Town of Inuvik, NT

# Submission in Support of Inuvik's Application for Renewal of Water Licence G06L3-001

**Prepared by:**

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## Revision History

| Revision # | Date | Revised By: | Revision Description |
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| **0** | 2016-10-31 | Jordan Hoffart | Draft Submission |
| **1** | 2017-01-27 | Jordan Hoffart | Draft Submission, Update for inclusion of additional data and information on new WTP |
| **2** | 2017-02-06 | Jordan Hoffart | Final |
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February 6, 2017

AlecSandra Macdonald
Regulatory Specialist
Gwich'in Land and Water Board
P.O. Box 2018
Inuvik, NT X0E 0T0

Dear AlecSandra:

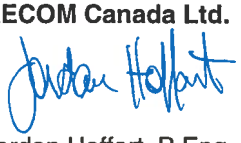
**Project No:** **60317863**

**Regarding:** **Town of Inuvik Water Licence No. G06L3-001 Application for Renewal Submission in Support of Inuvik's Application for Renewal**

We are pleased to provide you with our final report in support of the Town of Inuvik's Water Licence No. G06L3-001 Application for Renewal. We have incorporated updated details and background data regarding the new water treatment plant construction.

We look forward to working with you as the water licence renewal process progresses.

Sincerely,
**AECOM Canada Ltd.**



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cc: Rick Campbell, Town of Inuvik

# Quality Information

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**Report Reviewed By:**

Jordan Hoffart, P.Eng., PMP
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# Executive Summary

The Town of Inuvik applied to the Gwich'in Land and Water Board (GLWB) on October 31, 2016 for renewal of Water License #G06L3-001. The Town is seeking a renewal of its licence for a ten year period between July 1, 2017 and June 30, 2027.

This report has been provided to supplement the Town of Inuvik's Water License renewal application by providing additional information regarding the Town's water supply, sewage treatment and solid waste disposal facilities. The report's sections can be summarized as follows:

- **Section 1** provides a brief overview of the Town of Inuvik's Water Licence history.
- **Section 2** provides an overview of the Town's existing water supply, sewage treatment and solid waste disposal facilities and arrangements.
- **Section 3** provides discussion regarding projected trends and potential impacts on Inuvik's infrastructure during the proposed 2017 to 2027 licence period.
- **Section 4** provides an overview of Inuvik's existing Water Licence, with commentary on suggestions and changes.

The Town of Inuvik has maintained its Water Licence since June 1, 1978, regularly renewing the Licence as required. Inuvik shares the values and objectives of the Water Boards and applies diligent and sustained efforts to comply with Water Licence conditions. The Town's water supply, sewage and solid waste infrastructure are protected, operated and maintained according to the terms of the Water Licence and public interest. Monitoring, sampling and testing are regularly performed in compliance with the Surveillance Network and Quality Assurance / Quality Control programs. At a minimum, lagoon dike inspection occurs annually, with more frequent inspections occurring as required. The Town files quarterly and annual reports summarizing monitoring program activities and results to the Water Board, noting matters of interest. Inuvik also and maintains informal liaison with Inspectors and public health officials in order to be aware of any emerging concerns. The Town takes action on any concerns that arise.

During the proposed licence period between 2017 and 2027, growth forecasts project an increase in population and subsequent increased loading on Inuvik's water supply, sewage treatment and solid waste disposal infrastructure (assuming development of the Mackenzie Gas Project). The increased loading on the Town's infrastructure is estimated to be within the capacity of the existing systems, and is anticipated to meet current conditions of the Water Licence.

Construction of Inuvik's new East Channel Water Treatment Plant was completed in 2016. The plant's commissioning has changed the Town's water intake system, allowing East Channel to be used as the Town's primary raw water source year-round. Previous intake arrangements were based on seasonal withdrawals between East Channel during winter and Hidden Lake during summer. This change will not impact the Town's total yearly water demand. It will, however, increase the quantity of water withdrawn annually from East Channel, by an amount not significant to the river's regime. Hidden Lake's intake and pumphouse infrastructure will be phased-out, leading to a full decommissioning. Hidden Lake's water storage reservoir tank will be maintained for emergency treated water reserve, with an additional storage tank potentially constructed in the future.

No changes to sewage treatment and solid waste management infrastructure are currently planned for the proposed licence period.

No changes to the infrastructure's ownership, management, operation and maintenance are currently being contemplated for the proposed licence period, aside from minor operation and maintenance procedure revisions, completed as required to keep up with any evolving practices.

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# 1. Introduction

## 1.1 Application for Renewal of Water Licence

The Town of Inuvik applied to the Gwich'in Land and Water Board (GLWB) on October 31, 2016 for renewal of Water License # G06L3-001. The Town is seeking renewal of its licence for a ten year period between July 1, 2017 and June 30, 2027. A copy of the October 31, 2016 licence renewal application is provided in **Appendix A**.

## 1.2 Brief Review of Inuvik's Water Licence History

Inuvik's first Water Licence was issued for five years (June 1, 1978 to May 31, 1983). During that time, municipal water supply facilities were improved by upgrading the Hidden Lake Water Treatment Plant's chlorination system and constructing the East Channel Water Treatment Plant to provide filtration, chlorination and fluoridation. Municipal sewage treatment facilities were also improved during that time through the construction of two primary cells and two sludge retention cells within the pre-existing large, single-cell lagoon and by replacing the main outlet control structure.

Inuvik's second Water Licence was issued for ten years (June 1, 1983 to June 30, 1993). During that time, no significant changes were made to the Town's water supply, sewage treatment or solid waste disposal facilities, aside from routine infrastructure maintenance and repair works.

The Northwest Territories Water Board issued Inuvik's third licence for three years (1993 to 1996) in order to provide the Town with the opportunity to assess effluent effects on East Channel. Routine monitoring of lagoon effluent quality between 1983 and 1993 had revealed that the lagoon system could meet all Licence requirements in the summer and most requirements in the winter, but it was not able to reduce counts of indicator bacteria to required levels in 1983. Subsequent field study of East Channel concluded that Inuvik's lagoon effluent presented a low level of risk to public health and that the discharge was "unlikely to be of any practical significance to East Channel's waters or to East Channel's aquatic life" (Reid Crowther, 1995). During the 1993 to 1996 Licence period, no significant changes were made to water supply, sewage treatment or solid waste disposal facilities, aside from a significant maintenance operation done in 1993 to transfer accumulated sludge from primary lagoon cells to adjacent sludge holding cells.

Following a review of the 1994 Reid Crowther study methods, data and analyses, the Northwest Territories Water Board's Technical Advisory Committee approved the study's conclusions and issued Inuvik's fourth Water Licence for ten years (July 1, 1996 to June 30, 2006). An additional study was performed on Inuvik's wastewater effluent plume on East Channel in 1997, in response to requests from the Fisheries Joint Management Committee Joint Secretariat and the Inuvik Hunters and Trappers Committee. This study was presented at a public meeting in Inuvik on April 20, 1999 and concluded that there were no significant concerns.

During the 1996 to 2006 Licence period, no fundamental changes were made to water supply, sewage treatment and solid waste disposal facilities. Minor changes included a change to metered water and consumption-based billing, abandonment and removal of the High Temperature Hot Water district heat distribution system, as well as the maintenance and restoration of the sewage lagoon's secondary cell west dike and several primary cell median dikes.

During the following 2006 to 2016 Licence period, no fundamental changes were made to water supply, sewage treatment or solid waste disposal facilities. Minor changes included the installation of an intake screen for the East Channel pumphouse, restoration of dikes around the lagoon's primary and sludge holding cells to design levels and the installation of a honeybag drop-off station at the Solid Waste site. Lagoon sampling identified effluent pH spikes during summer, likely due to extensive algae growth; the Town subsequently revised their sampling procedure to include additional mid-summer pH readings in order to determine the extents of the pH spikes. Sampling of ponds adjacent to the lagoon began in 2007 in order to monitor possible groundwater leakage after unusual levels of ammonia were detected in Gate Pond. Scans for metals were also performed in 2008 and 2011. Analysis results implied no public health or environmental concerns.

In 2006, the Town submitted an assessment of the Mount Baldy Solid Waste Disposal Facility which explored the suitability of the Mount Baldy site. Conclusions of the study note that the Mount Baldy "landfill site has been well chosen to pose no undue threat to public health or the environment."

Studies in 2011 and 2013 were performed to assess the Town's sewage treatment options and identify suitable options to allow the Town to meet territorial and federal guidelines. Since federal guidelines had not yet been formalized, they were assumed based on then-current Department of Fisheries and Oceans (DFO) requirements for other areas in Canada. The studies noted that should these regulations be modified to include the Far North, Inuvik's lagoon effluent quality would not meet the standard for carbonaceous BOD on an annual average basis during the winter and spring months. Lagoon effluent quality complies with all other aspects of the assumed regulations.

In 2016, the Gwich'in Land and Water Board (GLWB) approved a 1 year renewal of the Town's water license, as the Town was then in the process of constructing the new East Channel Water Treatment Plant. This plant will provide Inuvik with a year-round water intake in the East Channel and allow for the phase-out of Hidden Lake's existing intake and pumphouse infrastructure. The new water treatment plant was commissioned in late 2016.

# 2. Existing Facilities and Current Operation

The following sections provide an overview of the existing water supply, sewage treatment and solid waste disposal facilities, as well as the Surveillance Network Program monitoring stations. The locations of principal components are shown in **Figure 2.1**.

## 2.1 Ownership, Management and Operation

### 2.1.1 Ownership and Management

Inuvik fulfils the functions of owner and operator of the public water and sewage facilities, but titles for much of the system are owned by the Government of Northwest Territories (GNWT).

When Inuvik was incorporated as a Town in 1969, it declined to accept ownership of the area's water and sewage infrastructure until certain conditions had been met. The Inuvik Utilities Planning Committee (IUPC) was formed to act as custodian and manager of the system. The Northern Canada Power Commission (subsequently Northwest Territories Power Corporation) had been the system's operator and maintainer from Inuvik's beginnings, and continued in that role.

In the early 1990's, GNWT arranged transfer of federally-owned components of the system to itself, to consolidate ownership prior to transfer to Inuvik. In 1996, Inuvik agreed in principle to undertake ownership and the IUPC subsequently disbanded in 1999, leaving Inuvik the custodian, manager and operator of the infrastructure. However, GNWT has been unable to complete the intended formal transfer due to lack of easements covering the many locations where the utilidor system informally crosses private land.

The Town owns and manages its solid waste disposal site.

### 2.1.2 Operation and Maintenance

Inuvik operates and maintains all of the community's water, sewage and solid waste facilities. The Town's operations and maintenance (O&M) practices include the following:

- East Channel Water Treatment Plant Operations and Maintenance Manual (to be provided upon completion)
- Operations and Maintenance Water and Sewage Systems, Inuvik NWT (Reid Crowther and Partners Ltd., 2000)
- Operations and Maintenance Manual, Sewage Treatment Facility, Inuvik NWT (Reid Crowther and Partners Ltd, 1994 with a 2012 update by AECOM)
- Operations and Maintenance Manual for Solid Waste Disposal Facilities (Earth Tech Canada Inc., 2006, with a 2012 update by AECOM)

The Town performs a yearly review of these manuals to ensure procedures keep up with evolving practices. Revisions are issued through updates and errata, as required. A draft Spill Contingency Plan was submitted for review in September 2016 to formalize the Town's procedures for emergency environmental spill events. Updates to the plan will be completed as new information becomes available.

### 2.1.3 Surveillance Network Program

Inuvik maintains a Surveillance Network Program (SNP) to monitor water use quantities, sewage discharge effluent, solid waste facility runoff and pond quality near the lagoon. Samples are taken by the Town's operations and maintenance staff either annually or monthly, depending on the station. Results and findings of the SNP are then summarized and included in quarterly and yearly reports to the Gwich'in Land and Water Board. The SNP consists of the following stations:

- Station 0036-1 monitors water quantity withdrawal for the Mackenzie River pumphouse. Volumes of water used are logged daily and tabulated monthly.
- Station 0036-2 monitors water quantity withdrawal for the Hidden Lake pumphouse. Volumes of water used are logged daily and tabulated monthly.
- Station 0036-3 monitors sewage effluent quality for East Channel. Samples are taken monthly and analyzed for five-day biochemical oxygen demand (BOD5), suspended solids (SS), fecal coliforms (FC), ammonia (NH3) and pH.
- Station 0036-4 monitors solid waste facility runoff (westward). Samples are taken monthly when there is flow. Parameters monitored include a range of metals, BOD5, SS, oil and grease, phenols, among others.
- Station 0036-5 monitors near-shore water quality in a pond east of the solid waste facility site. Samples are taken monthly when there is flow. Parameters monitored include a range of metals, BOD5, SS, oil and grease, phenols, among others.
- Station 0036-6 (also known as "Gate Pond" or Station 6) occupies a former small quarry just outside the lagoon system's west dike, adjacent to the west sludge cell. Samples are taken annually for the same lagoon effluent parameters as SNP 0036-3.
- Station 0036-7 (also known as "Far Pond" or Station 7) is located outside the lagoon system's west dike, opposite the middle-north part of the secondary cell, about 800 m northwest of Gate Pond and 250 m south of the outlet structure. Samples are taken annually for the same lagoon effluent parameters as SNP 0036-3.
- Station 0036-8 (also known as Station 8) is a background benchmark station located at the south end of north Twin Lake. Samples are taken annually for the same lagoon effluent parameters as SNP 0036-3.

SNP site locations were selected by the Gwich'in Land and Water Board and their predecessor, the Northwest Territories Water Board. Station 006-2 will be removed from the program after commissioning the new East Channel Water Treatment Plant. In light of the gradual development and growth of the solid waste site, the locations of Station 0036-4 and Station 0036-5 will be reviewed by the Town during the proposed license period.

# 2.2 Water Supply

## 2.2.1 Overview

Historically, Inuvik has employed a seasonal water supply arrangement where water is drawn from East Channel during the winter and Lake B (also known as Three Mile Lake) during the summer. The seasonal water supply arrangement avoided the capital and operating costs that year-round dependence on a single water source would entail. Specifically, it avoided the cost of treating East Channel's water in summer when the river is highly turbid and alternatively, avoided the cost of winterizing the Lake B intake and pipeline and operating that system in cold weather.

Hidden Lake was used as a reservoir to carry the Town through the spring break-up and fall freeze-up periods when the Town's primary water sources were unavailable and unable to be effectively operated. Hidden Lake was re-filled in the summer season by water piped from Three Mile Lake and re-filled in winter using treated water from East Channel. Water supply contributions from Hidden Lake's catchment area are insignificant (Dillon, 2013).

The Town's water treatment facilities are nearing their intended lifespans. Therefore, in 2012, Inuvik began to undertake the East Channel Water Treatment Plant project. The water plant improvement is intended to bring Inuvik's water quality in line with current foreseeable standards for protection of public health and for aesthetics, and will avoid the need to replace and upgrade all of the summertime-use water supply and treatment facilities centered around Hidden Lake. The plant will include new filtration, disinfection and storage, as well as a year-round intake and raw pump station. The construction contract was awarded in early 2015, with plant commissioning completed in December of 2016.

Construction of the East Channel Water Treatment Plant will end the Town's historic reliance of the Lake B and Hidden Lake water supply infrastructure, which otherwise is in need of replacement and major upgrade. The Town is considering keeping some elements of Hidden Lake's water supply infrastructure for emergency reserve, such as the storage tank.

In the fall of 2006, Inuvik commenced work on the planning and provision of intake screens, complying with Department of Fisheries and Oceans guidelines, as per Water License Condition C3. A screen was installed at the East Channel pumphouse in 2009. Initial problems were encountered due to ice binding, but by 2010, the problems had been solved.

Due to the planned phase-out of Lake B - Hidden Lake water supply system, screens were not installed at either Hidden Lake or Lake B. The Hidden Lake intake and pumphouse were removed from use with the completion of the new water treatment plant.

## 2.2.2 Water Supply Facilities

A summary of the Town's existing water supply and treatment facilities, as well as their anticipated usage over the proposed license period, includes the following:

- Former East Channel Water Treatment Plant. This Plant was first constructed in 1979 to treat water from East Channel during periods of ice cover from October to May, providing filtration, chlorination, fluoridation and tempering. The Plant was incorporated into the New East Channel Water Treatment Plant and will not be in use during the proposed license period.

- Former East Channel intake, pumphouse and raw water pipeline. This was set up on river ice each fall, generally in November. It is not anticipated to be in use during the proposed license period.
- Lake B intake, pumphouse and raw water pipeline. Lake B's infrastructure was constructed in 1973 and only equipped for warm weather operation. The pumphouse discharged into Hidden Lake, but the Town expects to phase-out most of the infrastructure during the proposed license period. Lake B's existing raw water storage will continue to be maintained as a backup source in case of emergency.
- Hidden Lake intake, pumphouse, water treatment plant, and storage reservoir tank. Hidden Lake's existing infrastructure provided water tempering and chlorination. The raw water intake and pumphouse are not anticipated to be used during the proposed license period. The water storage reservoir tank will be maintained for emergency reserve. An additional treated water storage tank may be required at Hidden Lake in the future.

In addition to the aforementioned infrastructure, a new East Channel Water Treatment Plant was constructed in 2016. The upgraded water treatment plant included expansion of the former plant's building envelope, as well as construction of a new building addition and raw water intake pump station (located on the southeast corner of Duck Lake). The new plant was designed to provide the Town of Inuvik with potable water as per Health Canada's Guidelines for Canada Drinking Water Quality and included raw water intake systems for both winter and summer operation.

As per the Water Treatment Plant Design Brief (Dillon, 2013), treatment of raw water by the new plant included processes for pH adjustment, coagulation, flocculation, clarification/sedimentation, filtration, disinfection, fluoridation and treated water storage/pumping. The plant's treatment processes are briefly summarized as follows:

- Coagulation: Raw water is rapidly mixed with a coagulant (such as polyaluminum chloride) which assists in the creation of flocs by destabilizing the raw water's particles. This process occurs in a coagulation tank which overflows into an injection tank.
- Flocculation: The formation of flocs is progressed through continual mixing (although at a slower rate than in the coagulation stage). A coagulant aid (such as high molecular weight polymer) is added to assist with bridging, binding, and strengthening the floc. This process occurs in a maturation tank.
- Clarification: Microsand is used to settle out flocs created in the coagulation and flocculation stages. A hopper is used to collect solids and a gravity overflow allows clarified water to progress to the next treatment stage. This process occurs in a clarification tank.
- Filtration: Suspended solids still contained in the water after leaving the clarification stage will be removed by the filtration system. Backwash pumps and air blowers assist with the build-up of solids on the filter units.

It should be noted that, following the original design brief submission, a UV System was also designed and incorporated into the plant's treatment process.

The plant will use five chemical feed systems to transport coagulant, sodium hydroxide, polymer, fluoride and chlorine. Two chlorine contact tanks have been included to provide chlorine contact time for the inactivation of viruses and Giardia, as well as filter backwashing. Existing distribution pumps will be replaced by three new pumps that are designed to transfer potable water stored in the chlorine contact tanks to the treated water storage at Hidden Lake. The main treated water storage will remain at the water reservoir at Hidden Lake. There are currently no planned modifications to Hidden Lake's storage tank system, although an additional treated water storage tank may be required in the future.

A wastewater system, consisting of storage tanks, sump pit and pumps (as well as related piping, valves and instrumentation), was constructed. Wastewater generated from filter backwashing and sump pit collection will be sent to wastewater storage tanks, prior to being pumped to the Town's wastewater treatment facility via sanitary mains and wastewater pumps. Filter-to-rinse wastewater generated following the backwashing of the filter units will be disposed of to Duck Lake via the existing wastewater discharge pipe. This system will only contain suspended solids and no chemicals.

Locations of the Town's facilities are noted in Figure 2.2. Additional details regarding the new Water Treatment Plant are provided in **Appendix E**.

## 2.2.3 Water Demands and Sources

Water pumped into the piped water system from East Channel and Hidden Lake is metered. Water pumped into Hidden Lake from East Channel and Lake B are not metered directly, but can be calculated with sufficient accuracy from recorded daily measurements of Hidden Lake's water level.

In recent decades, Inuvik's water consumption has been mainly affected by changes in population, as well as the change from flat-rate to consumption-based billing in the early 1990's. Water demand peaked in 1986 at 853 ML/yr, during a brief increase in oil and gas interest. Subsequent population decline brought water demand down to 780 ML/yr by the early 1990's. The change to consumption-based billing, combined with population changes, decreased water demand to approximately 450 ML/yr by the late 1990's. By the mid-2000's water demand was increasing in response to Town growth, reaching 581 ML/yr in 2004.

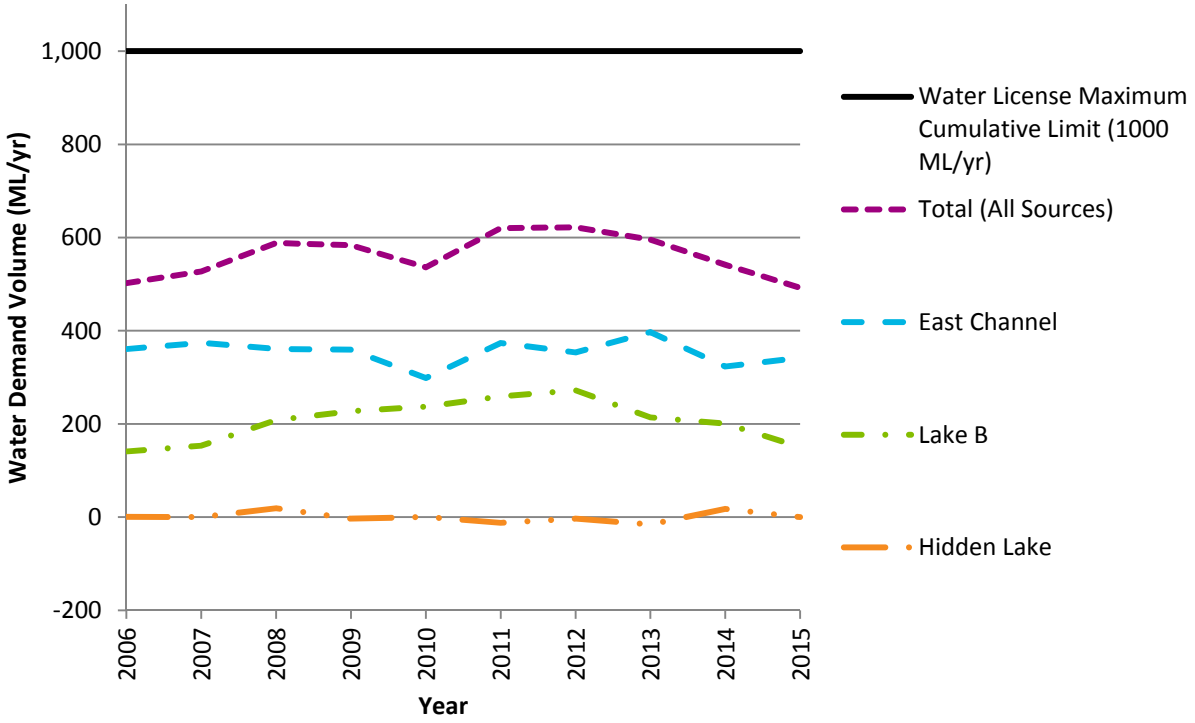
Table 2.1 and Sketch 2.1 show that recent water demand has fluctuated between approximately 500 – 600 ML/yr, with an average consumption of 561 ML/yr. Demand from East Channel and Lake B averages 354 ML/yr and 206 ML/yr, respectively. Demand from Hidden Lake averages 0.3 ML/yr; negative values in Table 2.1 and Sketch 2.1 indicating a year of net recharge. Inuvik has drawn 55 to 75 percent of its total annual demand from East Channel and 25 to 45 percent from Lake B over the last ten years. The maximum draw from East Channel was 397 ML (in 2013), Lake B was 272 ML (in 2012) and Hidden Lake was 19 ML (in 2008).

**Table 2.1: Town of Inuvik Water Demand per Source (2006 to 2015)**

| Year | East Channel (ML) | Lake B (ML) | Hidden Lake (ML) | Total (ML) |
|---|---|---|---|---|
| **2006** | 360.6 | 141.0 | 0.5 | 502.1 |
| **2007** | 374.1 | 153.1 | 0.0 | 527.2 |
| **2008** | 361.0 | 208.2 | 19.1 | 588.3 |
| **2009** | 359.3 | 227.3 | -3.2 | 583.4 |
| **2010** | 298.6 | 237.1 | 0.5 | 536.2 |
| **2011** | 373.7 | 258.9 | -12.2 | 620.4 |
| **2012** | 353.3 | 272.0 | -3.4 | 621.9 |
| **2013** | 397.2 | 213.9 | -15.6 | 595.5 |
| **2014** | 323.3 | 200.5 | 17.7 | 541.5 |
| **2015** | 341.7 | 150.4 | 0.0 | 492.1 |
| **Average** | **354.3** | **206.2** | **0.3** | **560.9** |
| **Water License Cumulative Limit** | **1,000** | **1,000** | **1,000** | **1,000** |

*Notes: 1. Values taken from the respective Town of Inuvik Water License No. G06L3-001 Year End Summary Reports*

*2. Negative values indicate a net recharge of Hidden Lake.*




**Sketch 2.1: Town of Inuvik Water Demand per Source (2006 to 2015)**

Several large water system leaks occurred in 2011, causing significant loss of water and leading to an inflated water demand. Deducting leakage (estimated at approximately 51 ML), consumption in 2011 was estimated at approximately 570 ML.

In 2012, unaccounted-for losses in March (likely further leakage, but this could not be confirmed) led to a 15% surcharge above usual levels in plant output. Also, deep snowpack in winter and heavy rainfall in summer raised the turbidity in Hidden Lake above usual levels, requiring that the municipal bleeders run throughout the summer to increase water turnover in the distribution system in an effort to improve chlorine residuals. These conditions led to a larger water demand volume for 2012 than normally expected.

Current trends since 2012 suggest an overall annual decrease in demand, consistent with the Town's decreasing population. Inuvik's water demand did not exceed the Water License cumulative limit of 1000 ML over the expiring 2006 to 2016 and 2016 to 2017 license periods.

# 2.3 Sewage Treatment and Disposal

## 2.3.1 Overview

Sewage generated by Inuvik's buildings is collected by the community's gravity pipe sewage collection system, and discharges into a lagoon located northwest of the Town's developed area near East Channel. The layout of the lagoon system is shown in Figure 2.3. A small number of establishments outside the limits of the piped system have trucked services, with water being supplied from Inuvik's truck fill point. All water is metered at point of use, including truck fill. Trucked services account for about 3 percent of the Town's total water use.

Sewage collected by the piped system and by trucks is discharged into the lagoon. Inuvik's water use is considered to be a practical measure of its sewage volume.

The primary cells were designed to be operated in parallel with slide gates at the inlet and crossflow and outlet structures open. The system operates as a flow through, continuous discharge facility throughout the year. Seasonal drawdowns are not included in the operating regime.

The receiving water body for the Town's treated wastewater is East Channel, with the discharge point located 1.2 km north of the developed town-site and 2.4 km north (downstream) of the Town's winter water intake.

In 2011, Inuvik initiated a study by Nelson Environmental Incorporated (Nelson Environmental) to complete an assessment of sewage treatment options that could be added to the treatment operations to meet territorial and federal guidelines for the discharge of municipal wastewater, as per Water License Condition B10. This study was followed by the 2013 "Assessment of Sewage Treatment Options" study and report (AECOM, 2013), which incorporated the earlier Nelson Environmental study.

Performance of the lagoon was reviewed relative to existing wastewater effluent quality standards as outlined by the Water Licence and was found to produce effluent well within current regulatory standards. Significant seasonal performance variation between the summer/fall and winter/spring months was identified, but no public health or environmental concerns (aside from limited environmental effects within a small mixing zone, common lagoon operations) were noted.

The study also noted that federal guidelines have not been formalized for the Northwest Territories, Nunavut and areas north of the 54$^{th}$ parallel in Quebec and Newfoundland and Labrador (the Far North). Performance of the lagoon was compared to current Department of Fisheries and Oceans (DFO) Wastewater Systems Effluent Regulations, as these regulations represent the most stringent standards that the Canadian Council of Ministers and the Environment would contemplate for communities in the Far North. Should these regulations be modified to include the Far North, Inuvik's lagoon effluent quality may not meet the standard for carbonaceous BOD on an annual average basis due to poor performance during the winter and spring months. Lagoon effluent quality complies with all other aspects of these regulations.

As of this submission, federal guidelines have still not been formalized and new GNWT standards have not been promulgated. Should monitoring of CBOD or other parameters according to changes to the regulations be required during the water license period, the Town will adjust the monitoring requirements accordingly.

Pursuant to Water License Condition B12, Inuvik maintains a Quality Assurance / Quality control (QA/QC) program covering the Town's activities under the SNP. This program is periodically reviewed by the Town's senior operations staff and revised as necessary. As per Water License Condition D9, inspections of the lagoon's retaining structures are performed annually.

Berms and dikes are observed frequently by Town staff during the course of regular duties and are formally inspected annually by an Engineer, as required by the Water Licence. Repair and restoration is an on-going need due to the nature of the lagoon's subsoils and dike material.

Inuvik obtains assurance from all waste hauling contractors and generators discharging into the lagoon from trucks that wastewater will be restricted to domestic origin and character, not contaminated by solvents, petroleum products, glycol, drilling fluids, or any other industrial waste of any sort in concentrations exceeding what would ordinarily be expected from domestic operations.

## 2.3.2 Volume of Wastewater Collected

Approximately 97% of wastewater reaching the lagoon is distributed and recollected by Inuvik's utilidor system, while the remaining 3% is distributed from Inuvik's water point and recollected by trucks. This predominantly above-ground system provides little opportunity for hidden losses or gains as the sewage system is separated from the typical sources of extraneous inflows which include the ground, road surfaces and roofs. In municipalities where water distribution and sewage collection systems are underground, wastewater flows tend to differ from water supply flows due to system losses from undetected leaks and inflow/infiltration of surface and groundwater into the sewage system.

Virtually all of the wastewater delivered to Inuvik's lagoon by trucks is from nearby establishments and camps originating from the Town's metered water supply. Truck service amounts to a very small percentage of total Town wastewater service volume and is not significant in terms of facility operation and management. Although Inuvik authorizes disposal in its lagoon of wastewater from a source other than the Town's water supply on a fee-for-service basis, volumes received to date have been negligible.

Therefore, neglecting the relatively small net effects of minor inflow, evaporation losses and uncontrolled water (for example, water used in firefighting, gardening and vehicle washing), inflow into the lagoon can be assumed to be essentially equal to the Town's metered water production. Since water meters have inherent design advantages relative to wastewater flow measurement devices, the adequacy of this approach is believed to be the best available option, and is recommended to continue.

## 2.3.3 Volume of Effluent Discharged

The volume of wastewater produced by Inuvik is in excess of the total storage capacity of the lagoon system. Therefore, continuous discharge of the system, including during winter, is necessary. Continuous flow during the winter also has the benefit of mitigating ice blockage in the outlet structure and effluent channel.

In 1992, an attempt to monitor the rate of discharge from the lagoon using graduated V-notch weirs was abandoned when the weirs repeatedly became blocked with ice, threatening the overall operation of the wastewater treatment and disposal facility. Since then, wastewater flows out of the lagoon have not been measured directly.

The total volume of effluent discharged from the lagoon system over an operating year is therefore thought to be equal to the total volume of Inuvik's wastewater collected, plus any surface water that directly enters the lagoon. A creek, which at one time discharged into the lagoon system's secondary cell near the cell's north end, has been deflected around the lagoon system by an earth berm. However, the system still remains open along its inland side, and some inflow from surface water occurs during the warm weather season.

## 2.3.4 Sewage Treatment Facility Operation and Maintenance

The facility is operated on a continuous discharge basis. Operations procedures aim at maintaining a constant level in all cells throughout the year, except when summer maintenance work on structures and dikes requires level adjustments.

Historical treatment performance has been typical for a primary-secondary lagoon system operating in high-latitude settings. In summer, a good standard of secondary treatment has been historically achieved, while in the winter, there is only primary treatment (settling). To achieve secondary-level effluent in winter, Inuvik would need a mechanical plant, involving major capital investment and hugely increased operating costs.

During the open water season, conditions for bacteria and algae populations improve significantly as winds provide mixing and the sun provides heat. The long retention times (approximately 30 days for the primary cells and 170 days for the secondary cell, based on a sewage generation rate of 525 ML/yr), flourishing bacteriological and algal populations, and natural treatment by the sun produce an effluent that rivals mechanical treatment during the summer and fall (Assessment of Sewage Treatment Options, AECOM 2013).

Ice cover and cold temperatures severely limit the treatment performance during the winter and spring months. Retention time is reduced to approximately 12 days for the primary cells and 50 days for the secondary cell (based on a sewage generation rate of 525 ML/yr) during the winter due to the thick ice cover and shallow depth of the secondary cell; biological activity is essentially reduced to zero. AECOM's 2004 "Assessment of Wastewater Management Facilities" report concluded that treatment within the lagoon system during the coldest parts of the year was reduced to primary treatment only (Assessment of Sewage Treatment Options, AECOM 2013).

In most years, only regular maintenance has been required, such as removing small amounts of settled and floating solids from around pipe ends in the primary cells and at the connection to the secondary cell. This is performed using a backhoe, with solids being deposited in the sludge holding cells. Recent major restoration projects included the following:

- In 2003, major restoration was performed on the lagoon's west dike from the primary cells to the outlet structure.
- In 2006, restoration of the lagoon's interior dikes around the primary cells was completed.
- In 2010, all of the dikes around the primary cells and the sludge holding cells were built back up to design levels to counter ongoing dike subsidence.
- In 1993, 13,500 m3 of sludge was removed from the primary cells and transferred to the adjacent sludge holding cells.

Survey of the primary lagoons in 2006 showed that sludge accumulations were still well below levels required for transfer. The reduced accumulation rates, relative to 1987-1993, have been previously attributed to lagoon conditioner that Inuvik has been adding to the primary cells. In the years following 2006 there has been no observation to suggest that another sludge transfer is needed or may be coming due. Further, lagoon performance has remained consistent, within usual ranges of seasonal and year-to-year variation

Batch decants are only performed if needed for major works (such as lagoon dike armouring or rebuilding the outlet control structure). These are performed in the early summer, when East Channel is at a very high stage. Batch decants are done infrequently (~once every 15 years) and on an as needed basis. Significant effects to effluent quality are not expected due to the high dilution, sunlight and background turbidity.

