

$$VACC = INV \times VRC \times VCRF$$

INV = 1 truck

VRC = \$ 105 000

VCRF = 0.174

$$VACC = (1)(\$ 105 000)(0.174) \\ = \$ 18 271.55$$

Sewage

$$VACC = INV \times VRC \times VCRF$$

INV = 1 truck

VRC = \$ 70 000

VCRF = 0.174 (same as for water truck)

$$VACC = (1)(\$ 70 000)(0.174) \\ = \$ 12 181.00$$

4. VEHICLE O&M COSTS

Water

$$VSC = INV \times VRC \times VSF$$

INV = 1 truck

VRC = \$ 105 000

VSF = 0.15 (GNWT standard for wheeled water vehicle)

$$VSC = (1)(\$ 105 000)(0.15) \\ = \$ 15 750$$

$$VOC PH = BHP (FR \times FUEL + MISC)$$

BHP = 40 hp = 30 kW

FR = 0.24 (GNWT standard for wheeled vehicle)

FUEL = \$ 0.61 / litre

MISC. = 0.011 (GNWT standard for wheeled vehicle)



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$$VOC PH = 30[(0.24)(0.61) + 0.011]$$

$$= 4.72$$

$$VOC = VOC PH \times THRS$$

$$VOC PH = 4.72$$

$$THRS = 1797$$

$$= 1484$$

hrs/year

hrs/year

Char Lake

Signal Hill

Char Lake

$$VOC = (4.72)(1797)$$

$$= \$8485$$

Signal Hill

$$VOC = (4.72)(1484)$$

$$= \$7007$$

$$VAOMC = VSC + VOC$$

$$VSC = \$15750$$

$$VOC = \$8485$$

$$\$7007$$

Char Lake

Signal Hill

Char Lake

$$VAOMC = \$15750 + \$8485$$

$$= \$24235$$

Signal Hill

$$VAOMC = \$15750 + \$7007$$

$$= \$22757$$



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Sewage

$$VSC = INV \times VRC \times USF$$

$$INV = 1 \text{ truck}$$

$$VRC = \$70,000$$

$$USF = 0.15 \text{ (wheeled water truck GNWT std)}$$

$$VSC = (1)(\$70,000)(0.15)$$

$$= \$10,500$$

$$VOC_{PH} = BHP (FR \times FUEL + MISC.)$$

$$BHP = 30 \text{ kW}$$

$$FR = 0.24 \text{ (GNWT standard for wheeled vehicle)}$$

$$FUEL = \$0.61/\text{litre}$$

$$MISC. = 0.011 \text{ (GNWT standard for wheeled vehicle)}$$

$$VOC_{PH} = 30 [(0.24)(0.61) + 0.011]$$

$$= 4.72$$

$$VOC = VOC_{PH} \times THRS$$

$$VOC_{PH} = 4.72$$

$$THRS = 1721$$

$$VOC = 4.72 \times 1721$$

$$= \$8,126$$

$$VACMC = VSC + VOC$$

$$VSC = \$10,500$$

$$VOC = \$8,126$$

$$VACMC = \$10,500 + \$8,126$$

$$= \underline{\underline{\$18,626}}$$



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5. LABOUR COST PER YEAR

Water and Sewer

$$LCPH = [WD + WH \times NH] \times LBF$$

$$WD = \$20 \text{ /hr}$$

$$WH = \$10 \text{ /hr}$$

$$NH = 1 \text{ helper}$$

$$LBF = 1.2 \text{ GNWT standard}$$

$$LCPH = [20 + (10)(1)] 1.2$$

$$= \$36 \text{ per hour}$$

Water

$$LCPA = LCPH \times THRS$$

$$LCPH = \$36 \text{ per hour}$$

$$THRS = 1797 \text{ Char Lake}$$

