5.0 DESIGN DATA

5.0 DESIGN DATA

For design purposes the planning horizon has been designated to be 20 years. The Government of the Northwest Territories five year capital plan calls for the construction completion of any recommended services or infrastructure arising out of this planning study by 1995. Therefore the planning period to be considered is from 1995 to 2015.

5.1 Projected Population

Population projections for the community of Pond Inlet have been obtained from the Bureau of Statistics, Department of the Executive, GNWT and are summarized below. These population projections show the population to be growing at approximately 2.3% per year. The census population recorded in June 1991 was 974. Through the 20 year planning period from 1995 to 2015 the population is estimated to increase from 1067 to 1696 persons.

Actual population growth rates can vary from that predicted, especially in small northern communities. The Bureau of Statistics includes such factors as age of population to determine future growth but do not forecast such influences as people moving into or out of the community.

For the purposes of this study, population forecasts based on Bureau of Statistics data will be used as the most accurate available data for planning purposes. The population projections are listed in Table 1.

Table 1 - POPULATION PROJECTIONS

YEAR		PROJECTED POPULATION	NOTES
1991		974	June 1991 Census Population
1992		997	Extrapolated
1993		1020	Extrapolated
1994		1040	Extrapolated
1995	(Year 0)	1067	Extrapolated
1996		1092	Bureau of Statistics projection
1997		1118	Extrapolated
1998		1144	Extrapolated
1999		1168	Extrapolated
2000	(Year 5)	1200	Extrapolated
2001		1228	Bureau of Statistics projection
2002		1257	Extrapolated
2003		1286	Extrapolated
2004		1312	Extrapolated
2005	(Year 10)	1347	Extrapolated
2006		1378	Bureau of Statistics projection
2007		1410	Extrapolated
2008		1443	Extrapolated
2009		1477	Extrapolated
2010	(Year 15)	1511	Extrapolated
2011		1546	Extrapolated
2012		1582	Extrapolated
2013		1619	Extrapolated
2014		1657	Extrapolated
2015	(Year 20)	1696	Extrapolated

SAMPLE CALCULATIONS (1995)

1. Projected Population

= (Annual Percent Growth between 1991 and 1995)^4 * Projected Population of 1991

= (1+((1092-974)/974)^(1/5))^4*974

= 1067 people

5.2 Projected Housing Construction

The Housing Corporation was unable to provide projections for future construction as allotment of housing units to various communities is influenced by a number of factors which cannot be predicted.

For the purposes of this study, it will be assumed that new housing construction will continue to increase at the current average rate of 4 or 5 housing units per year including any private construction which may take place. (Cook, 1992.)

Using this historical construction rate it is estimated that there will be an additional 104 housing units constructed between now and the design horizon of 2015.

An inventory of the existing building in Pond Inlet was provided by Jake Anaviapik, Senior Administration Officer for the Hamlet. This inventory is detailed in Table 2.

Table 2 - CURRENT BUILDING INVENTORY

	HOUSING	OTHER USES
REGISTERED OWNER	NUMBER OF UNITS	NUMBER OF UNITS
Housing Authority	142	
H. A. P.	16	
GNWT Buildings		26
CO-OP		8
Northern Store		3
NWTPC		4
RCMP		3
R.C. Mission		1
Baffin Regional Health Board		3
Hamlet of Pond Inlet		8
A.R.E.		1
M. T. Legal Aid		1
TOTALS	158	58

NOTE:

- There are 158 units defined exclusively as housing.
- Assume that 1/3 of the other buildings are used as residences.

The total number of residences therefore is 158 + (58/3) = 177
The total number of buildings of other uses therefore is 2 * (58/3) =39

5.3 Projected Honeybag Generation

Projected rates for the conversion (including new construction) of residences to sewage pumpout systems from the honeybag system is presented in Table 3.

Projected honeybag generation rates area presented in Table 4.

Assumptions used to produce the projected conversions rates and projected honeybag generation rates are listed below:

1. Population projections as prepared by Bureau of Statistics, Department of Executive, GNWT;

2. The honeybag generation rate is equal to:

   $0.0015\ m^3$ per person per day for residential production;

3. In September, 1992, 7 private residences were producing honeybags, 151 private residences were on sewage pumpout; and 58 other buildings were on sewage pump out including government, retail, and church occupied facilities;

4. The housing occupancy rate for Pond Inlet is 5.62 residents per housing unit assuming that one third of the buildings not specifically defined as residences are occupied as such;

5. Based on data provided by the NWT Housing Corporation, an average of four or five housing units have been constructed annually over the past 10 years. No projections could be made by the Housing Corporation for future construction and it will be assumed that this trend will continue. All new housing is complete with pressurized water systems and sewage pumpout tanks;

6. The first housing units to be replaced by the construction of any new housing not required by population growth will be those with no sewage pumpout system. For the purpose of this study the assumption that the reduction of residence using honey bags will be one per two years.

Based on these assumptions, it is projected that all residential units will be complete with pressurized water systems and sewage pumpout tanks by the year 2006.

Given a containment berm height of 2 metres, the required plan area for the anticipated volume of honey bag waste is 180 square metres. Reasonable plan dimensions for such an area are 12 metres by 15 metres. Given the backslopes of 3:1 and the berm width, reasonable centreline dimensions of the berms of the Honey Bag Retention Cell are 26 metres by 29 metres.

The operation of the cell will accept three 300 mm layers of waste bags complete with a 200 mm cover layer and a final granular cover layer of 500 mm.

See Figure 1 for clarity.

Table 3 - SEWAGE PUMPOUT CONVERSION PROJECTIONS

YEAR	PROJECTED POPULATION	PROJECTED RESIDENCES	PROJECTED RESIDENCES ON PUMPOUT	PROJECTED RESIDENCES ON HONEY BAGS
1991	974			
1992	997	177	170	7.0
1993	1020	181	175	6.5
1994	1040	185	179	6.0
1995 (Year 0)	1067	190	184	5.5
1996	1092	194	189	5.0
1997	1118	199	194	4.5
1998	1144	204	200	4.0
1999	1168	208	204	3.5
2000 (Year 5)	1200	213	210	3.0
2001	1228	219	216	2.5
2002	1257	224	222	2.0
2003	1286	229	227	1.5
2004	1312	233	232	1.0
2005 (Year 10)	1347	240	239	0.5
2006	1378	245	245	0
2007	1410	251	251	0
2008	1443	257	257	0
2009	1477	263	263	0
2010 (Year 15)	1511	269	269	0
2011	1546	275	275	0
2012	1582	282	282	0
2013	1619	288	288	0
2014	1657	295	295	0
2015 (Year 20)	1696	302	302	0

SAMPLE CALCULATIONS (1995)

1. Projected Residences
   = Projected Population / 5.62 residents per residence
   = 1067 residents / 5.62 residents per residence
   = 190

2. Projected Residences on Honey Bags
   =Previous Residences - 0.5 Residences per Year
   = 6 residences - 0.5 residences / year
   = 5.5 Residences

3. Projected Residences on Pumpout
   = Projected Residences - Projected Residences on Honey Bags
   = 190 Projected Residences-5.5 Residences with Honeybags
   = 184 Projected Residences on Pumpout