## 2.3.5 Effluent Quality and Sampling

Background information on the lagoon's performance is also found in various scientific studies: Dawson (1960), Jacobsen (1972), Miyamoto (1972) and Magditsch (1984). Associated Engineering Services Ltd.'s 1980 predesign study of wastewater treatment options, which led to construction of the two primary cells in 1982, made use of Jacobsen's and Miyamoto's work. When Magditsch's study was done, the then-new primary cells were in operation.

Under the SNP attached to Inuvik's water license, samples of effluent are taken monthly at Station 0036-3 and analyzed for five-day biochemical oxygen demand ($BOD_5$), suspended solids (SS), fecal coliforms (FC), ammonia ($NH_3$) and pH.

Generally, analysis results between 2006 and 2016 were in typical ranges, with running averages of parameters within license limits. Sampling history records at Station 0036-3 are provided in **Appendix B**.

Over the 2006 to 2016 license period, it was observed that effluent pH rises sharply in summer, sometimes to levels above the license limit of 9.0. The summer spike in pH is now understood to be due to "extensive algae growth. Algae consume alkalinity (inorganic carbon) for growth and the pH increases as algae consume the alkalinity species in the order carbon dioxide, bicarbonate and carbonate." (Richard, 2003). In recent years, the Town has been taking additional pH readings every few days during mid-summer to determine the duration of these summer pH spikes, as these spikes may be more frequent than the record shows (the spikes could easily fall between monthly samplings).

Sampling of ponds adjacent to the lagoon has been performed once per year in September, starting in 2007, in order to monitor for possible groundwater seepage from the lagoon. Samples are tested for the same parameters as lagoon effluent, and are taken at the following locations selected by GLWB:

- Control Station 0036-6 (also known as "Gate Pond" or Station 6) occupies a former small quarry just outside the lagoon system's west dike, adjacent to the west sludge cell.
- Control Station 0036-7 (also known as "Far Pond" or Station 7) is located outside the lagoon system's west dike, opposite the middle-north part of the secondary cell, about 800 m northwest of Gate Pond and 250 m south of the outlet structure.
- Control Station 0036-8 (also known as Station 8) is a background benchmark station located at the south end of north Twin Lake.

Analysis records of pond samples for Station 6, 7 and 8 are provided in **Appendix C**.

Scans for metals were done at Station 6, Station 7 and Station 8 in 2008 and 2011. The 2008 results indicated that the zinc and copper in Gate Pond was elevated, suggesting that Gate Pond's water may have passed through Inuvik's water distribution system, but the 2011 results reversed the 2008 finding. Overall, metal levels at all three stations appear similar, with nothing remarkable in either Gate Pond or Far Pond.

Over the expiring license period, ammonia was found in the Gate Pond samples and Twin Lakes samples (although at lower levels), which suggests that groundwater migration out of the west sludge holding cell is occurring at a point where permafrost melt at the dike foundation level is causing settlement during the summer. Ammonia has not been found in Far Pond, except for one reading in November 2007. Considering Gate Pond's small size and flow-through, the sample test results to date are not thought to be particularly significant in terms of protection of public health and the environment.

In 2014, fecal coliforms were found in Gate Pond. It is reasonably certain that the source was an intermittent leak in the trunk sewer west of Lagoon Road. Once the leak was detected and fixed, the coliform count declined, and levels have now returned to usual background.

## 2.3.6 East Channel

Inuvik sits on the bank of the East Channel of the Mackenzie River, and is the main access point for the Mackenzie Delta. At Inuvik, East Channel is approximately 210 m wide and, at winter low water levels, its maximum depth is roughly 3.5 m. Freeze-up usually occurs in October, whereas spring flood peak and break-up occur in May. Floods have peaked at approximately 7 m above the winter low water level. After the flood crest passes, the flow rate generally decreases until it reaches the year's minimum rate typically in March or April. Figure 2.2 illustrates East Channel's average monthly flow rates, as captured by the Mackenzie River (East Channel) at Inuvik station (Station 10LC002) using data between 1973 and 2015. The Lower Mackenzie system is extremely turbid during the summer.

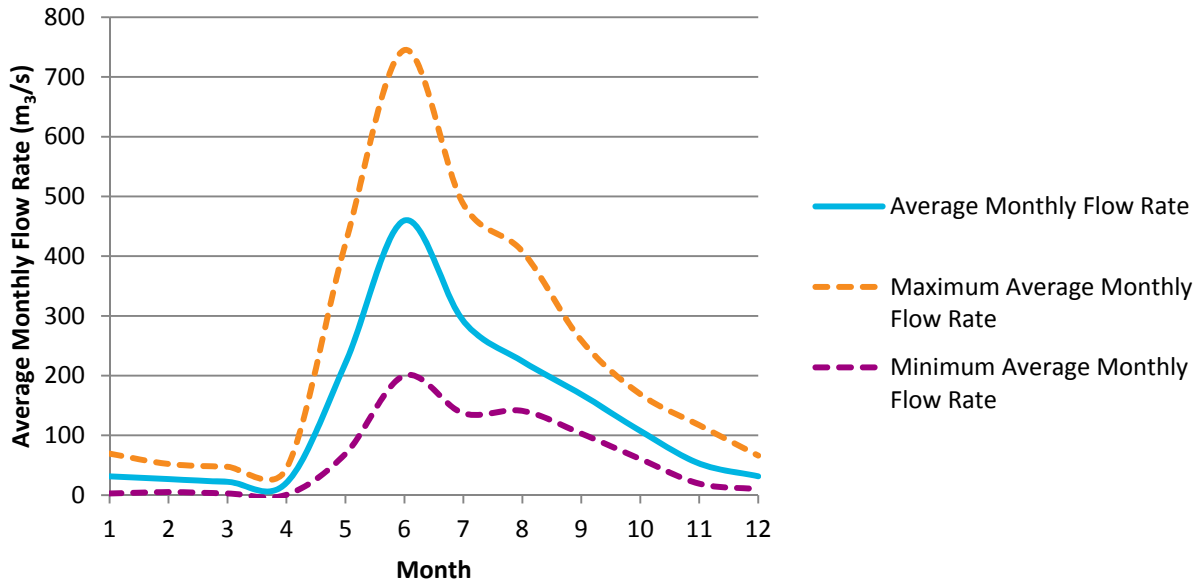
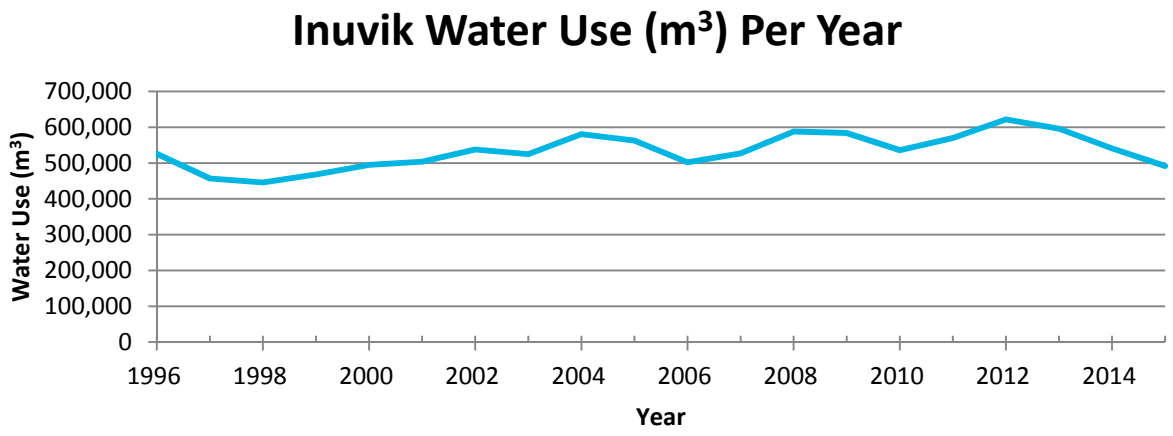


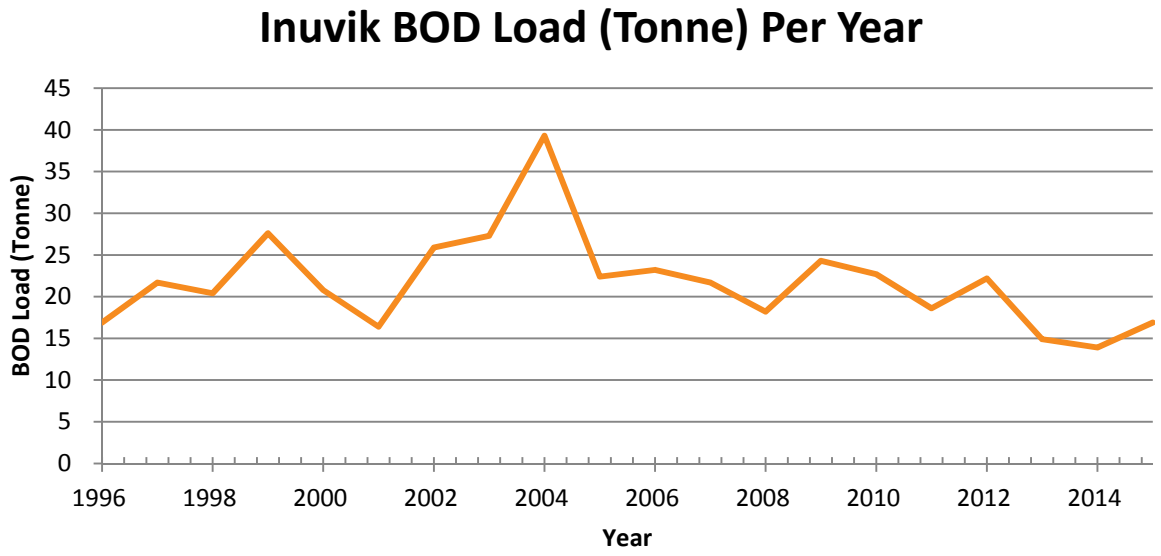

**Figure 2.2: East Channel Average Monthly Flow Rate**

Annual estimates of $BOD_5$ load on the receiving East Channel water system started in 1996. Combining the water consumption data with representative monthly readings for $BOD_5$ yields an estimate of the total $BOD_5$ load on the receiving East Channel water system, as shown in Sketch 2.4 and

Table 2.2. Water Use has been rounded to the nearest thousand cubic meters.




**Sketch 2.3: Town of Inuvik Water Use Per Year**




**Sketch 2.4: Town of Inuvik BOD Load per Year**

Possible explanations for the lower figures in more recent years include decline in Inuvik's population and higher standard of treatment possibly due to warmer, sunnier summers.

It should be noted that the full effluent BOD load in East Channel is not exerted at or close to Inuvik in a concentrated way and is distributed quite thinly far downstream. This is due to the slow BOD exertion rate in a northern river environment, especially at winter temperatures.

**Table 2.2: Inuvik Water Use and East Channel BOD Load Estimates**

| Year | Water Use ($m^3$) | BOD Load (Tonne) | Year | Water Use ($m^3$) | BOD Load (Tonne) |
|---|---|---|---|---|---|
| **1996** | 526,000 | 16.9 | **2006** | 502,000 | 23.2 |
| **1997** | 457,000 | 21.7 | **2007** | 527,000 | 21.7 |
| **1998** | 446,000 | 20.4 | **2008** | 588,000 | 18.2 |
| **1999** | 468,000 | 27.6 | **2009** | 584,000 | 24.3 |
| **2000** | 495,000 | 20.8 | **2010** | 536,000 | 22.7 |
| **2001** | 504,000 | 16.4 | **2011** | 570,000 | 18.6 |
| **2002** | 538,000 | 25.9 | **2012** | 622,000 | 22.2 |
| **2003** | 525,000 | 27.3 | **2013** | 596,000 | 14.9 |
| **2004** | 581,000 | 39.3 | **2014** | 541,000 | 13.9 |
| **2005** | 563,000 | 22.4 | **2015** | 492,000 | 16.9 |

# 2.4 Solid Waste Management

## 2.4.1 Overview

Waste collection services within the Town of Inuvik are provided by a private contractor. Waste is collected on a weekly basis throughout the Town and disposed at Inuvik's Solid Waste Disposal Facility, located at the foot of Mount Baldy, as shown in Figure 2.4. The Town bylaws regarding waste management and waste disposal are posted on the Town's website. Town staff are present on site to manage the disposal operations.

Over the last ten year license period, no major projects on the Solid Waste Disposal Facility were undertaken, aside from routine covering and compaction of completed cells. Typically, Inuvik does not accept solid waste from points of origin outside of the Town boundaries, the only notable exception over the expiring license period being in 2011, when the Town allowed a deposit of approximately 10 double-door coolers, already emptied of refrigerant, which came from the Tuktoyaktuk Northern Store. It should be noted that all refrigerant/cooling equipment disposed of at the solid waste facility is evacuated of potential contaminants by a private licensed operator, and sent out for disposal.

Until to mid-1990's, the Town also operated the Shale Pit landfill site for special dry inert wastes, such as asbestos. The Shale Pit was covered and closed in 1995, and the Town has no current intentions to re-open the site, with access to the site gated. Some stockpile of asbestos pipe is still present on site, but is to be buried. All asbestos materials currently go to the landfill.

In 2006, the Town installed a honeybag drop-off station at the Solid Waste site, for use by Inuvik residents that own hinterland cabins at Airport Lake. This honeybag drop-off station, as well as any paints and batteries, are at the waste management facility in separate signed locations.

Also in 2006, the Town submitted an assessment of the Mount Baldy Solid Waste Disposal Facility, in compliance with Water License Condition B12. The report explored the suitability of the Mount Baldy site, discussing the current site's location, hydrology, surface runoff and geotechnical conditions. No safety or quality concerns were identified, with the study's conclusions noting that the Mount Baldy "landfill site has been well chosen to pose no undue threat to public health or the environment."

## 2.4.2 Quantities of Solid Waste

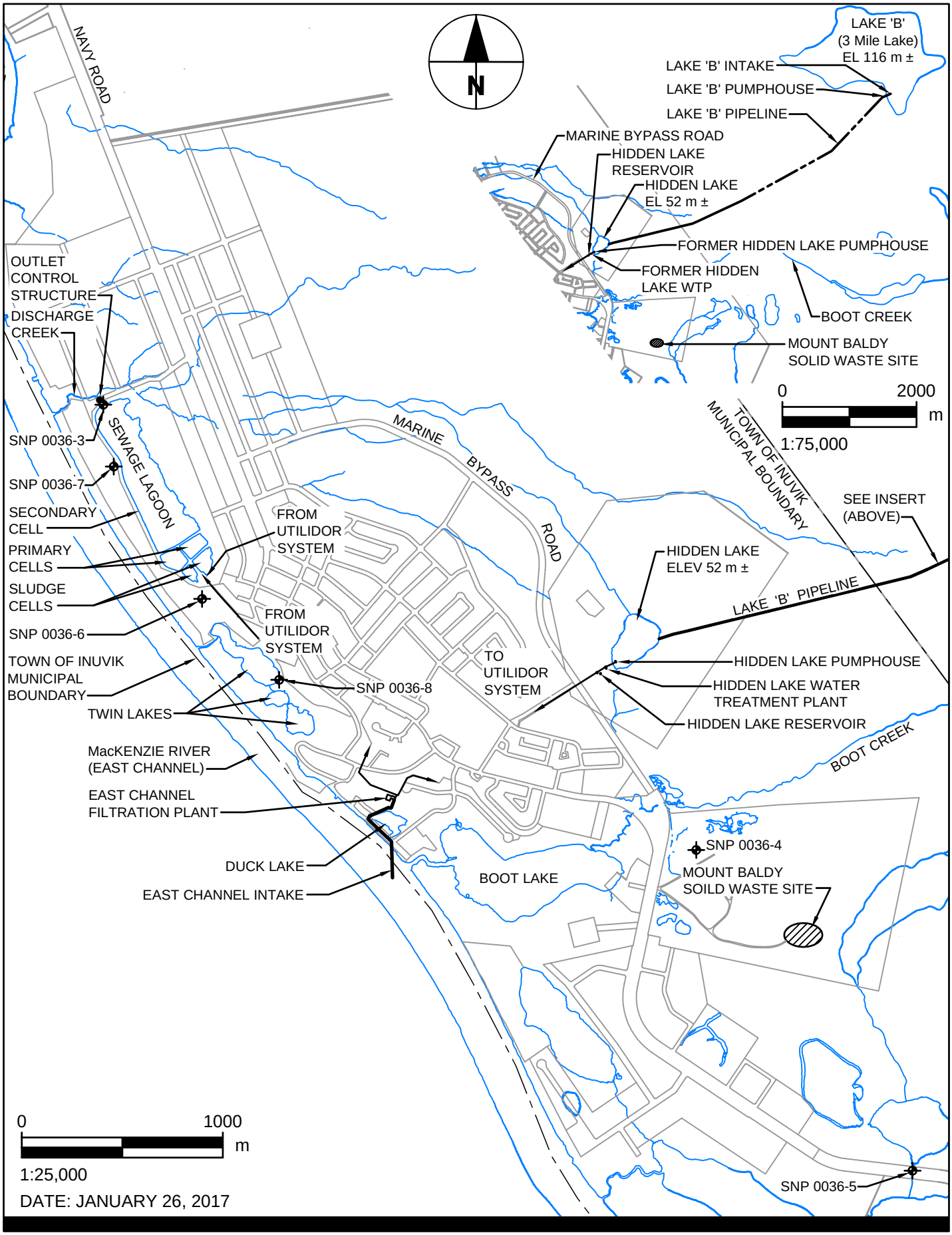
In 1996, it was estimated that the total amount of solid waste collected annually in Inuvik, including ordinary amounts of non-domestic items such as construction debris, was in the order of 2750 tonnes. Since Inuvik's population was approximately 3,296 in 1996 and 3,265 in 2015, this estimate is believed to be a reasonable indication of the current level of annual solid waste generation.

An additional statistic for solid waste generation, used for Solid Waste Disposal Facility site planning, is that Inuvik appears to be filling up the landfill area (approximately three lifts deep) at a rate of approximately 0.5 ha/year. This estimate is based on a comparison of landfill site surveys, done several years apart prior to the 2006 to 2016 license period. It is estimated that the current site has capacity for at least an additional 30 years.

## 2.4.3 Quality of Solid Waste

Runoff from the Mount Baldy solid waste site is sampled monthly during periods of flow. Station 0036-4 monitors flow westward, while Station 0036-5 monitors near-shore water quality in a pond east of the site. Due to the site's topography, very little runoff leaves the site. The volume of runoff leaving the site has been estimated to be confined to its own precipitation (less evaporation) due to the lack of overland runoff entering the site from higher ground.

Inuvik is not aware of any observation past or present to suggest any significant concern with the operation of its solid waste facility.

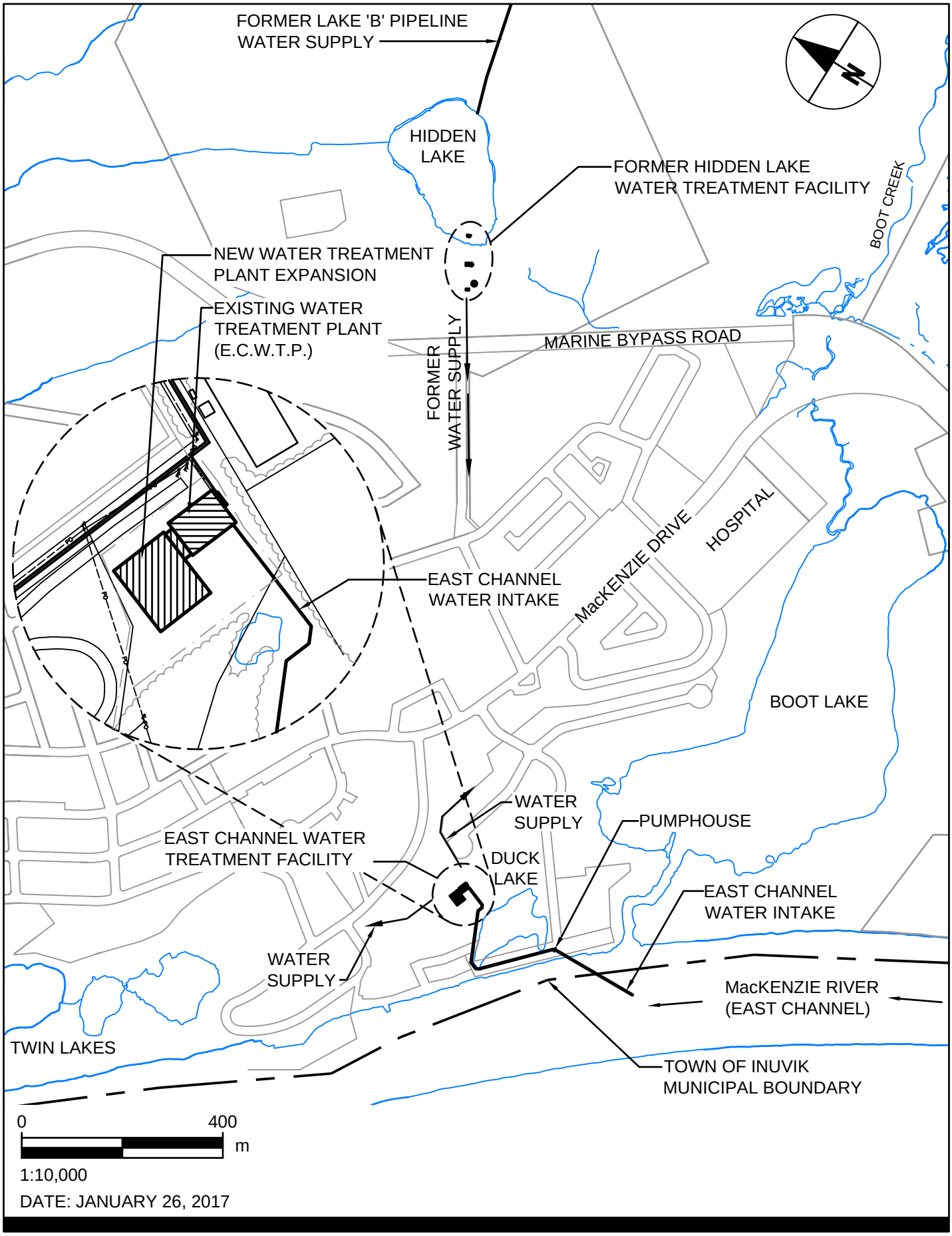



**APPLICATION FOR RENEWAL OF WATER LICENSE N3L4-0036**
TOWN OF INUVIK, N.W.T.
Project No.: 60317863

**MAIN WATER AND SEWAGE FACILITIES LOCATION PLAN**

AECOM

**FIGURE 2.1**

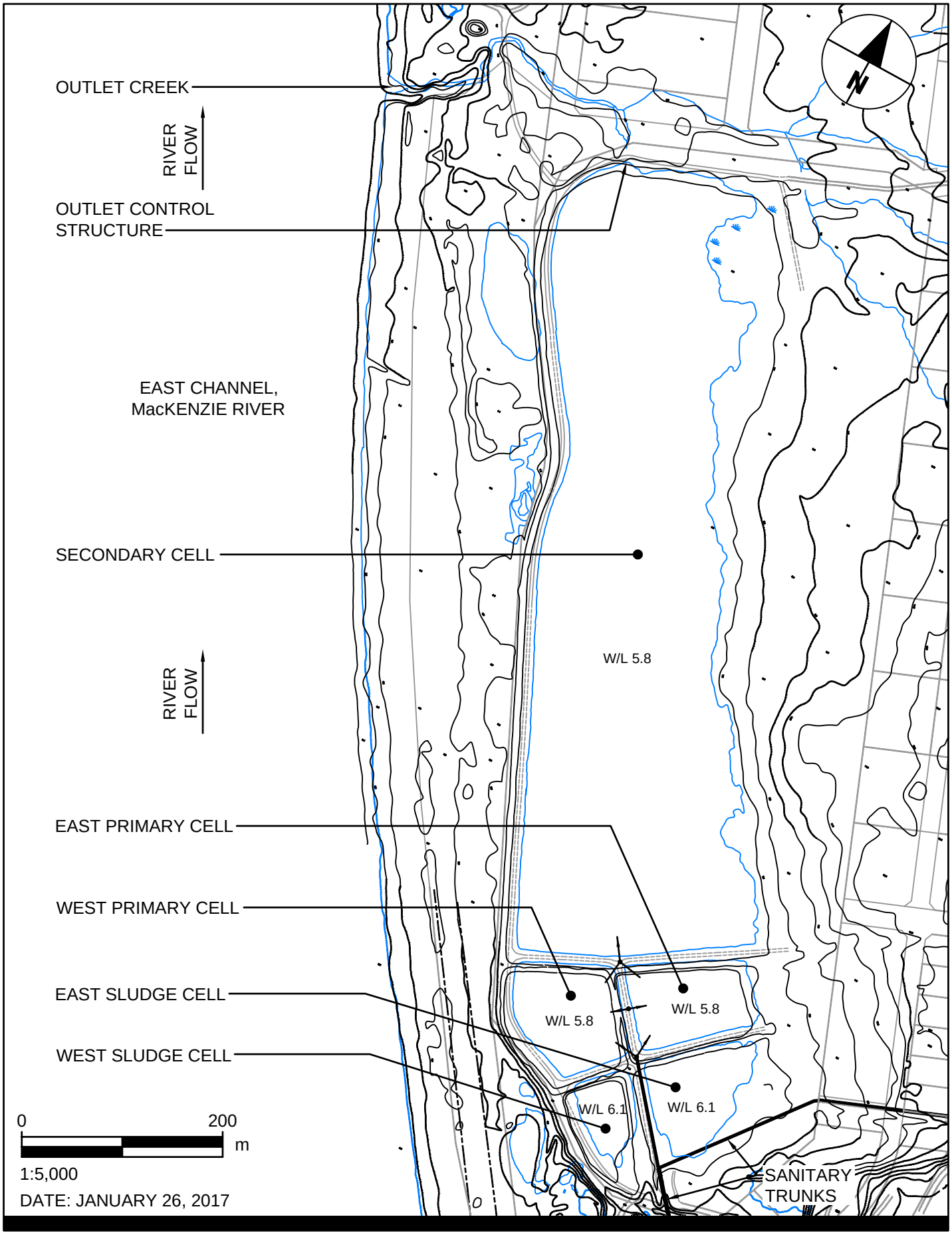



**APPLICATION FOR RENEWAL OF WATER LICENSE N3L4-0036**
TOWN OF INUVIK, N.W.T.
Project No.: 60317863

**WATER SUPPLY FACILITIES PLAN**

AECOM

**FIGURE 2.2**

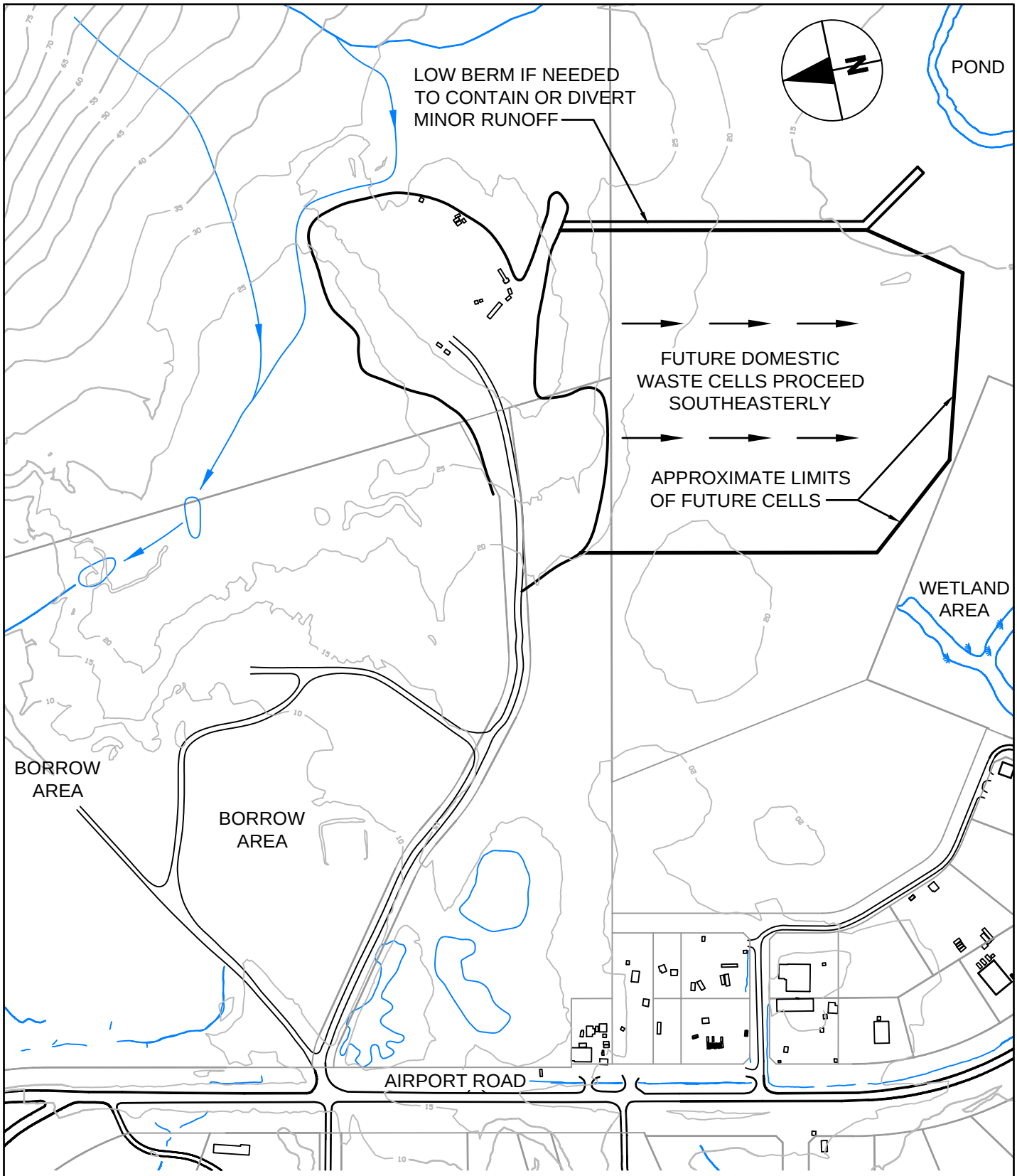



**APPLICATION FOR RENEWAL OF WATER LICENSE N3L4-0036**
TOWN OF INUVIK, N.W.T.
Project No.: 60317863

**SEWAGE TREATMENT SYSTEM LAYOUT PLAN**

AECOM

**FIGURE 2.3**




**APPLICATION FOR RENEWAL OF WATER LICENSE N3L4-0036**
TOWN OF INUVIK, N.W.T.
Project No.: 60317863

**MOUNT BALDY**
**LANDFILL FACILITIY SYSTEM**
**LAYOUT PLAN**

AECOM

**FIGURE 2.4**

# 3. Projected Outlook and Trends

The Town of Inuvik is requesting a renewal of its Water License for a ten year period between July 1, 2017 and June 30, 2027. A discussion of projected trends and potential changes over the proposed license period is presented in the following sections in an effort to estimate the Town's water, sewage and solid waste demands for the proposed license's duration.

## 3.1 Growth Forecasts

### 3.1.1 Population

Historically, the Town of Inuvik's water, sewage and solid waste demands have varied with respect to the Town's population. Therefore, projected system demands for the proposed licence period are assumed to change in proportion to future population changes.

As of 2015, the Northwest Territories Bureau of Statistics estimated Inuvik's population at 3,265. Data indicates that between 2004 and 2015, the average annual growth for Inuvik is -0.9%, with the Town experiencing negative growth since 2011 at an average rate of approximately -2.1%. This is reflective of the Town's current economic conditions, where Inuvik's economy has stalled. Future economic prospects, such as the Mackenzie Gas Project, "have not materialized to their full capacity or remain uncertain." (CBC News, 2015).

Inuvik's economic diversification plans from the dominant oil and gas development sector may provide the Town with marginal growth over the proposed licence period, but the most aggressive growth forecast would include development of the Mackenzie Gas Project (MGP). In June 2016, the National Energy Board approved an extension to the MGP's "sunset clause" to December 31, 2022 in order to give the project's consortium additional time to assess the project's development (CBC News, 2016). If the MGP proceeds, Inuvik is expected to experience a three or four year increase in economic activity and a modest increase in resident population.

The amount of long-term growth that Inuvik might experience if the MGP is built, due to operations and maintenance work on new installations and continued resource exploration, is unknown, but previous estimates of permanent growth are between 10% and 15% (Earth Tech, 2004).

The amount of short-term, transient growth that Inuvik might experience during MGP construction is also unknown. Construction workers would be housed in camps located 20 km to 30 km from Inuvik and would not directly impact Inuvik's population, but are anticipated to increase demands on a variety of services located in the Town. Construction in the area would occur in three successive winters, during which the combined camp populations would peak at 1600. Summertime activity would be limited to barging of materials and prefabricated elements. Shoulder seasons are expected to see little activity (Earth Tech, 2004).

Since the significant increase in population created by the development of the MGP would imply a significant increase in strain on the water supply, sewage treatment and solid waste disposal infrastructure, this report's peak demand projections assume that the MGP proceeds during the proposed licence period, regardless of the actual likelihood.

### 3.1.2 Water Demands

Since Inuvik has no industries that use significant amounts of water, the majority of the Town's metered water demand is from personal use by residents and transients at home or work. This implies that future water demand will reflect changes in population, either downward or upward.

Inuvik's water demand averaged 561 ML/yr between 2006 and 2015. The average annual change in water demand over this same time period has stagnated at approximately 0.1%, but this includes several large water system leaks in 2011 and 2012, as well as the atypical weather conditions noted in **Section 2.2.3** for 2012.

Since 2012, the Town's demand has decreased at an average of 5.5% per year, while population has decreased at an average of 2.5% per year. If future economic prospects materialize and proceed, the Town may expect an increase in water demand primarily through the increase in transient, non-recorded population living in hotels, apartments and in-town camps. The majority of this population would disappear as the construction phase winds down.

Given the uncertainty surrounding the MGP project and the Town's proposed economic diversification and the short and long term effects these would have on Inuvik, there is a wide range of uncertainty in projecting Inuvik's water demands. For this submission, it is assumed that the MGP project will proceed and Inuvik's water demand will peak again, at some point during the term of the requested ten-year water license, at 25% above the average total annual consumption rate of 561 ML/yr, before falling somewhat as the expected construction boom passes.

Therefore, the assumed design peak in water demand adopted in this submission is 700 ML/yr.

