FERGUSON SIMEK CLARK
ENGINEERS AND ARCHITECTS

NWB3CLY

Our File: 2002-1000-050
January 14, 2003

Phyllis Beaulieu
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0

Re: Clyde River Application- background information

Dear Phyllis:

Please find enclosed copies of the following reports:

Clyde River Solid Waste Facility Siting Study – Final Report, Dillon 2002

Yours truly,

Michelle MacLeod

Michelle MacLeod, B. Tech. Env.
Environment Department
Ferguson Simek Clark

INTERNAL	
PC	JP
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030114 CLY, Solid Waste Study - ILAE

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Government of Nunavut,
Community Government & Transportation

Clyde River Solid Waste Facility Siting Study - Final Report

July 8, 2002

Community Government & Transportation, GN
Attention: Sameh Elsayed

Submitted by

Dillon Consulting Limited

\\44dillon\data\Projects\02-0116 Clyde River Landfill Siting Study\FINALREPORT.wpd

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1.0 INTRODUCTION

The purpose of this solid waste management study is to determine if the existing landfill site can be expanded to accommodate 20 year waste volume projections and to recommend other solid waste management (SWM) alternatives.

Presented in this report is the scope of work, background review, population projections and preliminary landfill sizing, development of solid waste options, assessment of options, cost estimates, and recommendations.

1.1 General

Clyde River is situated at 70 27' N 68 33' W on the west shore of Patricia Bay, within Clyde Inlet. The local economy is based on subsistence hunting, trapping, fishing, carving, silk-screening and tourism. The climate is typical of northern regions. The average annual rainfall is 4.6 cm and the average annual snowfall is 168.9 cm. Mean July highs and lows are 7.8 C and 0.4, and mean January highs and lows are -22.5 C and -30.3 C respectively. Prevailing winds are generally from the north-west at an annual average of 14.4 km/h.

Local vegetation consists of lichens, mosses, hardy grasses and small shrubs. Clyde River is within the zone of continuous permafrost. Clyde River is located on a shallow gravel ridge, on a south facing slope, and is surrounded by hills. The surficial material is a thin layer of glacial till with lacustrine deposits of unconsolidated sand and gravel.

Clyde River is a small community with an approximate population of 800 people. The following services are available in the community: government offices, school, nursing station, churches, Post Office, RCMP detachment, radio station, Visitor's Centre and Northern Store. Access to Clyde River is limited to aircraft from Iqaluit, snowmobile access from other Baffin communities in winter and a marine sea-lift in the summer.

1.2 Project Scope

The scope of work for this assignment included the following tasks:

Background Collection and Review

Information including documents relating to the Clyde River solid waste site, topographic mapping of the area, air photographs, and population statistics was collected and reviewed. The hamlet Foreman, SAO, and Mayor were interviewed to obtain an understanding of issues relating to the existing landfill, and to get a sense of alternate landfill site locations.

Existing mapping and photos were reviewed to become familiar with the hamlet layout, and location of existing landfill and possible alternate landfill sites.

Technology Review

Briefly identified and documented the SWM technologies applicable for use in Clyde River.

Constraint Mapping

Regional mapping of the Clyde River area was used as the base for the Constraint Map. The intent was to visually show areas that are excluded from use as a solid waste facility, areas that are less favorable, and areas that are preferred.

Population Projection and Landfill Sizing

The 20 year population projection and the minimum preliminary landfill size requirements were estimated.

Site Investigations

Site investigations were conducted for the existing landfill site and potential alternate sites to obtain data related to sites and gather operational information, and opinions of the hamlet officials. The purpose of the investigation was to identify constraints that will affect site development and the operations. Issues to be addressed include: site access, location and access to cover material, surface features, drainage and drainage courses, site topography, location of water bodies, and location of bedrock outcrops.

Option Development and Analysis

Developed several SWM options based on the applicable technologies and available sites, and assessed these sites against a set of criteria to select the best option. These site options were rated by the hamlet officials and by the hamlet councillors. The exact location of the facility was not identified for each option as part of this study. However, each option identifies a general area in which a facility could be located.

Cost Estimates

Developed cost estimates for the proposed site options. Cost estimates were used in evaluating the feasibility of an option.

Reporting

Prepared this report detailing the landfill sizing, siting constraints, available SWM options, costs, evaluation criteria, and recommended option.

2.0 BACKGROUND COLLECTION AND REVIEW

Prior to visiting Clyde River, background information was collected and reviewed. The following is a summary of the information collected and a summary of the existing waste management system:

Topographic Mapping & Air Photographs

MACA topographic mapping was layered on top of aerial photos to create AutoCad mapping of Clyde River. This mapping was reviewed to identify the following:

- layout of the hamlet,
- topography of the area,
- location of existing landfill sites,
- location of water reservoir,
- location of airport,
- location of sewage lagoon, and
- location of granular sources.

Airport, aquatic, and residential buffer zones were displayed on the mapping as these areas are unsuitable for a solid waste facility. This mapping was also used to locate several preliminary solid waste site options prior to the site visit.

Population Statistics

Population statistics including 20 year projections were obtained from the Nunavut Bureau of Statistics in order to conduct preliminary size estimates of a 20 year landfill facility. Population projections are discussed in Section 4.0.

Northwest Territories Power Corporation Soil Remediation Plan & Correspondence

The soil remediation plan and correspondence between Northwest Territories Power (NTPC), CG&T, and the Municipality of Clyde River regarding the disposal of contaminated soil was reviewed.

In August 1999, 350 cubic meters of hydrocarbon contaminated soil (diesel fuel) was removed from NTPC property to facilitate the construction of a new power house in Clyde River. A site was selected adjacent to the existing landfill by hamlet and NTPC representatives as a location for a soil remediation site/landfarm. In September of 2000, a 40 m by 40 m remediation site was constructed to the northwest of the existing landfill and approximately 15 m east of the sewage lagoon berm. This site is surrounded by fence however the fencing appears to be falling down in several locations. According to the NTPC report, it is expected that the soil will reach acceptable hydrocarbon limits for industrial use by 2003.

The area where solid waste is dumped is to the south east of the fencing. A short road leads into the dumping face.