Table 4 - HONEY BAG GENERATION

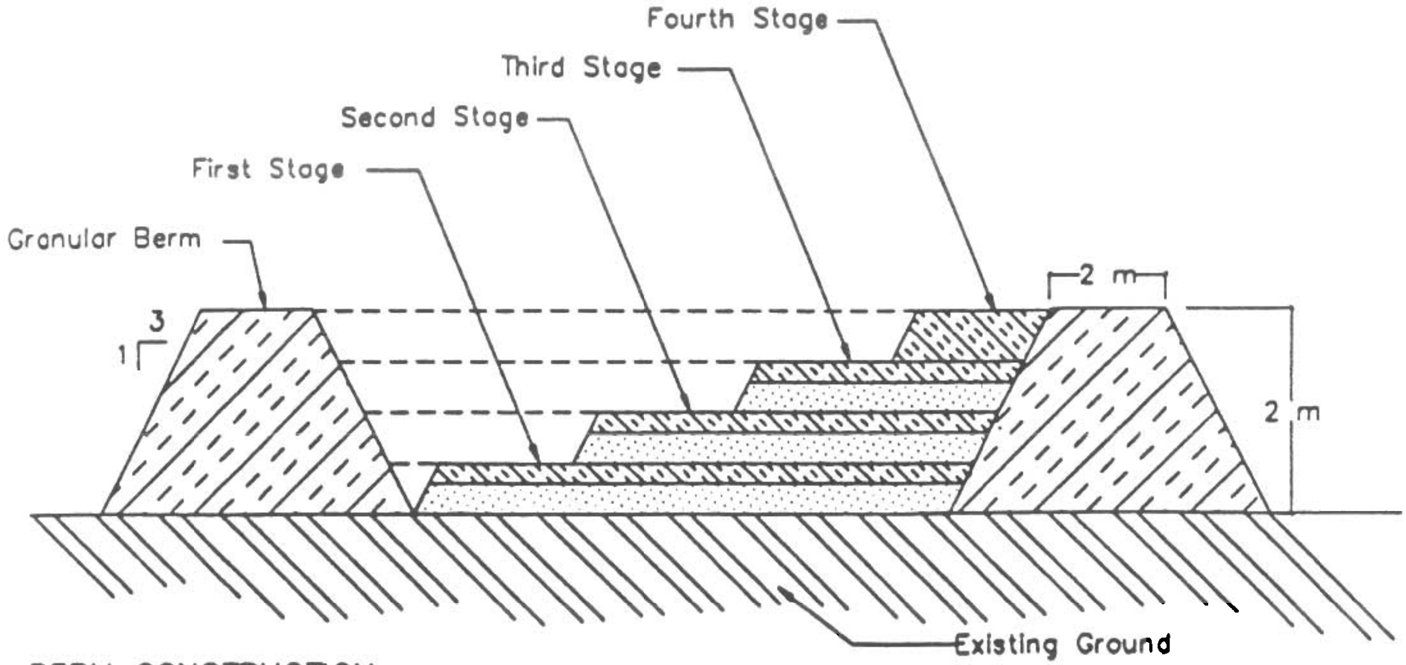
YEAR	POP.	PROJECTED RESIDENCES ON HONEYBAGS	POPULATION ON HONEYBAGS	DAILY GENERATION (Cu. m.)	ANNUAL GENERATION (Cu. m.)	CUMULATIV[illegible] GENERATIO[illegible] (Cu. m.)
1991	974					
1992	997	7.0	39	0.06	21.54	21.[illegible]
1993	1020	6.5	37	0.05	20.00	41.54
1994	1040	6.0	34	0.05	18.46	60.[illegible]
1995 (Year 0)	1067	5.5	31	0.05	16.92	76.[illegible]
1996	1092	5.0	28	0.04	15.38	92.31
1997	1118	4.5	25	0.04	13.85	106.[illegible]
1998	1144	4.0	22	0.03	12.31	118.[illegible]
1999	1168	3.5	20	0.03	10.77	129.23
2000 (Year 5)	1200	3.0	17	0.03	9.23	138.46
2001	1228	2.5	14	0.02	7.69	146.[illegible]
2002	1257	2.0	11	0.02	6.15	152.31
2003	1286	1.5	8	0.01	4.62	156.92
2004	1312	1.0	6	0.01	3.08	160.[illegible]
2005 (Year 10)	1347	0.5	3	0.00	1.54	161.[illegible]
2006	1378	0.0	0	0.00	0.00	161.54
2007	1410	0.0	0	0.00	0.00	161.[illegible]
2008	1443	0.0	0	0.00	0.00	161.[illegible]
2009	1477	0.0	0	0.00	0.00	161.54
2010 (Year 15)	1511	0.0	0	0.00	0.00	161.[illegible]
2011	1546	0.0	0	0.00	0.00	161.[illegible]
2012	1582	0.0	0	0.00	0.00	161.54
2013	1619	0.0	0	0.00	0.00	161.[illegible]
2014	1657	0.0	0	0.00	0.00	161.[illegible]
2015 (Year 20)	1696	0.0	0	0.00	0.00	161.54

SAMPLE CALCULATIONS (1995)

1. Population on Honeybags = projected residences x occupancy rate
   = 5.5 residences x 5.62 persons per residences
   = 31 persons

2. Daily Honeybag Generation Rate = population x 0.0015 m^3 per person per day
   = 31 persons x 0.0015 m^3 per person per day
   = 0.46 m^3

3. Annual Generation Rate = Daily Rate x One Year
   = 0.46 m^3 per day x 365 days per year
   = 169.23 m^3/year



BERM CONSTRUCTION

- Berms to be constructed of acceptable granular fill as reviewed in the geotechnical analysis attached to this document
- Berm dimensions to be 2 metres in height with a 2 metres top width backslopes not to be steeper than 3:1
- Granular Access Ramp to be Provided
- Estimated Granular Required for Initial Contruction 1100 cubic metres

DISPOSAL PROCESS (Heinke, 1991)

Stage One
- Place 300 mm Layer of Waste Honey Bags
- Cover with 200 mm Granular Material Once First Level is Full
- Cover Layer Will Be Required Approximately April 1994 (40 cubic metres)

Stage Two
- Place 300 mm Layer of Waste Honey Bags
- Cover with 200 mm Granular Material Once Second Level is Full
- Cover Layer Will Be Required Approximately Feb 1998 (40 cubic metres)

Stage Three
- Place 300 mm Layer of Waste Honey Bags
- Cover with 200 mm Granular Material Once Third Level is Full
- Cover Layer Will Be Required Approximately Dec 2005 (40 cubic metres)

Stage Four
- Place 500 mm Layer of Final Granular Material Cap
- Cover Layer Will Be Required Approximately Dec 2005 (100 cubic metres)

Note: Lifts of Waste and Granular Fill to be Placed to Limits of Berms

CALCULATIONS

Given: 161.5 cubic metres of waste (See Table 4)

Three – 300 mm layers for waste placement

Calculations: Required Cell Area = $\frac{\text{161.5 cubic metres of waste}}{\text{0.9 metres total fill depth}}$

= 180 square metres

Possible Cell Dimensions: 26 metres by 29 metres (berm centreline)

DRAWING TITLE: HONEY BAG RETENTION CELL		
JOB TITLE: POND INLET – Design Concept Brief		JOB NUMBER: 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY: KH	SCALE: NTS
	DRAWN BY: KH	DATE: 10 DEC 92
	CHECKED BY:	DRAWING NO: FIGURE 1

5.4 Projected Sewage Generation

Projected sewage generation quantities for the community of Pond Inlet are presented in Table 5. Assumptions used to produce the projected quantities are listed below:

1. Population projections as prepared by Bureau of Statistics, Department of Executive, GNWT;

2. Future sewage generation is equal to the water consumption;

3. Design value for residential water use for residents serviced by trucked water delivery and sewage pumpout collection is 90 litres per person per day (DPW Design Value);

4. Total per capita consumption of water for residential and non-residential activities for a population between 0 to 2,000 is equal to:

   Residential Rate x (1.0 + 0.00023 x Population).