$$= 1484 \text{ Signal Hill}$$

Char Lake

$$LCPA = (36)(1797)$$

$$= \$64,692 \text{ per year}$$

Signal Hill

$$LCPA = (36)(1484)$$

$$= \$53,424 \text{ per year}$$

Sewage

$$LCPA = LCPH \times THRS$$

$$LCPH = \$36 \text{ per hour}$$

$$THRS = 1721 \text{ hrs/year}$$



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$$LCPA = (36)(1721)$$

$$= \underline{\$61\ 956 \text{ per year}}$$

6. PARKING GARAGE COSTS (NEW)

$$PGCRF = \frac{DR(1+DR)^{PGEL}}{(1+DR)^{PGEL} - 1}$$

$$DR = 0.08 \quad (8\%)$$

$$PGEL = 20 \text{ years}$$

$$PGCRF = \frac{0.08(1+0.08)^{20}}{(1+0.08)^{20} - 1}$$

$$= 0.10185$$

$$PGACC = PGCC \times PGCRF$$

$$\frac{PGCC = \$400\ 000}{PGCRF = 0.10185}$$

$$PGACC = (\$400\ 000)(0.10185)$$

$$= \$40\ 740$$

$$PGAMOC = PGCC \times PGOMF$$

$$PGCC = \$400\ 000$$

$$PGOMF = 0.06 \quad (\text{GNWT standard factor})$$

$$PGAMOC = \$400\ 000 (0.06)$$

$$= \underline{\$24\ 000}$$

$$PGTAC = PGACC + PGAMOC$$

$$PGACC = \$40\ 740$$

$$PGAMOC = 24\ 000$$

$$PGTAG = \$40\ 740 + \$24\ 000$$



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$$PGTAC = \$64,740$$

7. COST OF BUILDING SYSTEMS

$$ACBRF = \frac{DR(1+DR)^{ABCEL}}{(1+DR)^{ABCEL} - 1}$$

$$DR = 0.08$$

$$ABCEL = 15 \text{ years}$$

$$ACBRF = \frac{0.08(1+0.08)^{15}}{(1+0.08)^{15} - 1}$$

$$= 0.11683$$

$$ACCB = C \times NCI$$

$$C = \$575,000$$

$$NCI = 1.0$$

See estimate sheet
Already accounted for

$$ACCB = \$575,000 \times 1.0$$

$$\underline{ACCB = \$575,000}$$

$$AACCB = ACCB \times ACBRF$$

$$ACCB = \$575,000$$

$$ACBRF = 0.11683$$

$$AACCB = \$575,000 \times 0.11683$$

$$= \$66,845$$

$$AAOMCB = ACCB \times AOMFB$$

$$ACCB = \$575,000$$

$$AOMFB = 0.02 \text{ (GNWT Standard)}$$

$$AAOMCB = \$575,000 \times 0.02$$



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$$\underline{AAOMCB = \$11\,700}$$

$$ATACB = AACCB + AAOMCB$$

$$AACCB = \$68\,345$$

$$AAOMCB = \$11\,700$$

$$\begin{aligned} ATA CB &= \$68\,345 + \$11\,700 \\ &= \$80\,045 \end{aligned}$$

8. TRUCKED SYSTEM TOTAL COST

8.1 Total Capital Costs

$$TSCC = VCC + PGCC + ACCB$$

$$VCC = \$105\,000 + \$70\,000$$

$$PGCC = \$400\,000$$

$$ACCB = \$575\,000$$

$$\begin{aligned} TSCC &= \$175\,000 + \$400\,000 + \$575\,000 \\ &= \$1\,150\,000 \end{aligned}$$

$$TSACC = VACC + PGACC + AACCB$$

$$VACC = \$18\,271 + \$12\,181$$

$$PGACC = \$40\,740$$

$$AACCB = \$67\,177$$

$$\begin{aligned} TSACC &= 18\,271 + 12\,181 + 40\,740 + 67\,177 \\ &= \$138\,369 \end{aligned}$$