### 3.1.3 Sewage Generation

For the reasons described in **Section 2.3.2**, Inuvik's water demand is a good measure of the Town's sewage generation. Since there are currently no proposed changes to the Town's wastewater infrastructure over the proposed license period, future sewage generation is assumed to equal the Town's future water demand.

Therefore, the assumed design peak for sewage generation adopted by this report is 700 ML/yr.

### 3.1.4 Solid Waste Generation

Similar to water demand and sewage generation, solid waste generation is anticipated to be a function of population. As such, annual generation of solid waste during the proposed licence period is assumed to peak at 25% above the current level of waste generation (estimated in **Section 2.4.2**), followed by a reduction to current levels after the expected construction boom passes.

According to MGP project planning prior to the 2006 to 2016 licence period, nearby camps would incinerate their solid waste and dispose of ash at Inuvik's solid waste facility. Assuming this proposed arrangement has not changed, the amount of material received from camps would be relatively small and insignificant to the planning, operation or lifespan of the solid waste facility. The ash generated would be limited to camp domestic ash, and not contain ash from hazardous substances.

The assumed design peak for solid waste generation adopted by this report is 3500 tonnes of waste generation per year, or 0.65 ha/year of landfill space.

# 3.2 Ownership, Management and Operation

## 3.2.1 Ownership and Management

Inuvik's position with respect to ownership and management of the Town's water, sewage and solid waste facilities is expected to remain unchanged during the proposed licence period. The background to Inuvik's current position is outlined in **Section 2.1.1.**

## 3.2.2 Operation and Maintenance

As noted in **Section 2.1.2,** Inuvik currently operates and maintains its water, sewage and solid waste facilities. This is expected to remain unchanged for the proposed licence period. There are currently no planned changes to overall operations and maintenance responsibilities.

# 3.3 Water Supply

## 3.3.1 Facilities

As noted in **Section 1.2**, Inuvik's previous Water Licence was renewed for one year to allow for completion of the new East Channel Water Treatment Plant (and a subsequent Water Licence reapplication reflecting changes in use of water sources). Construction of the East Channel Water Treatment Plant will end the Town's historic reliance of the Lake B and Hidden Lake water supply infrastructure.

The new water treatment plant was designed to meet the Town's projected demands for the assumed design horizon year of 2036. As per the Water Treatment Plant Design Brief (Dillon, 2013), this includes the following design assumptions:

- Population of 6,082 people.
- Average Day Demand of 30.9 L/s.
- Maximum Day Peaking Factor of 2.
- Maximum Month Daily Demand of 61.8 L/s.

Based on the Average Day Demand, the new water treatment plant is designed to provide an average capacity of 974 ML/year, which is in excess of the license period's projected peak demand of 700 ML/year.

With the new treatment plant being fully commissioned, Hidden Lake will no longer be used as a raw water reservoir, refilling of Hidden Lake from East Channel and Lake B will no longer occur, and Hidden Lake's intake, pumphouse and SNP monitoring station will be removed in the future.

Inuvik's water distribution system includes a treated water reservoir, located near Hidden Lake. Its storage provides for normal daily peaks in water demand, for fire flows, and a reserve against temporary water plant outages (such as occur if electricity supply is interrupted). The reservoir is a large lined steel tank. Inuvik intends to construct an additional storage tank to increase the emergency supply of water, and to allow for a storage tank maintenance rotation.

### 3.3.2 Use of Sources

Commissioning of the new East Channel Water Treatment Plant and subsequent phase-out of Hidden Lake's facilities is not expected to alter the Town's total annual peak water demand, but the quantities taken from each source will change; the volume of water taken from Lake B and Hidden Lake will decrease until dependency on the source is eliminated, whereas the volume taken from East Channel will increase to make up the difference. Therefore, annual volumes drawn from each source during the proposed license term are expected to remain within the ranges indicated in Table 3.1.

**Table 3.1: Town of Inuvik Future Water Demand per Source (2017 to 2027)**

| Water Supply Source | 2006 to 2016 Average Annual Volume | 2006 to 2016 Percent of Total Annual Volume | 2017 to 2027 Average Annual Volume | 2017 to 2027 Percent of Total Annual Volume | 2017 to 2027 Peak Annual Volume |
|---|---|---|---|---|---|
| **East Channel** | 354 ML/yr | 55% to 75% | 561 ML/yr | 100% | 700 ML |
| **Lake B** | 206 ML/yr | 25% to 45% | 0 ML/yr | 0% | 0 ML |

*Notes: 1. Peak Annual Volume for 2017 to 2027 assumes a 25% increase in water demand caused by the proposed MGP project.*

*2. Construction of the new East Channel Water Treatment Plant includes an all-season intake; therefore, East Channel and Lake B volumes for 2017 to 2027 account for the planned phase-out of the Lake B – Hidden Lake facility.*

## 3.4 Sewage Treatment and Disposal

### 3.4.1 Facilities

Regular sampling results of effluent into East Channel has not identified concerning levels of performance for the lagoon operation. The 2011 study by Nelson Environmental and 2013 study by AECOM noted that performance of the lagoon is well within the limits established by current quality and regulatory standards despite seasonal performance variation between the summer/fall and winter/spring months.

As noted in **Section 2.3.1**, the study also performed an assessment of lagoon performance compared to assumed federal guidelines. Performance of lagoon effluent quality was not found to meet standards for carbonaceous BOD on an annual average basis due to poor performance during the winter and spring months, but complied with all other aspects of the assumed guidelines. Alternative facility improvements, including mechanical enhancements, are outlined by AECOM's 2013 "Assessment of Sewage Treatment Options" report and range between $6.5 million and $25.5 million in capital costs.

Currently, no changes to Inuvik's sewage treatment and disposal facilities are being contemplated until federal guidelines are issued. This will allow for the Town's limited financial resources to be applied to the replacement and upgrading of existing infrastructure (for example, a second reservoir before the existing one fails due to rust, a second water main from the reservoir site for fire protection/rationed water before the existing karst-distorted watermain fails, and repairs to the utilidor system).

## 3.4.2 Operation of Facilities

The lagoon system operates on a continuous discharge basis and at a constant level throughout the year, aside from very rare summertime drawdowns needed for maintenance. Operation and maintenance of the facilities is currently performed as per the most recent version of the Operation and Maintenance Manual, Sewage Treatment Facility, Inuvik NWT (Reid Crowther and Partners Ltd, 1994). The manual is continually updated to reflect evolving practice. This includes general maintenance to remove berm growth, and periodic removal of sludge directly at the inlets as needed.

Based on the projected growth in sewage generation, an assumed peak rate of 700 ML/year is within the capacity of the existing facility, assuming that continuous discharge is maintained. The volume of wastewater produced by Inuvik is in excess of the total storage capacity of the entire lagoon system; conversion to an annual discharge system would cost an estimated $18 million in capital costs (AECOM, 2013).

Therefore, no changes to facility operation are currently planned.

## 3.4.3 Effluent Quality

The growth in Inuvik's population (assuming that the MGP proceeds), is expected to increase hydraulic and organic loading on the lagoon by 25% above assumed average annual values.

Lagoon retention times will be reduced accordingly to accommodate the increased loadings. Table 3.2 estimates future retention times based on the assumed peak wastewater generation rate of 700 ML/yr, as well as current estimated retention times based on a wastewater generation rate of 525 ML/yr.

**Table 3.2: Estimated Lagoon Retention Times**

| Lagoon Cell | Estimated Summer Retention Time (based on 700 ML/yr peak generation) | Estimated Summer Retention Time (based on 525 ML/yr generation) | Estimated Winter Retention Time (based on 700 ML/yr peak generation) | Estimated Winter Retention Time (based on 525 ML/yr generation) |
|---|---|---|---|---|
| **Primary Cells** | 20 | 30 | 9 | 12 |
| **Secondary Cell** | 130 | 170 | 30 | 50 |

The reduction in retention time and increase in loading is anticipated to have minimal effect on effluent quality in summer and minor effects on effluent quality in winter. In general, effluent quality is expected to remain close to current values.

## 3.4.4 Effects in East Channel

As noted in **Section 1.2**, the effects of Inuvik's lagoon system on East Channel have been assessed in two studies. The studies determined that the effluent plume presented a low level of risk to public health, aquatic life and the environment, and concluded that there were no significant concerns (Reid Crowther, 1994; Canada DIAND, 1998).

The Reid Crowther study involved collection and analysis of water samples from East Channel at three times during the year, with the times selected to represent typical seasonal conditions: soon after river break-up, late autumn and late winter. Samples were taken at various depths across river cross sections at 0 km, 0.5 km, 1.0 km and

2.2 km downstream of the effluent discharge point, with control samples taken upstream of the discharge point and in the lagoon outlet. Samples were analyzed for three wastewater microbiological indicator organisms, for ammonia and for a range of metals according the then-current edition of Standard Methods for the Examination of Water and Wastewater (APHA-AWWA-WPCF).

The principal findings of the Reid Crowther study were:

- The lagoon discharge presents a low level of risk to public health. In summer, it provides a relatively good standard of disinfection, coupled with rapid mixing and high dilution of the effluent plume in East Channel. In winter, there is little disinfection but still fairly rapid mixing and dilution; and at that time of year no significant exposure to the public to the effluent plume provided that any water consumers downstream observe normal water disinfection procedures which are necessary in any case.

- The ammonia carried in the discharge plume from the lagoon system is very unlikely to be of any practical significance to East Channel's waters, or to East Channel's fish or other aquatic life.

- Metals carried in the effluent are not distinguishable, or, at most, barely distinguishable from background (river and other water source) values and are of no practical significance to public health or the environment.

- The lagoon effluent is free of floatables, visible solids (other than algae), oil and grease. The suspended solids concentration is usually much less than East Channel's. There is no observable odour below the discharge point. In sum, the lagoon discharge plume has no observable aesthetic effect on East Channel.

The Department of Indian Affairs and Northern Development (DIAND) study involved collection and analysis of water samples from East Channel under mid-winter (January) and late-winter (March) conditions. In both cases, samples were taken from just below ice level at river center and near both banks at transects located 0.5 km, 1 km, 2 km, 4 km, 8 km, 12 km, 16 km, 20 km, 24 km and 27 km downstream of the discharge point (with control samples taken above the lagoon, at the Town's winter water intake and at the lagoon outlet). Samples were analyzed for microbiological indicator organisms, inorganic and organic chemistry and physical properties. Dissolved oxygen was measured in the field.

In addition, DIAND collected benthic samples at 13 stations including one control station upstream of the discharge point, and collected fish for physical examination.

Like the Reid Crowther study, the DIAND study did not find any cause for concern. In general, observable effects of Inuvik's wastewater plume on East Channel were found to be small; outside of a mixing zone along the east bank that extends 0.5 km to 1 km downstream of the effluent discharge point, effects were found to be very small.

Since these past studies are considered to effectively address public health and environmental protection concerns regarding the effluent plume, future studies are not currently planned.

Assuming a 25% increase in the average $BOD_5$ loading on East Channel over the last ten years, the anticipated peak annual $BOD_5$ loading on East Channel during the proposed licence period may reach as high as approximately 24.5 tonnes, which is only slightly higher than the 24.3 tonne loading experienced in 2009. This estimate is relatively conservative given the current population trends and recent recorded levels; however the historical records are subject to annual fluctuations that should be anticipated.

The projected increases in population and effluent flow over the proposed licence period are not anticipated to be significant enough to alter the Reid Crowther and DIAND study's conclusions. Therefore, since Inuvik's lagoon effluent has been previously found to have no significant effects to public health, the environment or aesthetics in East Channel, it is believed that this will continue to be the case through the duration of the proposed licence period.

# 3.5 Solid Waste Management

## 3.5.1 Facilities and Operations

As noted in **Section 2.4.1**, the Town submitted an assessment of the Mount Baldy Solid Waste Disposal Facility in 2006, which confirmed the suitability of the current site. Therefore, Inuvik intends to continue to develop and use its Mount Baldy landfill site while continuing to complete improvements in its operation and aesthetics as are found practical through trial and experience.

Operations and Maintenance (O&M) programs are in line with the current Operations and Maintenance Manual for Solid Waste Disposal Facilities (Earth Tech Canada Inc, 2006), as confirmed through yearly reviews of the Town's O&M plans. The manual will be regularly updated to reflect evolving practice.

Due to the development and growth of the solid waste facility over the last decade, monitoring Station 0036-4 and Station 0036-5 locations will be reviewed over the proposed licence period to determine whether the stations should be relocated, or if additional stations are required.

## 3.5.2 Use of Site

As noted in **Section 2.4.2**, Inuvik appears to be filling up the Mount Baldy landfill site at a rate of 0.5 ha/year, with approximately three lifts fill thickness. Based on the assumed population forecasts, use of the site may peak at approximately 0.65 ha/year during the proposed ten-year license period, provided the MGP proceeds.

Previous estimates of Mount Baldy site capacity in 2006 indicated that the site has enough capacity to continue to serve Inuvik for two to three more decades (or longer if the number of lifts is increased). As such, the site likely has sufficient capacity to accommodate the Town's solid waste over the proposed ten year license period to 2027.

# 4. Water Licence

The Town of Inuvik's Water Licence for 2016 to 2017 is presented below, as well as a brief discussion of the Town's compliance with Water Licence requirements.

## 4.1 Water Licence G06L3-001

A copy of the Town of Inuvik's current, one-year, water licence is provided in **Appendix D**.

## 4.2 Town's Compliance

Inuvik shares the values and objectives of the Water Boards and makes diligent and sustained efforts to comply with Water Licence conditions.

The Town's water supply, sewage and solid waste infrastructure are protected, operated and maintained according to the terms of the Water Licence and public interest. Public access is controlled by fences and signage.

Monitoring, sampling and testing are regularly performed in compliance with the SNP and QA/QC programs. Infrequently, a monitoring sample is inadvertently missed, usually as a result of some disruption of normal staff routine (for example, medical leave or vacation). Lagoon dike inspection occurs annually or as required.

The Town files quarterly and annual reports covering monitoring programs to the Water Board, noting matters of interest, and maintains informal liaison with the Inspector and public health officials in order to be aware of any emerging concerns. The Town takes action on any concerns that arise.

General compliance regarding monitoring and performance also includes the following notes:

- Water extraction has remained in compliance throughout the current 1-yr Licence period for all sources. Additional details regarding the new East Channel Water Treatment Plant are found in the Appendix. Copies of the Operations and Maintenance Manuals will be provided to the GLWB once the documents have been finalized. This is anticipated to be completed in the coming months.

- Lagoon effluent has remained in compliance throughout the current Licence period, with the exception of mid-summer pH levels, as discussed in **Section 2.3.5**. SNP monitoring adjacent to the lagoon has not revealed any major concerns. There have been no reported observations suggesting that Inuvik's lagoon effluent has had any significant detrimental effect on East Channel or other aspects of the environment, or posed any significant risk to public health.

- The solid waste site has been in compliance throughout the Licence period, with no major concerns raised regarding the facility's operation. SNP monitoring has not revealed any major concerns significant to environmental or public health.

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# Appendix A

## October 31, 2016 Application for Water Licence No. G06L3-001 Renewal

**GWICH'IN LAND AND WATER BOARD**
**P.O. Box 2018, Inuvik, NT X0E 0T0**
**867-777-4954**
**867-777-2304**
**glwb.com**

**SCHEDULE III**

**(Subsection 6(1) of the Northwest Territories Water Regulations) APPLICATION FOR WATER LICENCE, AMENDMENT OF LICENCE OR RENEWAL OF LICENCE**

**APPLICATION/LICENCE NO:** G06L3-001

(Amendment or Renewal only)

**1. NAME AND MAILING ADDRESS OF APPLICANT**

| | | | |
|---|---|---|---|
| Applicant's Name | Rick Campbell | | |
| Mailing Address | P.O. Box 1160, #2 Firth Street | | |
| Community | Inuvik | | |
| Prov/Terr | NT | Postal Code | X0E 0T0 |
| Telephone | (867) 777-8615 | Fax | (867) 777-8601 |
| Email | rcampbell@town | Other | |

**2. ADDRESS OF HEAD OFFICE IN CANADA IF INCORPORATED**

| | | | |
|---|---|---|---|
| Mailing Address | | | |
| Community | | | |
| Prov/Terr | | Postal Code | |
| Telephone | | Fax | |

**3. LOCATION OF UNDERTAKING**

(Describe and attach a map, indicating watercourses and location of any proposed waste deposits)

See attached

Longitude _____ Latitude _____

**4. DESCRIPTION OF UNDERTAKING**
(Describe and attach plans)

See attached

**5. TYPES OF UNDERTAKING**

Miscellaneous

See attached

**6. WATER USE**

Other (describe)

See attached

**7. QUANTITY OF WATER INVOLVED**
(Litres per second, litres per day or cubic metres per year, including both quantity to be used and quality to be returned to source)

See attached

**8. WASTE DEPOSITED**
(Quantity, quality, treatment and disposal)

See attached

**9. OTHER PERSONS OR PROPERTIES AFFECTED BY THIS UNDERTAKING**
(Give name, mailing address and location; attach list if necessary)

See attached

**10. PREDICTED ENVIRONMENTAL IMPACTS OF UNDERTAKING AND PROPOSED MITIGATION**

See attached

**11. CONTRACTOR AND SUB-CONTRACTORS**
(Names, addresses and functions)

n/a

**12. STUDIES UNDERTAKEN TO DATE**
(Attach list if necessary)

See attached

**13. PROPOSED TIME SCHEDULE**

Start Date: 01-Jul-2017

Completion Date: 30-Jun-2027

Name (Print) Rick Campbell Title (Print) Director of Public Services

Signature R Campbell Date Oct 31/2016

***FOR OFFICE USE ONLY***

| | | |
|---|---|---|
| Application Fee | Amount: $ | Receipt No.: |
| Water Use Deposit | Amount: $ | Receipt No.: |

(Please make all cheques payable to the Receiver General)

# Appendix B

## Town of Inuvik Station 0036-3 Sampling (Lagoon Effluent Quality Sampling)

**INUVIK SURVEILLANCE NETWORK PROGRAM** — **HISTORY ADJ. FOR AVERAGING** — **HISTORY RUNNING AVERAGE** — **EAST CHANNEL WATER USE & BOD**

**SNP 0036-3 (from January 2006 to June 2016)**

| | | | | | | | | | | | | | | | | | | | | EC | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Adj | Adj | Adj | Adj | Adj | Curr | Avg4 | Avg4 | Avg4 | GAvg4 | | Wuse | BOD | Total per Year |
| Item | | | pH | BOD | SS | NH3-N | Fecal Coli | pH | BOD | SS | NH3-N | Fecal Coli | pH | BOD | SS | NH3-N | Fecal Coli | | m3 | load | |
| Unit | | | | mg/L | mg/L | mg/L | CFU/dL | | mg/L | mg/L | mg/L | CFU/dL | | mg/L | mg/L | mg/L | CFU/dL | | | Tonne | |
| | | | | | | | | | | | | | 6-9 | 150 | 70 | | 1000000 | | | | |
| 2006 | 01 | 24 | 7.1 | 40 | 14 | 21.4 | 117700 | 7.1 | 40 | 14 | 21.4 | 117700 | 7.1 | 29 | 16 | 17.0 | 13136 | | 48060 | 1.92 | |
| 2006 | 02 | 27 | 6.7 | 58 | 14 | 23.2 | 310000 | 6.7 | 58 | 14 | 23.2 | 310000 | 6.7 | 42 | 13 | 20.0 | 141541 | | 44850 | 2.60 | |
| 2006 | 03 | 28 | 6.9 | 79 | 8 | 25.8 | 180000 | 6.9 | 79 | 8 | 25.8 | 180000 | 6.9 | 54 | 12 | 22.0 | 163946 | | 50750 | 4.01 | |
| 2006 | 04 | 26 | 7.0 | 136 | 38 | 25.5 | 360000 | 7.0 | 136 | 38 | 25.5 | 360000 | 7.0 | 78 | 19 | 24.0 | 220510 | | 44640 | 6.07 | |
| 2006 | 05 | 16 | 6.9 | 88 | 21 | 23.0 | 170000 | 6.9 | 88 | 21 | 23.0 | 170000 | 6.9 | 90 | 20 | 24.0 | 241739 | | 46800 | 4.12 | |
| 2006 | 06 | 27 | 7.5 | 41 | 198 | 11.8 | 72 | 7.5 | 41 | 28 | 11.8 | 72 | 7.5 | 86 | 24 | 22.0 | 29843 | | 38810 | 1.59 | |
| 2006 | 07 | 19 | 9.0 | 13 | 34 | 0.9 | 4 | 9.0 | 13 | 34 | 0.9 | 4 | 9.0 | 70 | 30 | 15.0 | 2049 | | 37170 | 0.48 | |
| 2006 | 08 | 24 | 7.9 | 17 | 28 | 9.0 | 130 | 7.9 | 17 | 28 | 9.0 | 130 | 7.9 | 40 | 28 | 11.0 | 282 | | 36900 | 0.63 | |
| 2006 | 09 | 12 | 7.3 | 15 | 12 | 9.4 | 1000 | 7.3 | 15 | 12 | 9.4 | 1000 | 7.3 | 22 | 26 | 8.0 | 78 | | 35280 | 0.53 | |
| 2006 | 10 | 30 | 7.4 | 16 | 34 | 13.1 | 1900 | 7.4 | 16 | 34 | 13.1 | 1900 | 7.4 | 15 | 27 | 8.0 | 177 | | 36170 | 0.58 | |
| 2006 | 11 | 29 | 7.6 | 10 | 18 | 17.3 | 54000 | 7.6 | 10 | 18 | 17.3 | 54000 | 7.6 | 15 | 23 | 12.0 | 1911 | | 38800 | 0.39 | 502090 |
| 2006 | 12 | 13 | 7.1 | 6 | <2 | 17.2 | 46000 | 7.1 | 6 | 2 | 17.2 | 46000 | 7.1 | 12 | 17 | 14.0 | 8289 | | 43860 | 0.26 | 23.2 |
| 2007 | 01 | 16 | 7.1 | 48 | 3 | 22.3 | 60000 | 7.1 | 48 | 3 | 22.3 | 60000 | 7.1 | 20 | 14 | 17.0 | 23068 | | 51730 | 2.48 | |
| 2007 | 02 | 20 | 7.1 | 59 | <5 | 25.6 | 100000 | 7.1 | 59 | 5 | 25.6 | 100000 | 7.1 | 31 | 7 | 21.0 | 62133 | | 43910 | 2.59 | |
| 2007 | 03 | 13 | 7.0 | 65 | <3 | 27.8 | 200000 | 7.0 | 65 | 3 | 27.8 | 200000 | 7.0 | 45 | 3 | 23.0 | 86196 | | 50800 | 3.30 | |
| 2007 | 04 | 10 | 7.0 | 92 | <5 | 27.2 | 100000 | 7.0 | 92 | 5 | 27.2 | 100000 | 7.0 | 66 | 4 | 26.0 | 104664 | | 50890 | 4.68 | |
| 2007 | 05 | 08 | 7.0 | 92 | 3 | 26.6 | 10000 | 7.0 | 92 | 3 | 26.6 | 10000 | 7.0 | 77 | 4 | 27.0 | 66874 | | 48580 | 4.47 | |
| 2007 | 06 | 05 | 6.8 | 36 | 7 | 18.0 | 51 | 6.8 | 36 | 7 | 18.0 | 51 | 6.8 | 71 | 5 | 25.0 | 10050 | | 36470 | 1.31 | |
| 2007 | 07 | 17 | 10.0 | 27 | 161 | 4.2 | <1 | 10.0 | 27 | 161 | 4.2 | 1 | 10.0 | 62 | 44 | 19.0 | 475 | | 37950 | 1.02 | |
| 2007 | 08 | 08 | 7.5 | 16 | 23 | 5.2 | 300 | 7.5 | 16 | 23 | 5.2 | 300 | 7.5 | 43 | 49 | 13.0 | 111 | | 36700 | 0.59 | |
| 2007 | 10 | 02 | 7.7 | 10 | 15 | 10.6 | 17000 | 7.7 | 10 | 15 | 10.6 | 17000 | 7.7 | 22 | 52 | 9.0 | 127 | | 38480 | 0.38 | |
| 2007 | 10 | 25 | 7.5 | 4 | 12 | 11.3 | 1000 | 7.5 | 4 | 12 | 11.3 | 1000 | 7.5 | 14 | 53 | 8.0 | 267 | | 47980 | 0.19 | |
| 2007 | 11 | 06 | 7.4 | 6 | 9 | 12.3 | 12000 | 7.4 | 6 | 9 | 12.3 | 12000 | 7.4 | 9 | 15 | 10.0 | 2797 | | 41930 | 0.25 | 527190 |
| 2007 | 12 | 11 | 7.2 | 10 | 14 | 15.5 | 122000 | 7.2 | 10 | 14 | 15.5 | 122000 | 7.2 | 8 | 13 | 12.0 | 12560 | | 41770 | 0.42 | 21.7 |
| 2008 | 01 | 08 | 7.2 | 32 | 27 | 20.5 | 200000 | 7.2 | 32 | 27 | 21 | 200000 | 7.2 | 13 | 16 | 15.0 | 23262 | | 47390 | 1.52 | |
| 2008 | 02 | 05 | 7.1 | 9 | 17 | 20.3 | 130000 | 7.1 | 9 | 17 | 20 | 130000 | 7.1 | 14 | 17 | 17.0 | 78547 | | 47530 | 0.43 | |
| 2008 | 03 | 04 | 7.2 | 56 | 12 | 25.7 | 200000 | 7.2 | 56 | 12 | 26 | 200000 | 7.2 | 27 | 18 | 21.0 | 158705 | | 50460 | 2.83 | |
| 2008 | 04 | 15 | 7.4 | 78 | 7 | 28.0 | 210000 | 7.39 | 78 | 7 | 28 | 210000 | 7.4 | 44 | 16 | 24.0 | 181784 | | 45390 | 3.54 | |
| 2008 | 05 | 13 | 6.9 | 95 | 4 | 2.6 | 110000 | 6.93 | 95 | 4 | 3 | 110000 | 6.9 | 60 | 10 | 19.0 | 156548 | | 50510 | 4.80 | |
| 2008 | 06 | 18 | 7.2 | 38 | 31 | 14.7 | 890 | 7.24 | 38 | 31 | 15 | 890 | 7.2 | 67 | 14 | 18.0 | 45031 | | 52860 | 2.01 | |
| 2008 | 07 | 07 | 9.6 | 16 | 63 | 4.7 | 10 | 9.63 | 16 | 63 | 5 | 10 | 9.6 | 57 | 26 | 12.0 | 3787 | | 49880 | 0.80 | |
| 2008 | 08 | 13 | 8.5 | 11 | 21 | 1.2 | 25 | 8.47 | 11 | 21 | 1 | 25 | 8.5 | 40 | 30 | 6.0 | 396 | | 50380 | 0.55 | |
| 2008 | 09 | 09 | 7.3 | 10 | 16 | 0.4 | 5100 | 7.27 | 10 | 16 | 0 | 5100 | 7.3 | 19 | 33 | 5.0 | 184 | | 50300 | 0.50 | |
| 2008 | 10 | 22 | 7.3 | 6 | 8 | 8.9 | 40000 | 7.3 | 6 | 8 | 9 | 40000 | 7.3 | 11 | 27 | 4.0 | 475 | | 50230 | 0.30 | |
| 2008 | 11 | 18 | 6.9 | <4 | 9 | 13.5 | 100000 | 6.89 | 4 | 9 | 14 | 100000 | 6.9 | 8 | 14 | 6.0 | 4752 | | 46400 | 0.19 | 588220 |
| 2008 | 12 | 15 | 6.9 | 15 | 10 | 14.5 | 120000 | 6.85 | 15 | 10 | 15 | 120000 | 6.9 | 9 | 11 | 9.0 | 39555 | | 46890 | 0.70 | 18.2 |
| 2009 | 01 | 06 | 7.1 | 53 | 12 | 16.7 | 64000 | 7.1 | 53 | 12 | 16.7 | 64000 | 7.1 | 20 | 10 | 13.0 | 74448 | | 52790 | 2.80 | |
| 2009 | 02 | 10 | 6.8 | 71 | 8 | 20.1 | 45000 | 6.8 | 71 | 8 | 20.1 | 45000 | 6.8 | 36 | 10 | 16.0 | 76673 | | 49560 | 3.52 | |
| 2009 | 03 | 17 | 6.9 | 82 | 12 | 21.3 | 160000 | 6.9 | 82 | 12 | 21.3 | 160000 | 6.9 | 55 | 11 | 18.0 | 86233 | | 52260 | 4.29 | |
| 2009 | 04 | 07 | 7.0 | 88 | 6 | 24.5 | 180000 | 7.0 | 88 | 6 | 24.5 | 180000 | 7.0 | 74 | 10 | 21.0 | 95432 | | 46870 | 4.12 | |
| 2009 | 05 | 19 | 7.1 | 58 | 10 | 18.1 | 105000 | 7.1 | 58 | 10 | 18.1 | 105000 | 7.1 | 75 | 9 | 21.0 | 108006 | | 52150 | 3.02 | |
| 2009 | 06 | 16 | 7.2 | 32 | 47 | 13.0 | 1300 | 7.2 | 32 | 47 | 13.0 | 1300 | 7.2 | 65 | 19 | 19.0 | 44528 | | 45860 | 1.47 | |
| 2009 | 07 | 07 | 9.1 | 14 | 46 | 0.9 | 24 | 9.1 | 14 | 46 | 0.9 | 24 | 9.1 | 48 | 27 | 14.0 | 4928 | | 46130 | 0.65 | |
| 2009 | 08 | 05 | 7.5 | 17 | 20 | 4.2 | 440 | 7.5 | 17 | 20 | 4.2 | 440 | 7.5 | 30 | 31 | 9.0 | 1096 | | 45610 | 0.78 | |
| 2009 | 09 | 28 | 7.4 | 10 | 7 | 12.9 | 400 | 7.4 | 10 | 7 | 12.9 | 400 | 7.4 | 18 | 30 | 8.0 | 272 | | 46230 | 0.46 | |
| 2009 | 10 | 20 | 7.6 | 18 | 6 | 15.8 | 200000 | 7.6 | 18 | 6 | 15.8 | 200000 | 7.6 | 15 | 20 | 8.0 | 959 | | 55280 | 1.00 | |
| 2009 | 11 | 10 | 7.5 | 15 | 6 | 16.8 | 210000 | 7.5 | 15 | 6 | 16.8 | 210000 | 7.5 | 15 | 10 | 12.0 | 9272 | | 45900 | 0.69 | 584440 |
| 2009 | 12 | 08 | 7.3 | 32 | 6 | 19.1 | 260000 | 7.3 | 32 | 6 | 19.1 | 260000 | 7.3 | 19 | 6 | 16.0 | 45716 | | 45800 | 1.47 | 24.3 |
| 2010 | 01 | 12 | 7.2 | 55 | 6 | 22.3 | 500000 | 7.2 | 55 | 6 | 22.3 | 500000 | 7.2 | 30 | 6 | 19.0 | 271830 | | 50720 | 2.79 | |
| 2010 | 02 | 09 | 7.4 | 30 | <5 | 26.0 | 50000 | 7.4 | 30 | 5 | 26.0 | 50000 | 7.4 | 33 | 6 | 21.0 | 192213 | | 49220 | 1.48 | |
| 2010 | 03 | 09 | 7.5 | 92 | 6 | 39.3 | 230000 | 7.5 | 92 | 6 | 39.3 | 230000 | 7.5 | 52 | 6 | 27.0 | 196635 | | 49760 | 4.58 | |
| 2010 | 04 | 13 | 7.4 | 88 | 13 | 21.5 | 103000 | 7.4 | 88 | 13 | 21.5 | 103000 | 7.4 | 66 | 8 | 27.0 | 156001 | | 48000 | 4.22 | |
| 2010 | 05 | 11 | 7.3 | 61 | 18 | 17.9 | 130000 | 7.3 | 61 | 18 | 17.9 | 130000 | 7.3 | 68 | 11 | 26.0 | 111396 | | 43620 | 2.66 | |
| 2010 | 06 | 08 | 8.0 | 28 | 31 | 14.1 | 10900 | 8.0 | 28 | 31 | 14.1 | 10900 | 8.0 | 67 | 17 | 23.0 | 76117 | | 39400 | 1.10 | |
| 2010 | 07 | 05 | 8.7 | 20 | 37 | 11.2 | 4000 | 8.7 | 20 | 37 | 11 | 4000 | 8.7 | 49 | 25 | 16.0 | 27642 | | 39980 | 0.80 | |
| 2010 | 08 | 10 | 7.7 | 20 | 22 | 9.6 | 400 | 7.7 | 20 | 22 | 10 | 400 | 7.7 | 32 | 27 | 13.0 | 6900 | | 36560 | 0.73 | |
| 2010 | 09 | 14 | 7.7 | 27 | 28 | 11.1 | 10400 | 7.7 | 27 | 28 | 11 | 10400 | 7.7 | 24 | 30 | 12.0 | 3670 | | 37300 | 1.01 | |
| 2010 | 10 | 19 | 7.9 | 8 | 12 | 12.0 | 1000 | 7.9 | 8 | 12 | 12.0 | 1000 | 7.9 | 19 | 25 | 11.0 | 2020 | | 48950 | 0.39 | |
| 2010 | 11 | 23 | 7.6 | 29 | 10 | 18.0 | 80000 | 7.6 | 29 | 10 | 18 | 80000 | 7.6 | 21 | 18 | 13.0 | 4271 | | 49370 | 1.43 | 536160 |
| 2010 | 12 | 14 | 7.4 | 35 | 15 | 18.0 | 76000 | 7.4 | 35 | 15 | 18 | 76000 | 7.4 | 25 | 16 | 15.0 | 15857 | | 43280 | 1.51 | 22.7 |
| 2011 | 01 | 25 | 7.4 | 47 | 6 | 21.0 | 160000 | 7.4 | 47 | 6 | 21 | 160000 | 7.4 | 30 | 11 | 17.0 | 31406 | | 51730 | 2.43 | |
| 2011 | 02 | 22 | 7.4 | 73 | 7 | 22.4 | 260000 | 7.4 | 73 | 7 | 22 | 260000 | 7.4 | 46 | 10 | 20.0 | 126110 | | 49460 | 3.61 | |
| 2011 | 03 | 15 | 7.6 | 61 | 4 | 23.5 | 260000 | 7.6 | 61 | 4 | 24 | 260000 | 7.6 | 54 | 8 | 21.0 | 169325 | | 50210 | 3.06 | |
| 2011 | 04 | 12 | 7.3 | 98 | <5 | 25.2 | 650000 | 7.3 | 98 | 2 | 25 | 650000 | 7.3 | 70 | 5 | 23.0 | 289564 | | 51850 | 5.08 | |
| 2011 | 05 | 24 | 7.3 | 7 | 3 | 3.3 | 225 | 7.3 | 7 | 3 | 3 | 225 | 7.3 | 60 | 4 | 18.6 | 56074 | | 58740 | 0.41 | |
| 2011 | 06 | 27 | 8.0 | 15 | 32 | 10.7 | 264 | 8.0 | 15 | 32 | 11 | 264 | 8.0 | 45 | 10 | 15.7 | 10010 | | 41750 | 0.63 | |
| 2011 | 07 | 19 | 8.8 | 34 | 68 | 3.0 | 260 | 8.8 | 34 | 68 | 3 | 260 | 8.8 | 39 | 26 | 10.5 | 1780 | | 38610 | 1.31 | |
| 2011 | 08 | 10 | 7.6 | 18 | 20 | 3.3 | 220 | 7.6 | 18 | 20 | 3 | 220 | 7.6 | 19 | 31 | 5.1 | 241 | | 42550 | 0.77 | |
| 2011 | 09 | 19 | 7.8 | 10 | 39 | 4.8 | 2000 | 7.8 | 10 | 39 | 5 | 2000 | 7.8 | 19 | 40 | 5.4 | 417 | | 37930 | 0.38 | |
| 2011 | 10 | 18 | 7.9 | 5 | 11 | 8.2 | 4000 | 7.9 | 5 | 11 | 8 | 4000 | 7.9 | 17 | 35 | 4.8 | 822 | | 49080 | 0.25 | |
| 2011 | 11 | 21 | 7.7 | 12 | 10 | 12.2 | 70000 | 7.7 | 12 | 10 | 12 | 70000 | 7.7 | 11 | 20 | 7.1 | 3332 | | 47320 | 0.57 | 569570 |
| 2011 | 12 | 13 | 7.5 | <4 | 20 | 14.6 | 50000 | 7.5 | 3 | 20 | 15 | 50000 | 7.5 | 8 | 20 | 10.0 | 12936 | | 50340 | 0.15 | 18.6 |
| 2012 | 01 | 10 | 7.3 | 39 | 13 | 18.5 | 76000 | 7.3 | 39 | 13 | 19 | 76000 | 7.3 | 15 | 14 | 13.0 | 32117 | | 53270 | 2.08 | |
| 2012 | 02 | 14 | 7.3 | 60 | 10 | 22.5 | 400000 | 7.3 | 60 | 10 | 23 | 400000 | 7.3 | 29 | 13 | 17.0 | 101563 | | 53680 | 3.22 | |
| 2012 | 03 | 20 | 7.3 | 108 | 6 | 23.4 | 81000 | 7.3 | 108 | 6 | 23 | 81000 | 7.3 | 53 | 12 | 20.0 | 105337 | | 57580 | 6.22 | |