The projected annual sewage generation quantities for the projected population of 1696 in the year 2015 is approximately 66,253 m^3.Given this anticipated volume and knowing the plan area of the existing pond, the required berm height of the lagoon can be calculated. (See Figure 2)

The existing pond is approximately 200 metres by 125 metres in plan. Dividing the anticipated annual sewage production of the year 2015 by this plan area, the required berm depth for sewage containment is 2.65 metres. The construction of a berm about the pond will eliminate any overland flow from entering the berm, therefore the only The annual precipitation is by the

Table 5 - PROJECTED SEWAGE PRODUCTION

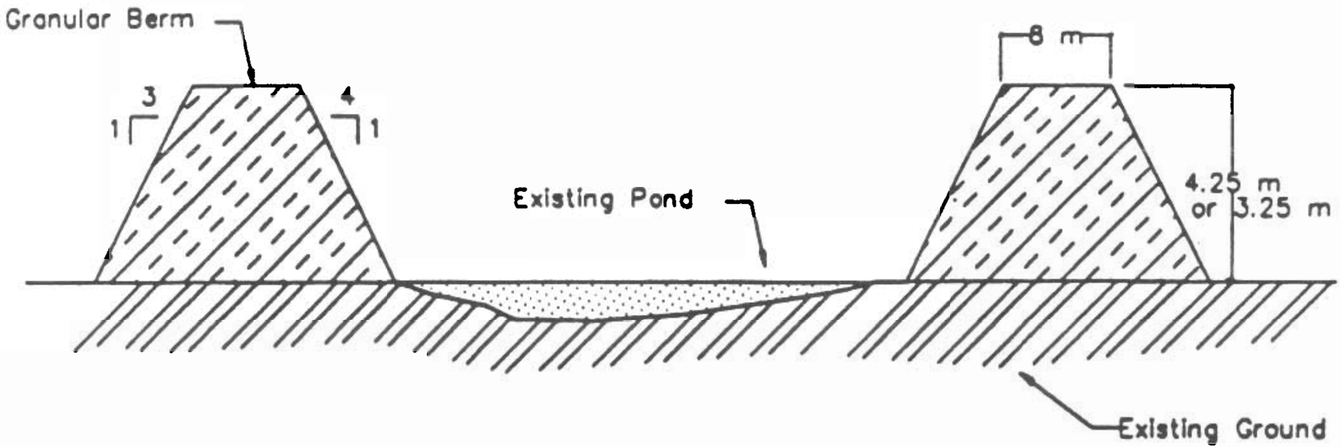
YEAR	POP.	RESIDENCES ON PUMPOUT	POPULATIONS ON PUMPOUT	SEWAGE PROD. RATE (L/person day)	DAILY SEWAGE GENERATION RATE (L/day)	ANNUAL GENERATION RATE (cu.m./year)
1991	974					
1992	997	170	957.27	109.82	105123.51	38370.08
1993	1020	174	979.75	110.28	108048.07	39437.55
1994	1040	178	1002.23	110.75	110993.56	40512.65
1995 (Year 0)	1067	182	1024.71	111.21	113959.97	41595.39
1996	1092	186	1047.19	111.68	116947.31	42685.77
1997	1118	190	1069.67	112.14	119955.56	43783.78
1998	1144	194	1092.15	112.61	122984.74	44889.43
1999	1168	198	1114.63	113.07	126034.83	46002.71
2000 (Year 5)	1200	202	1137.11	113.54	129105.85	47123.64
2001	1228	206	1159.59	114.00	132197.79	48252.19
2002	1257	210	1182.07	114.47	135310.66	49388.39
2003	1286	214	1204.55	114.93	138444.44	50532.22
2004	1312	218	1227.03	115.40	141599.14	51683.69
2005 (Year 10)	1347	222	1249.51	115.86	144774.77	52842.79
2006	1378	226	1271.99	116.33	147971.32	54009.53
2007	1410	231	1297.28	116.85	151592.44	55331.24
2008	1443	235	1322.57	117.38	155240.04	56662.62
2009	1477	240	1347.86	117.90	158914.13	58003.66
2010 (Year 15)	1511	244	1373.15	118.42	162614.69	59354.36
2011	1546	249	1398.44	118.95	166341.73	60714.73
2012	1582	253	1423.73	119.47	170095.24	62084.76
2013	1619	258	1449.02	119.99	173875.24	63464.46
2014	1657	262	1474.31	120.52	177681.72	64853.83
2015 (Year 20)	1696	267	1499.60	121.04	181514.67	66252.85

SAMPLE CALCULATIONS (1995)

1. Sewage Production Rate = Water Consumption

Daily Water Consumption Rat = (90 Lpcd) x (1.0 + (0.00023 x 1067 persons))
= 111.21 lpcd

2. Annual Generation Rate = Daily Rate x Population x One Year
= 111.21 lpcd x 1025 persons x 365 days
= 41,595,390 litres



BERM CONSTRUCTION

- Berms to be constructed of acceptable granular fill as reviewed in the geotechnical analysis attached to this document
- Top width of berm to be 8 metres with a 1.5 m freeboard
- Freeboard can be reduced to 0.5m with the addition of rigid insulation in the berm construction (See geotechnical report)

DISPOSAL PROCESS

- Waste to be dumped from the truck directly into the sewage retaining lagoon
- Effluent to be discharged annually in the fall through the well-vegetated drainage course to Eclipse Sound.

CALCULATIONS

Given:
Projected Annual Sewage Production 66,253 cubic metres (Table 5)
Annual Precipitation 101 mm (Environment Canada)
Existing Pond approx 200 metres by 125 metres
Single Annual Discharge

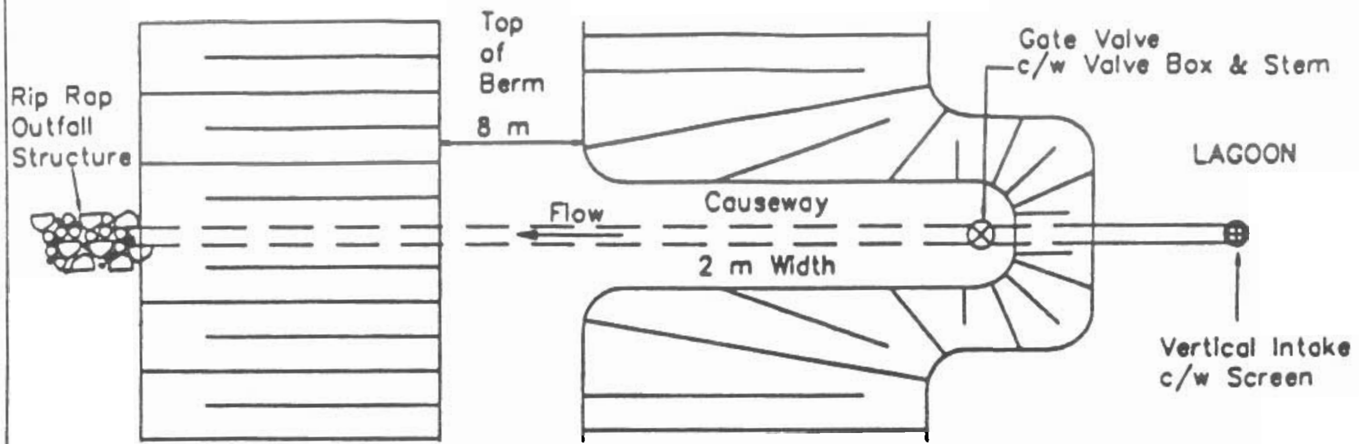
Calculations:

Required Berm Height = $\frac{\text{66,253 cubic metres of waste}}{\text{200 metres x 125 metres}}$ + Freeboard + Precipitaion

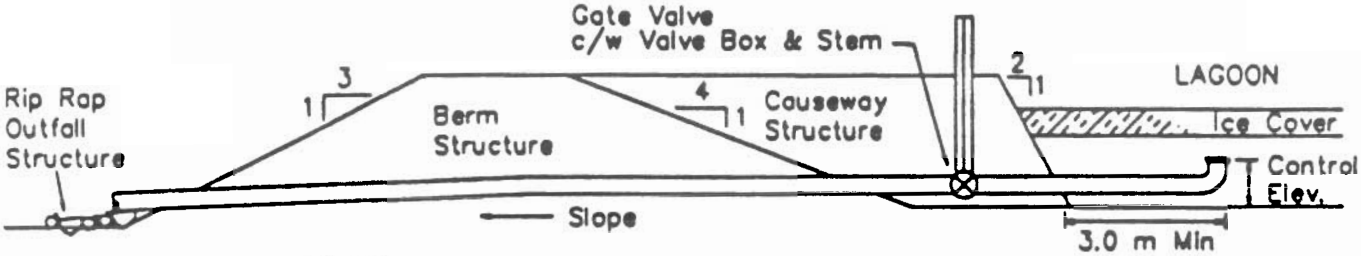
= 2.65 metres + 1.5 m (or 0..5 m) + 101 mm

= 4.25 metres (or 3.25 metres)

DRAWING TITLE SEWAGE LAGOON		
JOB TITLE POND INLET – Design Concept Brief		JOB NUMBER 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY KH	SCALE NTS
	DRAWN BY KH	DATE 10 DEC 92
	CHECKED BY	DRAWING NO FIGURE 2



PLAN



PROFILE

EFFLUENT DISCHARGE STRUCTURE CONSTRUCTION

- Causeway to be constructed of acceptable granular fill as reviewed in the geotechnical analysis attached to this document
- Top width of causeway to be 2 metres.
- Outlet pipe to be HDPE insulated with 50 mm of polyurethane foam c/w HDPE protective jacket.
- Outlet to have either a thaw pipe or heat tape as dictated by the Hamlet's thawing equipment.
- Valve to be fitted with heat tape and insulated.
- Outlet control to be governed by the elevation of the vertical inlet.
- Vertical inlet to be fitted with a screen to prevent solids from discharging.
- Valve to be fitted with a locking mechanism to allow selective disposal.

DISPOSAL PROCESS

- Effluent to be discharged annually in the fall through the outlet pipe to the well-vegetated drainage course to Eclipse Sound.
- Thaw devices to be utilized in the event that the system is partially or fully frozen.
- Effluent to be drained, level is controlled by the preset inlet elevation.
- Valve to be closed and secured for proper collection and treatment of the influent produced over the next 12 months.

DRAWING TITLE: EFFLUENT DISCHARGE STRUCTURE		
JOB TITLE: POND INLET - Design Concept Brief		JOB NUMBER: 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY: KH	SCALE: NTS
	DRAWN BY: KH	DATE: 10 DEC 92
	CHECKED BY:	DRAWING NO: FIGURE 3

5.5 Projected Solid Waste Generation

Projected solid waste generation quantities are presented in Table 6. Assumptions used to produce the projected quantities are listed below:

1. Population projections as prepared by Bureau of Statistics, Department of Executive, GNWT;

2. The solid waste generation rate (uncompacted) is equal to:

   0.014 m^3. per person per day for residential production
   0.001 m^3. per student per day (annual);

3. The full time equivalent (FTE) student population in 1991 was 367 (Dept. of Education). Assume that student population will increase at rate projected for total population for community;

4. Total per capita generation of solid waste for residential and non-residential activities for a population between 0 to 2,000 is equal to:

   (Residential rate + school rate) x (1.0 + 0.00023 x Population);

5. Combination of burning and compaction of waste will result in a volume reduction of 70 percent.

The projected cumulative solid waste generation over the 20 year period from 1995 to 2015 equals 217,144 m^3 uncompacted or 65,143 m^3 after burning and compaction.

Table 6 - SOLID WASTE GENERATION

			UNCOMPACTED VOLUME			COMPACTED VOLUME		
YEAR	POP.	STUDENT POP.	DAILY RATE (cu.m./d)	ANN. RATE (cu.m.)	CUMUL. (cu.m.)	DAILY RATE (cu.m./d)	ANN. RATE (cu.m.)	CUMUL. (cu.m.)
1991	974							
1992	997	367	17.60	6424.11	6424.11	5.28	1927.23	1927.23
1993	1020	375	18.08	6601.00	13025.10	5.43	1980.30	3907.53
1994	1040	383	18.52	6759.91	19785.01	5.56	2027.97	5935.50
1995 (Year 0)	1067	393	19.10	6971.39	26756.40	5.73	2091.42	8026.92
1996	1092	402	19.63	7165.19	33921.59	5.89	2149.56	10176.48
1997	1118	412	20.19	7370.36	41291.96	6.06	2211.11	12387.59
1998	1144	421	20.77	7582.09	48874.04	6.23	2274.63	14662.21
1999	1168	430	21.29	7771.77	56645.81	6.39	2331.53	16993.74
2000 (Year 5)	1200	442	21.99	8026.16	64671.97	6.60	2407.85	19401.59
2001	1228	452	22.63	8259.01	72930.98	6.79	2477.70	21879.29
2002	1257	463	23.27	8494.98	81425.96	6.98	2548.49	24427.79
2003	1286	473	23.94	8738.51	90164.47	7.18	2621.55	27049.34
2004	1312	483	24.54	8957.24	99121.71	7.36	2687.17	29736.51
2005 (Year 10)	1347	496	25.34	9249.31	108371.02	7.60	2774.79	32511.31
2006	1378	507	26.07	9517.16	117888.18	7.82	2855.15	35366.45
2007	1410	519	26.83	9793.73	127681.91	8.05	2938.12	38304.57
2008	1443	531	27.61	10079.32	137761.22	8.28	3023.79	41328.37
2009	1477	544	28.42	10374.26	148135.49	8.53	3112.28	44440.65
2010 (Year 15)	1511	556	29.26	10678.92	158814.41	8.78	3203.68	47644.32
2011	1546	569	30.12	10993.64	169808.04	9.04	3298.09	50942.41
2012	1582	582	31.01	11318.79	181126.83	9.30	3395.64	54338.05
2013	1619	596	31.93	11654.78	192781.61	9.58	3496.43	57834.48
2014	1657	610	32.88	12001.99	204783.60	9.86	3600.60	61435.08
2015 (Year 20)	1696	624	33.87	12360.87	217144.47	10.16	3708.26	65143.34

SAMPLE CALCULATIONS (1995)