Existing Waste Management System

The hamlet of Clyde River currently has an operational solid waste facility. The facility utilizes open burning and landfilling to dispose of waste. Waste is burned at the end of each day under supervision of the hamlet Foreman. The site is covered with granular material once per year in the summer. There is a separate site for disposal of bulky wastes.

The open dump/landfill is located approximately 1 Km west of the hamlet. The landfill is on the south side of the access road. This site is approximately 600 m from the ocean and slopes towards the ocean. The sewage lagoon and bulky waste disposal site are also located in this area.

The site is unsupervised as there is no full time landfill operator. The hamlet Foreman is in charge of landfill operations and generally visits the site once per day.

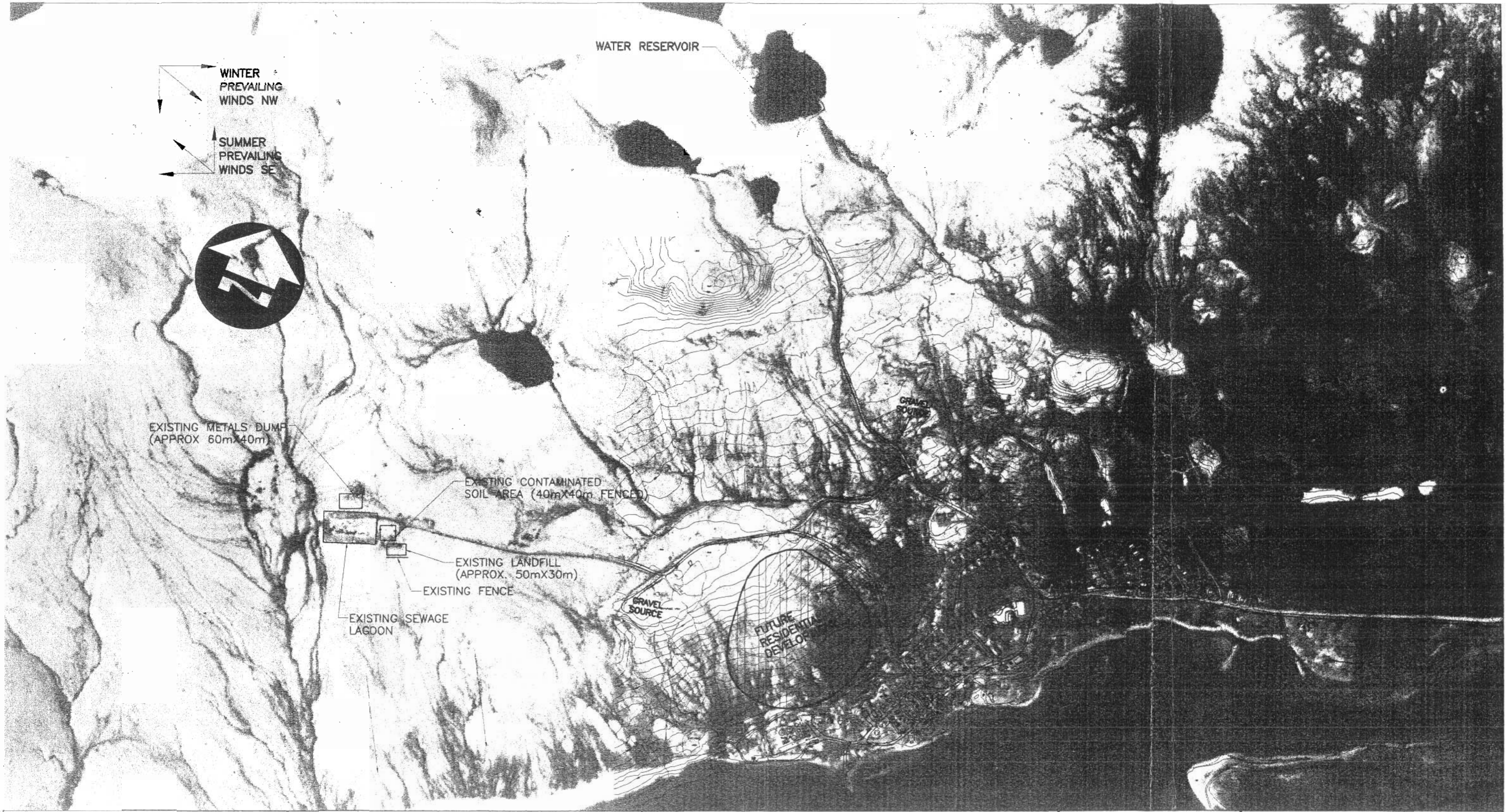
There is a dilapidated fence located on the south face of the landfill which is intended to prevent debris from being blown from the site into the ocean. The landfill does not have berms, gate, lights, or designated areas for different wastes.

The current site has been in operation for approximately 14 years. According to previous reports, the landfill was designed to be a 300 m by 300 m by 0.75 m site and was estimated to service the needs of the community until 2008. Due to the winter conditions, the active landfill area which could be seen was approximately 50 m by 30 m.

Hydrocarbon contaminated soil from the local Nunavut Power Corporation site was recently accepted at this facility. The soil was placed within a fenced area on the landfill site. There have been complaints from hamlet officials that the contaminated soil area has reduced the landfill capacity and has interfered with operation of the landfill. Therefore this study was required to determine if the existing landfill may be expanded and to locate alternative sites for a solid waste facility.

Site photographs are presented in Appendix A.

Figure 2-1 presents the location of the existing solid waste landfill, bulky wastes landfill, soil landfarm, sewage lagoon, and water reservoir with respect to the hamlet.



DILLON
CONSULTING

PROJECT	CLYDE RIVER SOLID WASTE FACILITY SITING STUDY
TITLE	CLYDE RIVER INFRASTRUCTURE
PROJECT NUMBER	02-0116
DATE	MARCH 2002
FIGURE NUMBER	FIGURE 2-1
SCALE	1:10,000

3.0 APPLICABLE TECHNOLOGY REVIEW

There are several solid waste management (SWM) technologies available in which some are more suitable to a northern community than others. The open dump/landfill is the method which is most often used by communities in the north. The existing Clyde River landfill is an open dump/landfill concept however burning is used regularly to reduce the waste volumes. The open dump/landfill involves placing wastes and covering periodically with granular fill and occasionally compacting. Typically there is a separate area for bulky wastes.