**INUVIK SURVEILLANCE NETWORK PROGRAM**
**SNP 0036-3 (from January 2006 to June 2016)**

| | | | | | | | | | **HISTORY ADJ. FOR AVERAGING** | | | | | **HISTORY RUNNING AVERAGE** | | | | | **EAST CHANNEL WATER USE & BOD** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Adj | Adj | Adj | Adj | Adj | Curr | Avg4 | Avg4 | Avg4 | GAvg4 | | EC | |
| Item | | | pH | BOD | SS | NH3-N | Fecal Coli | | pH | BOD | SS | NH3-N | Fecal Coli | pH | BOD | SS | NH3-N | Fecal Coli | Wuse | BOD | Total per Year |
| Unit | | | | mg/L | mg/L | mg/L | CFU/dL | | | mg/L | mg/L | mg/L | CFU/dL | | mg/L | mg/L | mg/L | CFU/dL | m3 | load | |
| | | | | | | | | | | | | | | 6-9 | 150 | 70 | | 1000000 | | Tonne | |
| 2012 | 04 | 24 | 7.2 | 92 | 20 | 23.6 | 140000 | | 7.2 | 92 | 20 | 24 | 140000 | 7.2 | 75 | 12 | 22.0 | 136261 | 52800 | 4.86 | |
| 2012 | 05 | 29 | 7.2 | 14 | 7 | 3.8 | 22000 | | 7.2 | 14 | 7 | 4 | 22000 | 7.2 | 69 | 11 | 18.3 | 99948 | 54100 | 0.76 | |
| 2012 | 06 | 19 | 7.6 | 17 | 25 | 13.0 | 7 | | 7.6 | 17 | 25 | 13 | 7 | 7.6 | 58 | 15 | 16.0 | 6464 | 53020 | 0.90 | |
| 2012 | 07 | 24 | 8.2 | 15 | 25 | 5.9 | 900 | | 8.2 | 15 | 25 | 6 | 900 | 8.2 | 35 | 19 | 11.6 | 2099 | 51240 | 0.77 | |
| 2012 | 08 | 28 | 7.7 | 10 | 14 | 6.0 | 180 | | 7.7 | 10 | 14 | 6 | 180 | 7.7 | 14 | 18 | 7.2 | 397 | 51420 | 0.51 | |
| 2012 | 09 | 18 | 7.8 | 22 | 28 | 4.2 | 270 | | 7.8 | 22 | 28 | 4 | 270 | 7.8 | 16 | 23 | 7.3 | 132 | 49800 | 1.10 | |
| 2012 | 10 | 23 | 7.9 | 8 | 14 | 4.0 | 400 | | 7.9 | 8 | 14 | 4 | 400 | 7.9 | 14 | 20 | 5.0 | 364 | 49360 | 0.39 | |
| 2012 | 11 | 27 | 7.6 | 14 | 10 | 5.6 | 280000 | | 7.6 | 14 | 10 | 6 | 280000 | 7.6 | 14 | 17 | 5.0 | 1527 | 47300 | 0.66 | 621930 |
| 2012 | 12 | 10 | 7.4 | 16 | 8 | 9.7 | 110000 | | 7.4 | 16 | 8 | 10 | 110000 | 7.4 | 15 | 15 | 5.9 | 7594 | 48360 | 0.77 | 22.2 |
| 2013 | 01 | 15 | 7.4 | 28 | 8 | 12.3 | 101000 | | 7.4 | 28 | 8 | 12 | 101000 | 7.4 | 17 | 10 | 7.9 | 33399 | 59460 | 1.66 | |
| 2013 | 02 | 12 | 7.4 | 34 | 9 | 16.1 | 200000 | | 7.4 | 34 | 9 | 16 | 200000 | 7.4 | 23 | 9 | 10.9 | 157934 | 54370 | 1.85 | |
| 2013 | 03 | 12 | 7.1 | 58 | 5 | 18.8 | 92000 | | 7.1 | 58 | 5 | 19 | 92000 | 7.1 | 34 | 8 | 14.2 | 119573 | 59090 | 3.43 | |
| 2013 | 04 | 16 | 7.5 | 46 | 4 | 20.4 | 82000 | | 7.5 | 46 | 4 | 20 | 82000 | 7.5 | 42 | 7 | 16.9 | 111106 | 47920 | 2.20 | |
| 2013 | 05 | 18 | 8.0 | 27 | 30 | 11.6 | 50000 | | 8.0 | 27 | 30 | 12 | 50000 | 8.0 | 41 | 12 | 16.7 | 93197 | 51560 | 1.39 | |
| 2013 | 06 | 25 | 7.7 | 28 | 5 | 20.9 | 52000 | | 7.7 | 28 | 5 | 21 | 52000 | 7.7 | 40 | 11 | 17.9 | 66549 | 53140 | 1.49 | |
| 2013 | 07 | 08 | 8.1 | 13 | 16 | 6.5 | 92 | | 8.1 | 13 | 16 | 7 | 92 | 8.1 | 29 | 14 | 14.9 | 11834 | 48200 | 0.63 | |
| 2013 | 08 | 27 | 7.9 | 11 | 40 | 1.5 | 700 | | 7.9 | 11 | 40 | 2 | 700 | 7.9 | 20 | 23 | 10.1 | 3597 | 44400 | 0.49 | |
| 2013 | 09 | 24 | 8.0 | 10 | 35 | 1.6 | 4700 | | 8.0 | 10 | 35 | 2 | 4700 | 8.0 | 16 | 24 | 7.6 | 1992 | 46800 | 0.47 | |
| 2013 | 10 | 29 | 7.6 | 7 | 11 | 3.4 | 180 | | 7.6 | 7 | 11 | 3 | 180 | 7.6 | 10 | 26 | 3.3 | 483 | 43600 | 0.31 | |
| 2013 | 11 | 25 | 7.5 | <4 | 4 | 5.9 | 5300 | | 7.5 | 3 | 4 | 6 | 5300 | 7.5 | 8 | 23 | 3.1 | 1331 | 42840 | 0.13 | 595560 |
| 2013 | 12 | 17 | 7.5 | 20 | <5 | 6.8 | 1500 | | 7.5 | 20 | 4 | 7 | 1500 | 7.5 | 10 | 14 | 4.4 | 1610 | 44180 | 0.88 | 14.9 |
| 2014 | 01 | 07 | 7.4 | 20 | 60 | 10.4 | 74000 | | 7.4 | 20 | 60 | 10 | 74000 | 7.4 | 13 | 20 | 6.6 | 3208 | 48360 | 0.97 | |
| 2014 | 02 | 04 | 7.3 | 33 | 6 | 13.7 | 90000 | | 7.3 | 33 | 6 | 14 | 90000 | 7.3 | 19 | 19 | 9.2 | 15169 | 46120 | 1.52 | |
| 2014 | 03 | 11 | 7.2 | 34 | <3 | 18.0 | 110000 | | 7.2 | 34 | 2 | 18 | 110000 | 7.2 | 27 | 18 | 12.2 | 32377 | 51740 | 1.76 | |
| 2014 | 04 | 08 | 7.0 | 68 | 4 | 21.1 | 400000 | | 7.0 | 68 | 4 | 21 | 400000 | 7.0 | 39 | 18 | 15.8 | 130837 | 51230 | 3.48 | |
| 2014 | 05 | 29 | 7.3 | 32 | 4 | 10.3 | 280000 | | 7.3 | 32 | 4 | 10 | 280000 | 7.3 | 42 | 4 | 15.8 | 182479 | 50410 | 1.61 | |
| 2014 | 06 | 17 | 7.5 | 45 | 65 | 11.8 | 34000 | | 7.5 | 45 | 65 | 12 | 34000 | 7.5 | 45 | 19 | 15.3 | 143061 | 38360 | 1.73 | |
| 2014 | 07 | 15 | 8.3 | 22 | 65 | 4.0 | 1700 | | 8.3 | 22 | 65 | 4.0 | 1700 | 8.3 | 42 | 35 | 11.8 | 50441 | 42070 | 0.93 | |
| 2014 | 08 | 19 | 7.1 | 14 | 40 | 0.6 | 130 | | 7.1 | 14 | 40 | 0.6 | 130 | 7.1 | 28 | 44 | 6.7 | 6773 | 46160 | 0.65 | |
| 2014 | 09 | 23 | 7.8 | 5 | 3 | 6.8 | 2200 | | 7.8 | 5 | 3 | 6.8 | 2200 | 7.8 | 22 | 43 | 5.8 | 2016 | 35090 | 0.18 | |
| 2014 | 10 | 27 | 7.7 | 5 | 3 | 9.1 | 38 | | 7.7 | 5 | 3 | 9 | 38 | 7.7 | 12 | 28 | 5.1 | 369 | 35770 | 0.18 | |
| 2014 | 11 | 18 | 7.4 | 9 | 4 | 11.1 | 56000 | | 7.4 | 9 | 4 | 11 | 56000 | 7.4 | 8 | 13 | 6.9 | 883 | 51170 | 0.46 | |
| 2014 | 12 | 16 | 7.5 | 10 | 12 | 15.4 | 64000 | | 7.5 | 10 | 12 | 15 | 64000 | 7.5 | 7 | 6 | 10.6 | 4160 | 44940 | 0.45 | 13.9 |
| 2015 | 01 | 28 | 7.5 | 52 | 7 | 21.2 | 250000 | | 7.5 | 52 | 7 | 21 | 250000 | 7.5 | 19 | 7 | 14.2 | 13584 | 54120 | 2.81 | |
| 2015 | 02 | 17 | 7.6 | 50 | 4 | 21.9 | 200000 | | 7.6 | 50 | 4 | 22 | 200000 | 7.6 | 30 | 7 | 17.4 | 115700 | 52370 | 2.62 | |
| 2015 | 03 | 17 | 7.5 | 72 | 8 | 23.0 | 270000 | | 7.5 | 72 | 8 | 23 | 270000 | 7.5 | 46 | 8 | 20.4 | 171446 | 59150 | 4.26 | |
| 2015 | 04 | 21 | 7.4 | 76 | 8 | 23.8 | >60000 | | 7.4 | 76 | 8 | 24 | 60000 | 7.4 | 63 | 7 | 22.5 | 168702 | 51460 | 3.91 | |
| 2015 | 05 | 19 | 7.2 | <4 | 3 | 2.3 | 1200 | | 7.2 | 3 | 3 | 2 | 1200 | 7.2 | 50 | 6 | 17.7 | 44405 | 37930 | 0.11 | |
| 2015 | 06 | 16 | 7.6 | 15 | 11 | 12.1 | 1800 | | 7.6 | 15 | 11 | 12 | 1800 | 7.6 | 42 | 8 | 15.3 | 13677 | 31880 | 0.48 | |
| 2015 | 07 | 07 | 9.0 | 26 | 50 | 4.0 | <10 | | 9.0 | 26 | 50 | 4.0 | 9 | 9.0 | 30 | 18 | 10.5 | 1039 | 33030 | 0.86 | |
| 2015 | 08 | 18 | 8.2 | 15 | 16 | 4.2 | 500 | | 8.2 | 15 | 16 | 4.2 | 500 | 8.2 | 15 | 20 | 5.7 | 314 | 30030 | 0.45 | |
| 2015 | 09 | 08 | 7.9 | 16 | 30 | 5.0 | 2000 | | 7.9 | 16 | 30 | 5.0 | 2000 | 7.9 | 18 | 27 | 6.3 | 357 | 31940 | 0.51 | |
| 2015 | 10 | 07 | 8.0 | 6 | 25 | 5.5 | 2900 | | 8.0 | 6 | 25 | 6 | 2900 | 8.0 | 16 | 30 | 4.7 | 402 | 38050 | 0.23 | |
| 2015 | 11 | 21 | 7.6 | 7 | 6 | 8.0 | 2600 | | 7.6 | 7 | 6 | 8 | 2600 | 7.6 | 11 | 19 | 5.7 | 1657 | 35650 | 0.25 | 492020 |
| 2015 | 12 | 08 | 7.4 | 10 | 4 | 8.6 | >8000 | | 7.4 | 10 | 4 | 9 | 8000 | 7.4 | 10 | 16 | 6.8 | 3314 | 36410 | 0.36 | 16.9 |
| 2016 | 01 | 12 | 7.3 | 34 | 6 | 16.1 | 140000 | | 7.3 | 34 | 6 | 16 | 140000 | 7.3 | 14 | 10 | 9.6 | 9586 | 41090 | 1.40 | |
| 2016 | 02 | 16 | 7.5 | 58 | 6 | 19.8 | >60000 | | 7.5 | 58 | 6 | 20 | 60000 | 7.5 | 27 | 6 | 13.1 | 20445 | 41380 | 2.40 | |
| 2016 | 03 | 15 | 7.4 | 50 | 4 | 20.9 | 66000 | | 7.4 | 50 | 4 | 21 | 66000 | 7.4 | 38 | 5 | 16.3 | 45891 | 43110 | 2.16 | |
| 2016 | 04 | 05 | 7.4 | 86 | <3 | 22.3 | 13000 | | 7.4 | 86 | 2 | 22 | 13000 | 7.4 | 57 | 5 | 19.8 | 51813 | | | |
| 2016 | 05 | 17 | 7.2 | 31 | 17 | 8.1 | 72000 | | 7.2 | 31 | 17 | 8 | 72000 | 7.2 | 56 | 7 | 17.8 | 43878 | | | |
| 2016 | 06 | 27 | 8.1 | 33 | 47 | 13.9 | 1600 | | 8.1 | 33 | 47 | 14 | 1600 | 8.1 | 50 | 18 | 16.3 | 17731 | | | |

# Appendix C

## Town of Inuvik Station 0036-6, Station 0036-7 and Station 0036-8 Sampling

INUVIK SURVEILLANCE NETWORK PROGRAM 2015 Table G06L3-001-6, 7 & 8
MONITORING OF PONDS NEAR LAGOON

Station 0036-6, SW pond, near gate. La N 68 d 21.861 m, Lo W 133 d 44.994 m
Station 0036-7, NW pond, mid-north along west dike. La N 68 d 22.230 m, Lo N 133 d 45.599 m
Station 0036-8, control, Twin Lakes below Happy Valle La N 68 d 21.644 m, Lo 133 d 44.439 m

SNP requirements. Sample annually. Report parameters tabulated below.
Reports are due quarterly within thirty days and for the calendar year by March 31.

SAMPLE RESULTS AMBIENT CONDITIONS

| Item | | | SNP | pH | BOD | SS | NH3-N | Fecal Coli | Temp | Wind | Prcp |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | | | | | mg/L | mg/L | mg/L | CFU/dL | ° C | km/h | |
| 2015 | 09 | 08 | 6 | 7.7 | <4 | 3 | 12.8 | 2 | 1 | NW 4 | Cloudy |
| 2015 | 09 | 08 | 7 | 8.4 | <4 | <7 | <0.025 | <1 | 1 | NW 4 | Cloudy |
| 2015 | 09 | 08 | 8 | 8.2 | <4 | 8 | 1.6 | 1 | 1 | NW 4 | Cloudy |

Note: Results from recent earlier years are included below for comparison.

| Item | | | SNP | pH | BOD | SS | NH3-N | Fecal Coli | Temp | Wind | Prcp |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | | | | | mg/L | mg/L | mg/L | CFU/dL | ° C | km/h | |
| 2014 | 10 | 07 | 6 | 7.7 | <4 | 4 | 12.4 | 81 | -3 | NW 30 | Snow |
| 2014 | 10 | 07 | 7 | 8.0 | <4 | 4 | <0.05 | <1 | -3 | NW 30 | Snow |
| 2014 | 10 | 07 | 8 | 8.1 | <4 | 47 | 1.9 | 1 | -3 | NW 30 | Snow |
| 2013 | 09 | 24 | 6 | 7.8 | <4 | <1 | 14.4 | 2 | 0 | NE 5 | Cloudy |
| 2013 | 09 | 24 | 7 | 8.1 | <4 | 15 | <0.05 | 24 | 0 | NE 5 | Cloudy |
| 2013 | 09 | 24 | 8 | 8.1 | <4 | <2 | 1.9 | <1 | 0 | NE 5 | Cloudy |
| 2012 | 09 | 18 | 6 | 8.1 | <4 | 3 | 10.4 | 4 | 7 | S 10 | Clear |
| 2012 | 09 | 18 | 7 | 8.3 | <4 | <1 | <0.05 | 1 | 7 | S 10 | Clear |
| 2012 | 09 | 18 | 8 | 8.2 | <4 | <2 | 3.4 | 2 | 7 | S 10 | Clear |
| 2011 | 09 | 19 | 6 | 8.0 | <4 | <2 | 13.6 | <1 | 0 | NE 15 | Cloudy |
| 2011 | 09 | 19 | 7 | 8.3 | <4 | <2 | <0.05 | <1 | 0 | NE 15 | Cloudy |
| 2011 | 09 | 19 | 8 | 8.1 | <4 | 6 | 1.6 | <1 | 0 | NE 15 | Cloudy |
| 2010 | 09 | 21 | 6 | 7.8 | <4 | <1 | 14.3 | 1 | 1 | NW 15 | Cloudy |
| 2010 | 09 | 21 | 7 | 8.1 | <4 | <1 | <0.05 | <1 | 1 | NW 15 | Cloudy |
| 2010 | 09 | 21 | 8 | 8.1 | <4 | 50 | 2.6 | <1 | 1 | NW 15 | Cloudy |
| 2009 | 09 | 28 | 6 | 7.1 | <4 | 3 | 11.2 | <1 | -3 | NW 4 | Snow |
| 2009 | 09 | 28 | 7 | 8.2 | 5 | 6 | <0.05 | <1 | -3 | NW 4 | Snow |
| 2009 | 09 | 28 | 8 | 7.8 | <4 | 6 | 2.8 | <1 | -3 | NW 4 | Snow |
| 2008 | 09 | 15 | 6 | 7.7 | <4 | 5 | 10.0 | 1 | -3 | E 12 | Clear |
| 2008 | 09 | 15 | 7 | 8.6 | <4 | 3 | <0.05 | <1 | -3 | E 12 | Clear |
| 2008 | 09 | 15 | 8 | 8.3 | <4 | 6 | 1.3 | <1 | -3 | E 12 | Clear |
| 2007 | 11 | 14 | 6 | 7.2 | <4 | 13 | 8.9 | <1 | -12 | SE 07 | Snow |
| 2007 | 11 | 14 | 7 | 7.3 | 14 | 303 | 0.3 | 1 | -12 | SE 07 | Snow |
| 2007 | 11 | 14 | 8 | 7.4 | 5 | 6 | 4.3 | <1 | -12 | SE 07 | Snow |

# Appendix D

## Water Licence No. G06L3-001 (valid between July 1, 2016 and June 30, 2017)

**GWICH'IN LAND AND WATER BOARD**
**Box 2018 Inuvik, NT X0E 0T0**
**Ph: 867-777-4954**
**Fx: 867-777-2304**
**www.glwb.com**

# WATER LICENCE

Pursuant to the *Mackenzie Valley Resource Management Act* and Regulations, and the *Waters Act*, the Gwich'in Land and Water Board, hereinafter referred to as the Board, hereby grants to:

**The Town of Inuvik**
(Licensee)

of **P.O. Box 1160, #2 Firth Street, Inuvik, NT XOE 0T0**
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water subject to the restrictions and conditions contained in the *Waters Act* and Regulations made thereunder and subject to and in accordance with the conditions specified in this Licence.

| | |
|---|---|
| Licence Number: | G06L3-001 |
| Licence Type: | A |
| Water Management Area: | Northwest Territories 03 |
| Location: | Inuvik, Northwest Territories |
| Purpose: | Water Use & Waste Disposal |
| Description: | Municipal Undertakings |
| Quantity of water not to be exceeded: | 1, 000, 000 cubic metres per year |
| Effective Date of Licence: | July 1, 2016 |
| Expiry Date of Licence: | June 30, 2017 |

This Licence issued and recorded at Inuvik includes and is subject to the annexed conditions.

Signed the 3rd Day of May, 2016 on behalf of the Gwich'in Land and Water Board

**Witness – Mr. Leonard DeBastien**

**Chair – Mr. Paul Sullivan**

**APPROVED BY:**

**Minister of Environment and Natural Resources**

## PART A: Scope and Definitions

### 1. Scope

a) This Licence entitles the Town of Inuvik to use water and dispose of waste for municipal undertakings at the Town of Inuvik, Northwest Territories.

b) This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended under the *Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations.

c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

### 2. Definitions

**"*Act*"** means the *Waters Act*.

**"Analyst"** means an Analyst designated by the Minister under subsection 65(1) of the Act.

**"Average Concentration For Faecal Coliforms"** means the geometric mean of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the Surveillance Network Program.

**"Average Concentration For Biological Oxygen Demand & Suspended Solids"** means the arithmetic mean of any four consecutive analytical results, or if less than four analytical results collected , the arithmetic mean of the analytical results collected, and as submitted to the Board in accordance with the sampling and analysis requirements specified in the Surveillance Network Program.

**"Batch Decant"** means the intentional release of effluent from the Sewage Disposal Facilities, at a release rate exceeding that of the normal discharge, for the purpose

of lowering the liquid level within the sewage lagoon.

**"Board"** means the Gwich'in Land and Water Board established under Part 3 of the *Mackenzie Valley Resource Management Act*..

**"Commercial Waste Water"** means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet water or greywater.

**"Freeboard"** means the vertical distance between water line and the lowest elevation of the effective water containment crest on a dam or dyke's upstream slope.

**"Greywater"** means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes.

**"Inspector"** means an Inspector designated by the Minister under section 65(1) of the Act.

**"Licensee"** means the holder of this Licence (The Town of Inuvik).

**"Minister"** means a duly appointed member of the Executive Council who is responsible for the Waters Act or the department responsible for administering that Act.

**"Modification"** means an alteration to a physical work that introduces a new structure or eliminates an existing structure and which the alteration does not change the purpose or function of the licensed physical work, but does not include an expansion.

**"Professional Engineer"** means a person registered with the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists to practice as a Professional Engineer in the Northwest Territories in accordance with the Engineering and Geoscience Professions Act, S.N.W.T. 2006, V.16, or amendments, and whose principal field of specialization is appropriate to address the components of the undertaking at hand.

**"Pumpout Sewage"** means all toilet wastes and/or greywater collected by means of a vacuum truck for disposal at an approved facility.

**"Regulations"** means Regulations proclaimed pursuant to Section 63 of the Act.

**"Sewage"** means all Toilet Wastes and Greywater.

**"Sewage Disposal Facilities"** comprises the area and engineered structures designed to treat Sewage.

**"Solid Waste Disposal Facilities"** comprises the area and associated structures designed to contain solid wastes as described in Drawings forming part of or appended to the Operation and Maintenance Manual, Solid Waste Disposal Facilities, Inuvik, N.W.T. (most recent edition).

**"Spill Contingency Plan"** means a document, developed in accordance with Indian Affairs and Northern Development Canada's April 2007, or subsequent editions, *Guidelines for Spill Contingency Planning*, that describes the set of procedures to be implemented to minimize the effects of a spill.

**"Surveillance Network Program"** means a monitoring program established to define environmental sampling and analysis requirements, to collect water quality data, and to assess discharge quality, licence compliance, and potential for impacts to the environment.

**"Toilet Wastes"** means all human excreta and associated products, but does not include Greywater.

**"Waste"** means waste as defined by Section 1 of the Act.

**"Waste Disposal Facilities"** mean all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities, Solid Waste Disposal Facilities, and Bagged Toilet Wastes Disposal Facilities.

**"Water Supply Facilities"** comprises the area and associated infrastructure designed to collect, treat, and supply Water for municipal purposes.

**"Water"** means any waters as defined by Section 1 of the Act.

**Part B: General Conditions**

1. The Licensee shall file an Annual Report with the Board in duplicate, with an additional copy to the inspector, not later than March 31st of the year following the calendar year reported, which shall contain the following information:

   a) the monthly and annual quantities in cubic metres of fresh water obtained from all sources;

   b) the monthly and annual quantities in cubic metres of each and all waste discharged;

   c) the monthly and annual quantities of Sewage solids removed from the Sewage Disposal Facilities for disposal;

   d) a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures;

   e) tabular summaries of all data generated under the Surveillance Network Program, as approved by the Board;

   f) tabular and graphic summaries of data generated for Parameters specified in Part D, Item 2 of this licence, as approved by the Board;

   g) a list of unauthorized discharges;

   h) an outline of any spill training and communications exercises carried out;

   i) a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

   j) a summary of any studies requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

   k) a brief description of the annual review of the approved Operation and Maintenance Plans and any updates or revisions to these plans;

   l) a report of the inspection required under Part D, item 9 of this licence;

m) any other details on water use or waste disposal requested by the Board by November 1st of the year being reported;

n) a summary addressing the performance of the Sewage Disposal Facilities and, if applicable, an outline of necessary steps to achieve optimal performance.

2. The Licensee shall comply with the Surveillance Network Program annexed to this Licence, and any amendment to the said Surveillance Network Program as may be made from time to time, pursuant to the conditions of this Licence.

3. The Surveillance Network Program and compliance dates specified in the Licence may be modified at the discretion of the Board.

4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, within sixty (60) days of the issuance of this Licence, post the necessary signs, where possible, to identify the stations of the Surveillance Network Program. All postings shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall, within sixty (60) days of issuance of this Licence, post signs in the appropriate areas to inform the public of Water Supply and Waste Disposal Facilities. All postings shall be located and maintained to the satisfaction of an Inspector.

7. The Licensee shall ensure a copy of this Licence is maintained at the municipal office at all times.

8. The Licensee shall conduct further studies and submit the findings to the Board, if requested by the Board to do so at any time during the term of this licence.

**Part C: Conditions Applying to Water Use**

1. The Licensee shall obtain all fresh water from Hidden Lake, Lake B and the Mackenzie River using the Water Supply Facilities, or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 1,000,000 cubic metres.

3. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size that is satisfactory to an Inspector and sufficient to ensure no entrainment of fish.

**Part D: Conditions Applying to Waste Disposal**

1. The Licensee shall direct all piped and Pumpout Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.

2. All Sewage effluent discharged from the Sewage Disposal Facilities at Surveillance Network Program Station 0036-3 shall meet the following effluent quality standards:

| Parameter | Maximum Average Concentration |
|---|---|
| Suspended Solids | 70 mg/L |
| $BOD_5$* | 150 mg/L |
| Faecal Coliforms | $1 \times 10^6$ CFU/100mL |

* In addition: The maximum concentration of any grab sample shall be 150 mg/L. The total mass of BOD discharged to the receiving water, on an annual basis, shall not be greater than 80 tonnes.

The Waste discharged shall have a pH between 6 and 9, and no visible sheen of oil and grease.

3. A Freeboard limit of 1.0 metre, or as recommended by a Professional Engineer and as approved by the Board, shall be maintained al all dykes and earthfill structures associated with the Sewage Disposal Facilities.

4. All bagged toilet wastes (honey bags) shall be disposed of at the Bagged Toilet Waste Disposal Facilities to the satisfaction of an Inspector.

5. The Licensee shall advise an Inspector at least ten (10) days prior to initiating the Batch Decant of the sewage lagoon.

6. The sewage lagoon shall be maintained and operated in such a manner as to prevent structural failure.

7. The Licensee shall maintain the Sewage Disposal Facilities to the satisfaction of an Inspector.

8. The Licensee shall dispose of all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board.

9. The dams, dykes and other engineered earth structures designed to contain waste within the Sewage Disposal Facilities shall be inspected annually by a professional engineer to determine the stability of the structures.

**Part E: Conditions Applying to Modifications**

1. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

    a) the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

    b) such modifications do not place the Licensee in contravention of either the Licence or the *Act*;

    c) the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and

    d) the Board has not rejected the proposed modifications.

2. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met, may be carried out only with written approval from the Board.

3. The Licensee shall provide to the Board as-built plans and drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications. (except municipal)

**Part F: Conditions Applying to Abandonment And Restoration**

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any Waste Disposal Facilities. The Plan shall include, but not be limited to:

   a) contaminated site remediation;

   b) leachate prevention;

   c) an implementation schedule

   d) maps delineating all disturbed areas, borrow material locations, and site facilities;

   e) consideration of altered drainage patterns;

   f) type and source of cover materials;

   g) future area use; and

   h) hazardous wastes.

2. The Licensee shall implement the Plan specified in Part F, Item 1 as and when approved by the Board.

**Part G: Conditions Applying to Contingency Plans**

1. The Licensee shall, by October 1, 2016, submit to the Board for approval an Spill Contingency Plan in accordance with the *MVLWB / GNWT Operation and Maintenance Plan Templates for Municipal Water Licences: Spill Contingency Plan.*

2. If during the period of this Licence, a spill or unauthorized discharge of Waste occurs or is foreseeable, the Licensee shall:

a) implement the Spill Contingency Plan;

b) report the incident immediately via the 24 Hour Spill Reporting Line (867) 920-8130 in accordance with the instructions contained in the Spill Report Form NWT 1752/0593 or subsequent editions;

c) report each spill and Unauthorized Discharge to an Inspector within 24 hours; and

d) within 30 days of an Unauthorized Discharge or an incident reported under Part I, Item 2b), the Licensee shall submit a detailed report to the Board and an Inspector. The report shall include descriptions of root causes, response actions, and any changes to procedures to prevent similar occurrences in the future.

**Part H: Conditions Applying to Construction**

1. Prior to construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes, the Licensee shall submit to the Board for approval design drawings stamped by a professional engineer registered in the Northwest Territories.

2. Construction of designed structures shall be carried out as approved by the Board.

3. As-built drawings of any changes from the original design, including rationale for the changes to any of the dams, dykes or structures referred to in Part H, Item 1 shall be submitted to the Board within ninety (90) days of completion of the construction.

## Part I: Conditions Applying To Operation And Maintenance

1. The Licensee shall operate and maintain the Waste Disposal Facilities in accordance with the approved Operation and Maintenance Plans.

2. The Licensee shall operate and maintain the Sewage Treatment Facilities in accordance with the approved Operation and Maintenance Plans.

3. The Licensee shall review, and amend as needed, the approved Operation and Maintenance Plans on an annual basis and shall advise the Board of the results of this annual review in accordance with Part B, Item 1 of this Licence.

**GWICH'IN LAND AND WATER BOARD**

**Witness – Leonard DeBastien**

**Chair – Paul Sullivan**

**GWICH'IN LAND AND WATER BOARD**
**Box 2018 Inuvik, NT X0E 0T0**
**Ph: 867-777-4954**
**Fx: 867-777-2304**
**www.glwb.com**

| | |
|---|---|
| LICENSEE: | Town of Inuvik |
| LICENCE NUMBER: | G06L3-001 |
| EFFECTIVE DATE OF LICENCE: | July 1, 2016 |
| EFFECTIVE DATE OF SURVEILLANCE NETWORK PROGRAM (SNP): | July 1, 2016 |

## SURVEILLANCE NETWORK PROGRAM

**A. Location of Surveillance Stations**

| Station Number | Description |
|---|---|
| 0036 -1 | The Mackenzie River pumphouse. |
| 0036 -2 | The Hidden Lake pumphouse. |
| 0036 -3 | The decant structure at the Sewage Disposal Facilities. |
| 0036 -4 | Run-off below the Solid Waste Disposal Facilities at 68°21'7" N, -133°41'1.3"W. |
| 0036 -5 | Run-off to two (2) tundra ponds located southwest of the Solid Waste Disposal Facilities. |
| 0036 -6 | Pond near the southwest corner of the Sewage Disposal Facilities at 68°21'52.5"N, -133°45'3.2"N. |
| 0036 -7 | Pond near the northwest corner of the Sewage |

| | |
|---|---|
| | Disposal Facilities at (exact location to be determined) |
| 0036 -8 | Background for 0036-6 & 0036-7 (exact location to be determined) |

**B. Sampling and Analysis Requirements**

1. Water at Station Number 0036-3 shall be sampled monthly, and analyzed for the following parameters:

| | | |
|---|---|---|
| Ammonia Nitrogen | $BOD_5$ | Fecal Coliform |
| pH | Suspended Solids | |

The period of time, between sampling, shall be no less than 15 days.