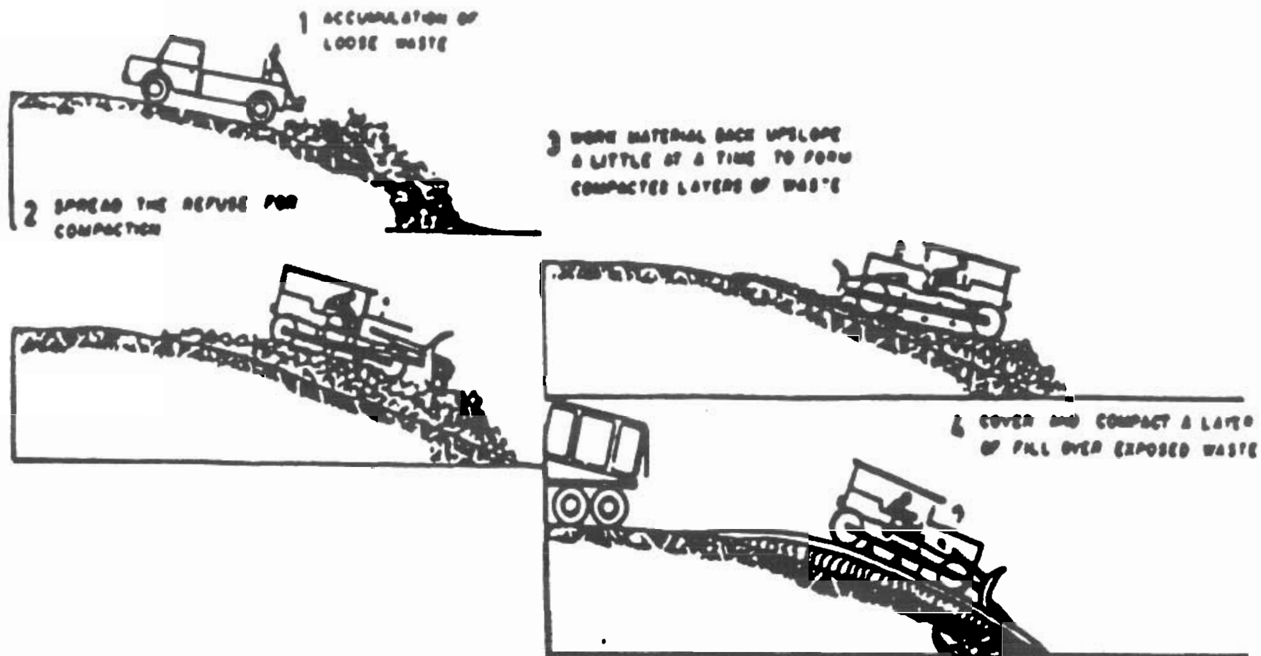
1. Daily Solid Waste Generation Rate
   = (Residential + School) x (1.0+0.00023 x Population)
   =((0.014 m^3 pcd x pop.) + (0.001 m^3 psd x students)) x (1.0 + 0.00023 x pop.)
   =((0.014 m^3 pcd x 1067) + (0.001 m^3 psd x 393)) x (1.0 + 0.00023 x 1067)
   = 17.60 cu.m./d

2. Annual Generation Rate (Uncompacted Volume)
   = Daily rate x one year
   = 17.60 cu.m./d x 365 days/year
   = 6424.11 cu.m./year

2. Annual Generation Rate (Compacted Volume)
   =(Daily rate x one year) * 0.30
   = 5.73 cu.m./d x 365 days/year
   = 2091.42 cu.m./year

MODIFIED LANDFILL METHODS OF OPERATION

AREA METHOD SLOPING GROUND



OPERATION PLAN

COMPACTION AND COVER OPERATION FOR A SOLID WASTE LANDFILL SITE

Source: General Terms of Reference for a Community Solid Waste Management Study, Government of the Northwest Territories.

DISPOSAL METHOD

- Method described above to be followed. Depth of waste layers to be 750 mm.
- Depth of operational cover to be 200 mm. Final cover layer to be 500 mm.
- Disposal should be contained to a manageable area at any one time.
- Cover material should be place over the spread waste on a biweekly schedule.
- Cover material should be left sloped to allow for drainage across the fill.

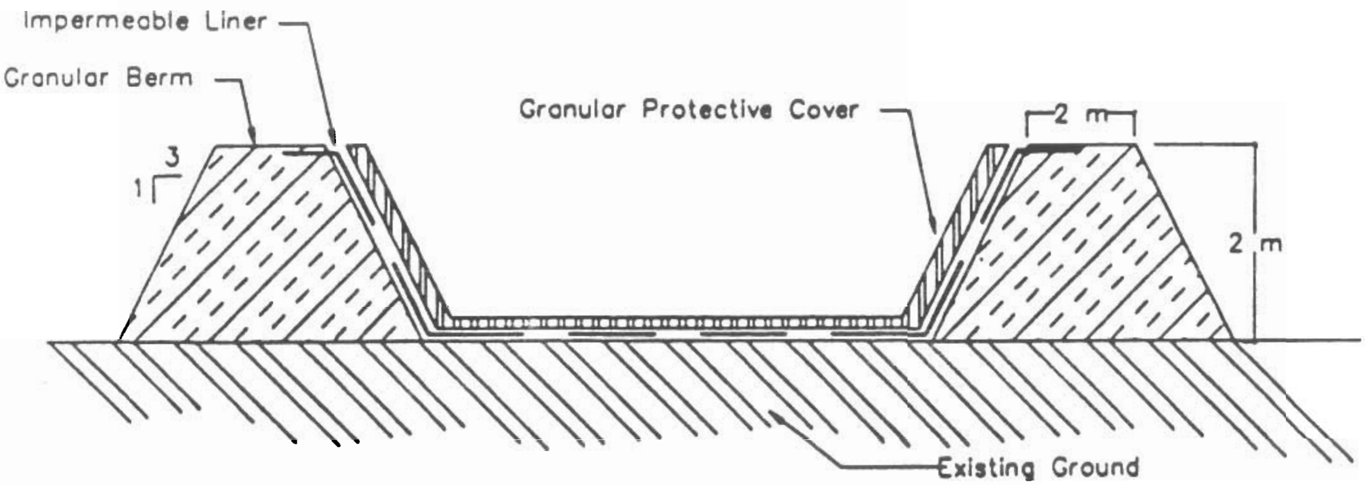
CALCULATIONS

Given: 65,143 cubic metres of waste (See Table 6)
Three – 500 mm layers for waste placement

Calculations: Required Disposal Area = 65,143 cubic metres of waste / 1.5 metres total fill depth
= 43,429 square metres

Possible Area Dimensions: 200 metres by 215 metres

DRAWING TITLE: SOLID WASTE DISPOSAL METHOD		
JOB TITLE: POND INLET – Design Concept Brief		JOB NUMBER: 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY: KH	SCALE: NTS
	DRAWN BY: KH	DATE: 10 DEC 92
	CHECKED BY:	DRAWING NO: FIGURE 4



CELL CONSTRUCTION

- Berms to be constructed of acceptable granular fill as reviewed in the geotechnical analysis attached to this document
- Berm dimensions to be 2 metres in height with a 2 metres top width backslopes not to be steeper than 3:1
- Impermeable liner to be placed within berm and keyed to top
- Granular protective cover to be provided over liner