Proper management is essential in the operation of any disposal technology. An effective disposal system should provide a means of waste disposal without harming public health or the environment. The disposal system must also be acceptable to the residents of the community.

3.1 Available Technology for the North

The following SWM alternatives were identified and evaluated for Clyde River:

- Modified Landfill
- Landfill with Open Burning
- Sanitary Landfill
- Incineration
- Baling

To select an appropriate technology, the criteria that guide the process would include; capital cost minimization; operations and maintenance cost minimization; community acceptance; and regulatory agency acceptance. The evaluation of the options will take these into account.

3.1.1 Modified Landfill

The modified landfill is similar to an open dump/landfill. The difference is that the modified landfill requires careful planning and operation. A modified landfill is engineered from site selection to site closure. The site is selected, access road is constructed, berms and fencing may be constructed, disposal areas are identified, and cover materials are stockpiled. The wastes are disposed in predetermined areas, and compacted and covered more frequently than an open dump/landfill to ensure efficient use of the site. There are separate areas within the site identified for bulky waste and hazardous waste disposal.

The modified landfill is appropriate for small populated communities where it is not feasible to have continuous supervision or dedicated equipment at the site. The modified landfill has reasonable capital and operating costs, involves minimal operation and supervision, and is more aesthetically pleasing and provides a better level of service than an open dump.

3.1.2 Landfill with Open Burning

This method of waste disposal is similar to an open dump/landfill however the waste is burned regularly to reduce the volume of waste. Waste is burned to extend the life of the landfill and to reduce windblown debris, and renders waste less accessible to birds and animals. Authorization for burning is the discretion of the community council however in recent years the Department of Health and Social Services has been urging communities to stop burning wastes.

Much of the waste in northern communities is combustible, however certain wastes are not. These wastes may pose a threat to the operator or community if not segregated from the burn pile. Burning also creates concerns due to the potential effects on the health of the operators and residents, and the environment.

In discussion with the regulatory agencies, in particular the Department of Sustainable Development (DSD), Government of Nunavut, the Nunavut Water Board (NWB), and the Department of Health and Social Services, Dillon understands that the practice of open burning may be banned by regulators in the near future. For this reason, the use of open burning will not be considered further in this assessment.

3.1.3 Sanitary Landfill

The sanitary landfill is an engineered solid waste site which involves careful planning, supervision, and regularly scheduled compaction and covering of waste. The sanitary landfill is commonly used in the south.

Regular covering of wastes involves a considerable volume of granular material. This amount of cover material is generally unavailable in small northern communities. Sanitary landfilling also requires regular use of earth moving equipment which is not typically available in small communities.

Due to the amount of supervision, equipment, and cover material required for sanitary landfilling, this method will not be considered further in this report.

3.1.4 Incineration

Incinerators burn municipal waste at high temperatures (650 C to 1600 C) reducing waste to inert ash. Municipal waste can be reduced in volume by approximately 85% and the resulting ash is disposed in a controlled landfill/ashfill.

Energy from incinerators can be used to heat houses or buildings by utilizing waste heat recovery. It is also possible to generate electricity from the heat produced by an incinerator using a boiler and steam turbine generator set.

Incinerators tend to be mechanically complex, require regular maintenance, and require an experienced/trained operator. In small communities, incineration also has a much higher capital and operating cost than landfilling as it requires:

- purchase and installation of the incinerator unit;
- construction of a building to house the unit and to temporarily store waste and ash;
- construction of an ash landfill;
- incinerator operator;
- fuel;
- replacement parts.

Due to the high costs and complexity, incineration is much less feasible in communities such as Clyde River where suitable land is available for a landfill. For these reasons incineration will not be considered further in this report.

3.1.5 Baling

Baling involves preprocessing waste to reduce volume. A baler machine located inside a building is used to hydraulically press the waste into compacted bales which are then tied with wire. The bales are then stacked in a landfill. Baling increases the life of a landfill and reduces the amount of cover material required.

Baling machines require an operator and regular maintenance. In small communities, baling has a much higher capital and operating cost than landfilling as it requires:

- purchase and installation of the baler unit;
- construction of a building to house the unit and to temporarily store waste;
- construction of a landfill;
- baler operator;
- fuel;
- replacement parts, etc.

Due to the high costs and increased complexity, baling is much less feasible in communities such as Clyde River where suitable land is available for a landfill. For these reasons baling will not be considered further in this report.

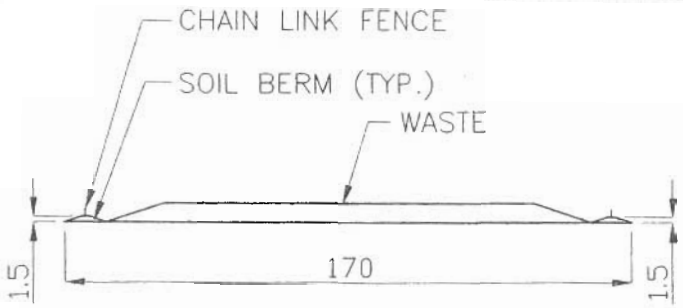
3.2 Recommended Disposal Method for Clyde River

The primary objective of any SWM system is to collect and dispose of wastes in the most economical manner and also to protect public health and provide reasonable protection to the environment. Landfilling is the most common form of waste disposal for smaller to medium size communities in North America, including Nunavut, as the capital and operating costs are minimal, operation of the facility is not complex, and if designed and maintained properly pose minimal threat to human health and the environment.

It is recommended that a modified landfill be the method of waste disposal utilized in Clyde River for the following reasons:

- Modified landfilling is an organized method of disposing of wastes which poses less of a health risk to workers and community than open burning and open dump/landfill.
- Modified landfill poses less of a threat to the environment than open dump/landfill with burning. With modified landfilling the waste is placed in an organized manner and is compacted and covered which reduces risk of leaching from hazardous wastes, berms and fencing may be installed to mitigate against waste and runoff leaving the site, and there is no open burning of waste therefore air emissions are reduced.
- There is adequate land available in Clyde River for the construction of a modified landfill.
- Modified landfilling is more economical than sanitary landfill, incineration, and baling.