2. Water at Station Number 0036-3 shall be sampled 10 days before beginning a Batch Decant, once at the beginning of the decant, once in the middle of the decant, and once at the end of the decant and analyzed for the following parameters:

| | | |
|---|---|---|
| Ammonia Nitrogen | $BOD_5$ | Fecal Coliform |
| pH | Suspended Solids | |

3. Water at Station Numbers 0036-6, 0036-7 and 0036-8 shall be sampled annually, during periods of flow, and analyzed for the following parameters:

| | | |
|---|---|---|
| Ammonia Nitrogen | $BOD_5$ | Fecal Coliform |
| pH | Suspended Solids | |

4. Water at Station Numbers 0036-4 and 0036-5 shall be sampled monthly, during periods of flow, and analyzed for the following parameters:

| | | |
|---|---|---|
| pH | Suspended Solids | $BOD_5$ |
| Sodium | Total Phosphate | Magnesium |
| Sulphate | Conductivity | Potassium |
| Calcium | Total Phenols | Total Chromium |
| Total Lead | Total Iron | Total Nickel |
| Total Copper | Total Cadmium | Total Zinc |

Total Mercury

5. Water at Station Numbers 0036 -3, 0036 -4, and 0036 -5 shall be inspected monthly, during periods of flow, for the presence of an oil sheen. If an oil sheen is detected, the water shall be sampled immediately and analyzed for the presence of Oil and Grease.

6. More frequent sample collection may be required at the request of an Inspector.

7. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standards Methods for the Examination of Water and Wastewater", or by such other methods approved by an Analyst.

8. All analyses shall be performed in a laboratory approved by an Analyst.

**C. Flow and Volume Measurement Requirements**

1. The monthly and annual quantities of water pumped from Surveillance Network Program Station Number 0036-1 and 0036-2 shall be measured and recorded in cubic metres.

2. The monthly and annual quantities of sewage solids removed from the sewage disposal facility shall be measured and recorded.

**D. Reports**

1. The Licensee shall submit quarterly reports for January through March, April through June, July through September, and October through December. These quarterly reports shall contain all of the information generated by parts A, B, and C of the Surveillance Network Program and shall be submitted within thirty (30) days of the end of the quarter being reported.

2. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the Surveillance Network Program including the results of the approved quality assurance/quality control program in the Licensee's Annual Report, which Report shall be submitted to the Board on or before March 31st of the year following the calendar year being reported.

3. The Licensee shall, within fifteen (15) days of the completion of the decant operation, submit to the Board all the data and information required in the Surveillance Network Program.

**GWICH'IN LAND AND WATER BOARD**

**Witness – Leonard DeBastien**

**Chair – Paul Sullivan**

# Appendix E

## Town of Inuvik Water Treatment Plant Upgrades Design Brief

# TOWN OF INUVIK
# WATER TREATMENT PLANT UPGRADES
# DESIGN BRIEF

*October 8, 2013*

Our File No: 12-6732

*Submitted by:*

**DILLON CONSULTING LIMITED**

October 8, 2013

Town of Inuvik
P.O. Box 1160
Inuvik, NT
X0E 0T0

Attention: Grant Hood
Senior Administrative Officer

***Inuvik Water Treatment Plant Upgrades - Design Brief***

Please find enclosed the Design Brief for the Town of Inuvik Water Treatment Plant Upgrades project.

Should you have any questions or require any additional information, please contact me via email mbutler@dillon.ca or by telephone (506) 633-5000.

Yours truly,

DILLON CONSULTING LIMITED

Mark Butler, P. Eng.
Project Manager

Our File: 12-6732

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# 1.0 BACKGROUND

The Town of Inuvik (Town) owns and operates the community's potable water supply, treatment and distribution systems on a year round basis. The existing treatment infrastructure has reached its lifecycle span and is need of significant upgrades. This purpose of this project is to provide the Town with a new and/or upgraded water treatment facility that is reliable, cost effective, operations friendly, has sufficient capacity to support growth, and meets or exceeds drinking water standards. The Town would prefer a system that is operable from a single source on a year round basis.

Currently, there are two (2) raw water sources that the Town utilizes for domestic consumption: the East Channel of the Mackenzie River, and a lake designated as Lake B, located approximately three (3) miles east of the town site. Prior to 1973, all of the Town's water was supplied from the East Channel. In the fall, as soon as the ice was strong enough to support a portable insulated pump house, a pump was installed to provide water to the distribution system. Excess water was pumped to Hidden Lake to be stored at Hidden Lake. In the spring (around May) when the ice started to melt, the pumps and pump house were removed from the channel and the source of supply was switched over to Hidden Lake filled with water from Lake B (still the practice today).

With continued growth in the 1970s, Hidden Lake's storage capacity was not sufficient to store the quantities of water required to satisfy demands through the warmer months. In 1973, a three (3) mile long un-insulated steel pipeline was constructed to convey raw water from Lake B to Hidden Lake and to provide an adequate supply. The Lake B water supply is conveyed with pumping to Hidden Lake through an un-insulated, above-ground (200 mm/150 mm diameter) steel pipeline for storage and use. Hidden Lake is used only as a storage reservoir, as the contribution to water supplies from its catchment area is insignificant.

During the ice break-up period in the spring, and in the fall during a freeze-up period, the Town relies entirely on the storage capacity of Hidden Lake as the pump houses in the East Channel and Lake B are unable to be effectively operated.

The Hidden Lake WTP (HWTP) consists of a pump house with two vertical turbine pumps (with provisions to add a third), and a transmission main through the existing utilidor to the treatment building. Within the building, water treatment consists of water tempering, followed by chlorine

disinfection and storage. Currently, no filtration or other water treatment is being provided at the HWTP.

## 1.1 East Channel Water Treatment Plant

The East Channel Water Treatment Plant (WTP), first constructed in 1979, treats water from the East Channel during periods of ice cover from mid to late October to mid to late May. The WTP consists of water tempering to heat the raw water, followed by up-flow rapid sand filtration, chlorination, and fluoridation. Water is supplied to the plant via a 200mm insulated raw water line (main) from the riverbank to the plant. The existing configuration (submersible pump and pump house) was considered to be a temporary solution until a permanent intake was constructed at a "future" date.

The existing East Channel WTP building consists of a 223 $m^2$ (2,400 $ft^2$) insulated metal envelope with a concrete floor constructed on treated wooden piles. The existing water treatment process includes:

- Tempering the raw water through dual heat exchangers;
- Pre-treatment with chlorine;
- Filtration through rapid sand media filters;
- Chlorination to provide residual chlorine; and,
- Fluoride addition using a chemical feed system and hydrofluosilicic acid from a drum.

The piping and process equipment were constructed and installed with provisions for a "future" extension of the plant to include flocculation and sedimentation clarifier for year-round operations. The plant was designed for a capacity of 60 L/s (950 USGPM) at full build-out, to service an estimated ultimate population of 10,000. The current raw water pumping capacity is limited to approximately 36 L/s (or 570 GPM).

The raw water quality is subject to high turbidity and suspended solids peaking in the spring (May) during the ice break up, and decreasing throughout the summer until the East Channel freezes over and the sediment begins to settle again as the current slow in the late fall season (around November).

## 1.2 Hidden Lake/Lake B Water Treatment Plant

The Hidden Lake/Lake B water treatment plant was constructed in 1973 with the intake structure being reconstructed in 1978 due to ice damage. Lake B water is currently pumped to Hidden Lake for storage, using a 75 HP pump at Lake B through an approximately 5,275 m long (3.25 mile) 150 mm/200 mm raw water welded steel pipeline. The pump is designed for a capacity of 600 USGPM (37.9 L/s) to lift the water to a 19 $m^3$ (5,000 gallon) capacity head tank at the top, then flow by gravity to Hidden Lake through the remaining pipeline.

At Hidden Lake, a second floating pumping station, consisting of two vertical turbine pumps (rated at 39 L/s), transfer water to the Hidden Lake water treatment plant (HWTP) where treatment consists of water tempering system with recirculation pumps, disinfection with chlorine 34 $m^3$ (9,000 gallon) capacity chlorine contact tank, and transfer pumps to pump the water into the 0.5 MG finished water reservoir. The existing storage reservoir was replaced in 1976, along with construction of a new valve house. The plans also indicate that a second finished water reservoir of 0.5 MG capacity was to be constructed at a future date.

## 1.3 Heat Recovery System

In 1998-1999, the Town constructed a hot water tempering system for the potable water at the EWTP, and for the municipal utilidor, using the residual heat recovery system from the NWT Power Corporation (K-Plant). This project also included construction of two unit heaters for heating of the plant space. The secondary side of one heat exchanger provides tempering of the incoming raw water from the East Channel. The secondary side of the second unit heat exchanger provides tempering of the water in the distribution system through in-line water recirculation pumps. A second project consisted of providing a high temperature water system, using two fuel-oil fired boilers, for space heating of the Hidden Lake WTP pump house, WTP, and associated utilidors, as well as heat to maintain adequate water tempering of the potable water circulation system using a process heat exchanger. The existing heat recovery system will be implemented into the WTP upgrades.

# 2.0 POPULATION PROJECTIONS AND WATER DEMAND

This section provides a summary of historical data and population projections, water demands, and general design criteria that will be used throughout the design of the water treatment plant upgrades.

## 2.1 Population Projections

The basis for the population data for the Town of Inuvik is obtained from a detailed report titled, "Town of Inuvik Unit Cost of Water, 2006" that was prepared by Earth Tech Canada Inc., February 2008. The data as summarized in the previous report projects a population of 5,242 people for the year 2026.

The previous population data from this study was reviewed and based on these population growth patterns, the population for years 2010 to 2012 were calculated to better understand the correlation with water demand. Population projections provided by Statistics Canada for the period from 2016 to 2026 were used to project population in the design horizon year.

Assuming the same projected rate of growth used by Bureau of Statistics Canada (1.5% annual average) going forward from year 2026 to year 2036, results in a population of 6,082 persons for year 2036.

The original plant design was based on anticipated population of 10,000 people anticipated from local oil and gas exploration development within the Gwich'in Settlement area including the Town of Inuvik. Based on Statistics Canada data and the current economic growth, the population for the year 2036 was used as the basis for design.

## 2.2 Water Demand and Design Criteria

Water consumption data for the period between February 2010 and May 2012 indicated that the annual average daily flow increased from 1,542 $m^3$/day (year 2010) to 1,869 $m^3$/day (through May 2012). This equates to an increase from 374 L/cap-d to an estimated 439 L/cap-d based on population estimates. This increase is believed to be attributed flushing of water mains in order to maintain water quality and chlorine residual in the distribution system and pumping finished water to fill the Hidden Lake reservoir during the seasonal switch over. As a result, average day

demand for year 2016 and beyond will be adjusted to match the average demand realized in 2012 (439 L/cap-d).

Using the projected per capita demand for the design horizon year 2036, the population and demand criteria to be used for year 2036 are as follows:

| | |
|---|---|
| Population: | 6,082 |
| Average Day Demand, ADD: | 30.9 L/s (2,669 $m^3$/d) |
| Maximum Day Peaking Factor: | 2 |
| Maximum Month Daily Demand, MMDD: | 61.8 L/s (5,338 $m^3$/d) |

Supporting data is presented in **Tables 2-1 and 2-2** in **Appendix A.**

# 3.0 RAW WATER SUPPLY

This section provides the summary of the raw water supply source, water quality and jar testing program and its results.

## 3.1 Source

Mackenzie River - East Channel will be the primary and year around raw water source for the Town. Hidden Lake/Lake B will be used as the back-up/emergency water source in any case where access to the Mackenzie River – East Channel WTP.

## 3.2 Water Quality

Historical raw water quality data for the Mackenzie River – East Channel from 2001 to 2008 is presented in **Table 3-1** in **Appendix A.** This data was used as the baseline for the design for the proposed new treatment system and process improvements at the East Channel WTP.

## 3.3 Jar Testing Program

A jar testing program was conducted by Dillon during the initial site visit in September 2012. Following Dillon's site visit, the Town personnel continued to run jar tests for two (2) weeks to

obtain additional jar testing data for the analysis. This additional data and information was included in the summary of the jar test results.

The purpose of the jar test program was to assess the water quality and characteristics of the raw water supply source, and to determine:

- The suitability of limited samples of flocculants and coagulants on the raw water source supply; and,
- If typical coagulants and flocculants are effective in obtaining settled water quality suitable for filtration based on the results of settled water turbidity.

A total of thirty seven (37) initial jar tests were run to determine optimal dosage and mixing conditions for achieving settling in the pre-treatment process step, using both coagulant (PACl) and coagulant aid (polymer) for raw water samples containing low, medium and high turbidity. One (1) type of coagulant, Polyaluminum Chloride (PACl), and two (2) coagulant aids (polymers) were used: one (1) anionic (negative charge) Flocbond TB30AE polymer, and one (1) cationic (positive charge) Flocbond TB54HC polymer, both supplied by SNF-Floerger. Note that only floc settling was used to determine the pre-sedimentation process requirements; there was no filtration of the water samples before analysis. A number of factors and conditions affecting the optimization of the coagulation and flocculation stages were varied during the tests (see **Table 3-2 of Appendix A**).

Based on the observations and results of the initial jar tests, the anionic polymer provided better floc formation compared to the cationic polymer. It was noted that the stage and timing of the coagulant and coagulant aid injections did not provide any additional benefit for floc formation. Raw water temperature did not seem to affect the speed of coagulation, the size of floc formation, or the settling rate. The water quality results that provided the required pre-treatment turbidity levels for filtration (< 5 NTU) were best observed when the following coagulation and flocculation conditions were used:

- 40 seconds of rapid mixing;
- 5 minutes of slow agitation;
- PACl dosage of 1.5 – 3 mg/L (5 – 10 mL); and,
- Anionic polymer dosage of 0.6 mg/L (5 mL).

These conditions were further investigated by the Town fluctuating two different PACl dosages and inlet water temperatures. The average jar test conditions of the un-filtered, settled water following coagulation and settling stages are shown in **Table 3-3 of Appendix A.**

# 4.0 OVERVIEW OF WTP UPGRADES

Upgrades to the Town's WTP facilities will incorporate modifications to the general arrangement of the existing East Channel WTP building along with the construction of a new WTP building. Features for the proposed upgrades to the East Channel WTP include:

- Raw water intake systems for both winter and summer operation;
- Raw water pump station at Mackenzie River - East Channel;
- New utilidor from new raw water pump station to existing utilidor connecting to the existing East Channel WTP building;
- Architectural, structural and mechanical modifications to the existing building in terms of additional space and/or rooms for the chemical systems, office, laboratory and washroom;
- New building to house new water treatment process including a connecting link to the existing WTP building;
- New water treatment process including associated new chemical systems, blower system, chlorine contact tanks, wastewater system and distribution pumps;
- Upgrades to mechanical systems including raw water tempering system and heating systems; and,
- Upgrades to electrical, control and monitoring systems.

Raw water will be transferred from Mackenzie River - East Channel via two (2) vacuum prime centrifugal pumps that will be located in the new East Channel pump station. A new utilidor will be constructed running along the East side of River Road that will connect to the existing utilidor to transfer water from the East Channel to the East Channel WTP. Similar to the previous operation, the raw water entering the East Channel WTP will be heated before proceeding to the new water treatment process. Based on the raw water characteristics of the East Channel raw water supply and the results of the jar testing program, the new water treatment process will consist of flocculation, coagulation, sedimentation/clarification, filtration, disinfection and fluoridation.

The new process treatment train tanks will be of common skid and constructed of ASTM A-304 stainless steel welded construction. The components and the top of the new treatment train tanks will be accessible via access stairs and platforms conforming to the specifications. The new chlorine contact and wastewater storage tanks will be constructed of glass infused to steel.

The main process equipment was tendered in early 2013 and is currently being designed and fabricated by Veolia Water Solutions and Technologies Canada. Process schematics for the proposed system are included in **Appendix C**.

## 4.1 Water Treatment Objectives

The water treatment process will be designed to provide potable water free of all pathogenic organisms, making it safe for human consumption. The water treatment process will be designed to meet the limits as specified in Health Canada's Guidelines for Canada Drinking Water Quality (GCDWQ). In general, the treatment objectives include:

- Removal of naturally organic compounds to reduce colour and reduce potential formation of disinfection by-products (DBPs);
- Reduction in turbidity to assist with disinfection;
- Stabilization of the finished water pH to control aluminum residuals;
- Disinfection; and,
- Continuation of the existing fluoridation program.

The new water treatment plant will produce potable water that will meet the GCDWQ limits as specified in the table below.

| Water Quality Parameter | Units | Performance Requirement |
|---|---|---|
| Turbidity | NTU | < 0.1 |
| Total Dissolved Solids, TDS | mg/L | < 500 |
| pH | pH units | 6.5 – 7.2 |
| pH (post chlorine contact tank) | pH units | 8.0 – 8.5 |
| True Colour | TCU | < 5 |
| Aluminum, Dissolved | mg/L | < 0.1 |
| Iron, Dissolved | mg/L | < 0.3 |
| Lead | mg/L | < 0.01 |
| Manganese | mg/L | < 0.05 |
| Hardness (as CaCO3) | mg/L | < 200 |
| Alkalinity (as CaCO3) | mg/L | > 40 |
| Dissolved Organic Carbon, DOC | mg/L | < 4.5 |
| THMs | mg/L | < 0.1 |
| Enteric Viruses | Min. 4-log reduction and/or inactivation | |
| Protozoa: *Giardia* and *Cryptosporidium* | Min. 3-log reduction and/or inactivation | |
| *Meet all other quality parameters outlined in GCDWQ | | |

## 4.2 Raw Water System

### *4.2.1 Storage*

There will be no raw water storage at the Mackenzie River – East Channel water treatment facility. The existing raw water storage located at Lake B/Hidden Lake will continue to be used as a backup raw water source in the case of an emergency. Long-term plans for emergency back-up supply are being investigated.

### *4.2.2 Intake Screen and Pipe*

A new year round intake screen and pipe system will be constructed in the Mackenzie River - East Channel which will include:

- A half size, wedge wire intake screen that meets the requirements as stated in the Department of Fisheries and Oceans (DFO) Freshwater End-of-Pipe Fish Screen Guideline;
- Intake casing and pipe complete with insulation and heat trace system; and,
- Flushing system for the intake screen, casing and pipe.

The existing winter intake screen and pipe system will remain available in the vent of problems with the new intake screen. This system consist of an insulated HDPE pipe complete with heat trace cable, submersible intake pump, intake screen and building enclosure located on a portable skid. The Town is considering fabricating a more robust barge-type of system that can serve as a back-up to the new pump house and intake.

### *4.2.3 Pump Station*

A new raw water pump station will be constructed on the south east corner of Duck Lake. The raw water pump station will house the following components:

- Two (2) raw water pumps, one duty one standby, rated for 100% of the max day flow rate including the associated piping, valves, instrumentation and controls for the operation of raw water pumps;
- Intake pipe heat trace system including heat trace controllers;
- Flushing system (blower) for the intake pipe and screen;
- Building control and operations;
- Electrical power supply and local control panels; and,
- SCADA telemetry to the East Channel WTP building.

There will also be a weather proof connection located on the raw water pump station to connect the winter operation intake pipe, submersible pump and heat trace cable.

### *4.2.4 Tempering*

A new heat exchanger system, located in the mechanical room of the existing WTP building, will replace the existing heat exchanger system used to heat the raw water prior to it entering the water treatment process. The raw water entering the plant will have an average temperature of 0.5ºC and will be heated to 8 – 9ºC.

## 4.3 Water Treatment Process

The treatment of the raw water will be achieved using a conventional treatment system with disinfection. The treatment system will consist of pH adjustment, coagulation, flocculation, and clarification/sedimentation, filtration, disinfection, fluoridation, corrosion control, treated water storage, and pumping.

There will be a total of three (3) treatment trains, each rated for a net design flow rate of 30.8 L/s (2,669 $m^3$/d). Each treatment train will consist of one (1) Actiflo®™ unit and one (1) Dusenflo™ unit. The Actiflo®™ unit will contain the coagulation, flocculation and clarification/sedimentation processes, each process housed in a separate tank compartments. The Dusenflo™ will contain the dual media rapid sand filtration process. All equipment and valves associated and contained on specific the Actiflo®™ and Dusenflo™ unit for a treatment train will be control by that individual treatment train's PLC which will be in communication with the main plant's PLC.

### *4.3.1 Coagulation*

Coagulation process involves the introduction of a coagulant such as polyaluminium chloride (PACl) and/or alum to the raw water which will assist with the creation of flocs by destabilizing the particles within the raw water. When coagulants with an opposite charge of that of the particles are added to the raw water, the negative charges on the dispersed solids are neutralized. Once the particles are neutralized, they are capable of sticking together to create flocs. This coagulation process will be a two stage process with a coagulation tank and an injection tank designed to provide the capacity for proper mixing of the coagulant and the raw water. The PACl will be injected into the raw water pipeline prior to entering the coagulation tank. The coagulation tank will overflow into the injection tank. Here the suspended particles in the raw water will begin to collide with and attached to the coagulant. Each tank is equipped with a turbine type mixer with inclined blades that will provide the mechanical mixing to assist with creating a homogenous solution and increasing the number of collisions between the coagulant and suspended particles. The mixing rate will be rapid. Duration will be short; the retention time in both the coagulation and injection tank will be approximately 2 minutes.

### *4.3.2 Flocculation*

Flocculation process involves the formation of flocs through the continual mixing, typically slower than that observed in the coagulation stage of the process, of the raw water and coagulant. Here is where the formation of the flocs will occur. A coagulant aid such as a high molecular weight polymer will be added during this stage. The polymer will assist with bridging, binding, and strengthening the floc as well as add weight and increase the settling rate. Flocculation will occur in the maturation tank. The maturation tank will contain a mixer that will provide slow mixing for the flocs to form and stick together to create larger flocs. The detention time in the maturation tank will be around 6 minutes. The maturation tank overflows will overflow into the clarification tank.

### *4.3.3 Clarification*

Clarification and/or sedimentation process involves the use of microsand to settle out the coagulated particles/flocs contained in the raw water created in the coagulation and flocculation stages. The clarification tank with a V-shaped hopper bottom will contain a scrapper to circulate the mircosand within the tank and collect the solids. Two (2) microsand recirculation pumps (1 duty, 1 standby) will transfer the excess microsand from the bottom of the tank back to the injection tank. The clarified water will overflow into a trough and flow by gravity to the filtration stage, Dusenflo™ filtrer units. The settling rate is approximately 37.4 m/h.

### *4.3.4 Filtration*

In the filtration process, the remaining suspended solids still contained in the water leaving the clarification process of the Actiflo®™ unit will be removed by passing the water through a filter media. The filtration system, Dusenflo™, will be a dual-media gravity type of filtration. Each filter will consist of one (1) filter compartment with an overall surface area of 13.9 $m^2$ (149.6 $ft^2$) containing 300 mm of sand and 450 mm of anthracite. Over time, the solida removed from the water will build up in the filter media, reducing the removal efficiency within the filters. The Dusenflo™ filter units will have an AWI type underdrain system that will provide a combined water and air backwashing of the filter media. Backwash pumps and air blowers will provide the required backwash water and air flow rates to remove the built up suspended solids being removed from the filter units. There will be automatic control valves for the influent, effluent, backwash, rinse and air scour pipelines. The design parameters of the Dusenflo™ filter units are listed in table format below.

| Parameter | Value |
|---|---|
| Filter Surface Loading Rate | 5.6 m/h - 8.4 m/hr |
| Backwash Water Flow Rate | 40 m/hr |
| Air Scour Blower Rate | 815 $m^3$/hr @ 4 psi |

## 4.4 Chemical Feed Systems

There will be a total of five (5) chemical feed systems that will be used in the water treatment process. These are:

- Coagulant for raw water and micro-coagulant;
- Sodium hydroxide;

- Polymer;
- Fluoride; and,
- Chlorine.

The feed and storage tanks for each chemical will be constructed of polyethylene and/or other corrosion resistant materials for that particular chemical. Each chemical feed system will consist of a mixing/preparation tank, feed/holding tank, metering pumps and flow paced controllers to feed chemicals based on the process operating conditions. The chemical metering pump skids will be designed to dose the required chemical at the desired process flow operating conditions. If the process operating conditions change, the metering pumps will be adjusted to the new flow rate.

### *4.4.1 Coagulant*

Coagulant will be injected into the raw water pipe line entering each of the treatment trains and in each of the Dusenflo™ filtration units. The coagulant feed system will consist of the following components:

- One (1) 2 $m^3$ coagulant feed storage tank;
- One (1) coagulant pump skid, containing three (3) metering pumps for dosing coagulant into the raw water for the Actiflo®™ units; and,
- Three (3) wall-mounted coagulant metering pumps for dosing coagulant into the injection tanks of the Dusenflo™ units; and,
- Associated piping, valves, instrumentation and controls.

The coagulant feed storage tank will hold sufficient coagulant solution for approximately one (1) month and one (1) week based on the anticipated winter and spring dosage rates, respectively.

### *4.4.2 Sodium Hydroxide*

The sodium hydroxide, or caustic soda, will be feed into the water treatment process in two (2) locations: (1) Raw water pipe line; and, (2) Potable water following the chlorine contact tank.

The sodium hydroxide system will be used to consist of the following components:

- One (1) 2 $m^3$ sodium hydroxide storage tank;
- One (1) sodium hydroxide pump skid, containing three (3) metering pumps (2 duty, 1 standby) for dosing into the raw and potable water; and,

- Associated piping, valves, instrumentation and controls.

The sodium hydroxide storage tank will hold enough 50% solution of sodium hydroxide for an operation period of one (1) month.

### *4.4.3 Polymer*

Polymer will be added to the water treatment process at the coagulation process to assist with the formation of the floc. The polymer system will be an automatic system where dry polymer will be mixed with service water to create a polymer feed solution prior to it being injected into the injection tank.

### *4.4.4 Fluoride*

A new fluoride metering pump skid will be supplied as a part of the upgrades to existing building. The fluoride will be pump directly from the 210 L (45 gallon) chemical drums. Both the fluoride pump skid and chemical drums will be housed in a new fluoride room located in the modified existing East Channel WTP building.

### *4.4.5 Chlorine*

The existing gas chlorine system consisting of chlorine gas cylinders and two (2) chlorinators that feed chlorine into the treated water before it enters the chlorine contact tanks and will be utilized which will feed the chlorine into the treated water. There will be no upgrades or modifications to the chlorination dosing system, with the exception of the control integration of the chlorinators within the new main plant PLC.

## 4.5 Treated Water System

### *4.5.1 Storage*

The two (2) chlorine contact tanks, located in lower section of the new East Channel WTP building, will have the sufficient volume storage capacity for chlorine contact time for the inactivation of viruses and Giardia and for the backwashing of the filters. The main treated water storage will remain at the water reservoir at the Hidden Lake WTP. There will be no modifications to the Hidden Lake water storage tank system, however, it is anticipated that an additional treated water storage tank at Hidden Lake will be required in the future.

### *4.5.2 Distribution Pumps*

The existing distribution pumps will be replaced by three (3) new distribution pumps that will be designed to transfer the potable water stored in the chlorine contact tanks to the treated water storage tank located at Hidden Lake/Lake B. The new distribution pumps will be controlled and operated by the main plant PLC located in the new electrical room located in the vestibule area.

## 4.6 Wastewater System

The wastewater system will consist of the following components:

- Two (2) 75 $m^3$ wastewater storage tanks;
- One (1) sump pit including pump; and,
- Two (2) wastewater pumps (1 duty, 1 standby) including associated piping, valves and instrumentation.

The wastewater generated from the backwashing of the filters and collected in the sump pit will be sent directly to the wastewater storage tanks. The wastewater collected and stored in the wastewater storage tanks will be pumped to the Town's wastewater treatment facility via sanitary mains and the wastewater pumps. The wastewater pumps will not exceed a pumping rate of 4.2 L/s to accommodate entrance into the existing sanitary force-main to the sewage treatment facility. Filter-to-rinse wastewater generated following the backwashing of the filter units will be disposed of directly to Duck Lake via the existing wastewater discharge pipe. The filter-to-rinse wastewater stream will only contain suspended solids and no chemicals.

## 4.7 Backwash Water Supply System

The required water for the backwashing of the filters will be drawn from the chlorine contact tanks via the backwash water pumps. There will be two (2) backwash water supply pumps (1 duty, 1 standby) that will transfer the water from the chlorine contact tanks to each of the Dusenflo® filter units.

## 4.8 Blower System

Air for the backwashing of the Dusenflo® filter media will be supplied by two (2) blowers (1 duty, 1 standby). Each of the blowers will be enclosed in an acoustical enclosure.

## 4.9 Mechanical Systems

### *4.9.1 Raw Water Tempering*

A new heat exchanger system will replace the existing heat exchange to heat the raw water entering the building prior to treatment.

### *4.9.2 Domestic and Service Water*

Domestic and service water system will consist of a water heater, domestic water pumps and associated valves, instrumentation and controls. Only the service water for the sodium hydroxide/caustic soda and polymer feed systems will need to be heated to 20ºC. All other service water will be at room temperature.

### *4.9.3 Heating, Ventilation and Air-Conditioning*

There will be a new air recovery unit for the new East Channel WTP building. Two (2) new dual fuel (natural gas and diesel fuel) boilers will provide space heating to both buildings. New ventilation will be added to the chlorine and fluoride room as per the Canada Building Code.

## 4.10 Electrical and Plant Control Systems

### *4.10.1 Power*

The main power will be supplied by the power transmission line from the Town's power plant. Back-up and emergency power will be supplied by a generator unit rated to keep the major and key equipment in operation during power outages.

### *4.10.2 Lighting*

The lighting in the existing East Channel WTP will be removed and replaced with new florescent lights as per the general arrangement layout of the new chemical and mechanical rooms located in the existing WTP building space.

### *4.10.3 Main Plant and Treatment Train Control*

There will be a main plant PLC that will be located in the new electrical room of the vestibule area. The main plant PLC will control and operate all sub-components that are not directly related to the operation of each treatment train which includes the caustic soda metering pumps, chlorine metering pumps and distribution pumps. Each water treatment train will have its own micro-PLC and will communicate with the main plant PLC. Each package plant will be capable

of independent operation should the main plant PLC fail. A cascade operational procedure will be provided. The local treatment train PLCs will allow for the automatic operation should the main plant PLC fail. This procedure will also allow for "smart" analyzers and instrument to take over process control upon the loss of the Main PLC. For example, this would include the chlorine analyzer operating the primary chlorine disinfection dosage. Full manual control will also be possible on all equipment functions.

## 4.11 Building Structure and Envelope

Upgrades to the water treatment process/system will require an expansion to the existing building envelope due to the limited floor space available in the existing building. The building envelope upgrades will include both modifications to the existing building as well as construction of a new building. General layout drawings of the modified existing building and the new building are included in **Appendix C**.

### *4.11.1 Existing Building*

It is proposed that the existing building be re-utilized in its current condition as much as possible and continue to serve as the main access point to the facility. The upgrades to the existing building will include:

- Demolition and removal of any equipment, piping, mechanical and electrical systems that are no longer required;
- Access to proposed building expansion;
- Construction of a new office space including vestibule, and washroom;
- Construction of a new mechanical room;
- Construction of a new fluoride room;
- Construction of a new sodium hydroxide/caustic soda room;
- Construction of a new space for coagulant and polymer systems;
- Upgrades to the existing mechanical systems including heat exchangers and boiler system; and,
- Upgrades to the plant PLC.

### *4.11.2 New Building*

The new connecting link and building addition to existing East Channel WTP will house the new electrical room, new water treatment trains, chlorine contact tanks, wastewater storage tanks, air

blower system, wastewater pumps, backwash water pumps, distribution pumps and associated valves, instrumentation and control panels.

The new WTP building will be dual level, steel framed structure, 20 m by 30 m, with an approximate overall area of 600 $m^2$. The lower section of the new building will house the chlorine contact tanks, wastewater storage tanks, wastewater pumps, distribution pumps and backwash water pumps with the upper section housing the new Actiflo®™ and Dusenflo™ treatment units, air blowers and associated treatment trains PLCs. The lower section will be accessible from the upper level via a staircase. The floor of the upper section will be a reinforced concrete slab at the same elevation as the existing WTP floor, supported by a pile foundation, with an open space between the bottom of the slab and the ground below. The building structure will consist of pre-engineered steel frames providing a clear span and roof line to match the existing building with galvanized girts to support the roofing system.

The underside of the floor will be insulated to RSI 3.5 by rigid insulation clad with plywood. The wall construction will consist of exterior pre-finished galvanized metal cladding on the exterior, supported by galvanized steel girts and sub framing to provide a cavity for 250 mm of fibre glass blanket insulation (RSI 5.3), and faced on the interior with pre-finished metal liner panels with sealed joints as the vapour retarder. The roof will be constructed of prefinished galvanized steel roofing secured with concealed clips, supported by galvanized steel girts and sub framing to provide a cavity for 300 mm of fiberglass blanket insulation (RSI 7.0), and faced on the interior with pre-finished metal liner panels sealed at the joints for the vapour retarder.

Windows will be fixed, triple glazed sealed units in fibre glass frames. Overhead doors will be embossed pre-finished galvanized steel sheets with foam core to achieve RSI 2.1, weather seals and chain lift operation. Personnel doors will be galvanized hollow metal with 18 ga face sheets, insulated cores, and sealed double glazed vision lites. Door frames will be 16 ga, galvanized steel incorporating thermal breaks. Weather stripping, door seals and thresholds will be provided. Perimeter doors will be provided with emergency release hardware and exterior handles with keyed locks.

Interior floor slabs will be painted with epoxy floor enamel over a light broom finish surface. Exposed structural steel, doors and frames will be painted. Access platforms and stairs will be constructed from aluminum tubes and structural sections with aluminum grating treads and

landings. Interior partitions and suspended ceilings at the laboratory will be constructed of light gauge metal framing with painted drywall finish.

All electrical and mechanical systems will be constructed as per the Canada National Building Code and designed in accordance with industry best practices for Northern water treatment facilitates.

