Section 1
Water Licence Application Form

Section 2
Information for the Water Licence Application

Information for the Water License Application for the Hamlet of Resolute Bay

License on file shows an expiry date of June 30, 1999 and the license # is: N4L3-1571.

(1) Name and Mailing Address of Applicant/Licensee

Hamlet of Resolute Bay
P.O. Box 60
Resolute Bay, NU, Canada
X0A 0V0

Phone: 1-867-252-3616
Fax: 1-867-252-3749

(3) Location of Undertaking

Resolute Bay Resolute is located at 74°42'N latitude and 94°50'W longitude, on the southern shore of Cornwallis Island. It is approximately 900 km north of the Arctic Circle and 1,561-air km northeast of Yellowknife.

Cornwallis Island is in the Innuition Region. Most of the land has been worn to a peneplained surface. There is a general slope toward the coast, with high bluffs up to 260 m in the southeast and lower elevations toward the north end of the Island. The shores of Resolute Bay are low and composed of Palaeozoic limestones and shales. The land surface slopes gradually from the shore in a series of gravel ridges, which appear to be raised beach lines. Rising to an elevation of 195 m, Signal Hill, a prominent landmark, is situated at the north end of the bay.

Bedrock is typically 1.5 to 9.5 m below the surface. Aggregate materials above the bedrock consist of gravel-sized frost-shattered material, cobbles averaging 20 cm in diameter and fines which are mainly non-plastic.

The depth of the permafrost active layer varies between 0.5 m and 1 m. The ice constant varies between 10% and 25% by volume.

Vegetation is limited to lichens, mosses and grasses. Grasses tend to grow in wetter areas near lakes and streams.

Resolute receives an average of 5.3 cm of rainfall and 84 cm of snowfall annually. Mean annual precipitation totals 13 cm. July mean high and low temperatures are 6.8° C and 1.4° C. January mean high and low temperatures are -28.4° C and -35.7° C. Winds are generally from the north-northwest and annually average 21.5 km/h.

Archaeological findings suggest that the Inuit frequented the Cornwallis Island area but did not permanently inhabit it. There is also evidence of Dorset, Thule and Alaskan Inuit habitation, although their visits were probably short-term as well. The first siting of the island was made by Parry in 1819 in his search for the Northwest Passage. The Hamlet was named for the 'H.M.S. Resolute', one of the ships in the search for the lost Franklin expedition.

An airfield was established at Resolute in 1947 when the American/Canadian weather station was completed. In 1953, Inuit from Port Harrison and Pond Inlet were relocated there.

In the early 1970's it was decided to relocate the settlement from the beach area south of Resolute Lake to a new site. 'New Town' was designed by Ralph Erskine, Architect and Planner from Drottningholm, Sweden. Designed for a population of 1200, the new subdivision improved residential, working, and community facilities markedly, although so far has not yet reached its carrying capacity.

In the last decade Resolute has developed into a major transhipment point for the supply of petroleum exploration equipment to points northward. Nearly five thousand aircraft takeoffs and landings take place each year.

Major economic activities revolve around transportation, communications, oil and gas exploration, and mining. Cominco's Polaris Mine is located nearby on Little Cornwallis Island. Resolute is a base for many Arctic island tours, photographic expeditions, fishing trips, and polar icecap visits. Businesses include air transport, general retail, food services, hotels, outfitting, and restaurants.

Resolute gained Hamlet status on November 3, 1987. A traditional name for the community is "Qausuittuq", meaning 'place that never dawns'.

(4) Description of Undertaking

Water Supply and Treatment

Resolute's potable water source, Char Lake, is located approximately 1.5 km west of the town site. The majority of the Hamlet is on a utilidor (piped) system. The south camp and buildings at the airport that are not on the piped system are served by trucked delivery.

A causeway, intake line, and pumpwell have been built into Char Lake to place the intake in a minimum water depth of four metres. There is a similar gravel causeway built into Strip Lake. An intake structure and pumps have been built to deliver water by insulated pipeline to tanks in a storage building at the airport complex. The pumps have been designed to automatically operate according to the amount of water in the reservoir, supplying the maximum daily requirements of the town site. The water distribution capacity of the pumphouse is 760 L/min. An insulated return line is buried alongside the supply line in the same trench.

Chlorination is provided by dual hypochlorite solution injection pumps (one from standby) located at the water treatment and storage facility.

Water Storage and Distribution

The aboveground-insulated steel reservoir (530,000 L) was designed to provide for peak hour and fire demands. It is situated north of the community at a sufficient elevation as to provide distribution main pressures by gravity.