8.2 Total Annual Operations and Maintenance Costs

$$TSAOMC = VAOMC + LCPA + PGAOMC + AAOMCB$$



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$$\begin{aligned}
 \text{VAOMC} &= \$24\,235 + \$18\,626 \\
 &= \$22\,757 + \$18\,626 \\
 \text{LCPA} &= \$64\,692 + \$61\,956 \\
 &= \$53\,424 + \$61\,956 \\
 \text{PGAOMC} &= \$24\,000 \\
 \text{AAOMCB} &= \$11\,500
 \end{aligned}$$

Char. Lake
Signal Hill
Char. Lake
Signal Hill

Char. Lake

$$\begin{aligned}
 \text{TSACMC} &= (\$24\,235 + \$18\,626) + (\$64\,692 + \$61\,956) \\
 &\quad + \$24\,000 + \$11\,500 \\
 &= \$205\,009
 \end{aligned}$$

Signal Hill

$$\begin{aligned}
 \text{TSACMC} &= (\$22\,757 + \$18\,626) + (\$53\,424 + \$61\,956) \\
 &\quad + \$24\,000 + \$11\,500 \\
 &= \$192\,263
 \end{aligned}$$

8.3 Total Annual Costs

$$\text{TSTAC} = \text{TSACC} + \text{TSACMC}$$

$$\begin{aligned}
 \text{TSACC} &= \$138\,369 \\
 \text{TSACMC} &= \$205\,009 \quad \text{Char. Lake} \\
 &= \$192\,263 \quad \text{Signal Hill}
 \end{aligned}$$

Char. Lake

$$\begin{aligned}
 \text{TSTAC} &= \$138\,369 + \$205\,009 \\
 &= \$343\,378
 \end{aligned}$$

Signal Hill

$$\begin{aligned}
 \text{TSTAC} &= \$138\,369 + \$192\,263 \\
 &= \$330\,632
 \end{aligned}$$



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TOTAL ANNUAL COST FOR TRUCKS

Char Lake

$$VACC = \$ 18\ 271 + \$ 12\ 181$$

$$VAOMC = \$ 24\ 235 + \$ 18\ 626$$

$$LCPA = \$ 64\ 692 + \$ 61\ 956$$

$$\begin{aligned} \text{Truck Costs} &= (\$ 18\ 271 + \$ 12\ 181) + (\$ 24\ 235 + \\ &\quad \$ 18\ 626) + (\$ 64\ 692 + \$ 61\ 956) \\ &= \$ 199\ 961 \end{aligned}$$

Signal Hill

$$VACC = \$ 18\ 271 + \$ 12\ 181$$

$$VAOMC = \$ 22\ 757 + \$ 18\ 626$$

$$LCPA = \$ 53\ 424 + \$ 61\ 956$$

$$\begin{aligned} \text{Truck Costs} &= (\$ 18\ 271 + \$ 12\ 181) + (\$ 22\ 757 + \\ &\quad \$ 18\ 626) + (\$ 53\ 424 + \$ 61\ 956) \\ &= \$ 187\ 215 \end{aligned}$$



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TO PROVIDE COSTS FOR TABLE S-5

2. Water and Sewer Trucks

$$\text{Capital Cost} = \text{VRC (Water Truck)} + \text{VRC (Sewer Truck)}$$

$$= \$105,000 + \$70,000$$

$$= \$175,000$$

$$\text{O\&M Cost} = \text{VAOMC (Water)} + \text{VAOMC (Sewer)} + \text{LCPA (Water)} + \text{LCPA (Sewer)}$$

$$\text{Char Lake} = \$24,235 + \$18,626 + \$64,692 + \$61,956$$

$$= \$169,500$$

$$\text{Signal Hill} = \$22,757 + \$18,626 + \$53,424 + \$61,956$$

$$= \$156,800$$

3. Garage Facilities - New Garage

$$\text{Capital Cost} = \text{PGCC}$$

$$= \$400,000$$

$$\text{O\&M Cost} = \text{PGAMOC}$$

$$= \$24,000$$

4. Conversion of Building Services

$$\text{Capital Cost} = \text{ACCB}$$

$$= \$585,000$$

$$\text{O\&M Cost} = \text{AAOMCB}$$

$$= \$11,700$$



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Design Calculations

Project _____

DATE _____ BY _____ JOB No. _____ SHEET 15 OF _____



PROJECT:

FILE NUMBER:

BY:

DATE _____

SHEET

1 OF 1

Item	Description	Unit	Approx. Quantity	Unit Price	Total
1.0	Char Lake Intake Pumphouse				
1.1	Chlorine System	lump sum	N/A	N/A	\$18,400
1.2	Piping and Pumps	lump sum	N/A	N/A	\$30,000
1.3	Truckfill Arm	lump sum	N/A	N/A	\$4,200
1.4	Electrical/Instrumentation	lump sum	N/A	N/A	\$18,600
	Total				\$71,200
2.0	Signal Hill Water Treatment Plant				
2.1	Building and pumping system changes As per Char Lake estimate)	lump sum	N/A	N/A	\$71,200
2.2	Turnaround pad	cu.m	6,610	\$25	\$165,250
	Total				\$236,450
	TOTAL				\$0



PROJECT:

FILE NUMBER:

BY:

DATE _____

SHEET

Building Modifications for Trucked System

Item	Description	Unit	Approx. Quantity	Unit Price	Total
1.	Materials for building (as per Bartle and Gibson quote)	bldg	50	\$8,000	\$400,000
2.	Electrical Materials	bldg	50	\$200	\$10,000
3.	Labour for plumbing	hours	50x20	\$50	\$50,000
4.	Labour for building modifications	hours	50x40	\$50	\$100,000
5.	Labour for electrical	hours	50x10	\$50	\$25,000
	TOTAL				\$585,000



UMA Engineering Ltd.

ESTIMATE SHEET

PROJECT:

Resolute Bay Infrastructure Assessment

FILE NUMBER:

1315-172-00-02-3.1

BY:

Ken Johnson

DATE

1995 10 06

SHEET

1 OF 1

Construction of Sewage Storage Lagoon - Trucked Services

Item	Description	Unit	Approx. Quantity	Unit Price	Total
1.	Overburden removal	lump sum	N/A	N/A	\$5,000
2.	Excavation	lump sum	N/A	N/A	\$10,000
3.	Dyke construction	cu.m	14,000	\$25	\$350,000
4.	Impermeable liner	cu.m	5,500	\$16	\$90,000
5.	Riprap	lump sum	N/A	N/A	\$50,000
6.	Overflow	lump sum	N/A	N/A	\$10,000
7.	Discharge (pipe and valve)	lump sum	N/A	N/A	\$25,000
8.	Access road	lump sum	N/A	N/A	\$10,000
9.	Signage	lump sum	N/A	N/A	\$1,000
10.	Truck discharge	lump sum	N/A	N/A	\$10,000
11.	Surface drainage	lump sum	N/A	N/A	\$5,000
12.	Decommissioning existing building	lump sum	N/A	N/A	\$4,000
13.	Contingency/engineering (40%)	lump sum	N/A	N/A	\$230,000
	TOTAL				\$800,000



PROJECT:

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BY:

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SHEET

1 OF 1

Item	Description	Unit	Approx. Quantity	Unit Price	Total
1.	Town piped system				
1.1	Remove existing mains (not in total)	lin.m	2,360	\$120	\$283,200
1.2	Remove existing access vaults	each	30	\$2,000	\$60,000
1.3	Additional backfill material	cu.m	200	\$25	\$5,000
2.0	Signal Hill Facility				
2.1	Drain and prepare equipment	hour	40	\$40	\$1,600
2.2	Secure building	hour	20	\$40	\$800
2.3	Relocate equipment to be used as spare parts	hour	20	\$40	\$800
2.4	Drain and gas free fuel tanks	hour	20	\$40	\$800
3.0	Supply Line				
3.1	Drain with air pressure (if pipe to remain in ground)	hour	20	\$40	\$800
3.2	Remove pipeline (not in total)	lin.m	1,880	\$120	\$225,600
3.3	Remove heat trace vaults	each	5	\$1,000	\$5,000
3.4	Additional backfill material (not in total)	cu.m	140	\$25	\$3,500
	TOTAL (with pipe remaining in ground)				\$74,800



