmission lines, the automatic transfer switch initiates the standby generator and a relay switch activates the battery bank. The diesel generator and batteries in the AES are standby power sources.

Diesel Generator:

Make & Model:	John Deere PowerTech E4045
Number of Cylinders:	4
Bore:	106 mm
Stroke:	127 mm
Displacement:	4.5 L
Rated Speed:	2400 rpm
Power Rating @ Rated Speed:	45 kW
Voltage:	120V
Configuration:	1-phase
Frequency:	60Hz

3.7 Accepted Risks

Accepted risks can be described as risks that occur for which protection could not be provided.

The truck fill arms located on the exterior of the Water Treatment Plant are designed to drain any excess water from the pipe back into the wastewater collection system. The angle of the truck fill arm is designed so that after the pumps are shut down, a solenoid valve will not sense flow and will open to release the remaining water back along the pipe into the septic tank. This prevents water from remaining in the pipe and being exposed to possible freeze-up. In the event that the pipe does freeze up, it can be thawed by the use of a Tiger Torch. To do this, apply the flame directly to the stainless steel pipe. This will thaw out the excess water and allow it to drain back into the wastewater tank where it can be properly disposed. To avoid overheating areas of unfrozen pipe, vise clamps can be used to isolate the frozen pipe sections.

3.8 Overload and Expansion Capability

The raw water pump is sized to accommodate the predicted population up to 2033. After that time, the pump will have to be changed to one of higher capacity to satisfy the community's further 25-year water requirements.

3.9 Emergency and Trouble Response

3.9.1 Alarm System

The Water Treatment Plant is also equipped with a monitoring alarm system that checks water levels, pumps, temperature and other features described in Chapter 6 – Monitoring Alarms. Alarms are categorized into major and minor alarms. The major alarms set off an auto-dialer that notifies maintenance staff with an emergency alert. Minor alarms set off a light and an alarm that rings throughout the building.

The alarm system enables the autodialer when a major trouble condition has occurred which requires the attention of the Operator. The precise trouble condition is indicated by a light on the control panel, with the exception of a complete loss of power. This condition will be apparent upon arrival at the water treatment plant.

Major alarms consist of:

- Intake pump RWP1 and RWP2 failure
- Low building temperature
- Power off – Standby Generator failure
- Very low fuel
- Heat Trace low temperature RWP1&2 and TWP1

Any alarm received should be treated as an emergency condition.

Minor trouble conditions do not enable the autodialer to transmit an alarm; they are only indicated by a light on the alarm panel and an audible alarm that can be heard within the building. The minor trouble conditions do not require the operator's immediate presence but should be taken as important.

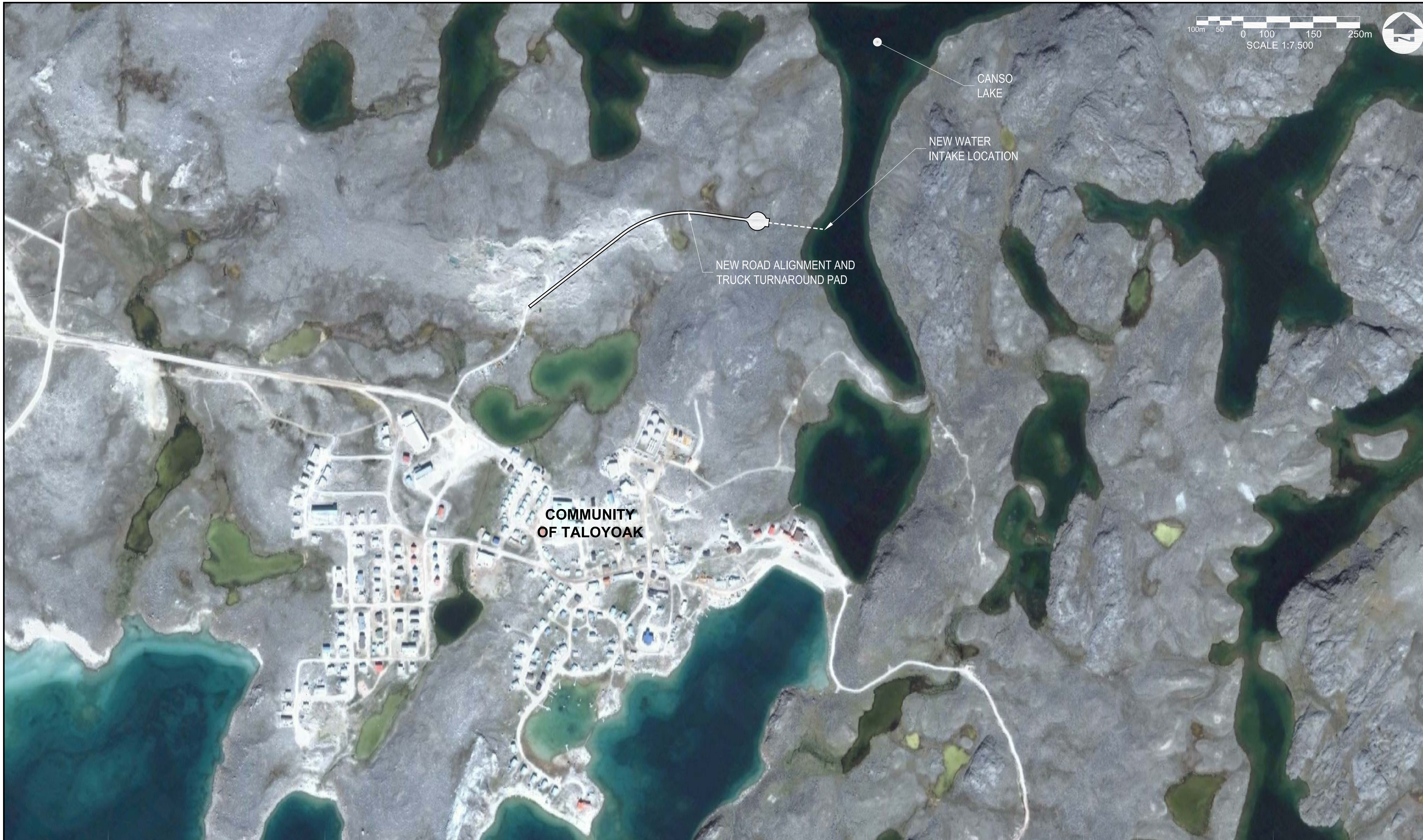
Minor alarms consist of:

- High building temperature
- Power off – Standby Generator on
- Low fuel temperature
- High Wastewater Tank level
- Heat Trace general fault
- Generator general fault

Chapter 6 provides additional detail on all major and minor alarm conditions that could occur in the Water Treatment Plant and the procedures in mitigating and address these alarm conditions.

APPENDIX A

SITE LOCATION



4920 47TH STREET, YELLOWKNIFE NT, X1A 2P1, PHONE 867.920.4555

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

Nunavut

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY

DESIGN	REVIEWED BY
DRAWN TPW	CHECKED BY
DATE JUNE 2011	
SCALE AS SHOWN	

TALOYOAK WATER TREATMENT PLANT
TALOYOAK, NUNAVUT

GENERAL SITE PLAN

PROJECT NO. 07-8107-2000

SHEET NO. **FIG 1**

APPENDIX B

CANSO LAKE WATER QUALITY ANALYSIS

Parameter	Units	GCDWQ		S2 T1 (Aug 8^{th})	S2 B1 (Aug 8^{th})	Site 2 (Oct 8^{th})
		MAC	AO			
Physicals						
Alkalinity	-	-	-	-	-	-
Total (as $CaCO_3$)	mg/L	-	-	83	83	97
PP (as $CaCO_3$)	mg/L	-	-	<1	<1	<1
Color, True	PtCo	-	≤15 TCU	5	5	2
Conductivity	uS/cm	-	-	221	221	252
Particle Size	-	-	-	-	-	-
pH	pH	-	6.5-8.5	8.1	8.2	8.1
Total Dissolved Solids	mg/L	-	≤500	110	109	127
Total Suspended Solids	mg/L	-	-	<2	<2	<2
Turbidity	NTU	0.3/1.0/0.1[a]	-	**0.5**	**0.5**	**0.6**
Major Ions (Dissolved)						
Calcium	mg/L	-	-	20.8	20.6	22.1
Chloride	mg/L	-	≤250	14	14	16
Fluoride	mg/L	1.5	-	-	-	-
Hardness (as $CaCO_3$)	mg/L	-	-	90	90	97
Magnesium	mg/L	-	-	9.3	9.3	10.1
Potassium	mg/L	-	-	0.9	0.9	1.2
Sodium	mg/L	-	≤200	9.9	9.9	12.2
Sulphate (as SO_4)	mg/L	-	≤500	5	4	7
Metals (Total)						
Arsenic	mg/L	0.01	-	<0.001	<0.001	<0.001
Aluminum	mg/L	-	0.1/0.2[b]	0.005	0.004	<0.04
Barium	mg/L	1	-	<0.01	<0.01	<0.01
Cadmium	µg/L	5	-	<0.01	<0.01	<0.0002
Chromium	mg/L	0.05	-	<0.001	0.001	<0.01
Copper	mg/L	-	≤1.0	<0.0002	<0.0002	0.0004
Iron	mg/L	-	≤0.3	<0.06	<0.06	<0.06
Lead	mg/L	0.01	-	<0.0002	<0.0002	<0.0002
Manganese	mg/L	-	≤0.05	<0.004	<0.004	<0.004
Mercury	mg/L	0.001	-	-	-	<0.0000
Selenium	mg/L	0.01	-	<0.001	<0.001	5 <0.001
Uranium	mg/L	0.02	-	0.0003	0.0003	0.0005
Zinc	mg/L	-	≤5.0	<0.0003	<0.0003	<0.0003
Organics						
Total Cyanide	mg/L	0.20	-	< 0.005	< 0.005	< 0.005
Total Trihalomethanes	mg/L	0.10	-	-	-	-
Tribromomethane	µg/L	-	-	<0.5	<0.5	<0.4
Trichloromethane	µg/L	-	-	<0.5	<0.5	<0.4
Bromodichloromethane	µg/L	16	-	<1	<1	<0.4
Chlorodibromomethane	µg/L	-	-	<0.5	<0.5	<0.4
Nutrients						
Total Dissolved Carbon	mg/L	-	-	-	-	3
Total Nitrate + Nitrite	mg/L	10	-	<0.2	<0.2	<0.2
Total Organic Carbon	mg/L	-	-	2.0	1.9	3.2
Total Phosphorous	mg/L	-	-	<0.003	<0.003	<0.1
Microbiological						
E. Coli	mpn/100	0	-	**<1**	**<1**	**<1**
Fecal Coliforms	mL	mg/L/100mL	-	-	-	-
Total Coliforms	mpn/100	-	-	**22**	**13**	**<1**
Standard Plate Count	mL	0	-	-	-	<1

a. Based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

b. Operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. Based on conventional treatment/all other treatment systems.

Source: "Water System Upgrades, Taloyoak Pre-Design Report", Dillon Consulting Limited, 2007.