The entire Hamlet is supplied by a shallow-buried water and sewer utility system. An insulated transmission main forms a single loop with continuous re-circulation. Pumps are located at the storage facility and boilers are used to maintain adequate water main temperatures and to prevent freezing. Electrical heat tracing was installed for emergency purposes in the mains but not in the service connections. Hydrants are placed at strategic points for fire protection.

A 9080 L water truck serves the south camp and some of the buildings at the airport; the service is currently under contract. Water used for the trucked delivery is taken from the piped system at the airport. The airport water storage building serves as the truck fill point. All water deliveries are metered.

Water Quality:

Refer to Baffin Regional Health Board reports.

Sewage Collection and Disposal

The shallow-buried pipe system houses both the water mains and the sewage pipes. Using insulated, electrically heat-traced piping, service lines run directly to each house.

Sewage is comminuted prior to discharge into the bay. Sewage runs approximately 500 m to the outfall pipe, located at the shore of the bay at the high tide water edge. The pipe is wrapped with insulation and protected by an outer plastic skin. The last 3 m of the pipe are contained in corrugated steel piping; the end is covered with a steel plate. An oval opening allows sewage to discharge onto a long, downward-sloping concrete surface.

Sewage from the airport complex is conveyed to a holding tank. The effluent from the tank discharges into the watercourse of the upper reaches of the Meretta and Resolute Lake system.

For those not on piped service, liquid pumpout sewage is collected from holding tanks using a tank truck (9080 L). The service is currently contracted.

Liquid pumpout sewage is discharged by the contractor at the MOT garbage dump, located approximately 5 km northwest of the south camp. The liquid sewage is separated from the solid waste. Treatment consists of the application of lime coupled with a covering of gravel in the summer.

Solid Waste Collection and Disposal:

Solid waste is collected daily by a one-person crew using a Ford model F-350 truck. Garbage is placed in 205 L drums prior to pick-up. Bulky wastes, stored at a separate site (300 m^2), are the responsibility of the individual. In August of each year the Hamlet organizes a clean-up day.

The solid waste management site (120 m²) is located on sloping ground, 7 km south south west of the Hamlet near the MOT base. Burning at the site is practiced every day and the site is covered and compacted monthly despite the absence of abundant cover material.

(5) Type of Undertaking

Municipal

(6) Water Use

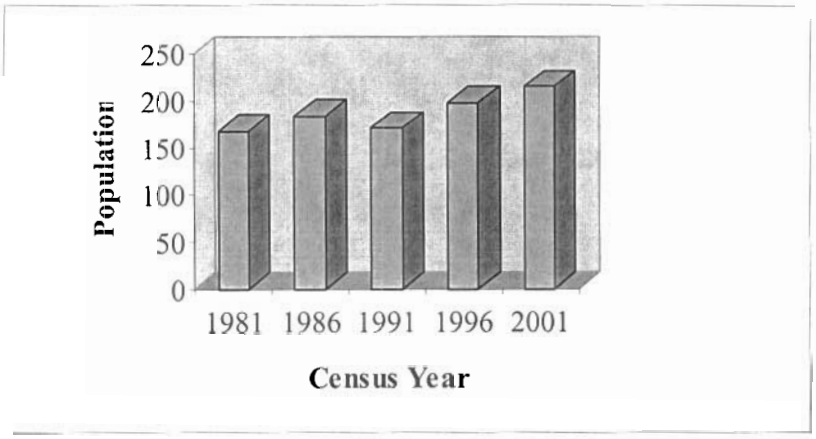
To obtain water

(7) Quantity of Water Involved:

Water Generation Projections:

The 2001 Census Report shows the increase in population of the Hamlet of Resolute Bay between the census years of 1981 to 2001. Figure 1 illustrates this population increase. A per capita growth rate of 0.80% was determined from data found in "Nunavut: Community Population Projections 2000-2020".

Figure 1 - Population Increase in the Hamlet of Resolute Bay



Water Use Projection for Utilidor System

CG&T planning guidelines suggest that the increase in the projected per capita water use in a utilidor service community should be modelled as follows:

RWU x (-1.0 + (0.323 x Ln (Population)) **2000<Population<10,000**

The RWU or residential water use is estimated to be 90 litres per capita (Lpcd) for populations lower than 2000 on trucked systems. The RWU is estimated to be 220 Lpcd for populations greater than 2000. The model has not been calibrated for populations less than 2000.