The following figure 3-1 represents the layout of a typical modified landfill.



A SECTION
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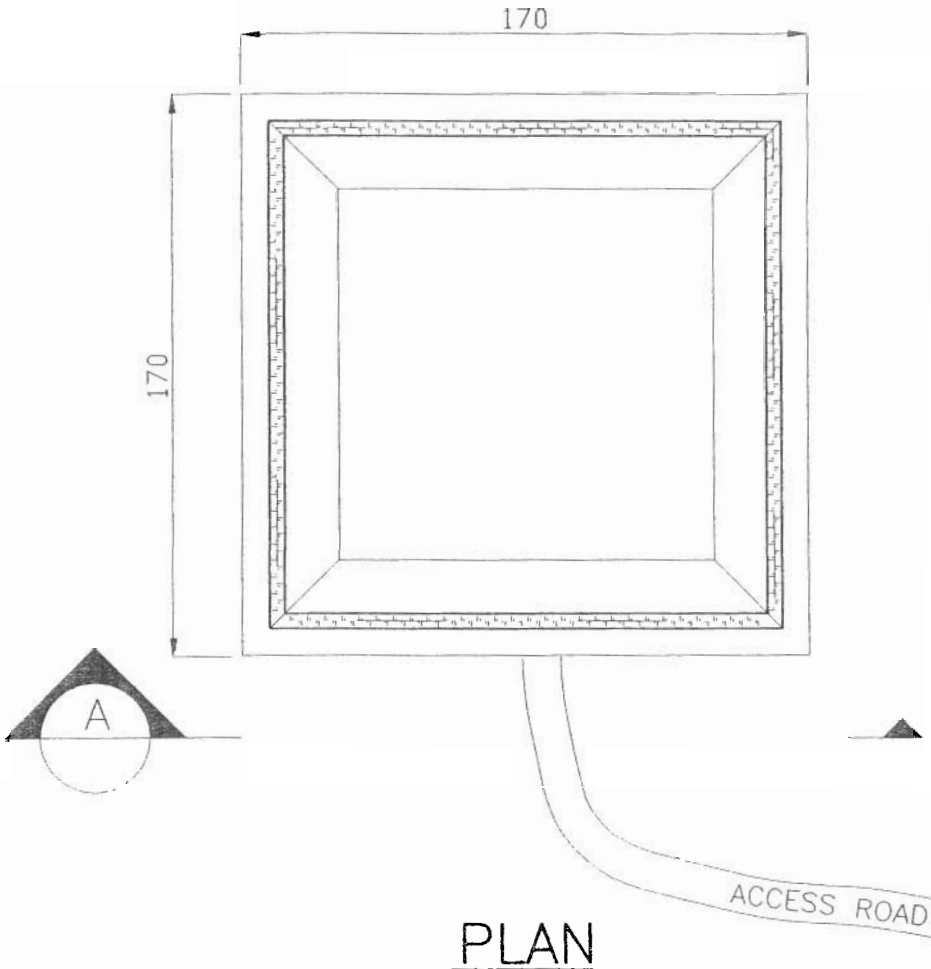


PLAN
NTS

DILLON CONSULTING

PROJECT: CLYDE RIVER SOLID WASTE FACILITY SITING STUDY	PROJECT NUMBER: 02-0116
	DATE: MARCH 2002
TITLE: TYPICAL MODIFIED LANDFILL	FIGURE NUMBER: FIGURE 3-1
	SCALE: NTS

4.0 POPULATION PROJECTION & LANDFILL SIZING

To determine if the existing landfill site can be expanded or to identify alternate solid waste sites, an approximate landfill footprint area was required. A solid waste landfill in the north is typically designed to accommodate 20 years of waste therefore the 20 year population projection was required. From this projection and other assumptions described below, the minimum landfill size requirements could be determined.

4.1 Population Projection

The 20 year population projection for Clyde River was required in order to estimate the size of the landfill facility. It was assumed that a new facility would not be constructed and commissioned until the summer of 2003 therefore population projections for 2003 to 2023 were required.

Population projections from 2000 to 2020 were obtained from the Nunavut Bureau of Statistics. These numbers were then projected by Dillon to the year 2023 using the given growth rates. Table 4-1 presents census data and Table 4-2 presents the population projections for the year 2023.

Table 4-1 Census Population Data

	Census Populations	Yearly Growth Rate
1991 Census	565	-
1996 Census	708	4.62 %
2001 Census	785	2.09 %
Bureau of Statistics projected growth rate	-	2.30 %

Table 4-2 Population Projections

	Bureau of Statistics Projections (1)
2003 Population	830
2013 Population	1050
2023 Population	1289

1) Bureau of Statistics 20 year projections are based on 1996 census data and reflect a 20 year growth rate of 2.30% per year.

4.2 Waste Quantity Generation

The average waste generation rate per capita is also required in order to determine the size of the landfill facility. An equation based on population was developed by the Department of Municipal and Community Affairs (MACA) of GNWT to estimate average waste quantities generated in northern communities. Dillon used this method to determine average waste quantities which would be produced in Clyde River over the next 20 years.

The yearly population projection and estimated volume of uncompacted waste is presented in Table 4-3. The volume of uncompacted waste which is expected to accumulate by the year 2023 is 101,000 cubic meters.

Table 4-3 Uncompacted Waste Quantity Estimates

Year	Population Projection	Annual Volume Solid Waste (m3)	Cumulative Waste Volume (m3)
2001	789	-	-
2002	812	-	-
2003	830	3,548	3,548
2004	848	3,646	7,194
2005	867	3,750	10,944
2006	890	3,877	14,821
2007	913	4,005	18,826
2008	937	4,139	22,965
2009	959	4,262	27,227
2010	982	4,392	31,619
2011	1,007	4,534	36,153
2012	1,028	4,653	40,806
2013	1,050	4,779	45,585
2014	1,072	4,905	50,491
2015	1,095	5,038	55,529
2016	1,121	5,189	60,717
2017	1,144	5,322	66,040
2018	1,167	5,457	71,496
2019	1,190	5,592	77,088
2020	1,214	5,733	82,821
2021*	1,238	5,878	88,699
2022*	1,263	6,026	94,725
2023*	**1,289**	6,177	**100902**

* Population projections for years 2021-2023 where based on average yearly percentage increase from 2017 to 2020 (2.01%) provided by Bureau of Statistics.