# 5.0 CONSTRUCTION AND COMMISSIONING CONSIDERATIONS

## 5.1 Proposed Construction Schedule

Construction of the modifications to the existing East Channel WTP and new WTP building is anticipated to begin in late 2013 and be completed by December 2014. The intent is that the construction of the upgrades to the East Channel WTP will be completed during the time period when the Hidden Lake WTP is in operation and the East Channel WTP is offline (mid-late May 2014 to mid-October 2014). The new East Channel WTP building will be constructed prior to any upgrades and modifications to the existing building is started. The new water treatment trains must be capable of manual production by mid October 2014, with controls and full integration to be completed by December 2014.

The construction of the intake system, East Channel raw water pump station and raw water utilidor connection to the East Channel WTP can proceed almost independently of the East Channel WTP construction schedule. These components will be constructed between late 2013 and late spring/early summer 2014.

Proposed construction schedule is shown in **Appendix D**.

## 5.2 Temporary Potable Water Supply

During the construction of the new East Channel WTP building, potable water will be supplied to the residents of Inuvik from Hidden Lake WTP from mid to late May 2014 to mid-October 2014. As stated above, it is intended that the new water treatment process at the East Channel WTP be completed and be manually operational by mid-October 2014. However, if there are delays in construction, the temporary East Channel pump station connection point will be left intact to allow for raw water from East Channel to be treated manually at the new water treatment process beyond mid-October 2014 while construction is being completed.

# Appendix A

Supporting Documents and Tables

Table 2-1
Town of Inuvik
Summary of Water Consumption Data, 2010-2012
Dillon Project 12-6732

Year 2010 Water Demand

| Month | Total Use | Daily Demand, m3/d | | |
|---|---|---|---|---|
| | | min | max | max, L/s |
| January | | | | |
| February | 47,250 | 1,180 | 2,060 | 24 |
| March | 48,440 | 1,230 | 2,160 | 25 |
| April | 60,076 | 1,180 | 2,440 | 28 |
| May | 42,053 | 1,024 | 1,719 | 20 |
| June | 39,404 | 1,055 | 1,732 | 20 |
| July | 38,659 | 1,054 | 1,505 | 17 |
| August | 36,533 | 895 | 1,678 | 19 |
| September | 37,300 | 1,410 | 1,871 | 22 |
| October | 47,223 | 1,095 | 2,010 | 23 |
| November | 50,233 | 1,095 | 2,019 | 23 |
| December | 67,930 | 1,850 | 2,710 | 31 |
| Year Total Demand, $m^3$ | 515,101 | | | |
| Minimum Month Average Day, $m^3$/day | | 895 | | |
| Year 2010 Average Day, $m^3$/day | 1,542 | | | |
| Maximum Month Average Day, $m^3$/day | | | 2,710 | 31 |

Year 2011 Water Demand

| Month | Total Use | Daily Demand, m3/d | | |
|---|---|---|---|---|
| | | min | max | max, L/s |
| January | | | | 0 |
| February | | | | 0 |
| March | | | | 0 |
| April | 62,358 | 1,280 | 2,820 | 33 |
| May | 69,786 | 1,422 | 3,110 | 36 |
| June | 41,753 | 691 | 2,077 | 24 |
| July | 38,611 | 1,005 | 1,656 | 19 |
| August | 46,053 | 714 | 3,076 | 36 |
| September | 65,471 | 831 | 2,830 | 33 |
| October | 49,072 | 1,020 | 2,109 | 24 |
| November | 55,527 | 1,344 | 2,342 | 27 |
| December | 51,410 | 1,010 | 2,000 | 23 |
| Year Total Demand, $m^3$ | 480,041 | | | |
| Minimum Month Average Day, $m^3$/day | | 691 | | |
| Year 2011 Average Day, $m^3$/day | 1,745.60 | | | |
| Maximum Month Average Day, $m^3$/day | | | 3,110 | 36 |

Table 2-1
Town of Inuvik
Summary of Water Consumption Data, 2010-2012
Dillon Project 12-6732

Year 2012 Water Demand

| Month | Total Use | Daily Demand, m3/d | | |
|---|---|---|---|---|
| | | min | max | max, L/s |
| January | 53,270 | 1,050 | 2,510 | 29 |
| February | 53,680 | 1,490 | 2,200 | 25 |
| March | 57,580 | 1,650 | 2,230 | 26 |
| April | 60,000 | 1,300 | 2,570 | 30 |
| May | 62,750 | 1,492 | 2,800 | 32 |
| June | 52,879 | 1,525 | 2,142 | 25 |
| Year Total Demand, $m^3$ | 340,159 | | | |
| Minimum Month Average Day, $m^3$/day | | 1,050 | | |
| Year 2012 Average Day, $m^3$/day | 1,869 | | | |
| Maximum Month Average Day, $m^3$/day | | | 2,800 | 32 |

Notes:

1. Historically, the high meter readings for April and May indicate that East Channel plant is being used to fill the Hidden Lake to prepare for switch over of water supply in the summer months.

2. Plant average and peak water demand readings are higher for 2011 and 2012 possibly due to a change in operations practices to bleed some water at dead end mains to maintain chlorine residuals in the distribution system.

Table 2-2
Town of Inuvik Water Treatment Plant Improvements
Projected Population and Water Demand
Dillon Project 12-6732

| | Units | Historical Population [1] | | Water Consumption and Demand Data (refer to Table 2-1) [5] | | | Projected Population [1,4] | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | | 2006 | 2009 | 2010 | 2011 | 2012 | 2016 | 2026 | 2036 [2] |
| Population (projected population) | # pop | 3586 | 4051 | 4119 | 4187 | 4255 | 4533 | 5242 | 6062 |
| Qave (year 2006), ML/d [3] | ML/d | 1.31 | 1.48 | 1.54 | 1.75 | 1.87 | 1.99 | 2.30 | 2.66 |
| Peaking Factor | | | | | | | 2.00 | 2.00 | 2.00 |
| Qmax mo-ave. day (year 2006),ML/d [3] | ML/d | 1.56 | 1.76 | 2.71 | 3.11 | 2.80 | | | |
| Qmin month (2006), ML/d [3] | ML/d | 1.12 | 1.26 | 0.89 | 0.69 | 1.05 | 1.05 | 1.05 | 1.05 |
| Per Capita Aveage, L/cap-d [3] | L/cap-d | 365 | 365 | 374 | 417 | 439 | 439 | 439 | 439 |
| Per Capita Consumption, Max Month, L/cap-d [3] | L/cap-d | 435 | 435 | 658 | 743 | 658 | 686 | 686 | 686 |
| Qave- projected, ML/d | ML/d | | 1.48 | | | | | | |
| Qmax mo-ave day, projected ML/d | ML/d | | 1.76 | | | | 0.00 | 0.00 | 0.00 |

Plant Water Treatment Design Criteria

| | Units | Design Year 2016 | 2026 | 2036 |
|---|---|---|---|---|
| Qmax Design, ML/d | ML/d | 3.98 | 4.60 | 5.32 |
| Qmax, L/s | L/s | 46.1 | 53.3 | 61.6 |
| Qave, L/s | L/s | 23.0 | 26.6 | 30.8 |
| Qmax, GPM | USGPM | 730 | 844 | 976 |
| Qmax, MGD | USMGD | 0.52 | 0.60 | 0.70 |

| | Units | Year 2036 Projected Capacity | Recommended Design Criteria |
|---|---|---|---|
| | L/s | 61.6 | 77.0 |
| Design Criteria (to meet | m3/d | 5322 | 6653 |
| Maximum Day Demand) | USGPM | 976 | 1220 |
| | USMGD | 1.41 | 1.76 |

Table 2-2
Town of Inuvik Water Treatment Plant Improvements
Projected Population and Water Demand
Dillon Project 12-6732

Notes:

1 Population Data and projections -Town of Inuvik Unit Cost of Water, 2006-Earth Tech Canada Inc., February 2008.

2 Dillon projected population year 2036 is equal to Bureau of Statistics' 1.5% annual avg. growth rate applied to 2026 projections.

3 Water Demand projections are based on per capita consumption data for minimum, averge and maximum month provided in Earth Tech Canada February 2008 report.

4 Earthtec Canada population projections provided in the 2008 study are based on Bureau of Statistics Canada growth rates for 2016 and 2026.

5 The water demand increase for 2011 and 2012 is attributed to operational changes requiring bleeding of dead end mains to maintain chlorine residual (telecon with Rick Campbell, 09/28/2012), and includes filling of the Hidden Lake during switch over from winter to summer operations. The flow data for 2011 and for 2012 average and maximum daily flow per capita were adjusted to match 2010-2012 averages to project 2016-2036 future water demand, based on this information.

Table 3-1
Inuvik WTP
Water Quality Design Criteria
Dillon Project 12-6732

| Parameter | Units | Observed Range, Inuvik East Channel Raw WQ Data 2001-2008 Max | Min | Ave | Inuvik WTP Drinking Water Quality Objectives Meet GCDQ minimum or as stated |
|---|---|---|---|---|---|
| Aluminium (extracable) | mg/l | 0.15 | 0.01 | 0.06 | 0.10 |
| Aluminum (dissolved) | mg/l | 0.77 | 0.01 | 0.04 | 0.10 |
| Aluminium (total) | mg/l | 21.10 | 0.08 | 1.81 | 0.10 |
| Arsenic (extractable) | mg/l | 0.010 | 0.010 | 0.010 | 0.010 |
| Arsenic (total) | mg/l | 0.010 | 0.001 | 0.007 | 0.010 |
| Antimony (total) | mg/l | 0.006 | 0.000 | 0.004 | 0.006 |
| Ammonium -N (dissolved) | mg/l | 0.180 | 0.050 | 0.056 | |
| P - Alkalinity ( as CaCO3) | mg/l | 5 | 5 | 5 | |
| T - Alkalinity (as CaCO3) | mg/l | 144 | 62 | 99.25 | |
| Barium (extractable) | mg/l | 0.067 | 0.0516 | 0.06 | 1 |
| Barium (total) | mg/l | 0.0616 | 0.0522 | 0.06 | 1 |
| Bicarbonate | mg/l | 163 | 76 | 120.78 | |
| BOD | mg/L | | | | |
| Boron (extractable) | mg/l | 0.027 | 0.014 | 0.02 | 5 |
| Boron (total) | mg/l | 0.022 | 0.014 | 0.02 | 5 |
| Bromodichloromethamne | mg/l | 0.003 | 0.001 | 0.00 | 0.016 |
| Cadmium (extractable) | mg/l | 0.0005 | 0.00001 | 0.00 | 0.005 |
| Cadmium (total) | mg/l | 0.0006 | 0.00001 | 0.00 | 0.005 |
| Calcium (dissolved) | mg/l | 43.4 | 22.2 | 35.74 | |
| Calcium (extractable) | mg/l | 40.3 | 32.7 | 37.3 | |
| Calcium (total) | mg/l | 47.2 | 37.6 | 39.16 | |
| Carbonate | mg/l | 6 | 6 | 6 | |
| Chloride (dissolved) | mg/l | 16.6 | 6.9 | 13.88 | ≤ 250 |
| Chormium (extractable) | mg/l | 0.001 | 0.0008 | 0.00 | 0.05 |
| Chromium (total) | mg/l | 0.0009 | 0.0005 | 0.00 | 0.05 |
| Coliforms (total) | CFU/ 100 ml | 4 | 1 | 2.50 | < 1 |
| Coliforms (fecal) | CFU/ 100 ml | 0 | 0 | | < 1 |
| Colour (true) | TCU | 70 | 3 | 17.69 | ≤ 15 |
| Conductivity | µS/cm @ 25ºC | 377 | 234 | 297.7143 | |
| Copper (extractable) | mg/l | 0.042 | 0.003 | 0.0324 | ≤ 1 |
| Copper (total) | mg/l | 3 | 0.039 | 0.59 | ≤ 1 |
| Cyanide (dissolved) | mg/l | 0.001 | 0.001 | 0.001 | 0.2 |
| DOC (nonpurgeable) | mg/L | 11.3 | 3.6 | 5.76 | |
| Fluoride | mg/l | 0.64 | 0.05 | 0.36 | <2.0 |
| Hardness (dissolved as CaCO3) | mg/l | 154 | 96 | 129.65 | |
| Hydroxide | mg/l | 5 | 5 | 5 | |
| Iron (extractable) | mg/l | 0.6 | 0.01 | 0.11 | ≤ 0.3 |
| Iron (dissolved) | mg/l | 2.39 | 0.01 | 0.12 | |
| Iron (total) | mg/l | 35 | 0.095 | 7.95 | ≤ 0.3 |
| Ionic Balance | % | 107 | 96 | 100.00 | |
| Lead (extractable) | mg/l | 0.002 | 0.0002 | 0.00 | |
| Lead (total) | mg/l | 0.002 | 0.0003 | 0.0017 | 0.01 |
| Manganese (extractable) | mg/l | 0.04 | 0.0007 | 0.01 | ≤ 0.05 |
| Manganese (total) | mg/l | 0.0051 | 0.0015 | 0.00306 | ≤ 0.05 |
| Magnesium (dissolved) | mg/l | 11.2 | 6.9 | 9.50 | |
| Magnesium (extractable) | mg/l | 10.4 | 8.6 | 9.51 | |
| Magnesium (total) | mg/l | 11 | 9.39 | 9.99 | |
| Mercury (extractable) | mgl | 0.0001 | 0.0001 | 0.0001 | 0.001 |
| Nitrate - N | mg/l | 0.157 | 0.05 | 0.11 | 10 |
| Nitrite - N | mg/l | 0.005 | 0.002 | 0.003 | 1 |
| Nitrate & Nitrite - N | mg/l | 0.157 | 0.05 | 0.11 | 10 |
| Kjeldahl Nitrogen (total) | mg/l | 0.86 | 0.14 | 0.41 | |
| pH | | 8.27 | 7.5 | 7.98 | 6.5 - 8.5 |
| Potassium (extractable) | mg/l | 7.5 | 1 | 2.15 | |
| Potassium (total) | mg/l | 1.2 | 1 | 1.06 | |
| Selenium (extractable) | mg/l | 0.004 | 0.0002 | 0.00 | 0.01 |
| Selenium (total) | mg/l | 0.018 | 0.0002 | 0.01 | 0.01 |
| Sodium (extractable) | mg/l | 11 | 6.1 | 10.02 | ≤ 200 |
| Sodium (total) | mg/l | 11.5 | 10.6 | 10.94 | ≤ 200 |
| Sulfate (SO4) (extractable) | mg/l | 29 | 29 | 29.00 | ≤ 500 |
| Sulfate (SO4) (total) | mg/l | 39 | 36.4 | 37.45 | ≤ 500 |
| Sulfide, Total | mg/L | 0.005 | 0.005 | 0.005 | ≤ 0.05 |
| Temperature on Sampling | ºC | 112.6 | 1 | 14.18 | ≤ 15 |
| Temperature of Observed | ºC | 23.7 | 17.8 | 21.27 | |
| TOC (nonpurgeable) | mg/l | 29.0 | 3.6 | 6.9 | |
| Total Dissolved Solids | mg/l | 260 | 140 | 170.29 | ≤ 500 |
| Total Suspended Solids | mg/l | 270 | 1 | 83.00 | |

Table 3-1
Inuvik WTP
Water Quality Design Criteria
Dillon Project 12-6732

| Parameter | Units | Observed Range, Inuvik East Channel Raw WQ Data 2001-2008 Max | Min | Ave | Inuvik WTP Drinking Water Quality Objectives Meet GCDQ minimum or as stated |
|---|---|---|---|---|---|
| Total Trihalomethanes | mg/l | 0.033 | 0.0033 | 0.02 | 0.1 |
| Turbidity | NTU | 1460 | 2.3 | 94.97 | 0.3 / 1.0 / 0.1 |
| Uranium (extractable) | mg/l | 0.05 | 0.0006 | 0.03 | 0.02 |
| Uranium (total) | mg/l | 0.0008 | 0.0008 | 0.00 | 0.02 |
| UV absorbance | $cm^{-1}$ | 0.38 | 0.01 | 0.17 | |
| Zinc (extractable) | mg/l | 0.0195 | 0.003 | 0.01 | ≤ 5 |
| Zinc (total) | mg/l | 0.0112 | 0.004 | 0.01 | ≤ 5 |
| SUVA (UV254 ($cm^{-1}$) * 100 / DOC (mg/l) ) | | 3.33 | 0.15 | 2.44 | |

Table 3-2
Town of Inuvik
Jar Testing Variables
Dillon Project 12-6732

| Variable | Description |
|---|---|
| Location and Timing of Coagulant Addition | Added immediately after the:<br>(1) Start of rapid mixing. |
| Location and Timing of Coagulant Aid Addition | Varied to be added with the coagulant at the:<br>(1) Start of rapid mixing.<br>(2) Start of slow agitation mixing following rapid mixing. |
| Concentration of PACL Used | 1% solution (by weight) diluted with de-ionized water from a 30% neat solution. |
| Concentration of Anionic Polymer | 0.12% solution (by weight) diluted with de-ionized water from a neat dry polymer. |
| Concentration of Cationic Polymer | 0.006% solution (by weight) diluted with de-ionized water from a neat dry polymer. |
| Dosage of PACL | Varied from 5 – 16 mL (1.5 – 4.8 mg/L) |
| Dosage of Anionic Polymer | Varied from 0 – 5 mL (0 – 0.6 mg/L) |
| Dosage of Cationic Polymer | Varied from 0 – 5 mL |
| Raw Water Temperature | 5°C, 8°C, 15°C [(a)] |
| Duration of Rapid Mixing | Varied from 20 – 40 sec to simulate the coagulation step in the treatment process during the jar tests |
| Duration of Slow Agitation Mixing | Varied from 5 – 12 min to simulate the flocculation step in the treatment process during the jar tests |
| Duration of Settling | 20 min |

Notes:
(a) The current temperature of the raw water was approximately 15°C as received from the river channel. The temperature for the raw water jar testing was varied by cooling with ice packs to a range of 5 – 10°C to determine the efficiency of the coagulation/flocculation process at colder winter conditions.

Table 3-3
Town of Inuvik
Average Jar Test Results
Dillon Project 12-6732

| Parameter (units) | PACL Dosage [1] | | | |
|---|---|---|---|---|
| | 1.5 mg/L (5 mL) | | 3 mg/L (10 mL) | |
| Raw Water from East Channel – Mackenzie River | | | | |
| Temperature, °C | 5 | 8 | 5 | 8 |
| Turbidity, NTU | 90.2 | 76.1 | 83.9 | 79.8 |
| pH | 7.83 | 7.76 | 7.82 | 7.60 |
| Unfiltered, Settled Water after Coagulation and Settling Stages | | | | |
| Temperature, °C | 12.5 | 12.5 | 11.5 | 13 |
| Turbidity, NTU | 1.94 | 1.99 | 0.74 | 0.60 |
| pH | 7.35 | 7.59 | 7.14 | 7.01 |

Notes:
(1) For a PACl concentration of 1% solution diluted from 30% stock solution.

# Appendix B

Jar Testing Data

# Inuvik WTP
# Dillon Project No. 12-6732

## Table 3a: Jar Testing Program Log Sheet for Jar Tests #1 - #15

| Date and Time | | | 5-Sep-12 | 5-Sep-12 | | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 | 5-Sep-12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Source/Location | | | Mackenzie River, East Channel | | | | | | | | | | | | | | |
| Sampel No. | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Sample Volume | | Litres | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| pH | | pH units | 7.79 | 7.99 | | | | | | | | | | | | 7.7 | 7.7 |
| Temperature | | C | 14 | 14.5 | | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Turbidity | | NTU | 88 | 88 | | 88 | 88 | 88 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 2100 | 2100 |
| Coagulant Dose (PACL) | | mL | 3.5 | 6.5 | | 5.0 | 5.0 | 10.0 | 10.0 | 10.0 | 8.0 | 8.0 | 5.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Flocculant Dose (Anionic Polymer) | | mL | 3.5 | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 3.0 | | 5.0 | 3.0 |
| Flocculant dose (Cationic Polymer) | | mL | | | | | | | 5.0 | | | | | | | | |
| Voume of Stock Solution Added | | mL | | | | | | | | | | | | | | | |
| Coagulant Dose, as Product | | mg/L | | | | | | | | | | | | | | | |
| Coagulant Dose, as 100% | | mg/L | | | | | | | | | | | | | | | |
| Initial Rapid Mixing | Time | sec | 20 | 30 | | 20 | 20 | 20 | 20 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| | Speed | rpm | 320 | 320 | | 160 | 318 | 179 | 178 | 178 | 178 | 270 | 178 | 270 | 300 | 275 | 300 |
| Slow Agitation Mixing | Time | min | 1 | 2 | | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Speed | rpm | 23 | 23 | | 24 | 32 | 24 | 25 | 24 | 23 | 23 | 23 | 23 | 23 | 25 | 25 |
| Sedimentation Phase, Settling Time | | min | 20 | 20 | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Turbidity after Settling | | 20 min | | 21.4 | | 15.8 | 14.3 | 7.05 | 22 | 4.34 | 3.41 | 1.99 | 10.5 | 3.5 | 3.02 | 5.75 | 13.1 |
| pH at End of Test | | pH units | | 7.54 | | 7.51 | 7.45 | 7.39 | 7.34 | 7.21 | 7.5 | 7.48 | 7.56 | 7.42 | 7.42 | | |
| Temp. at End of Test | | C | | 16 | | 18 | 19 | 19 | 19 | | | | | | | | |
| Notes: (1) PACl + Polymer added at rapid mixing; (2) PACl added at rapid mixing; Polymer added at slow agitation | | | 1 | 1 | | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

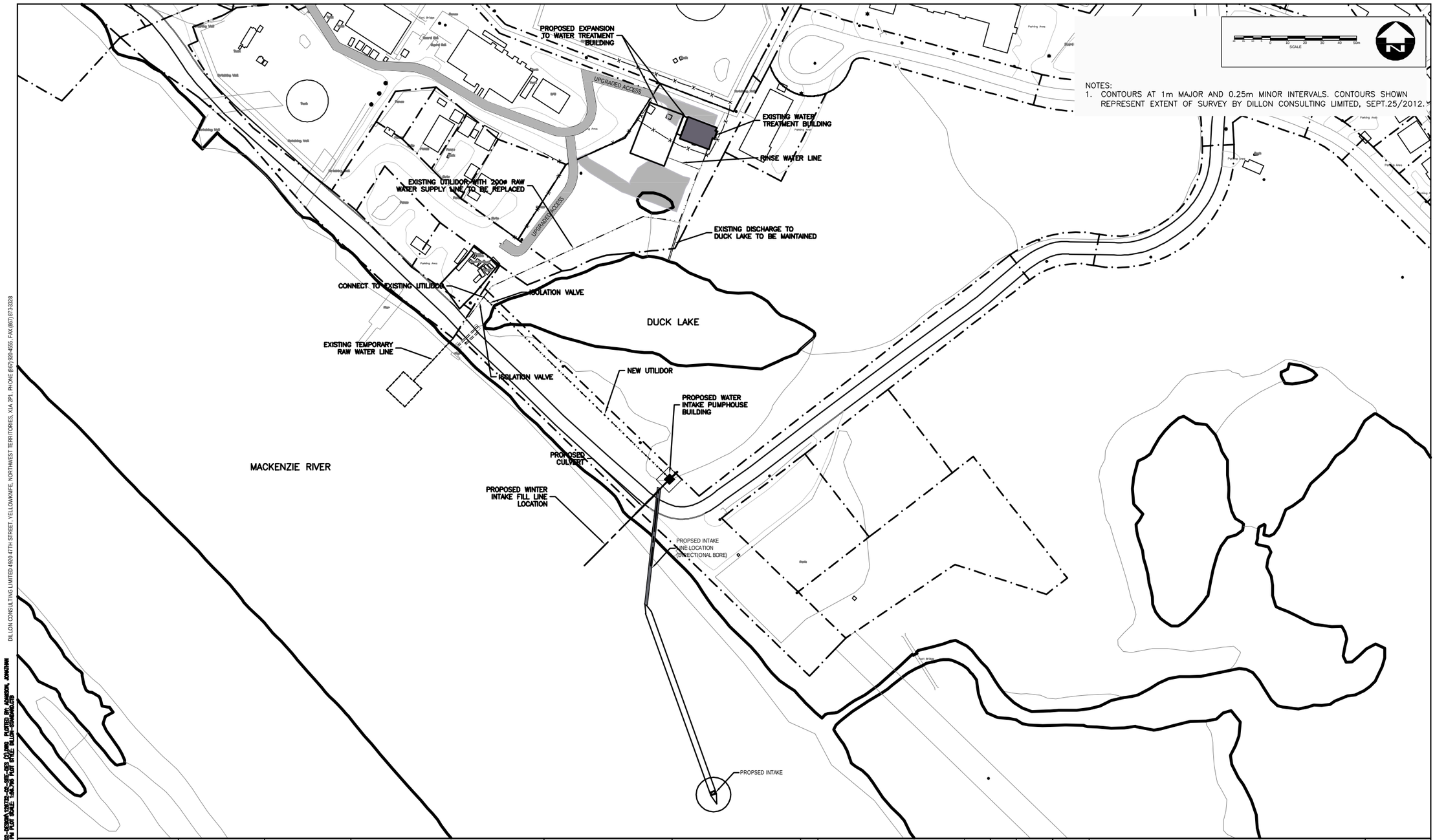
# Inuvik WTP
# Dillon Project No. 12-6732

## Table 3b: Jar Testing Program Log Sheet for Jar Tests #16 - #30

| Date and Time | | | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 6-Sep-12 | 7-Sep-12 | 7-Sep-12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Source/Location | | | Mackenzie River, East Channel | | | | | | | | | | | | | | |
| Sampel No. | | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Sample Volume | | Litres | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| pH | | pH units | 7.55 | 7.55 | 7.58 | 7.58 | 7.58 | 7.74 | 7.74 | 7.87 | 7.87 | 7.87 | 7.87 | 7.87 | 7.87 | 7.54 | 7.54 |
| Temperature | | C | 8 | 9 | 5 | 4 | 8 | 15 | 6.5 | 6 | 5.5 | 5 | 5 | 5 | 5 | 5.5 | 5.5 |
| Turbidity | | NTU | 2100 | 2100 | 2100 | 2100 | 2100 | 2100 | 2100 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| Coagulant Dose (PACL) | | mL | 8.0 | 12.0 | 16.0 | 14.0 | 7.0 | 16.0 | 12.0 | 10.0 | 7.0 | 6.0 | 7.0 | 6.0 | 8.0 | 8.0 | 9.0 |
| Flocculant Dose (Anionic Polymer) | | mL | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Flocculant dose (Cationic Polymer) | | mL | | | | | | | | | | | | | | | |
| Voume of Stock Solution Added | | mL | | | | | | | | | | | | | | | |
| Coagulant Dose, as Product | | mg/L | | | | | | | | | | | | | | | |
| Coagulant Dose, as 100% | | mg/L | | | | | | | | | | | | | | | |
| Initial Rapid Mixing | Time | sec | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| | Speed | rpm | 310 | 310 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 |
| Slow Agitation Mixing | Time | min | | | 5 | 5 | 8 | 5 | 8 | 8 | 8 | 8 | 10 | 10 | 9 | 10 | 8 |
| | Speed | rpm | | | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Sedimentation Phase, Settling Time | | min | | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Turbidity after Settling | | 20 min | | 11.4 | 5.65 | 6.03 | 9.64 | 5.56 | 4.82 | 1.74 | 7.19 | 7.19 | 4.65 | 15.4 | 5.47 | 5.24 | 2.54 |
| pH at End of Test | | pH units | 7.21 | | 7.08 | 7.15 | 7.33 | 7.1 | 7.23 | 7.23 | 7.47 | 7.63 | 7.43 | 7.53 | | 7.38 | 7.23 |
| Temp. at End of Test | | C | | | 9 | 8 | 9 | 15 | 9 | 8 | 8 | 7 | 8 | 8 | 8 | 10 | 9 |
| Notes: (1) PACl + Polymer added at rapid mixing; (2) PACl added at rapid mixing; Polymer added at slow agitation | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

# Appendix C

Drawings

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**FOR REVIEW**

**DRAWING REDUCED**

Northwest Territories
Public Works and Services

DILLON CONSULTING

| No. | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 0 | DESIGN STATEMENT | 08-10-2013 | JSA |

DESIGN: ---- REVIEWED BY:
DRAWN: TPW CHECK BY:
DATE: SEPTEMBER 2013
SCALE:

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

CIVIL WORKS

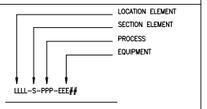
SITEPLAN

PROJECT NO. 12-6732

SHEET NO. 100

# PROCESS LEGEND – MISCELLANEOUS

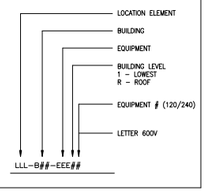
## EQUIPMENT FRAGMENT No. DESIGNATION



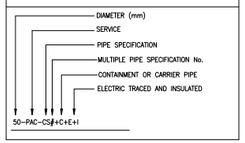

NOTE:
– EQUIPMENT No.'s RESTART AT 1 FOR EACH SECTION.

## NON PROCESS RELATED EQUIPMENT

(ie. PANEL, SUMP PUMP, ETC.)




## PIPING LINE DESIGNATION




# PIPE SIZE CONVERSION

| IMPERIAL(in) | METRIC(mm) | IMPERIAL(in) | METRIC(mm) |
|---|---|---|---|
| 1/8 | 3 | 14 | 350 |
| 1/4 | 6 | 15 | 380 |
| 3/8 | 10 | 16 | 400 |
| 1/2 | 12 | 18 | 450 |
| 3/4 | 20 | 20 | 500 |
| 1 | 25 | 24 | 600 |
| 1–1/4 | 32 | 30 | 750 |
| 1–1/2 | 40 | 36 | 900 |
| 2 | 50 | 42 | 1050 |
| 2–1/2 | 65 | 48 | 1200 |
| 3 | 75 | 54 | 1350 |
| 4 | 100 | 60 | 1500 |
| 5 | 125 | 66 | 1650 |
| 6 | 150 | 72 | 1800 |
| 8 | 200 | 78 | 2000 |
| 10 | 250 | 84 | 2100 |
| 12 | 300 | | |

NOTE:
–PIPE SIZES ARE NOMINAL
–PIPE SIZES FROM 2" TO 60" CONVERSION BASED ON CSA STANDARD Z245.1
–PIPE SIZES FROM 2" AND SMALLER CONVERSION BASED ON EUROPEAN ISO STANDARD
–OTHER PIPE SIZES ARE CONVERSIONS ROUNDED TO THE NEAREST ARBITRARILY ASSIGNED WHOLE NUMBER

# PIPE MATERIAL ABBREVIATIONS

| SYMBOL | MATERIAL |
|---|---|
| ABS | ACRYLONITRILE BUTADIENE STYRENE |
| AL | ALUMINUM |
| AC | ASBESTOS CEMENT |
| CONC | CONCRETE GRAVITY |
| CPP | CONCRETE PRESSURE |
| CS# | CARBON STEEL |
| CU# | COPPER |
| DI | DUCTILE IRON |
| FRP | FIBREGLASS REINFORCED PLASTIC |
| GALV | GALVANIZED STEEL |
| RR | REINFORCED RUBBER |
| PE | POLYETHYLENE |
| PPL | POLYPROPYLENE LINED CARBON STL. |
| PVC# | POLYVINYL CHLORIDE |
| SS# | STAINLESS STEEL |
| TUB# | TUBING |

# FOLLOWING SYMBOL INDICATES PIPING WITH MULTIPLE MATERIAL SPECIFICATIONS
EXAMPLE : SS1 (SCH. 40 316SS) SS2 (SCH. 80 316SS)

# PROCESS LEGEND – SERVICE ABBREVIATIONS

| SYMBOL | COMMODITY | SYMBOL | COMMODITY |
|---|---|---|---|
| AA | AQUEOUS AMMONIA | NaHCO | SODIUM BICARBONATE |
| AAS | AERATION AIR SUPPLY | NaOCl | SODIUM HYPOCHLORITE |
| ACTSI | ACTIVATED SILICA | NaOH | SODIUM HYDROXIDE |
| AMG | AMMONIA GAS (ANHYDROUS) | NaSI | SODIUM SILICATE |
| AML | AMMONIA LIQUID (ANHYDROUS) | NG | NATURAL GAS |
| AMS | AMMONIA SOLUTION | OF | OVERFLOW |
| ALUM | ALUMINUM SULPHATE | OZNE | OZONE TANK EFFLUENT |
| AS | AERATED SEWAGE | OZNI | OZONE TANK INFLUENT |
| CBD | CLARIFIER BLOWDOWN | OZ | OZONE |
| CEN | CENTRIFUGE CENTRATE WATER | PA | PROCESS AIR |
| CHW | CHEMICAL WASTE | PACL | POLYALUMINUM CHLORIDE |
| CLD | CHLORINE DIOXIDE | PLY | POLYELECTROLYTE |
| CLG | CHLORINE GAS | PLYPH | POLYPHOSPHATE |
| CLS | CHLORINE SOLUTION | PS | PRIMARY SLUDGE |
| CO2 | CARBON DIOXIDE | PSW | PLANT SERVICE WATER |
| CUS | COPPER SULPHATE | PW | POTABLE WATER |
| CW | COLD WATER | RAS | RETURN ACTIVATED SLUDGE |
| CWR | COOLING WATER RETURN | RSD | RECIRCULATED SLUDGE DISCHARGE |
| CWS | COOLING WATER SUPPLY | RSS | RECIRCULATED SLUDGE SUCTION |
| CWW | COOLING WASTE WATER | RSW | RAW SEWAGE |
| DHW | DOMESTIC HOT WATER | RW | RAW WATER |
| DIS | DIGESTED SLUDGE | RWAS | RAW WASTE ACTIVATED SLUDGE |
| DR | DRAIN | RWL | RAINWATER LEADER |
| EE | ENGINE EXHAUST | SA | SCOURING AIR |
| EW | EFFLUENT WATER | SAM | SAMPLE |
| F | FLUORIDE | SAN | SANITARY |
| FA | FLUOSILICIC ACID | SCE | SECONDARY CLARIFIER EFFLUENT |
| FBW | FILTER BACKWASH SUPPLY | SCS | SCRUBBING SOLUTION |
| FEC | FERRIC CHLORIDE | SCUM | SCUM |
| FEFF | FILTER EFFLUENT | SDG | SULPHUR DIOXIDE GAS |
| FESU | FERRIC SULPHATE | SDS | SULPHUR DIOXIDE SOLUTION |
| FHS | HYDROFLUOSILICIC ACID | SETW | SETTLED WATER |
| FILW | FILTER TO WASTE | SG | SLUDGE GAS (DIGESTER) |
| FINF | FILTER INFLUENT | SGC | SLUDGE GAS CIRCULATED (DIGESTER) |
| FLW | FLOCCULATED WATER | SGF | SLUDGE GAS FUEL (DIGESTER) |
| FLS | FLUORIDE SOLUTION | SGH | SLUDGE GAS (HIGH PRESSURE) |
| FO | FUEL OIL | SLD | SETTLED SLUDGE |
| FOF | FUEL OIL FILL | SLG | MIXED SLUDGE |
| FOR | FUEL OIL RETURN | SLU | SLUDGE UNLOADING |
| FOS | FUEL OIL SUPPLY | SQW | SQUEEZE WATER (FILTER PRESS) |
| FOV | FUEL OIL VENT | STM | STORM |
| FSW | FILTER SURFACE WASH | SUP | SUPERNATANT |
| FW | FILTERED WATER | TRW | TREATED WATER |
| GT | GRIT | TS | THICKENED SLUDGE |
| HCL | HYDROCHLORIC ACID | TWAS | TREATED WASTE ACTIVATED SLUDGE |
| HSO | SULPHURIC ACID | V | VENT |
| HWR | HOT WATER RETURN (HEATING) | VA | VENT (AIR) |
| HWS | HOT WATER SUPPLY (HEATING) | VP | VENT (PUMPING) |
| IA | INSTRUMENT AIR | VT | VENT (TANK) |
| KMnO | POTASSIUM PERMANGANATE | WAS | WASTE ACTIVATED SLUDGE |
| LPG | LIQUID PROPANE GAS | WD | WASTE DRAIN |
| ML | MIXED LIQUOR | WBW | WASTE BACKWASH WATER |
| NaCO | SODIUM CARBONATE | | |

# PROCESS LEGEND – VALVE SYMBOLS

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| VGA | GATE | VGL | GLOBE |
| VTW | THREE-WAY | VAN | ANGLE |
| VBA | BALL | VPL | PLUG |
| VBU | BUTTERFLY | VSQ | STOP COCK |
| VKG | KNIFE GATE | VNE | NEEDLE |
| VDM | DIAPHRAGM | VPN | PINCH |
| VMU | MUD | SQC | SQUARE HEAD COCK |
| VSC | SWING CHECK | VSC | SPRING CHECK |
| VSC | WEIGHTED CHECK | VSC | ELECTRIC CHECK |
| VDC | DOUBLE DOOR CHECK | VBC | BALL CHECK |
| VFP | FLAP | VFS | FOOT VALVE/ STRAINER |
| VAC | AIR VACUUM | VAV | AIR & VACUUM |
| VAR | AIR RELEASE | VSR | SAFETY RELIEF |
| PRV | PRESSURE REDUCING (SELF CONTAINED) | PRV | PRESSURE REDUCING |
| BPV | BACK PRESSURE (SELF CONTAINED) | BPV | BACK PRESSURE |
| SG | STOP GATE | AWG | ADJUSTABLE WEIR GATE |
| SLG | SLIDE GATE | STL | STOP LOGS |
| VRO | ROTARY | SCG | SLUICE GATE |
| DMP | DAMPER | VDB | DUCKBILL CHECK |
| INJQ | INJECTION QUILL WITH CORPORATION STOP | SHG | SHEAR GATE |
| VHYD | YARD HYDRANT | EDV | ENERGY DISSIPATING VALVE |

1. DIRECTION OF FLOW FOR THE ABOVE SYMBOLS IS FROM LEFT TO RIGHT.
2. STATUS MAY BE SHOWN– N.O.=NORMALLY OPEN, N.C.=NORMALLY CLOSED.
3. (VKG*) VKG INDICATES VALVE TYPE AND * INDICATES SPECIFICATION No..
4. ADD ACTUATORS TO VALVES FROM VALVE ACTUATOR TABLE.