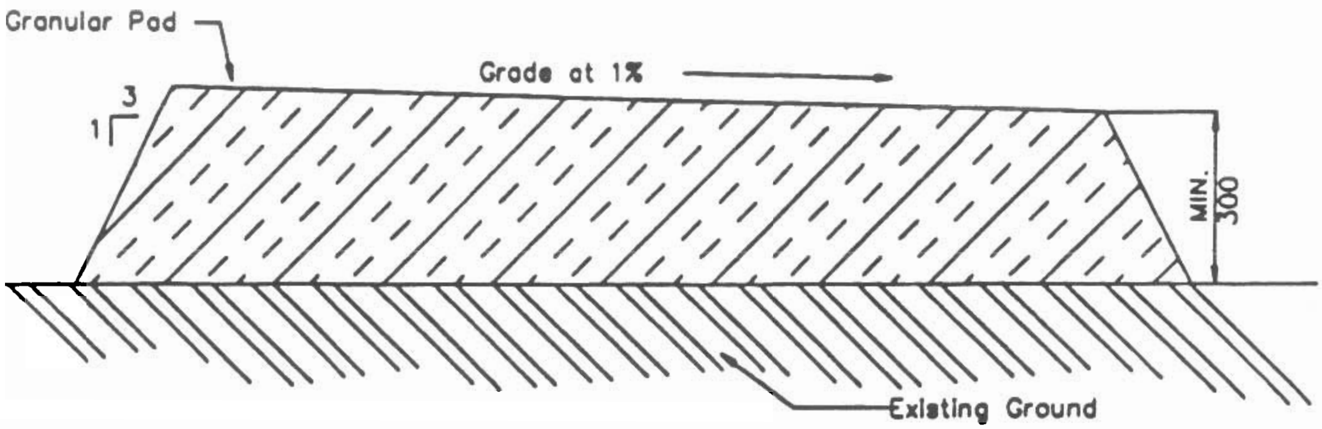
DISPOSAL PROCESS

- Waste oil currently stored within sealed containers to be collected and relocated to the new retention cell for disposal.
- Waste oil to be stored within sealed containers and disposed of within the retention cell.

CALCULATIONS

- Waste Oil production volumes are not readily available.
- Required Cell Area assumed to be 20 metres by 20 metres
- It is assumed that a facility of these dimensions will satisfy the current and future containment requirements.

DRAWING TITLE: WASTE OIL RETENTION CELL			
JOB TITLE: POND INLET – Design Concept Brief			JOB NUMBER: 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY: KH		SCALE: NTS
	DRAWN BY: KH		DATE: 10 DEC 92
	CHECKED BY:		DRAWING NO: FIGURE 5



PAD CONSTRUCTION

- Pad to be constructed of acceptable granular fill as reviewed in the geotechnical analysis attached to this document
- Pad dimensions to be 300 mm in height
  backslopes not to be steeper than 3:1
  top to be graded for drainage at 1% (minimum)

DISPOSAL PROCESS

Existing Bulky Waste to be relocated and disposed of at the new bulky waste disposal pad.
Waste to be disposed of on the pad in a neat and orderly manner

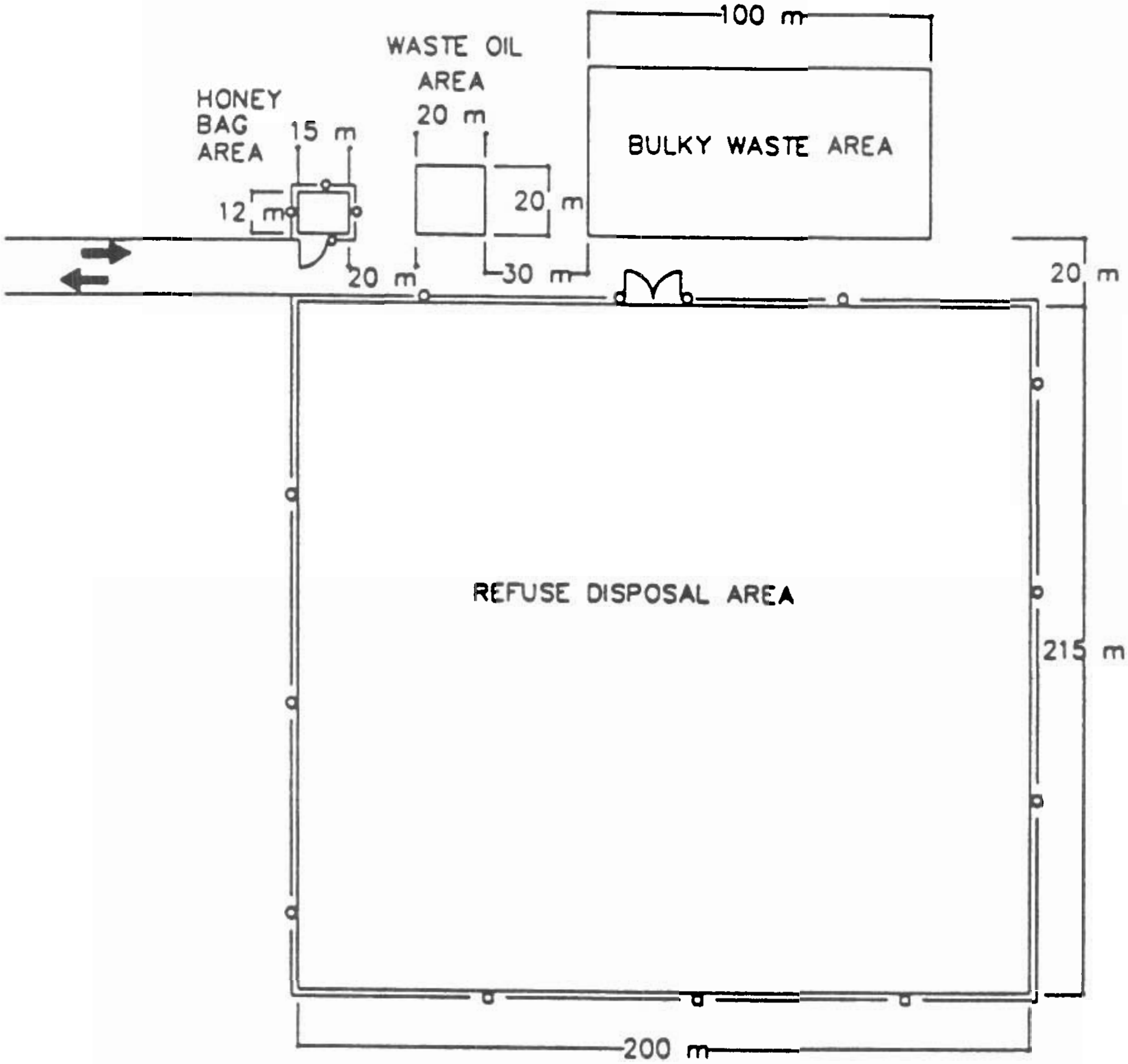
CALCULATIONS

Disposal capacity will be required for new waste plus the relocation of existing waste.

Required Pad Area assumed to be 100 metres by 50 metres

The facility will be located so that expansion is possible if required.

DRAWING TITLE: BULKY WASTE DISPOSAL PAD		
JOB TITLE: POND INLET – Design Concept Brief		JOB NUMBER: 92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	DESIGNED BY: KH	SCALE: NTS
	DRAWN BY: KH	DATE: 10 DEC 92
	CHECKED BY:	DRAWING NO: FIGURE 6



LEGEND

——o—— – Fencing

NOTES

- Plan Shows a Possible Waste Disposal Site Configuration
- Fencing Is Optional

DRAWING TITLE	POSSIBLE SOLID WASTE DISPOSAL FACILITY		
JOB TITLE	POND INLET – Design Concept Brief	JOB NUMBER	92-1070
FERGUSON, SIMEK, CLARK CONSULTING ENGINEERS & ARCHITECTS	DESIGNED BY KH	SCALE	NTS
	DRAWN BY KH	DATE	10 NOV 92
P.O. BOX 1777 YELLOWKNIFE N.W.T., CANADA X1A2P4	CHECKED BY	DRAWING NO	FIGURE 7

6.0 EVALUATION PROCESS

6.0 EVALUATION PROCESS

A modified version of the Kepner Tregoe analysis was utilized to objectively evaluate the alternative locations for both the solid waste and sewage disposal sites.