4.3 Preliminary Solid Waste Facility Sizing

In order to determine if a potential site was large enough for a solid waste facility, preliminary size calculations for a modified landfill were conducted. Based on the population growth rate of 2.30 % per year and the MACA waste generation rate, the volume of waste to be landfilled over the 20 year period is estimated to be 101,000 m3 uncompacted. To determine the approximate footprint area required for a modified landfill the following assumptions were utilized:

- soil berm height of 1.5 meters with 3:1 slopes,
- variable municipal waste height with 3:1 slopes,
- ratio of waste to cover of 5:1, and
- compacted waste density of 400 kg/m3 (light to moderate compaction).

The resulting active landfill area including the area required for berms is presented in Table 4-4. The required area depends on the final depth of waste which is selected.

Table 4-4 Preliminary Landfill Footprint Estimates

Height Waste & Soil (m)	Length (m)	Width (m)	Area (m2)	Area (ha)	Volume Available (m3)
3	**170**	**170**	28,900	2.89	45,802
4	150	150	22,500	2.25	45,791
5	140	140	19,600	1.96	46,229

For this study it was assumed that a maximum depth of 3 m would be used as the final depth and therefore the minimum parcel of land required for the 20 year landfill would be approximately 170 m by 170 m or 29,000 m2 (2.9 ha). This area was used during the site visit to determine if a potential site was large enough to be a viable option.

5.0 DEVELOPMENT OF SOLID WASTE FACILITY SITE OPTIONS

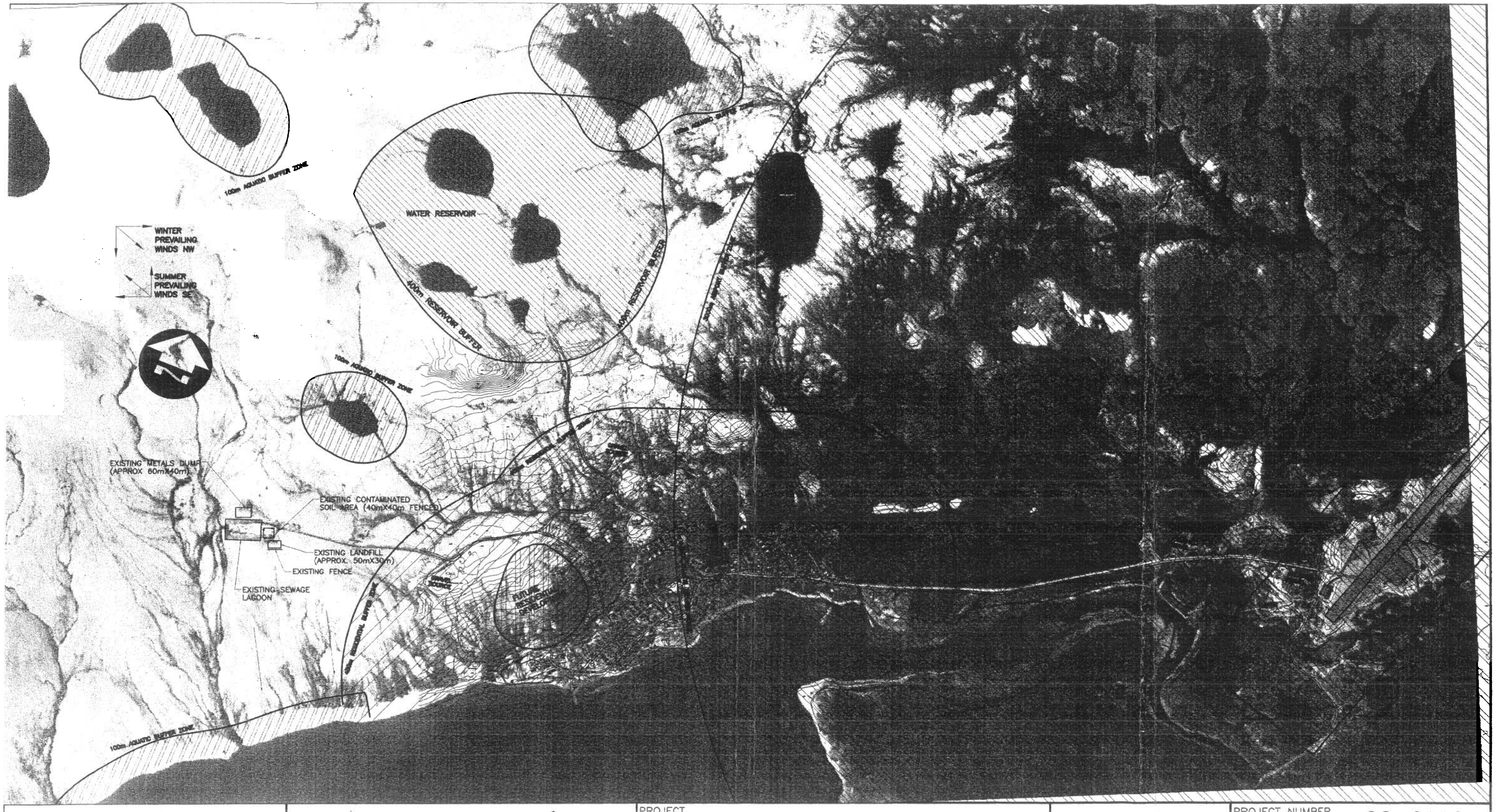
The following sections describe the constraints involved in siting the solid waste facilities, the general areas identified as possible sites for the facilities, and the proposed waste options.

