REVIEW AND SELECTION OF WATER SUPPLY SYSTEM
GJOA HAVEN, NUNAVUT

TERMS OF REFERENCE
FOR
A PLANNING STUDY

Government of Nunavut

1.0 THE PROJECT

The primary objective of this PLANNING STUDY is to select a water supply system (source/storage, transmission, treatment and distribution system) to provide a year round safe drinking water to the Hamlet of Gjoa Haven.

2.0 INTRODUCTION

The Hamlet of Gjoa Haven currently obtains potable water from a runoff lake known as WATER LAKE. The lake is recharged every fall by means of an overland pipe (250 mm in diameter, and about 4 km long) from Swan Lake. The existing water supply consists of Water Lake as the raw water source; an intake shack (Pumphouse); an 190 m long transmission main that delivers raw water from the Intake Pumphouse (situated on the shore of Water Lake) to a Distribution Pumphouse equipped with a truck fill arm. A chemical feed pump is used to chlorinate the water inline at the Distribution Pumphouse prior to filling the water delivery trucks. There is no intermediate or final storage in the processing of the water at either Pumphouse or in between.

The system is over twenty years old. The transmission (water supply) pipeline is characterized by "scars" from past and recent repairs to ruptures, breaks and leaks. As well subdivision has been developed in relatively close proximity to the shores of Water Lake thus raising concerns of potential contamination of the raw water source from runoff from the subdivision. And in December, 1999 bloodworms (midge fly larva) were discovered in some residential water tanks in the community. Water Lake was/is deemed to be the culprit.

3.0 PROPOSED SYSTEM

With view to the above information, the Department of Community Government and Transportation seeks proposals to conduct field surveys preliminary engineering studies leading to the selection of the most economical development to provide the Hamlet of Gjoa Haven with a reliable source of drinking water - year round water supply system (source, intake facilities, transmission main as applicable, water treatment/processing and distribution facilities) for the Hamlet of Gjoa Haven. The following scope has been identified to guide the search for a safe and cost-effective 20-year design horizon solution. The proposal is to review, evaluate and outline:

Raw Water Source/Storage:

Swan Lake:

- The community favours Swan Lake – requires bathymetric studies to evaluate depth and water storage capacity for the twenty years design horizon based on a consumption rate of 90 litres per capita per day (LCPD) plus provisions for Fire Protection, industrial and commercial demand.

- Conduct an environmental assessment and recommend measures to mitigate any potential bacteriological contamination of Swan Lake - the Lake is used for recreation, fishing and campsite purposes.

Carry out a formal water quality study to confirm compliance with the Nunavut Public Health Act and the Guidelines for Canadian Drinking Water Quality. The sole record/results of chemical analysis of water from Swan Lake dates back to two grab samples that were taken on April 27, 1989.

If midge fly larva is present, identify by field studies an area of the lake, which is free of larval infestation (midge fly larva in particular) for the location of the intake screening system, if Swan Lake is selected as the raw water source.

Water Lake:

Conduct an environmental assessment to evaluate the continued use of Water Lake as a storage and raw water source – if appropriate measures (cutoff trench) were deployed to mitigate any potential bacteriological contamination from the adjacent subdivision.

Propose storage modifications to the Lake to provide adequate winter storage capacity for the twenty years design horizon based on a consumption rate of 90 litres per capita per day (LCPD) plus provisions for Fire Protection, industrial and commercial demand.

Investigate the extent and origin of the midge fly larval infestation in Water Lake; and propose measures, as necessary, to augment the existing first line of filtration (intake screen designed to prevent the suction of larval forms into the system).

Earthen Reservoir:

Investigate the possibility of locating an earthen reservoir at a suitable site in the community to provide adequate year round storage capacity for the twenty years design horizon based on a consumption rate of 90 litres per capita per day (LCPD) plus provisions for Fire Protection, industrial and commercial demand. The reservoir may use Swan Lake and/or Water Lake as raw water source(s). The proposal must include provisions to safeguard the raw water source(s) from bacteriological contamination.