This involves the evaluation of the alternatives based on MUST and WANT criteria.

6.1 MUST Criteria

All alternatives MUST first satisfy certain criteria. If the alternative does not satisfy the MUST criteria it is rejected and no further analysis is performed on the alternative.

6.2 WANT Criteria

After an alternative has been found to satisfy the MUST criteria the alternative can be objectively evaluated against other alternatives through a series of WANT criteria.

The WANT criteria are a list of objectives that are weighted in accordance to their importance. The weighting make it possible to score how well the various alternatives satisfy the objectives of the decision. The highest weighting attached to a WANT criteria is ten and ranges down to zero.

6.3 Analysis of Alternatives

Each alternative is judged as to how well the WANT criteria are satisfied and compared to the relative adequacy of the other alternatives.
Then a point score from one to ten is awarded to each alternative for each WANT criteria. The alternative that satisfies the WANT the best is awarded the highest score.

The weighting of each WANT is then multiplied by the score awarded to the alternative to arrive with a weighted score. The weighted scores for each alternative are added to come up with a total which is utilized for the comparison of the alternatives.

7.0 SOLID WASTE SITES

7.0 EVALUATION OF SOLID WASTE DISPOSAL SITES

Through past experience and on-going evaluations of present solid waste disposal sites, DPW has directed that the minimum acceptable disposal method for solid waste is a modified landfill operation.

A modified landfill requires that all aspects of the disposal site from planning, to design, to operation and maintenance are "engineered". In a modified landfill, wastes are deposited at a designated location and are compacted and covered on a regular basis. A properly designed modified landfill will reduce the potential for hazards and nuisances to people and the environment in an economic manner.

7.1 MUST Criteria

The following are the MUST criteria that have to be satisfied by each alternative.

1. *Acceptable to Pond Inlet*

The residents of Pond Inlet will be directly affected by the operation and environmental impact of the solid waste disposal facility. Therefore the residents of Pond Inlet must approve of the alternative selected for the facility.

For example, if the facility is located upwind of the community, smoke and odours may impact the residents. Alternatives located upwind would, most likely, not be acceptable to Pond Inlet and would not meet this must criteria.

2. *Acceptable to DPW*

Not correct

DPW will be the department of the GNWT accountable in the future for the location selected and therefore the location must be acceptable to DPW.

A specific directive from DPW is that solid waste disposal sites be located a minimum of two km from the airport flight path. Alternatives must meet this requirement to be acceptable to DPW.

3. *Meets Legal Requirements*

The facility must meet existing regulatory requirements.

The primary legislation governing the construction and operation of a landfill site is the Northern Inland Waters Act. Water use and waste disposal is regulated by the communities water license which sets out requirements which the facilities must meet.

The Public Health Act is also directly applicable and the facility must meet the requirements of the Act and the General Sanitation Regulations.

4. *Accepts Predisposed Bulky Waste and Waste Oil*

In order to remediate the existing facility, the new facility must accept the volume of waste previously disposed in the bulky waste storage area and the volume of waste oil remaining in containers in the existing disposal facility.

7.2 WANT Criteria

The following are the WANT criteria that will be used to evaluate each alternative.

1. *Minimize Pollution to Receiving Environment (weighting of 10)*

This want criterion has been given the maximum weighting of 10 because protection of the surrounding environment is one of the most important concerns in the siting of a solid waste disposal site. The site should be located in a manner to prevent the pollution of surrounding waters, vegetation and animal species. Each site will be evaluated on its ability to contain deleterious substances within the site boundaries.

2. *Capital Cost (weighting of 10)*

Providing the most cost efficient facilities is important as the works are publicly funded. The ultimate cost of constructing the facility is given a weighting of 10.

3. *Maximize Local Involvement* **(weighting of 10)**

Maximizing local involvement receives a high weighting as the GNWT has identified that increasing job opportunities, providing training and improving economic conditions are priorities in capital works projects.

The alternatives are rated as to how they benefit the community realizes in these areas through the construction and operation of the facility.

4. *Maximize Distance/Location from Existing/Future Development (weighting of 4)* → should be a must, this is the reason why it is moved.

Within reason, the greater the separation between the solid waste disposal site and any existing or future development the more preferable the alternative.

This WANT has been limited to a weighting of 4 as all sites are generally located south of the present community and an acceptable distance from any existing or future development.

5. *Minimize Disturbance to Recreation/Fishing Areas (weighting of 6)*

While it may appear that this WANT is a duplication of a previous WANT, regarding minimizing the pollution of the receiving environment, it allows for the evaluation of alternatives based on the fact that certain receiving environments are utilized for fishing and recreation more frequently than others. The perceived impact of the disposal location by residents and visitors may detract from the usefulness of the area

This WANT has been given a weighting of 6 to reflect that it should be considered in the evaluation of the alternatives but that the residents of Pond Inlet presently utilize all areas south of the community to some degree.

is approximately 300 metres. This pond is acceptable by MACA, DPW, and the Hamlet for use as the new sewage lagoon. (Discussions, 1992) No other possible locations for the Sewage Treatment facility have been noted or recommended by either MACA, DPW, or the Hamlet.

DPW has begun designing an access road of approximately 1600 metres to provide an all season route to this area south of Pond Inlet.

Described below are the two sites that have been proposed as possible locations for solid waste disposal sites, as well as the site proposed as a possible location for the sewage treatment facility. Preliminary geotechnical testing was carried out by Thurber Consultants at these sites in early September, 1992.

7.3.2 Existing Facility

This site is located 500 metres southwest of Pond Inlet, and is presently utilized as the communities solid waste disposal site.(See Dwg 1) The facility is operated as open dump/landfill. The method of disposal at this site is generally not acceptable. Wastes should be better segregated at the time of their disposal and the practice of disposing honeybags with the solid waste should be discontinued. Honeybags should be disposed of at the pit provided for this purpose.

The site is located within 1000 m of the west end of the runway. This location is not acceptable under DPW's guidelines of a minimum airfield separation of 2 km and does not pass the MUST criteria of acceptability to DPW.

The community also does not find this location acceptable. It is visible from the Hamlet and is odorous in the summer. The only present area of expansion for the community is in the direction of the landfill. Therefore this alternative also fails the MUST criteria of acceptability to Pond Inlet.

This alternative has failed to pass a MUST criteria and therefore the relocation of the facility is justified.

Construction of a solid waste disposal facility at this site would not require any further access road extension since the planned alignment is adjacent to this site. The disposal of solid waste at SWS 2 will be assumed to be by the modified landfill method to minimize contamination of ground water flow and disturbance of the permafrost. There is sufficient granular material in the adjacent ridge to satisfy the requirement of cover material for such a landfill operation.

A preliminary review of the site finds that there is no MUST that is not satisfied so the alternative will be considered in the evaluation process.

7.4 Analysis of Alternatives

The following summary (refer to Table 8) compares the two alternatives which fulfilled all MUST criteria.