5.1 Siting Constraints

MACA topographic mapping was layered on top of aerial photos in AutoCad to create mapping of Clyde River. Constraints were added to the mapping to indicate areas that are excluded from use as a solid waste facility, areas that are less favorable, and areas that are preferred. The buffer zones included on the map are:

- Transportation restrictions for airports, highways and marine activities;
- Community build up areas, and areas planned for community expansion;
- Water shed management areas for drinking water supplies;
- Exclusionary land use areas such as parks, recreational use areas, etc;
- Geological constraints, such as rock outcrops;
- Water bodies that have fisheries impacts;
- Buffer zones to community activities. Typically a buffer zone respects the communities need to have the facility out of sight, and have the community not adversely impacted by odour;
- Also shown on the map is the prevailing wind direction, the watershed for regional drainage systems, and common landmarks such as rivers, lakes, and other prominent physical features.

From this mapping Dillon explored the areas where a landfill could be reasonably located. The landfill constraint mapping is presented in Figure 5-1.



DILLON CONSULTING

PROJECT: CLYDE RIVER SOLID WASTE FACILITY SITING STUDY

TITLE: LANDFILL CONSTRAINT MAP

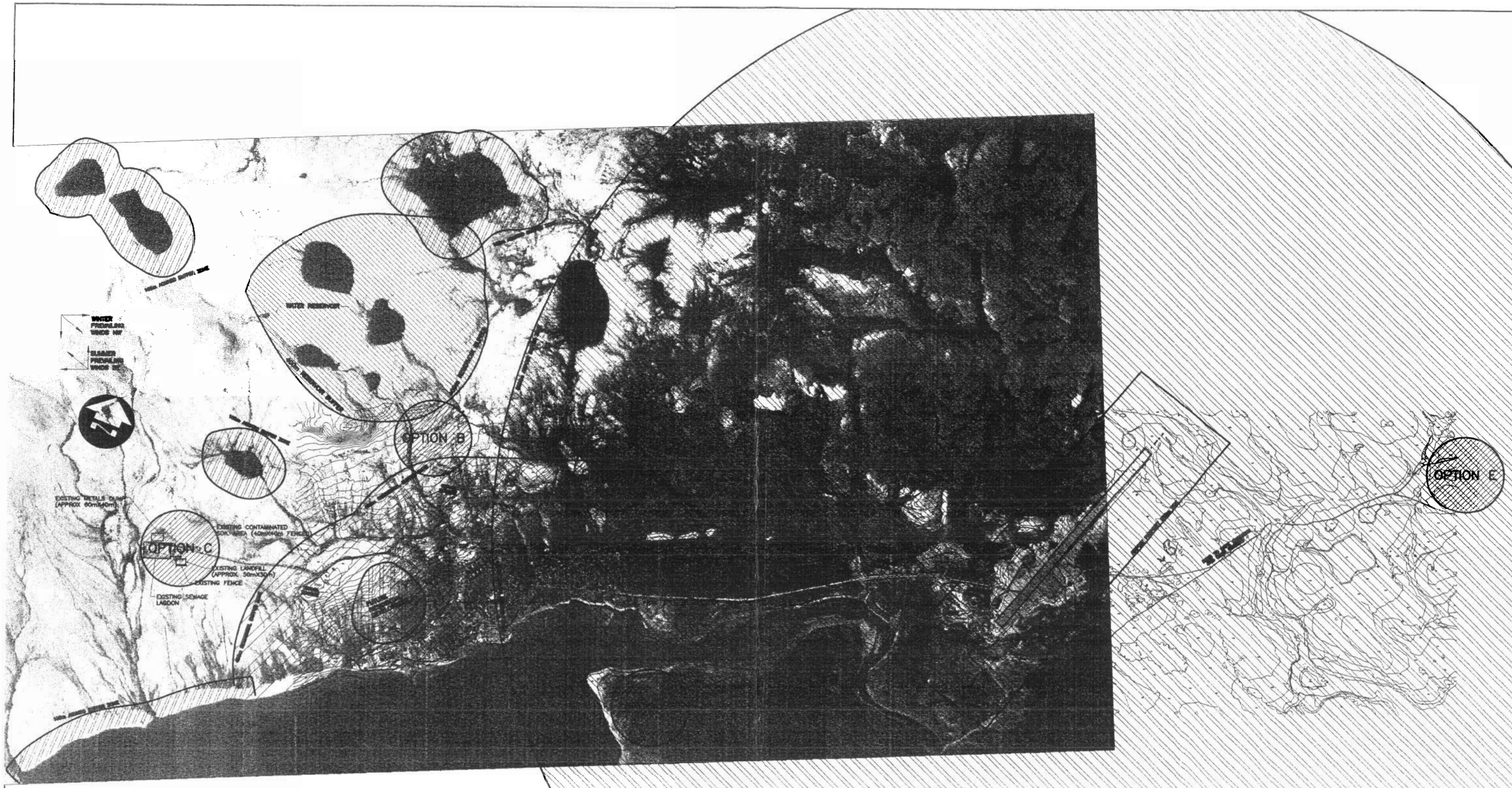
PROJECT NUMBER	02-0116
DATE	MARCH 2002
FIGURE NUMBER	FIGURE 5-1
SCALE	1:15,000

5.2 Preliminary Solid Waste Facility Site Options

Based on the constraint mapping, several possible areas for landfill sites were identified by Dillon before visiting Clyde River. These preliminary site options were chosen based on the buffer zones, and land topography and features. The purpose of selecting preliminary sites was to create a basis for discussion with the hamlet officials on locations which would be more or less favorable to the hamlet. The preliminary sites identified for these discussions are presented in Figure 5-2 and are described as follows:

A) North side of the Road which leads from the Airport to hamlet. Approximately 1.5 Km from airport and 400 m from residential area.
B) East side of Road to Water Reservoir. Approximately 450 m from residential area and 500 m from reservoir (downstream).
C) Area of the existing landfill sites and sewage lagoon. Approximately 1 Km from residential area and 600 m from the ocean.
D) Peninsula across from the hamlet.
E) Road to Cape Christian. Approximately 1.5 Km from airport and 3.5 Km from hamlet.
F) Northeast of hamlet in area of an old dump site. Approximately 400 m from residential area.