# PROCESS LEGEND – VALVE ACTUATORS

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| | FLOAT | | DIAPHRAGM |
| | GEAR | | SOLENOID |
| | LEVER | CW | CHAIN WHEEL |
| | MOTORIZED | | VALVE BOX (C/W EXTENSION STEM) |
| | NON RISING STEM (HANDWHEEL) | | QUICK OPENING |
| | RISING STEM (HANDWHEEL) | # | DOUBLE ACTION PISTON (FAIL CLOSE) |
| # | SINGLE ACTION PISTON (FAIL OPEN) | | |
| | | | |

NOTE: GATE VALVES ARE USED FOR ILLUSTRATION PURPOSES ONLY

# PROCESS LEGEND – EQUIPMENT

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| | CENTRIFUGAL PUMP | | ROTARY PUMP |
| | METERING PUMP | | DUPLEX METERING PUMP |
| | VERTICAL TURBINE PUMP | | CIRCULATING PUMP/INLINE PUMP |
| | SUBMERSIBLE PUMP | | PROGRESSIVE CAVITY PUMP |
| | SUMP PUMP | | RECIPROCATING PUMP |
| | RECIPROCATING COMPRESSOR | | BLOWER (LOBE TYPE) |
| ENG | COMBUSTION ENGINE | GEN | GENERATOR |
| | CENTRIFUGAL COMPRESSOR | | BLOWER (CENTRIFUGAL) |
| VAC | VACUUM PUMP | | CENTRIFUGE |
| | INLINE MIXER | | TRAVELING WATER SCREEN |
| | MIXER | | HEAT EXCHANGER |
| | TANK (OPEN) | | PRESSURE TANK OR ACCUMULATOR |
| OR | TANK (CLOSED) | | GAS CYLINDER (INDICATE CONTENTS) |
| | SWAB LAUNCHER | | SWAB CATCHER |
| | ULTRAVIOLET MODULE | | PROPELLER PUMP |
| | INLINE GRINDER | | |

(*) – DENOTES CONSTANT SPEED DRIVE

(VFD) * – DENOTES VARIABLE SPEED DRIVE (* M FOR MECHANICAL, E FOR ELECTRICAL)
CONSTANT SPEED DRIVES ARE USED FOR ILLUSTRATION PURPOSES ONLY.

# PROCESS LEGEND – P & ID SYMBOL DESIGNATIONS

| SYMBOL | DESCRIPTION |
|---|---|
| | PRIMARY FLOW LINE |
| | SECONDARY FLOW LINE |
| | TERTIARY LINE |
| | EXISTING PRIMARY FLOW LINE |
| | EXISTING SECONDARY FLOW LINE |
| | EXISTING TERTIARY LINE |
| | FUTURE PRIMARY FLOW LINE |
| | FUTURE SECONDARY FLOW LINE |
| | FUTURE TERTIARY FLOW LINE |
| | DIRECTION OF FLOW |
| SLOPE 2% | DIRECTION OF SLOPE (ARROW DOWN GRADE) |
| | CONNECTION LINE |
| | LINES CROSSING OVER (BREAK LESSER LINE) |
| | CHANNEL |
| INJECTION POINT #1 TYPE | LINE CONTINUATION– TO ANOTHER DRAWING |
| OUTSIDE | LINE CONTINUATION– FROM ANOTHER DRAWING |
| SS | LINE SPECIFICATION CHANGE |
| | PNEUMATIC LINE |
| | ELECTRICAL SIGNAL |
| | HYDRAULIC LINE |
| | DATA LINK/FIELDBUS |
| | INSULATED LINE WITH ELECTRIC TRACING |
| | FLEXIBLE LINE |

# PROCESS LEGEND – INSTRUMENTATION
## INSTRUMENTATION DESIGNATION – (ISA–S5.4 1991)

| LETTER | FIRST LETTER | | SUCCEEDING LETTERS | | |
|---|---|---|---|---|---|
| | INITIATING OR MEASURED VARIABLE | MODIFIER | READOUT OR PASSIVE FUNCTION | OUTPUT FUNCTION | MODIFIER |
| *** A | ANALYSIS (2) | | ALARM | | |
| B | BURNER, COMBUSTION | | | CLOSE/STOP/DECREASE (1) | |
| C | | | | CONTROL | |
| D | | DIFFERENTIAL | | OPEN/START/INCREASE (1) | |
| E | VOLTAGE | | SENSOR (PRIMARY ELEMENT) | | |
| F | FLOW RATE | RATIO (FRACTION) | | | FAIL (1) |
| G | | | GLASS/VIEWING DEVICE | | |
| ****H | HAND | | | | HIGH (OPENED) |
| I | CURRENT (ELECTRICAL) | | INDICATE | | |
| J | POWER | SCAN | | | |
| K | TIME, TIME SCHEDULE | TIME RATE OF CHANGE | | CONTROL STATION | |
| L | LEVEL | | LIGHT | | LOW (CLOSED) |
| M | MOTOR, MOTION (1) | MOMENTARY | | MOTOR (1) | MIDDLE OR INTERMEDIATE |
| N | | | | | ON OR OPERATE (1) |
| O | | | ORRIFICE/RESTRITCION | | OVERLOAD (1) |
| P | PRESSURE/VACUUM | | POINT (TEST) CONNECTION | PUMP (1) | |
| Q | QUANTITY | INTEGRATE/TOTALIZE | | | |
| R | RADIATION | | RECORD | | |
| S | SPEED/FREQUENCY | SAFETY | | SWITCH | |
| T | TEMPERATURE | | | TRANSMIT | |
| U | MULTIVARIABLE (2) | | MULTIFUNCTION | MULTIFUNCTION (2) | MULTIFUNCTION (2) |
| V | VIBRATION, MECHANICAL ANALYSIS | | | VALVE/DAMPER/LOUVRE | |
| W | WEIGHT/FORCE | | WELL | | |
| X | UNCLASSIFIED | | UNCLASSIFIED (2) | UNCLASSIFIED (2) | UNCLASSIFIED (2) |
| Y | EVENT/STATE/PRESSENCE | | | RELAY/COMPUTER/CONVERT | |
| Z | POSITION/DIMENSION | | | DRIVER/ACTUATOR/UNCLASSIFIED FINAL/CONTROL ELEMENT | |

| WATER TREATMENT | | WASTEWATER | |
|---|---|---|---|
| *** | DESCRIPTION | *** | DESCRIPTION |
| ALU | ALUMINUM | ALU | ALUMINUM |
| F | FLUORIDE | CB | COMBUSTION GAS |
| CLC | CHLORINE LEAK | CH4 | METHANE |
| CLR | CHLORINE RESIDUAL | CLC | CHLORINE LEAK |
| COL | COLOUR | CLR | CHLORINE RESIDUAL |
| CON | CONDUCTIVITY | CO | CARBON MONOXIDE |
| OZL | OZONE LEAK | DO | DISSOLVED OXYGEN |
| OZR | OZONE RESIDUAL | H2S | HYDROGEN SULPHIDE |
| pH | pH | pH | pH |
| SCD | STREAMING CURRENT DETECTOR | SS | SUSPENDED SOLIDS |
| Tu | TURBIDITY | Tu | TURBIDITY |
| SBI | SLUDGE BLANKET INTERFACE | | |
| **** | HAND SWITCH ANNOTATIONS | | |
| FR | FORWARD/REVERSE | RLT | REMOTE–LOCAL–TEST/JOG |
| LOA | LOCAL–OFF–AUTO (VENDOR RPU) | RST | RESET |
| LOR | LOCAL–OFF–REMOTE (FACILITY PLC/SCADA) | SS | START/STOP |
| LOS | LOCKOUT/STOP | | |

NOTE: THIS TABLE IS NOT ALL–INCLUSIVE.
*A, ALARM, THE ANNUNCIATING DEVICE, MAY BE USED IN THE SAME FASHION AS S, SWITCH, THE ACTUATING DEVICE.
**THE LETTERS H AND L MAY BE OMITTED IN THE UNDEFINED CASE.
1) USER'S CHOICE
2) WHEN USED, SYMBOL OR SIGNAL LINE IS ANNOTATED

## GENERAL INSTRUMENTATION

| SYMBOL | DESCRIPTION | | SYMBOL | DESCRIPTION | |
|---|---|---|---|---|---|
| (MAY) | MOUNTED LOCALLY | INSTRUMENT SYMBOLS | | LOGIC GATE – AND (INTERLOCK IS EFFECTIVE ONLY IF ALL INPUTS ARE ACTIVE) | INTERLOCK SYMBOLS |
| (MAY) (CONT) | MOUNTED ON FACE OF PANEL | | | LOGIC GATE – OR (INTERLOCK IS EFFECTIVE IF ONE OR MORE INPUTS ARE ACTIVE) | |
| (MAY) (CONT) | MOUNTED BEHIND PANEL DOOR | | | LOGIC GATE – OR (INTERLOCK IS EFFECTIVE IF ONE OR MORE INPUTS ARE ACTIVE) | |
| | SCADA INPUT/OUTPUT | SCADA SYMBOLS | | COMPLEX OR UNDEFINED INTERLOCK | |
| (10) (MC) | NOT ACCESSIBLE TO OPERATOR | DISTRIBUTED CONTROLS, OR PROGRAMMABLE SYMBOLS | | PANEL NUMBER n | AUTOMATION SYMBOLS |
| (10) (MC) | ACCESSIBLE TO OPERATOR | | | MOTOR CONTROL CENTRE NUMBER n | |
| (AUX) (MC) | AUXILIARY LOCATION | | | PROGRAMMABLE CONTROLLER I/O RACK NUMBER n | |
| (AUX) (MC) | NOT ACCESSIBLE TO OPERATOR | PROGRAMMABLE SYMBOLS | | SUPPLIED AND INSTALLED BY OTHER DIVISIONS, CONNECTED BY THIS DIVISION. | |
| (AUX) (MC) | ACCESSIBLE TO OPERATOR | | | RESET FOR LATCH TYPE ACTUATOR | MISCELLANEOUS SYMBOLS |
| (MAY) (PL) | PILOT LIGHT | | | PURGE OR FLUSHING DEVICE | |

# PROCESS LEGEND – PRIMARY FLOW ELEMENTS

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|---|---|
| | WEIR | F | SNAP–ON FLOW METER | | THERMAL WELL |
| | INSERT VENTURI | | SONIC FLOW METER | | TURBINE/PROPELLER FLOW METER |
| | PITOT TUBE (SINGLE) | M | MAGNETIC FLOW METER | | |
| | PILOT TUBE (AVERAGING) | | ORIFICE PLATE | | |
| | FLUME | | FLOW SIGHT GLASS | | |
| | TURBINE / PROPELLER | | ROTAMETER | | |
| | POSITIVE DISPLACEMENT | | STATIC INLINE MIXER | | |
| | GAUGE INDICATOR | | ULTRASONIC LEVEL METER | | |

# PROCESS LEGEND – MISCELLANEOUS SYMBOLS

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| SP | SAMPLE POINT (12mm) | | UNION |
| DP | DRAIN POINT (MIN. 12mm) | | HOSE CONNECTION |
| | IN LINE STRAINER | | EYEWASH |
| | DRAIN / OVERFLOW | | AERATION SYSTEM FINE OR COARSE BUBBLE |
| | PIPE MATERIAL CHANGE | | DIAPHRAGM SEAL |
| | TRENCH DRAIN | | |

## 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.



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| - | - |
| DRAWN | CHECKED BY |
| - | - |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROJECT NO. 126732

PROCESS AND INSTRUMENTATION
PROCESS LEGEND

SHEET NO. PD0

KITCHENER

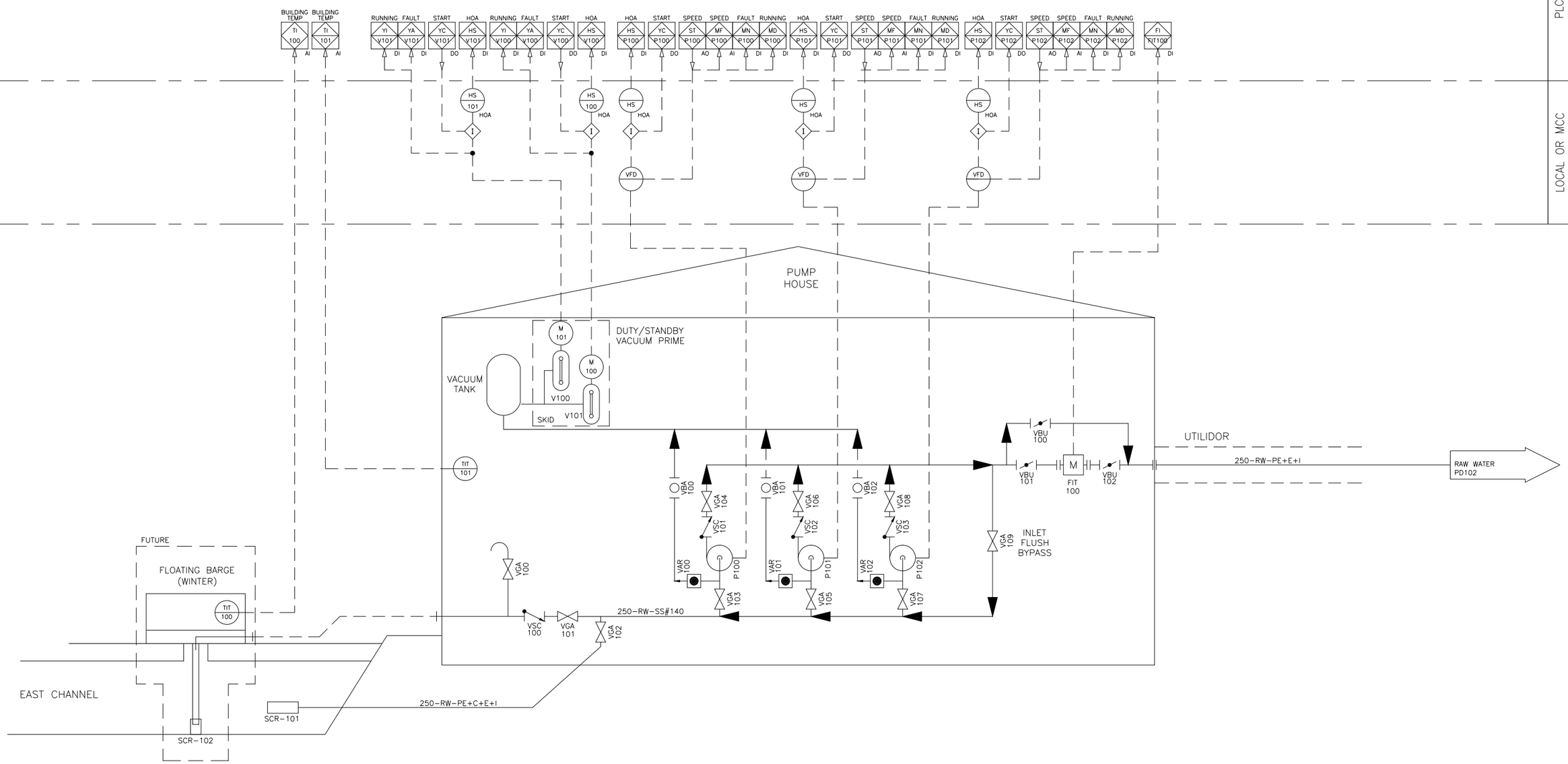
FILENAME: G:\CAD\126732–INUVIK WTP\10–WATER_WASTE\126732 – PD0.DWG PLOTTED BY: ZORGRAGER, SHANNON
PLOT DATE: 2013–10–08 @ 10:44:21 AM PLOT SCALE: 1.500 PLOT STYLE: DILLON–STANDARD.CTB

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL




KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGDRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:22 AM PLOT SCALE: 1:508 PLOT STYLE: DILLON-STANDARD.CTB

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| DRAWN SMZ | CHECKED BY MB |
| DATE AUGUST 2013 | |
| SCALE NTS | |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
INTAKE

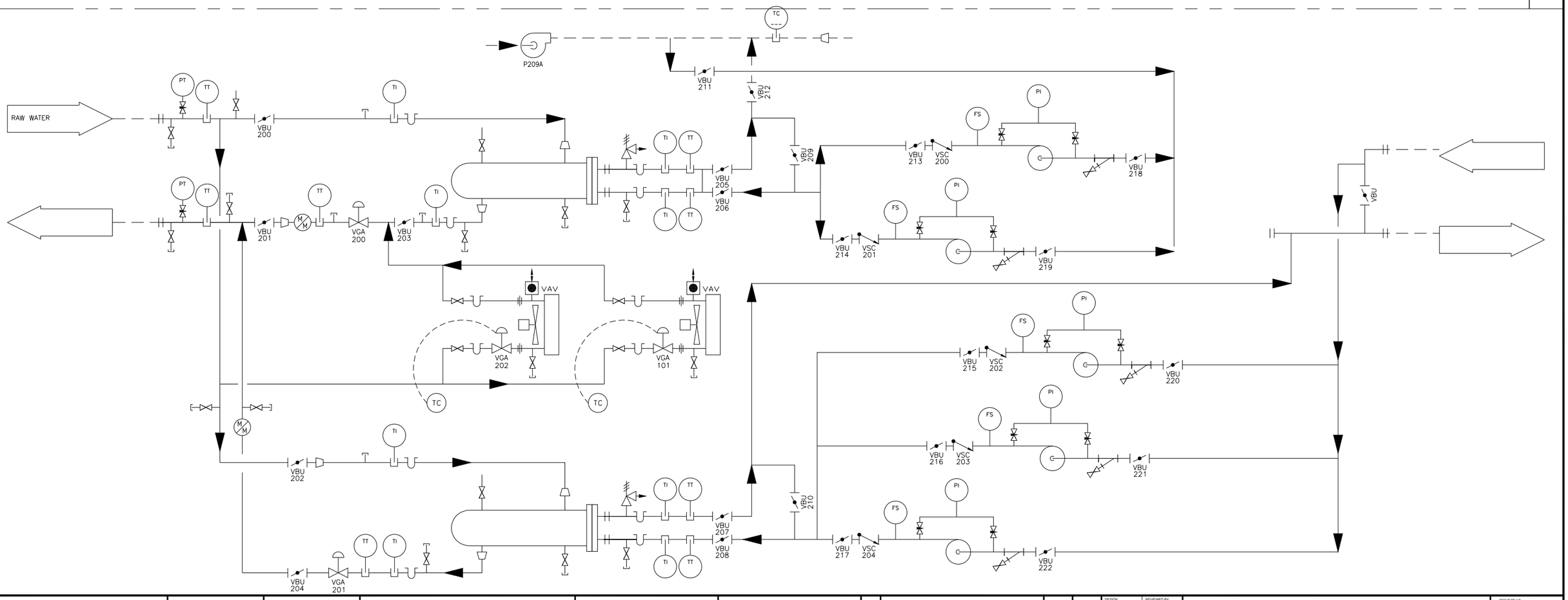
PROJECT NO. 126732

SHEET NO. PD101

SCADA

PLC PANEL

LOCAL OR MCC PANEL




KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:23 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB

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|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
RAW WATER TEMPERING SYSTEM

PROJECT NO. 126732

SHEET NO. PD102

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL

VEOLIA PRE-SELECTED EQUIPMENT PACKAGE

KITCHENER

POLYMER — 20-PLY-TUB#

COAGULANT — 13-COAG-TUB#

POLYMER — 20-PLY-TUB#

COAGULANT — 13-COAG-TUB#

POLYMER — 20-PLY-TUB#

COAGULANT — 13-COAG-TUB#

RAW WATER PD102 — 250-RW-SS#40

NaOH — 13-NaOH-TUB#

ACTIFLOW 500

ACTIFLOW 600

ACTIFLOW 700

50- -SS#40 → SLUDGE TO WW TANK PD602

250--SS#40 → CLARIFIED WATER PD301 TO FILTER 500

50- -SS#40 → SLUDGE TO WW TANK PD602

250--SS#40 → CLARIFIED WATER PD301 TO FILTER 600

50- -SS#40 → SLUDGE TO WW TANK PD602

250--SS#40 → CLARIFIED WATER PD301 TO FILTER 700

50-DR- 50-DR- 100-DR- 50-DR- 50-DR- 100-DR-

50-DR- 50-DR- 100-DR-

DRAIN COLLECTION TROUGH

NOTE:
1. SEE VEOLIA P&ID'S FOR MORE DETAILS

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:24 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB

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| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
ACTOFLOW

PROJECT NO. 126732

SHEET NO. PD201

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL

VEOLIA PRE-SELECTED EQUIPMENT PACKAGE

MICRO-COAGULANT
13-COAG-TUB#
FROM ACTIFLOW 500 PD201
250- -SS#40
AIR PD603
150-AIR-SS#40
FROM BACKWASH PUMPS PD601
300-FBW-SS#40
VBU
FILTER 500
350-OF-SS#40
350-WBW-SS#40
200-FWS-SS#40

MICRO-COAGULANT
13-COAG-TUB#
FROM ACTIFLOW 600 PD201
250- -SS#40
AIR PD603
150-AIR-SS#40
FROM BACKWASH PUMPS PD601
300-FBW-SS#40
VBU
FILTER 600
350-OF-SS#40
350-WBW-SS#40
200-FWS-SS#40

MICRO-COAGULANT
13-COAG-TUB#
FROM ACTIFLOW 700 PD201
250- -SS#40
AIR PD603
150-AIR-SS#40
FROM BACKWASH PUMPS PD601
300-FBW-SS#40
VBU
FILTER 700
350-OF-SS#40
350-WBW-SS#40
150-FWS-SS
200-FWS-SS#40

150-FWS-SS

350-WBW-SS#40
BACKWASH WATER TO WW TANK PD602
FILTERED WATER TO CC'S PD401
200-FWS-SS#40
350-FILW-SS#40
OVERFLOW PD401

DRAIN COLLECTION TROUGH

NOTE:
1. SEE VEOLIA P&ID'S FOR MORE DETAILS

KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGPRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:25 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB



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|---|---|
| DESIGN: JLD | REVIEWED BY: IAP |
| DRAWN: SMZ | CHECKED BY: MB |
| DATE: AUGUST 2013 | |
| SCALE: NTS | |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
FILTERS

PROJECT NO. 126732

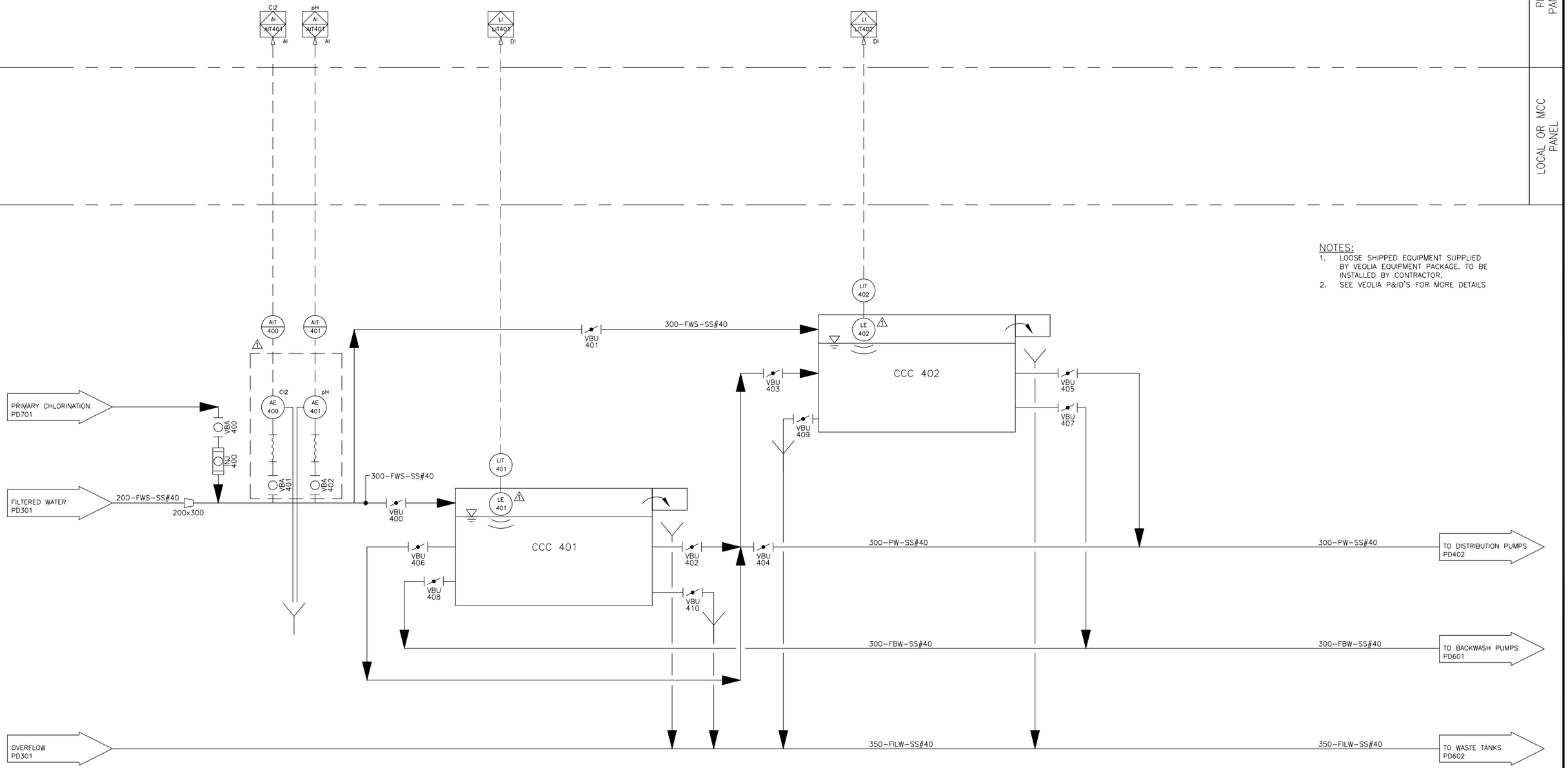
SHEET NO. PD301

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL




NOTES:
1. LOOSE SHIPPED EQUIPMENT SUPPLIED BY VEOLIA EQUIPMENT PACKAGE. TO BE INSTALLED BY CONTRACTOR.
2. SEE VEOLIA P&ID'S FOR MORE DETAILS

KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGDRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:26 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB

Conditions of Use

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| DESIGN | JLD |
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| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
CHLORINE CONTACT CHAMBERS

PROJECT NO. 126732

SHEET NO. PD401

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL

RUNNING FAULT START HOA
YI YA YC HS
P400 P400 P400 P400
DI DI DI DI

RUNNING FAULT START HOA
YI YA YC HS
P401 P401 P401 P401
DI DI DI DI

RUNNING FAULT START HOA
YI YA YC HS
P402 P402 P402 P402
DI DI DI DI

HS HOA
I
VFD

PI PIT400 AI

FIT FIT400 AI

TI TIT400 AI

CI2 AI AIT402 AI

pH AI AIT403 AI

TURB AI AIT404 AI

KITCHENER

NoOH

SECONARY CHLORINATION PD701

FROM CHLORINE CONTACT CHAMBERS PD401

300-PW-SS#40

FLUORIDE

13-FLS-TUB#

INJ 401 VBA 403

INJ 402 VBA 404

INJ 403 VBA 405

PG VBA 408 M P400 VBU 411 VSC 400 VGA 414

PG VBA 409 M P401 VBU 412 VSC 401 VGA 415

PG VBA 410 M P402 VBU 413 VSC 402 VGA 416

PIT 400 VBA 406 VBA 407 VBU 417

FIT 403 M FIT 400 VBU 418 VBU 419 VBU 420

TIT 400

AIT 402 AIT 403

CI2 AE 402 VBA 411

pH AE 403 VBA 412

TURB AE 404 AIT 404 FI

250-PW-SS#40 TO DISTRIBUTION SYSTEM

100- -SS TO SERVICE WATER SYSTEM PD604

NOTES:
1. LOOSE SHIPPED EQUIPMENT SUPPLIED BY VEOLIA EQUIPMENT PACKAGE. TO BE INSTALLED BY CONTRACTOR.