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SHEET

1 OF 1

Item	Description	Unit	Approx. Quantity	Unit Price	Total
1.	Town piped system				
1.1	Remove existing mains (not in total)	lin.m	2,360	\$120	\$283,200
1.2	Remove existing access vaults	each	30	\$2,000	\$60,000
1.3	Additional backfill material	cu.m	200	\$25	\$5,000
TOTAL (with pipe remaining in ground)					\$65,000

**LIFE CYCLE
COST ESTIMATES**

LIFE CYCLE COSTS FOR TABLES 5-4 AND 5-6 (1996 \$)

YEAR	PIPED SYSTEM				TRUCKED SYSTEM								LIFE CYCLE COST	
	AS-IS	PARTIAL	BURIED	UTILIDOR	CONV1.1	CONV1.2	TRK2.1	TRK2.2	GRG3.1	GRG3.2	HSCON4	LGNS	DEC6.1	DEC6.2
1996	\$246,500	\$2,100,700	\$5,329,300	\$6,088,300	\$145,200	\$377,450	\$344,500	\$331,800	\$424,000	\$0	\$596,700	\$810,300	\$74,800	\$65,000
1997	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
1998	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
1999	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2000	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2001	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2002	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2003	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2004	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2005	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2006	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2007	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2008	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2009	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2010	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2011	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2012	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2013	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2014	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
2015	\$246,500	\$234,300	\$218,300	\$218,300	\$74,000	\$141,000	\$169,500	\$156,800	\$24,000	\$0	\$11,700	\$10,300	\$0	\$0
LIFE CYCLE COST	\$2,613,787	\$4,350,823	\$7,425,766	\$8,184,766	\$855,866	\$1,731,557	\$1,972,310	\$1,837,644	\$654,486	\$0	\$709,062	\$909,217	\$74,800	\$65,000

**BUILDING EXTERIOR UPGRADES
COST ESTIMATES**

LIFE CYCLE COSTS FOR HEATING (TABLE 5-8)

YEAR	CHAR LAKE PUMPHOUSE		SIGNAL HILL	
	PAINT	INSULATE	PAINT	INSULAT
1996	\$16,500	\$31,400	\$17,960	\$31,420
1997	\$5,100	\$3,600	\$7,400	\$5,300
1998	\$5,100	\$3,600	\$7,400	\$5,300
1999	\$5,100	\$3,600	\$7,400	\$5,300
2000	\$5,100	\$3,600	\$7,400	\$5,300
2001	\$5,100	\$3,600	\$7,400	\$5,300
2002	\$5,100	\$3,600	\$7,400	\$5,300
2003	\$5,100	\$3,600	\$7,400	\$5,300
2004	\$5,100	\$3,600	\$7,400	\$5,300
2005	\$5,100	\$3,600	\$7,400	\$5,300
2006	\$5,100	\$3,600	\$7,400	\$5,300
2007	\$5,100	\$3,600	\$7,400	\$5,300
2008	\$5,100	\$3,600	\$7,400	\$5,300
2009	\$5,100	\$3,600	\$7,400	\$5,300
2010	\$5,100	\$3,600	\$7,400	\$5,300
2011	\$5,100	\$3,600	\$7,400	\$5,300
2012	\$5,100	\$3,600	\$7,400	\$5,300
2013	\$5,100	\$3,600	\$7,400	\$5,300
2014	\$5,100	\$3,600	\$7,400	\$5,300
2015	\$5,100	\$3,600	\$7,400	\$5,300
LIFE CYCLE COST	\$65,478	\$65,973	\$89,027	\$82,319