Current water use on the utilidor system is projected based on the current rate of 180 Lpcd. *(According to Hamlet - Municipal Questionnaire)*

The water use is projected as follows for the 200 people on the utilidor system:

- The current amount of water use was estimated to be 13,140,121 L annually. This corresponds to a per capita water use of 180 Lpcd.
- In the year 2008, the per capita water use would be 183.9 *Lpcd corresponding to an annual water use of* 14,082,814 *L.*

Table 1.2 - Water Use Projection (Utilidor) Hamlet of Resolute Bay

Planning Year	Calendar Year	Total Population	Projected Water Use	Daily Projected Volume	Annual Projected Volume
		#	Lpcd	Litres	Litres
0	2002	200	180.0	36,000	13,140,121
	2003	202	180.7	36,420	13,293,163
	2004	203	181.3	36,843	13,447,814
	2005	205	182.0	37,271	13,604,088
	2006	206	182.6	37,704	13,762,002
5	2007	208	183.3	38,141	13,921,572
	2008	210	183.9	38,583	14,082,814
	2009	211	184.6	39,029	14,245,745
	2010	213	185.2	39,480	14,410,382
	2011	215	185.9	39,936	14,576,741
10	2012	217	186.5	40,397	14,744,840

Water Use Projection for Truck Delivery

CG&T planning guidelines suggest that the increase in the projected per capita water use in a trucked service community should be modelled as follows:

RWU x (1.0 + (0.0023 x Population)) **Population <2000**

The RWU or residential water use is estimated to be 90 litres per capita (Lpcd) for populations lower than 2000.

The water use is projected as follows for the 40 people on the truck system:

- The current amount of water use was estimated to be 1,326,089 L annually. This corresponds to a per capita water use of 90.8 Lpcd.
- In the year 2008, the per capita water use would be 90.9Lpcd corresponding to an annual water use of 1,391,649L.

Table 1.1 - Water Use Projection (Delivered) Hamlet of Resolute Bay

Planning Year	Calendar Year	Total Population	Projected Water Use	Daily Projected Volume	Annual Projected Volume
		#	Lpcd	Litres	Litres
0	2002	40	90.8	3,633	1,326,089
	2003	40	90.8	3,662	1,336,795
	2004	41	90.8	3,692	1,347,588
	2005	41	90.8	3,722	1,358,470
	2006	41	90.9	3,752	1,369,440
5	2007	42	90.9	3,782	1,380,499
	2008	42	90.9	3,813	1,391,649
	2009	42	90.9	3,844	1,402,889
	2010	43	90.9	3,875	1,414,221
	2011	43	90.9	3,906	1,425,646
10	2012	43	90.9	3,937	1,437,164

Total Combined Water Use.

The current combined annual volume is 14,466,210 litres.

The estimated combined annual volume for 2008 is 15,474,463 litres.

(8) Waste Generated

Sewage:

Piped Sewage

Sewage generation is assumed to equal water use. For the population on the utilidor system the volume for the year 2002 of sewage generated by Resolute Bay is 13,140,121litres corresponding to the annual water use. In 2008, the annual volume of sewage generated by the Hamlet of Resolute Bay will be 14,082,814 litres.

Pumpout Sewage

Sewage generation is assumed to equal water use. For the population on the pump out system the volume for the year 2002 of sewage generated is 1,326,089 litres corresponding to the annual

water use. In 2008, the annual volume of sewage generated by the Hamlet of Resolute Bay will be 1,391,649 litres

Solid Waste Treatment:

The solid waste management site is located on sloping ground, 7 km south south west of the Hamlet near the MOT base. The disposal area is 120 m^2, with an average depth of 6 m.

Burning at the Resolute Bay solid waste disposal site is practiced every day and the site is covered and compacted monthly despite the absence of abundant cover material.

Bulky wastes are stored at a separate site (300 m^2)

Solid Waste Volume Projections

The types and quantities of materials in the Resolute Bay waste stream available for reuse, recycling, recover and composting programs was estimated in by reviewing current information and by literature.

A recent solid waste composition study has not been conducted in Resolute Bay. The literature provides an insight. The Heinke and Wong study (1989) used by MACA in their planning studies to determine waste volumes suggests a certain volume and mix of MSW. A study by Quay and Heinke (1992) in Inuvik, Tsiigehtchic, and Fort McPherson suggests similar waste stream mix shown in the table that follows.

