



Memorandum

Project Name: Resolute Bay Water

Project #: FRE-00261400-A0

To: Bhabesh Roy, P.Eng.

From: Tony Whalen, P.Eng.

Date: October 3, 2020

Subject: Sustainability of Char Lake

Distribution: Daryl Burke, P.Eng.

This intent of this memo is to demonstrate how much water will be sufficient to meet the community's needs from now until 2047 and whether Char Lake is capable of supplying that demand.

EXP have calculated consumption from now (2020) to the design horizon of 2047 based on projected population increases. A review of the population projection for Resolute Bay indicates than a growth rate of 1%, compounded annually is anticipated. The Water and Sewage Facilities Capital Program Standards and Criteria present a design value for average day residential consumption of 225 liters per capita day. In view of the long design life of the proposed facilities, the potential for changes over the life of the system and the challenges associated with providing more capacity in this location it is felt appropriate to adopt the more demanding criterion of 225 litres per capita day.

For the airport area a per capita average daily water consumption estimate of 140 liters was developed during the preparation of the Pre-Design Report. This leads to an average day consumption of 38,100 liters in 2017. Despite the lack of a long-term population estimate for the airport area, an allowance must be provided for growth in demand over the life of the project. For current purposes, it will be assumed that demands in the airport area will grow in comparable fashion to demands in the town site. This leads to an average demand in the airport area of 52,000 liters at the end of the design period.

The Water and Sewage Facilities Capital Program Standards and Criteria, as published by the Department of Municipal and Community Affairs. Government of the Northwest Territories (MACA), recommend a maximum day factor of 2.75 times average demand. This is consistent with the design guidelines of other agencies. This gives rise to a maximum day demand of 387,750 at the end of the design period. This can be expressed as a flow rate of 4.5 L/s if this demand is met over 24 hours.

Ongoing flow into the sewage collection network is required to offset heat loss from the piping. During the design of the piped sewage collection network an allowance for bleed demands was developed. This water requirement is estimated at 3.0 L/s or 259,200 liters per day at the end of the design period. Calculated annual consumption are presented in Table 1 below for 2020, 2030, 2040 and 2047.

Table 1 - Calculation of annual water extraction from Char Lake

	Year	2020	2030	2040	2047
Population	Persons	290	318	346	365
Community Per Capita Consumption	L/capita/day	225	232	239	243.9
Community Consumption	L/day	65,250	73,724	82,843	89,000
Airport Consumption (based on approx 140L/c/d)	L/day	38,100	43,248	48,396	52,000
Total Consumption	L/day	103,350	116,973	131,239	141,000
Total Consumption (based on max day factor 2.75)	L/day	284,213	321,675	360,907	387,750
Total Consumption (based on max day factor 2.75)	L/s	3.3	3.7	4.2	4.5
Bleedwater	L/day	155,520	193,920	232,320	259,200
Bleedwater as % of total water extracted	%	35%	38%	39%	40%
Community Wide Demand	L/day	439,733	515,595	593,227	646,950
Community Wide Demand	m ³ /day	440	516	593	647
Community Wide Demand	L/s	5.1	6.0	6.9	7.5
Annual Consumption	Liters	160,502,363	188,192,040	216,527,835	236,136,750
Annual Consumption	m³	160,502	188,192	216,528	236,137

Tabulated values of watershed yield are presented below in Table 2. As such, the recharge into Char Lake is capable of meeting the estimated demands and sufficient until about 2040.

Table 2 – Estimated Watershed Yield

Event	Estimated Watershed Yield (m ³)	Watershed Yield Net of Lake Evaporation (m ³)
20-year return	204,000	200,000
100-year return	168,000	164,000
Lowest observed annual precipitation	166,000	162,000
Typical (Climate Normals)	342,000	338,000

However, it is recommended that additional technologies be investigated (such as mechanical lifting systems, heat tracing, etc.) to replace the bleedwater system to prevent water from freezing since Char Lake cannot sustain supply in this fashion past 2040

Submitted by:



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