Dillon visited Clyde River in March of 2002 and these preliminary options were discussed with hamlet officials as outlined below in Section 5.3.



DILLON CONSULTING

PROJECT	CLYDE RIVER SOLID WASTE FACILITY SITING STUDY
TITLE	PRELIMINARY LANDFILL SITE OPTIONS
PROJECT NUMBER	02-0116
DATE	MARCH 2002
FIGURE NUMBER	FIGURE 5-2
SCALE	1:20,000

5.3 Site Visit & Evaluation of Preliminary Site Options by Hamlet Officials

Dillon met with the hamlet Foreman, SAO, and Mayor to obtain an understanding of issues relating to the existing landfill, and to get a sense of alternate areas for a landfill. Dillon staff visited the existing solid waste landfill and bulky waste landfill and the proposed alternate sites to further identify the feasibility of constructing an engineered landfill site at these locations.

The following is a summary of comments regarding the preliminary landfill site options given by the hamlet officials and comments by Dillon:

5.3.1 Road from the Airport to Hamlet

Hamlet officials:

- Location is too close to the community. Felt the residents would not support a landfill along this road due to esthetics.
- The land in this area is very flat so the landfill would be visible from the road. This road provides the first impression of the hamlet for tourists so it is not an appropriate location for a landfill.

Dillon:

- Agreed with the hamlet officials on the above comments.
- The location is also within the 3 Km Airport buffer zone.

Recommendation: **Option will not be carried forward at this time.**

5.3.2 Road to Water Reservoir

Hamlet officials:

- Location is too close to the water reservoir. Felt the residents would not support a landfill along this road due to perceived proximity to the water reservoir.
- Location is too close to the community and is north of the community so smoke/odour would blow into town for most of the year (northwest winds are predominant for most of the year).

Dillon:

- Agreed with the hamlet officials on the above comments
- There is an existing road leading to the site which is currently cleared during winter months.
- The site is outside the 3 Km airport zone.
- The area is on a hill where residents and tourists can go to overlook the hamlet, and the ocean. Common area for iceberg viewing.

Recommendation: **Option will not be carried forward at this time.**

5.3.3 General Area of Existing Landfill Sites and Sewage Lagoon

Hamlet officials:

- This area would likely be the favored location by the residents of the community.
- It is not a recreation area.
- This area is not visible from the hamlet.
- There have not been many complaints of smoke or odour problems from the existing landfill sites or sewage lagoon.
- The existing landfill site and bulky waste site could be expanded to a larger landfill facility provided fencing and appropriate drainage was provided.
- They would prefer to see the landfill even further from the hamlet than the existing sites if possible.

Dillon:

- Agreed with the hamlet officials on the above comments.
- There is an existing road leading to the site which is currently cleared during winter months.
- The site is outside the 3 Km airport zone.
- The site is approximately 1 Km from residential development.
- The area is currently impacted by two waste sites and the sewage lagoon. Therefore it makes sense to keep the new landfill in the same general area and upgrade the operation.

Recommendation: **Recommend the following three options be technically evaluated for this general area:**

1) **Expand Existing Landfill Site** - The existing landfill site is bound on the west by the sewage lagoon and the north by the road however it could be expanded to the south towards the ocean and to the east. The existing site is approximately 600 m from the ocean and slopes towards the ocean.
2) **Expand Existing Bulky Waste Site** - The existing bulky waste site is bound on south by the road and to the west by a wet area however it could be expanded significantly to the north and to the east. The area is fairly flat and does not appear to slope towards the ocean.
3) **Northwest of Existing Waste Sites** - Extend the existing road approximately 400 to 700 m to the northwest of the existing waste sites and construct a new landfill in this area. The area is fairly flat and does not appear to slope towards the ocean.

5.3.4 Peninsula Across from the Hamlet

Hamlet officials:

- Location is visible from the community as it is a peninsula located directly across from the hamlet.
- Recreational area used for picnicking and camping during summer months.
- Road to this area is not cleared in winter.

- Area is too far of a drive from the hamlet, too inconvenient.

Dillon:

- Agreed with the hamlet officials on the above comments.
- An additional 1.5 Km of road would require upkeep and snow clearing if the landfill was located on this peninsula.
- The location is also within the 3 Km Airport buffer zone.

Recommendation: **Option will not be carried forward at this time.**

5.3.5 Road to Cape Christian

Hamlet officials:

- Location is visible from the community as it is a peninsula located directly across from the hamlet.
- Recreational area used for picnicking and camping during summer months.
- Road to this area is not cleared in winter.
- Area is too far of a drive from the hamlet, too inconvenient.

Dillon:

- Agreed with the hamlet officials on the above comments.
- An additional 2-3 Km of road would require upkeep and snow clearing if the landfill was located along this road.
- The location is also within the 3 Km Airport buffer zone.

Recommendation: **Option will not be carried forward at this time.**

5.3.6 Northeast of Hamlet in Area of an Old Dump Site

Hamlet officials:

- Location is too close to the community. Felt the residents would not support a landfill along this road due to esthetics and due to the possibility of smoke and odour blowing into the east end of the community.
- There was a dump site in this area many years ago and was abandoned due to residents complaining of smoke and odour.

Dillon:

- Agreed with the hamlet officials on the above comments.
- The location is also within the 3 Km Airport buffer zone.

Recommendation: **Option will not be carried forward at this time.**

5.4 Proposed Solid Waste Management Options

After reviewing available technology in the north, examining the constraint mapping for potential solid waste sites, visiting the existing and potential sites, and meeting with hamlet officials it is recommended that the following solid waste management (SWM) options be further evaluated in this study:

Option 1 Continue Open Dump/landfill with Burning at Existing Landfill
Option 2 Expand Existing Bulky Waste Site to Modified Landfill
Option 3 Expand Existing Landfill Site to Modified Landfill
Option 4 Construct Modified Landfill Northwest of Existing Waste Sites

Option 1 is basically a "do nothing" approach and is not a recommended method for long term SWM. It is included for further evaluation for comparison purposes only.