1. *Minimize Pollution to the Receiving Environment*

It is assumed that both sites will be designed, constructed, operated and maintained in such a fashion that dumping of wastes and burning will be controlled and that the solid waste residue will be covered on a regular basis. These practices will minimize the odour, smoke, dust and wind blown material emanating from the site. SWS 1 is more sheltered from the prevailing east-west winds than SWS 2.

Ground water levels, surface drainage and permafrost are site specific conditions which will influence the cost and percolation of leachates from the site.

It is proposed that at both sites solid waste be disposed of on the ground surface. Leachates generated will be limited to overland flow and precipitation directly onto the site. Due to the shallow active layer in the region, it is expected that the volume of leachates penetrating the ground surface will be minimal. Both sites are expected to have approximately the same quantity of run-off from the adjacent gravel ridges.

Any leachates originating from SWS 1 will make their way 200 m to the east along an intermittent drainage path into the ravine. This ravine drains into the ocean 1300 metres away.

Table 7 - SOLID WASTE SITE CONSTRUCTION CAPITAL COST ESTIMATE

			GRANULAR REQUIREMENTS SWS1 & SWS2				
	(m)	(m)	Area (m^2)	Depth (m)	Volume (m^3)	Granular Cost	TOTAL
Honey Bag Retention Cell	18	21	378	2.00	1100.00	$18,700.00	**$18,700.00**
Waste Oil Retention Cell	20	20	400	2.00	2000.00	$34,000.00	**$34,000.00**
Bulky Waste Disposal Pad	100	50	5000	0.5	2500	$42,500.00	**$42,500.00**

	CHAIN LINK FENCING		
	Required Length (m)	Installed Unit Cost ($/m)	**TOTAL VALUE ($)**
SWS1 & SWS2	884	80	**$70,720**

	WASTE OIL CELL LINER		
	Required Area (m^2)	Installed Unit Cost ($/m^2)	**TOTAL VALUE ($)**
SWS1 & SWS2	1200	$25	**$30,000**

	ADDITIONAL ACCESS ROAD				
	Required Length (m)	Required Width (m)	Average Depth (m)	Volume (m^3)	Granular Cost
SWS1	400	6	1	3200	**$54,400**

TOTAL ESTIMATED CAPITAL COST	
SWS1	$250,320.00
SWS2	$195,920.00

Estimated Unit Prices:
Granular - $17.00 per placed cubic metre
Waste Oil Cell Liner - $30 per placed square metre
based on a 30 mil Supported Secondary Containment Arctic Liner
as supplied by Layfield Plastics (1978) Ltd.

Both SWS 1 and 2 are 2.6 kilometres from the Pond Inlet airport facility. This distance exceeds the minimum separation of 2 kilometres therefore being acceptable by these standards. SWS 1 and 2 each are awarded 6 points.

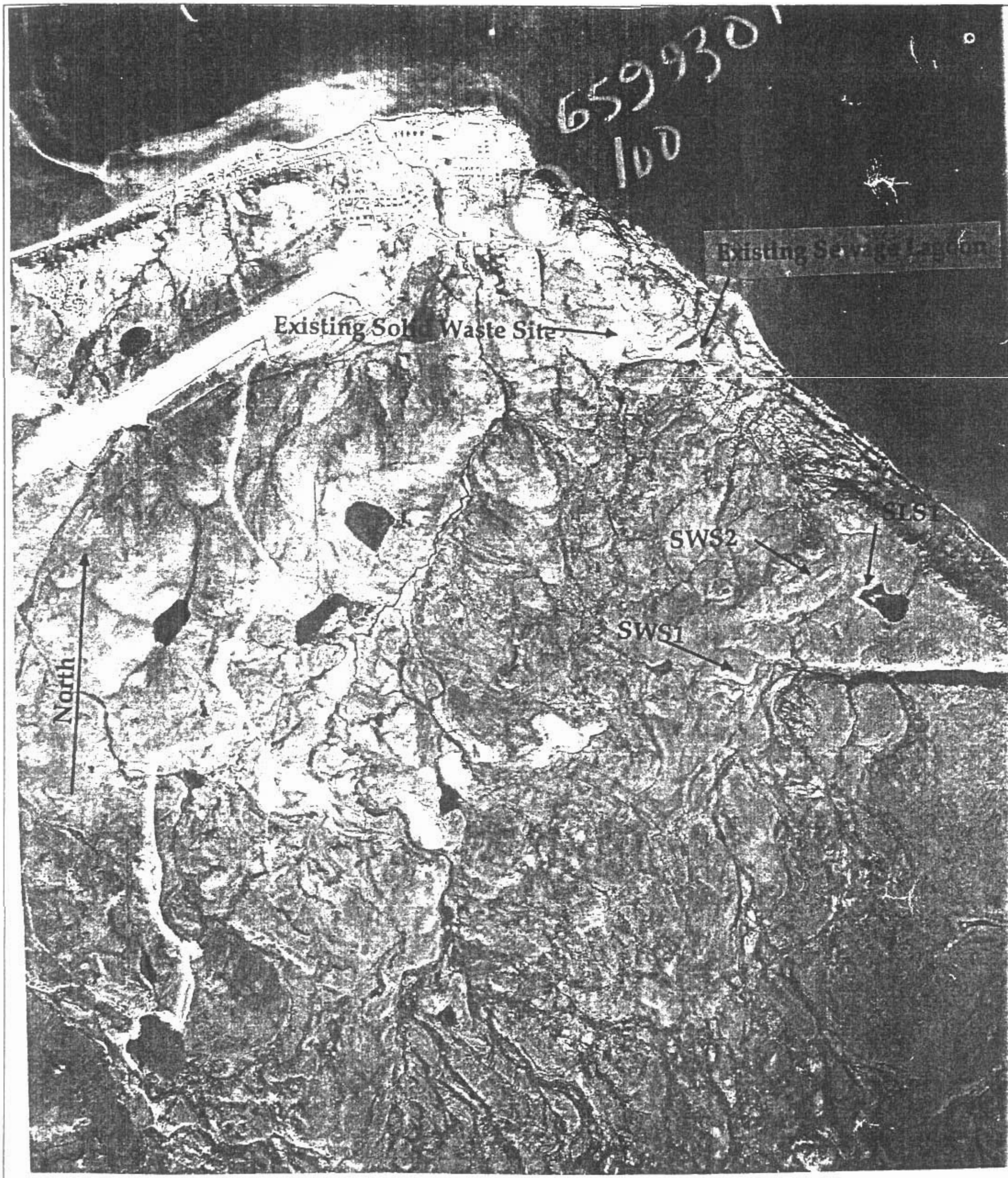
5. *Minimize Disturbance to Recreation/Fishing Areas*

SWS 1 and SWS 2 are both in an area which has not been used historically for recreation. There is however regular foreshore fishing activity for char in the fall and spring seasons and narwhal, beluga, and seal hunting, during the summer.(Young, 1992.) This general area was recommended by DPW and MACA and is acceptable to the community. (Anaviapik, 1992). Drainage from this area is generally toward the ocean through non direct well-vegetated courses.

SWS 1 and SWS 2 are awarded a score of 4 because of their equal possibility of disruptions caused by their siting.

FERGUSON SIMEK CLARK

CONSULTING ENGINEERS & ARCHITECTS



POND INLET SITE PLAN

DWG 1

PROJECT SEWAGE & SOLID WASTE RELOCATION.		JOB NO. 92-1071	SHEET NO.
DESIGNED BY	CHECKED BY	DATE	