<u>Intake System:</u>

Intake Pumphouse:

Propose a pumphouse to suit the selected water source/storage facility. Make/include provisions for emergency water withdrawal to meet community demand at this location. Incorporate a chemical disinfection system into the emergency water withdrawal system.

Intake Line:

Investigate the following options: a) single line – gravity drained; or b) a dual re-circulation system. Indicate whether the pipeline is to be installed above ground or buried.

Identify line size, type of line supports, intake casing, dual or single intake and required freeze protection for all components (including valves and fittings) of the intake line assembly.

Intake Screen:

- Examine potential location and type. This first level of filtration is to form an integral part of the water processing/treatment system.
- Include provisions for a backwash system for the intake screen

Tempering System:

- If required, propose the nature and type (boilers, heat exchanges etc).

Intake Pumps:

- Examine the options (single, series or parallel combinations) and recommend a suitable choice for a twenty-year design horizon at 29 LCPD plus Fire Protection, industrial and commercial demand.

Transmission Main/Water Supply Pipeline:

- Examine the cost effectiveness of a transmission main from the selected water source to the existing Distribution Pumphouse (to be retrofitted, as necessary) IN COMPARISON to locating a new distribution facility with a truckfill station at the selected water source. The existing distribution pumphouse is conveniently located close to the community. It is connected to the existing raw water source by means of a 100-mm diameter x 190-m long pipeline from the Intake Pumphouse. A new transmission main will be necessary whether the current set up is maintained or a new intake and distribution pumphouses are proposed.

Water Treatment/Processing and Distribution Facilities:

- The following requirements are to be met by the treated water: absence of turbidity and colour; absence of taste and odour; properly adjusted with respect to chemical balance (known as "pH") to prevent corrosion and excessive formation of scale within the distribution system; disinfected so that it is bacteriologically safe for drinking purposes. The treatment should destroy or inactivate bacterial microorganisms, which may pose a threat to public health.

- The Distribution Pumphouse/truckfill station is to house the equipment required to successfully treat/process to potable standards.

- If the selected water supply system include a separate Intake and Distribution pumphouses: a) consideration may be given to treating /processing the water entirely at either location or both as the project economics dictate; b) include details of a year round access, if the intake facility is located at Swan Lake, for example.

4.0 SUMMARY

In summary a proposal is required to provide the Hamlet of Gjoa Haven with an adequate supply of water that is free of health hazards, and meets or exceeds the Canadian Drinking Water Guidelines and all specific requirements of the community's Nunavut Water Board Licence to Operate. Water that is aesthetically acceptable and is of sufficient quality and quantity for household, Fire Protection, commercial, and industrial use.

Scenarios/Concept Alternatives:

- Swan Lake - will require power (either power line or generator); upgrade the existing access road to allow water to be trucked year round; construction intake system and water treatment/truckfill station. Deploy measures to safeguard the lake from bacteriological contamination.

- Swan Lake - construct intake facilities (including a pumphouse) at the Lake and a watermain to transport water from the lake to the existing distribution pumphouse/truckfill station in town. The existing distribution pumphouse/truckfill station is to be retrofitted as necessary. Make provisions to safeguard the lake from bacteriological contamination.

- Barthen Reservoir - Construct Water Reservoir and recharge infrastructure (water pipeline from an appropriate water source) with year round road access, intake system and water treatment facility/truckfill station. May require delivery of power to the site or a generator.

- Barthen Reservoir - construct Water Reservoir and recharge infrastructure and waterline to a new or the existing distribution pumphouse/truckfill station in town. The existing distribution pumphouse/truckfill station is to be retrofitted as necessary.

- Water Lake – propose improvements: a) to increase the winter storage capacity of the lake; and b) to safeguard the lake from bacteriological contamination due to runoff from the adjacent subdivision – a cutoff trench or drainage structure may be considered. Replace the aging pipeline with a new appropriately sized water transmission main. Retrofit/upgrade both the intake pumphouse (may be relocated, if need be) and the distribution pumphouse/truckfill station. Maintain the existing lake recharge (overland pipeline from Swan Lake), water treatment and distribution systems and practices.