Table 3 - Estimated Solid Waste Composition

Food Wastes	20.3 %
Cardboard	9.8 %
Newsprint	2.4 %
Other Paper Products	14.8 %
Cans	4.4 %
Other Metal Products	6.2 %
Plastic, Rubber, Leather	14.0 %
Glass, Ceramics	5.7 %
Textiles	3.8 %
Wood	9.9 %
Diapers	3.8 %
Dirt	4.9 %
	100.0 %

NAPP Protocol

The National Packaging Protocol is an initiative by CCME in 1992 to respond to municipalities and the public over the proliferation of disposable consumer packaging. While per capita consumption of new packaging has decreased overall in the south where the data was generated, the implications for the North and, specifically, for Resolute Bay is not as clear.

Southern reductions were primarily a result of recycling, an opportunity not available in Resolute Bay. It is assumed that packaging for shipping foodstuff and consumer products has increased proportionately with population.

However, southern data for post-consumer packaging has shown an increase for various "sectors" of between 100 to 200 percent over a 5-year period (1992-1996). These sectors include: accommodation, food & beverage, amusement, and recreational services; retail; aluminium packaging; plastic; and paper sacks and bags. This data may have a direct implication in Resolute Bay for increased quantities of waste as the data may transfer directly to current disposal practices.

The classes, "Other paper products", "Cans", and "Plastic, Rubber, Leather" may represent the increasing sectors as per the NAPP data. These first two classes currently account for approximately 19.2% of the estimated waste stream in Resolute Bay. If it can be assumed equal contribution from each waste in the third stream, then plastics account for an additional 5%. It appears then, increasing packaging impacts on approximately 24% of the waste stream. Assuming worst case, then, the 200% increase over 5 years is about 40% per year and causes an overall increase of approximately (40% of 24%) 10% per year. This value may over estimate the additional contribution and is unlikely to remain at this level during the entire planning horizon.

Regardless, it is prudent to assume some increase during the planning horizon not directly attributed to a population increase, assuming that recycling programs may not be cost-effective, or implemented in Resolute Bay.

Therefore, a 1% increase in the overall garbage generation rate has been incorporated in the volume estimations.

Table 2.2 shows the projected garbage projections.

The following assumptions were made to prepare this table:

- Per capita volume described by Heinke and Wong (1990) has been increasing at a rate of 1 % per year
- The per capita population growth rate of the Hamlet of Resolute Bay is 0.80% per year.
- The waste density is 0.099 tonnes/m^3 (Bryant et al., 1996)

Table 2.2 - Solid Waste Projection estimates for the Community of Resolute Bay

Planning Year	Calendar Year	Total Population	Projected Daily Rate (m^3pcd)	Projected Daily Volume (m^3/day)	Projected Daily Weight (Tonnes)	Projected Annual Volume (m^3)	Projected Annual Weight (Tonnes)	Running Total (m^3)
0	2002	240	0.014	3.4	0.3	1226	121	1226
	2003	242	0.014	3.4	0.3	1249	124	2475
	2004	244	0.014	3.5	0.3	1271	126	3746
	2005	246	0.014	3.5	0.4	1294	128	5040
	2006	248	0.015	3.6	0.4	1318	130	6358
5	2007	250	0.015	3.7	0.4	1341	133	7699
	2008	252	0.015	3.7	0.4	1366	135	9065
	2009	254	0.015	3.8	0.4	1390	138	10455
	2010	256	0.015	3.9	0.4	1415	140	11870
	2011	258	0.015	3.9	0.4	1441	143	13311
10	2012	260	0.015	4.0	0.4	1467	145	14778

Solid Waste Water Runoff Quality:

Refer to DIAND inspection reports.

Bulky Waste:

Bulky wastes are stored in a separate area (300 m^2) at the solid waste disposal site.

Hazardous Waste:

The community stores batteries at the Hamlet garage for furtherance down south via the summer sealift.

(11) Inuit Water Rights

Will the project or activity substantially affect the quality, quantity, or flow of water flowing through Inuit Owned Lands and the rights of Inuit under Article 20 of the Nunavut Land Claims Agreement? No

(12) Contractors and Sub-contractors

None

(13) Studies Undertaken to Date

Volume 1 - Utilidor Upgrade, Dillon 1999
Volume 2 - Water System Building Assessment, Dillon 1999
Volume 3 - Sewage Treatment and Future Expansion, Dillon 1999

(14) The following documents must be included with the application for the regulatory process to begin

Supplementary Questionnaire (where applicable: see section 5)	Yes
Inuktitut/English Summary of Project	Yes
Application fee of $30.00 (c/o Receiver General for Canada)	Yes