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGGRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:28 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB



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| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
DISTRIBUTION PUMPS

PROJECT NO. 126732

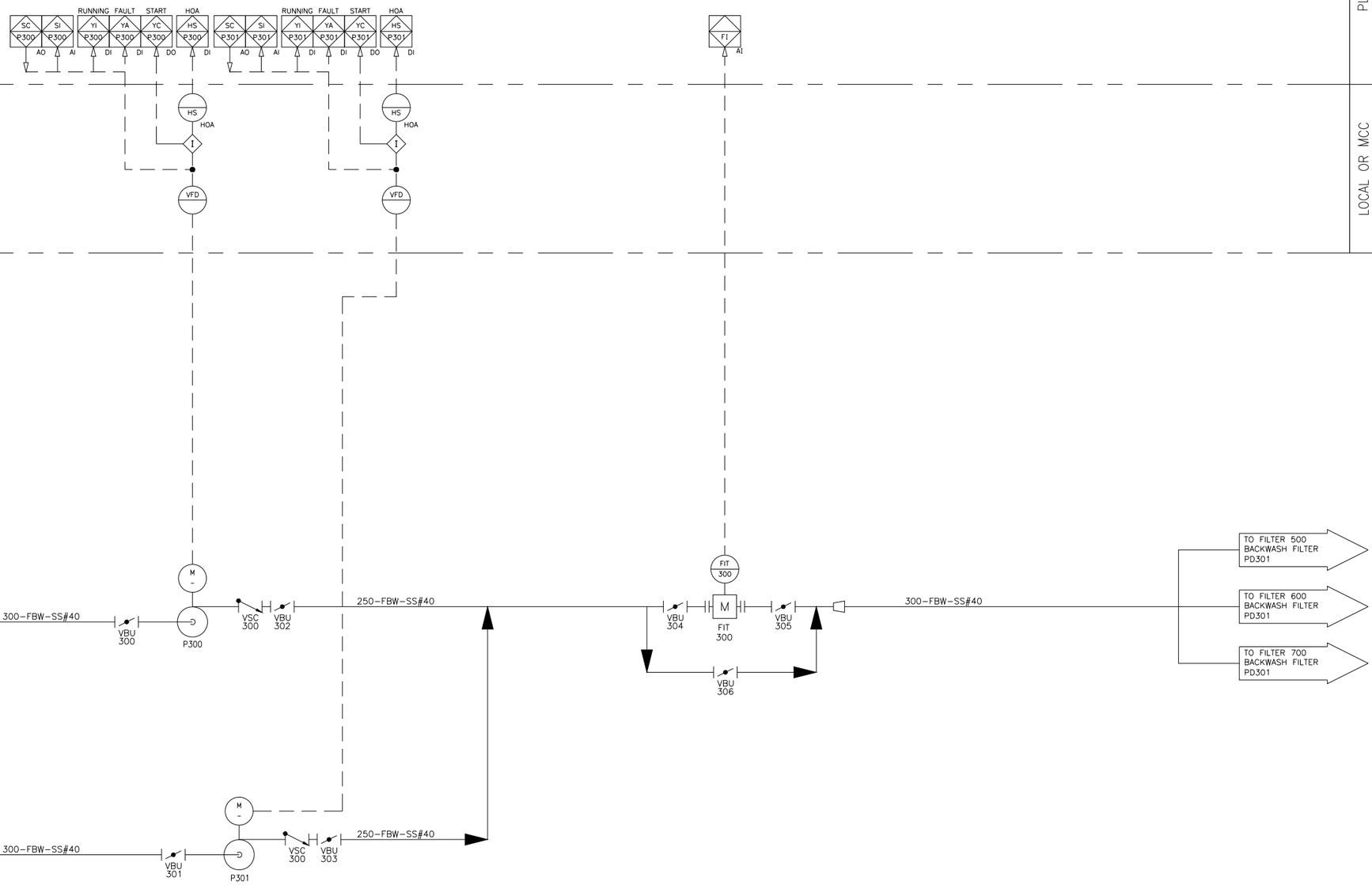
SHEET NO. PD402

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL




P301/302
BACKWASH WATER PUMPS
MOTOR: 30 HP, 575V/3Ph/60Hz ( To be confired)
CAPACITY: 560m/h@ 9.1m TDH

Conditions of Use

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| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
BACKWASH PUMPS

PROJECT NO. 126732

SHEET NO. PD601

KITCHENER

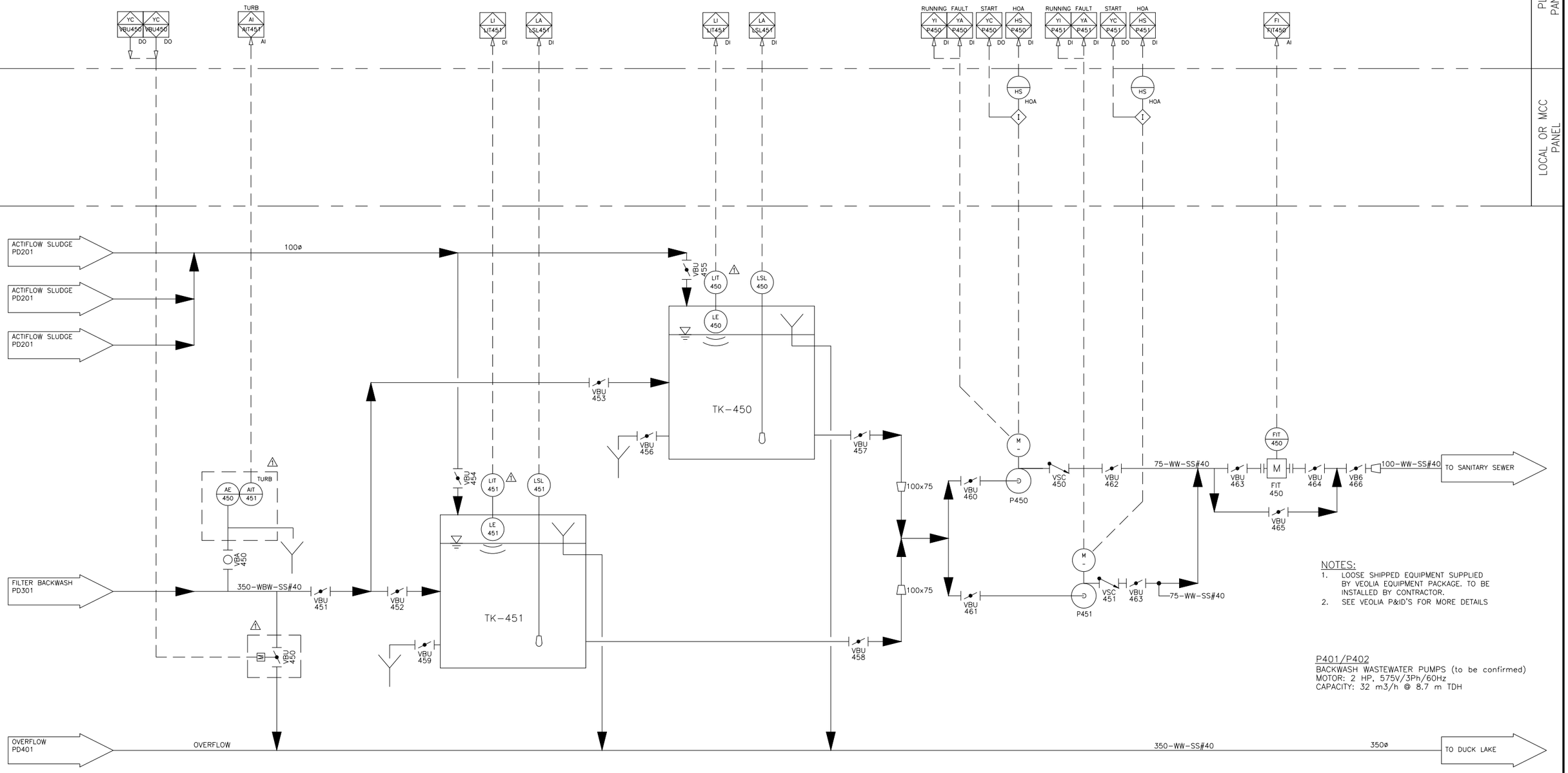
FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGGRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:29 AM PLOT SCALE: 1:50.8 PLOT STYLE: DILLON-STANDARD.CTB

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL




NOTES:
1. LOOSE SHIPPED EQUIPMENT SUPPLIED BY VEOLIA EQUIPMENT PACKAGE. TO BE INSTALLED BY CONTRACTOR.
2. SEE VEOLIA P&ID'S FOR MORE DETAILS

P401/P402
BACKWASH WASTEWATER PUMPS (to be confirmed)
MOTOR: 2 HP, 575V/3Ph/60Hz
CAPACITY: 32 m3/h @ 8.7 m TDH

KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:30 AM PLOT SCALE: 150.8 PLOT STYLE: DILLON-STANDARD.CTB



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| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
WASTEWATER SYSTEM

PROJECT NO. 126732

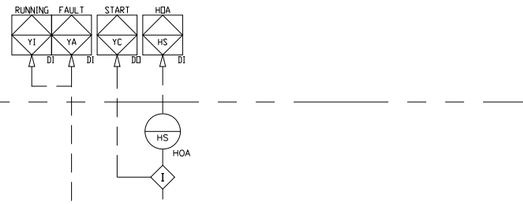
SHEET NO. PD602

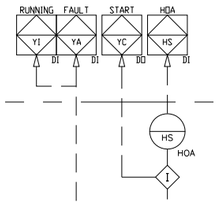
NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

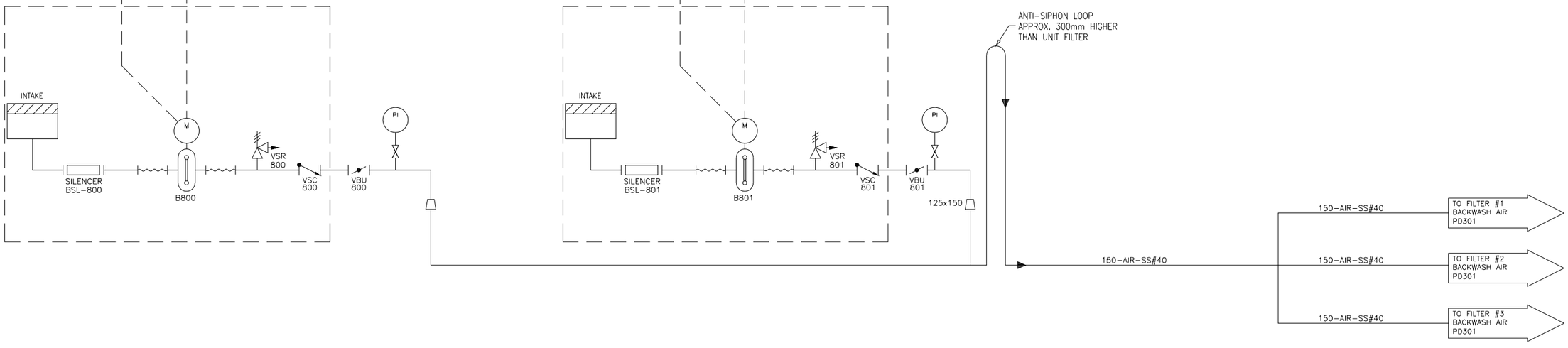
SCADA

PLC PANEL

LOCAL OR MCC PANEL




KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGDRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:31 AM PLOT SCALE: 1.3508 PLOT STYLE: DILLON-STANDARD.CTB

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| No. | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 1 | DESIGN STATEMENT | 2013-08-10 | MB |

| | |
|---|---|
| DESIGN: JLD | REVIEWED BY: IAP |
| DRAWN: SMZ | CHECKED BY: MB |
| DATE: AUGUST 2013 | |
| SCALE: NTS | |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS AND INSTRUMENTATION
BLOWERS

PROJECT NO. 126732

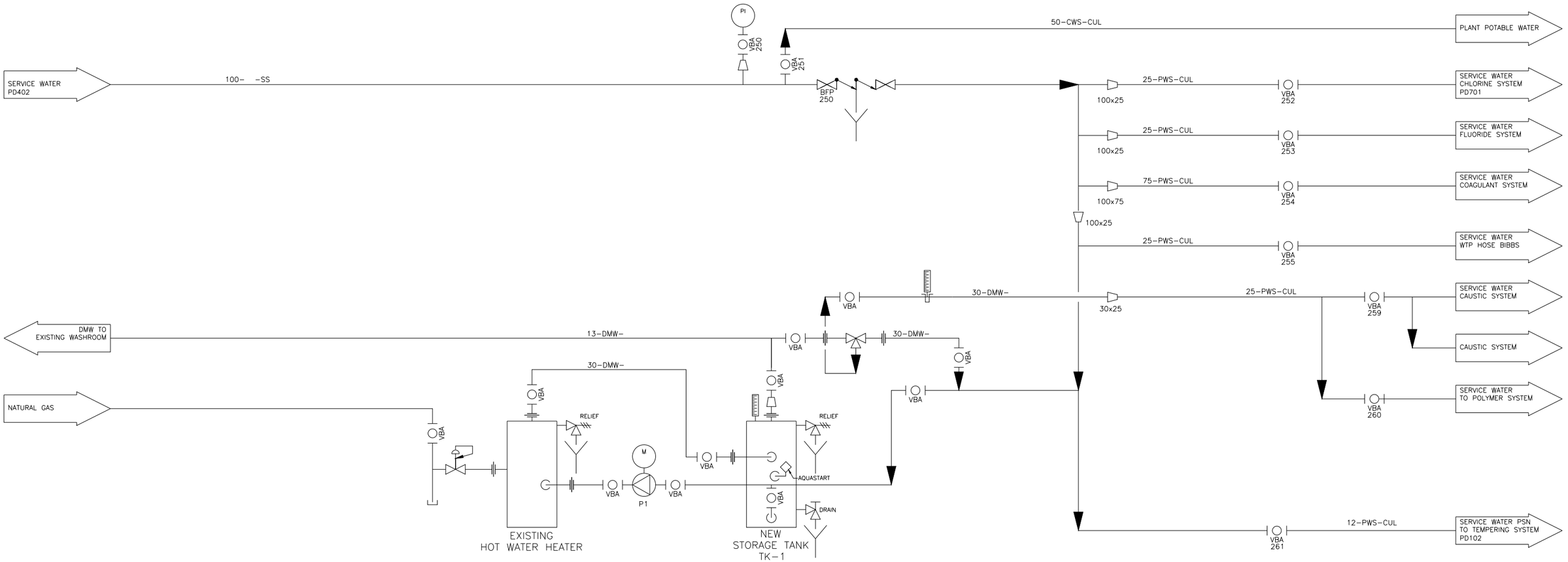
SHEET NO. PD603

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL




KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGORAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:32 AM PLOT SCALE: 1.3508 PLOT STYLE: DILLON-STANDARD.CTB

## 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.



**PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

DILLON CONSULTING

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| 1 | DESIGN STATEMENT | 2013-08-10 | MB |

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|---|---|
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| DRAWN: SMZ | CHECKED BY: MB |
| DATE: AUGUST 2013 | |
| SCALE: NTS | |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROJECT NO. 126732

PROCESS AND INSTRUMENTATION
SERVICE WATER SYSTEM

SHEET NO. PD604

NOTE:
I/O SHOWN ON PLC PANEL SHALL BE INCLUDED IN SCADA EXCEPT WHERE NOTED OR SHOWN SYMBOLICALLY.

SCADA

PLC PANEL

LOCAL OR MCC PANEL

FI X850 DO

FC X851 DO

YO SVGA850 DO

YO SVGA851 DO

EXISTING CHLORINE ROOM

VENT LINE C/W SOLVENT WELDED CAP & BIRD SCREEN TO EXTERIOR

CHLORINE CYLINDER

LC

CYLINDER SCALE

VSC 850

VGA 850

VSC 851

VGA 851

AUTOMATIC SWITCHOVER VALVE 850

PRV 850

PI

VBA 851

SVGA 851

VBA 850

VBA 852

VBA 857

SERVICE WATER PD602

VGA 856

VGA 852

X-850

CHLORINATOR (DUTY)

VGA 854

VGA 857

INJ 851

VGA 853

X-851

CHLORINATOR (DUTY)

VGA 855

SVGA 850

INJ 850

PI

VBA 853

VBA 854

VBA 855

PRIMARY CHLORINATION PD401

VBA 856

SECONDARY CHLORINATION PD402

KITCHENER

FILENAME: G:\CAD\126732-INUVIK WTP\10-WATER_WASTE\126732 - P&ID.DWG PLOTTED BY: ZORGDRAGER, SHANNON
PLOT DATE: 2013-10-08 @ 10:44:33 AM PLOT SCALE: 1.3508 PLOT STYLE: DILLON-STANDARD.CTB



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DILLON CONSULTING

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|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | AUGUST 2013 |
| SCALE | NTS |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

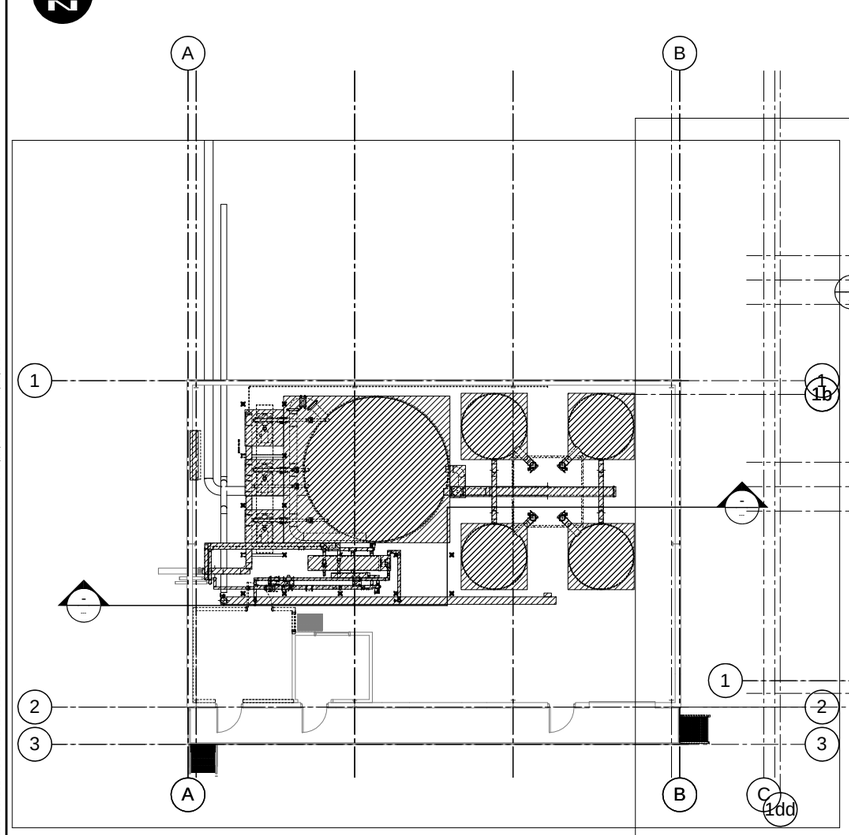
PROCESS AND INSTRUMENTATION
CHLORINATION SYSTEM

PROJECT NO. 126732

SHEET NO. PD701

DILLON CONSULTING LIMITED 3200 DEZIEL DRIVE, SUITE 608, WINDSOR, ONTARIO, N8W 5K8, PHONE (519) 948-5000, FAX (519) 948-5054

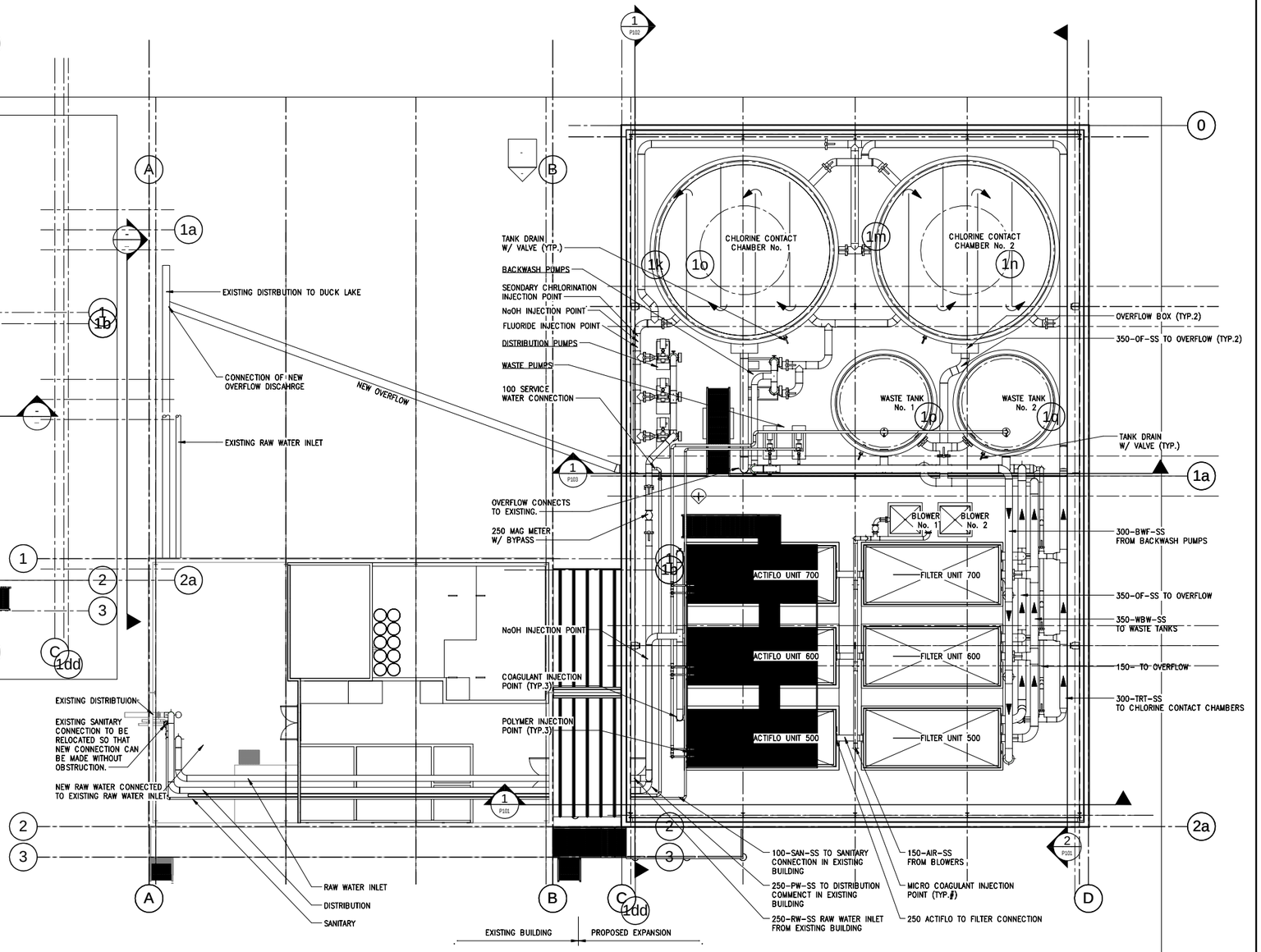
PLOT DATE: 09/10/2013 10:14:39 AM
FILE NAME: G:\CAD\126732-Inuvik WTP\10-Water_Waste\126732-10-WWW-DES.rvt




## DEMOLITION PLAN

SCALE: 1 : 100

INDICATES ITEM TO BE REMOVED AND OR DEMOLISHED. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ADDITIONAL DETAILS ON SCOPE OF DEMOLISION AND UPGRADE.




## OVERALL PLAN

SCALE: 1 : 100

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.

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*NOT TO BE USED FOR CONSTRUCTION*
2013-10-08

| No. | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 1 | DESIGN STATEMENT | 2013-10-08 | MB |

| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | 09 SEP 2013 |
| SCALE | As indicated |

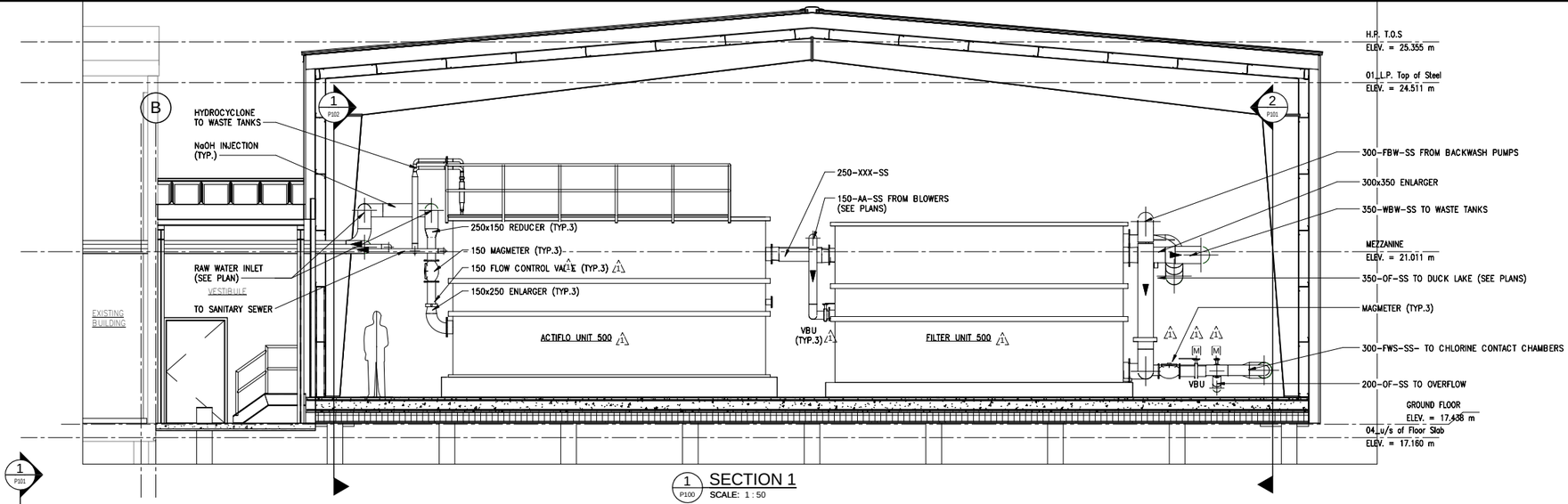
INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS

DEMOLITION PLAN AND OVERALL PLAN

PROJECT NO. 126732

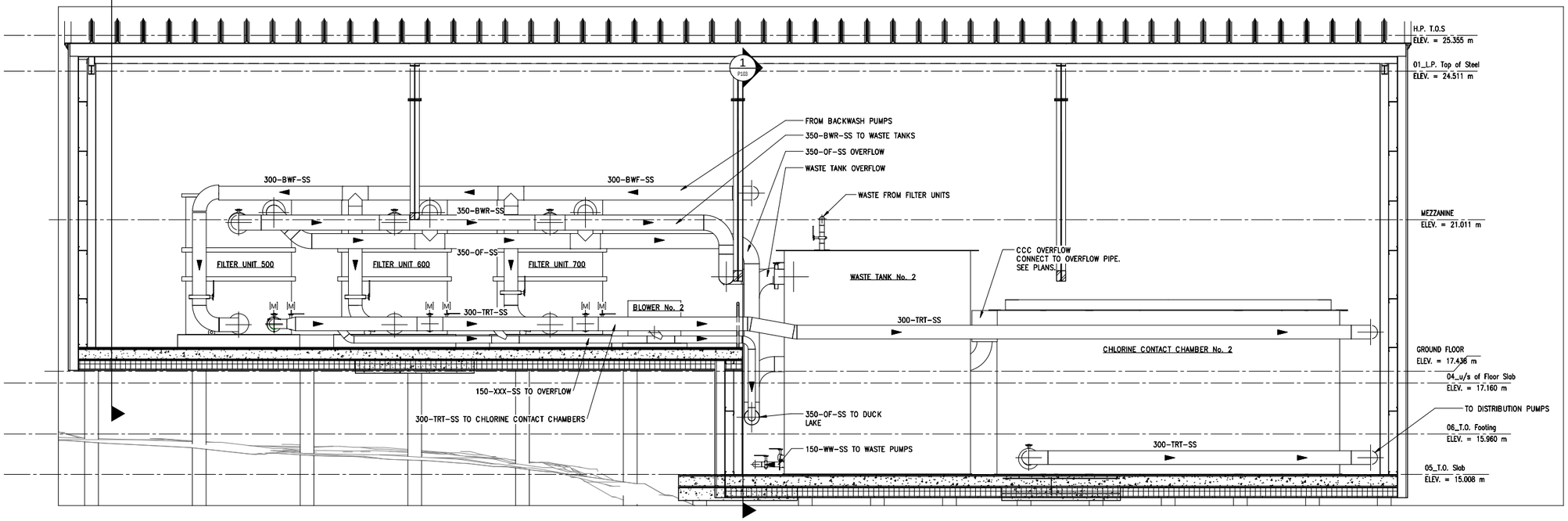
SHEET NO. P100




1 P101

1 P100 SECTION 1
SCALE: 1 : 50

NOTES:
1. SUPPLIED BY VEOLIA




SECTION 2
SCALE: 1 : 50

DILLON CONSULTING LIMITED 130 DUFFERIN AVENUE, SUITE 1400, LONDON, ONTARIO, N6A 5R2, PHONE (519) 438-6192, FAX (519) 672-8209





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| | |
|---|---|
| DESIGN | JLD |
| REVIEWED BY | IAP |
| DRAWN | SMZ |
| CHECKED BY | MB |
| DATE | 09 SEP 2013 |
| SCALE | 1 : 50 |

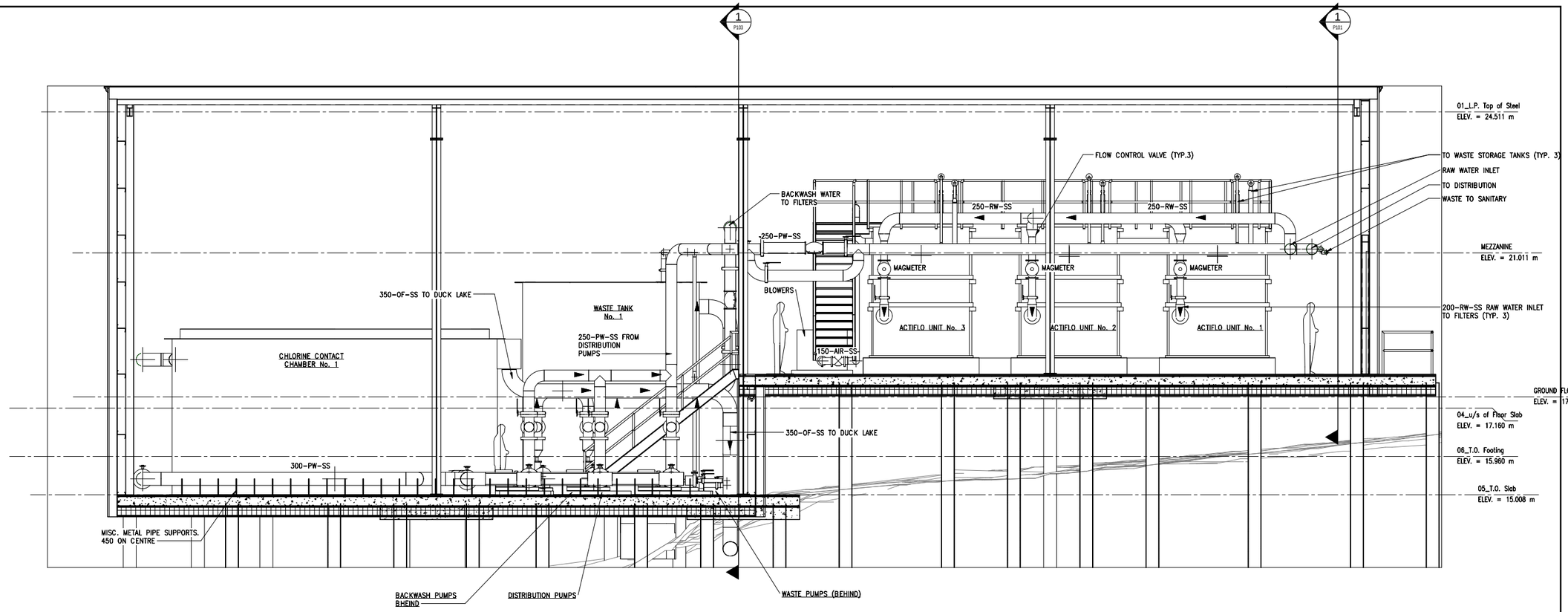
INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS

SECTIONS

PROJECT NO. 126732

SHEET NO. P101




## SECTION 1

SCALE: 1 : 50



Conditions of Use

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2013-10-08

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| 1 | DESIGN STATEMENT | 2013-10-08 | MB |

| | |
|---|---|
| DESIGN: JLD | REVIEWED BY: MB |
| DRAWN: Author | CHECKED BY: IAP |
| DATE: 09 SEP 2013 | |
| SCALE: 1 : 50 | |

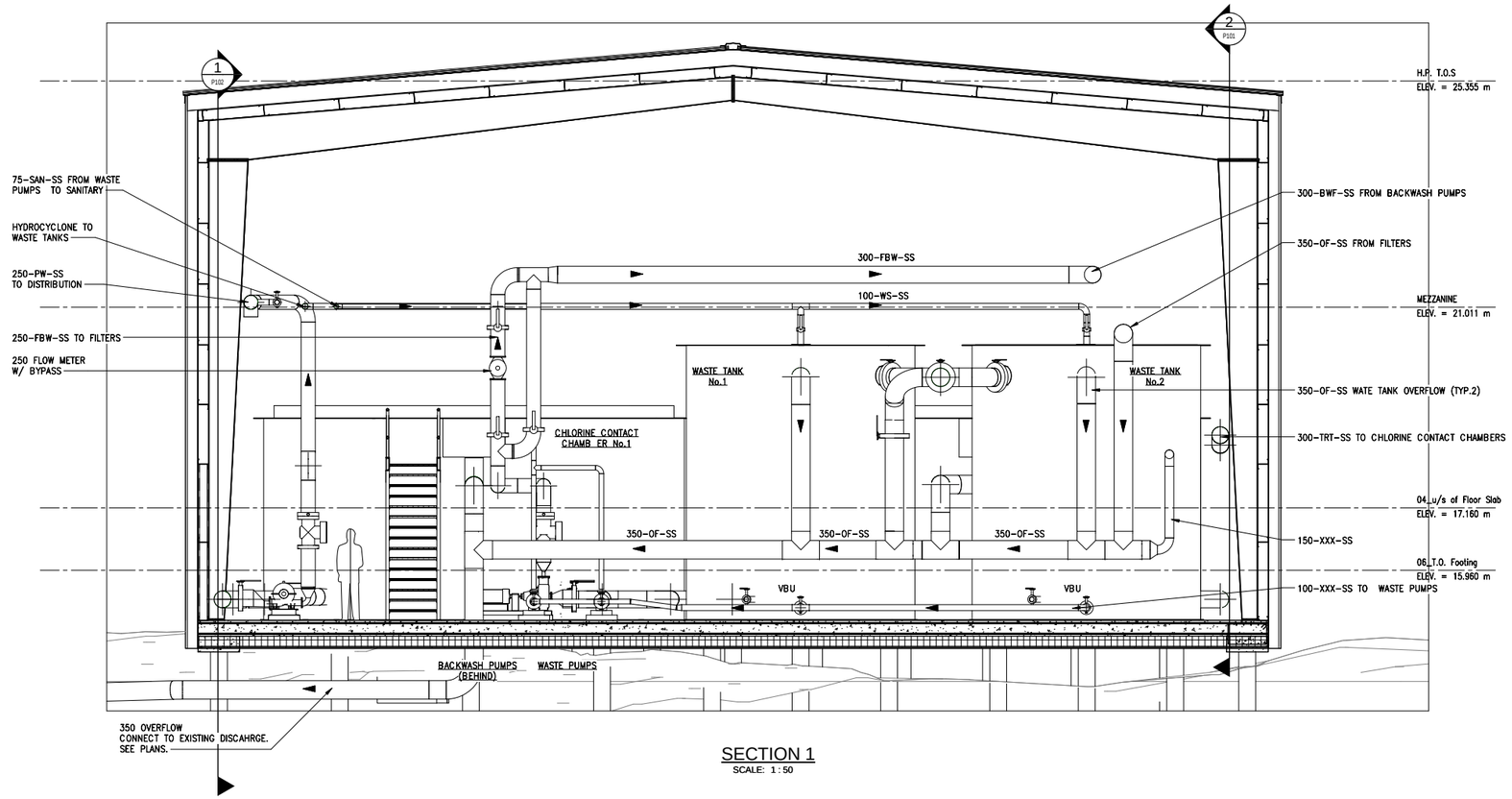
INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS

SECTIONS

PROJECT NO. 126732

SHEET NO. P102




SECTION 1
SCALE: 1 : 50



PLOT DATE: 09/10/2013 10:14:50 AM
FILE NAME: G:\CAD\126732-InuvK WTP\10-Water_Waste\126732-10-WWW-DES.rvt

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| | |
|---|---|
| DESIGN: JLD | REVIEWED BY: MB |
| DRAWN: SMZ | CHECKED BY: IAP |
| DATE: 09 SEP 2013 | |
| SCALE: 1 : 50 | |

INUVIK WATER TREATMENT PLANT
TOWN OF INUVIK

PROCESS

SECTIONS

PROJECT NO. 126732

SHEET NO. P103