Options 2, 3, and 4 involve constructing a modified landfill. Modified landfilling was discussed in Section 3.1.1 and 3.2 and is the recommended form of waste disposal for Clyde River. As discussed previously, modified landfilling is recommended for the following reasons:

- It poses less of a health risk to workers and community than open burning and open dump/landfill;
- It poses less of a threat to the environment than open dump/landfill with burning;
- There is adequate land available for the construction of a modified landfill.
- It is more economical than sanitary landfill, incineration, and baling.

The general area, not the exact location of the facility, is identified for each option. The location of these SWM options are presented in Figure 5-3. The options are described below.

5.4.1 Option 1 - Continue Open Dump/landfill with Burning at Existing Landfill

Option 1 involves continuing to use the existing open dump/landfill sites. The municipal and bulky waste sites were inspected in March 2002. During this visit the ground was covered with snow however based on what could be seen and discussions with the hamlet Foreman, it appeared that there is adequate space for both sites to continue to operate as they currently are for several years.

The existing municipal waste and bulky waste sites are not engineered or planned facilities. The waste is not enclosed by berms or fencing. The municipal landfill does not have designated areas for wood waste, hazardous waste, municipal wastes, or a designated burn pile. The existing site is disorganized and unsightly. The waste is scattered due to wind blown debris and unsupervised dumping. The existing site uses open burning to reduce waste volumes. The decision to open burn is the hamlet councils discretion however open burning is not recommended by the Government of Nunavut Department of Health and Social Services.

The operation of the existing sites could be improved to decrease the health and safety risks to workers and residents. An engineered waste site is much more preferred than the operations at the existing sites however the open dump/landfill with burning has been an accepted form of waste disposal in the North for many years.

The sites could continue to expand for several years as there is adequate land around both sites. **However the open dump/landfill with burning method of SWM is not recommended**. It is recommended that an engineered site be constructed in the near future to increase the safety of the residents and the environment.

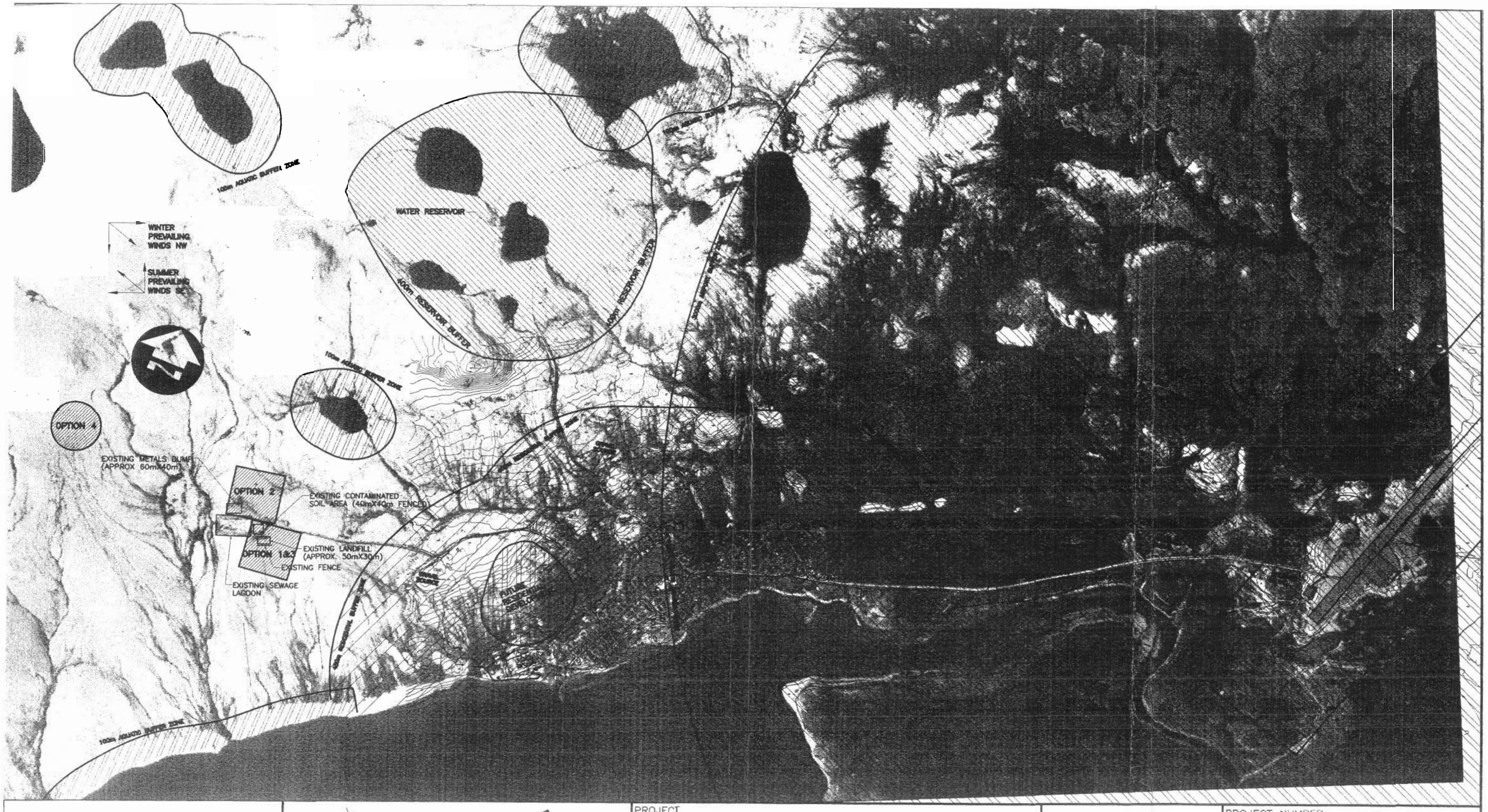
5.4.2 Option 2 - Expand Existing Bulky Waste Site to Modified Landfill

Option 2 involves planning and constructing a 20 year modified landfill at the existing Bulky Waste Site.

The existing bulky waste site is located on the north side of the access road. The existing bulky waste site is bound on the south by the road and to the west by a wet area however there is abundant land to the north and east where a modified landfill facility could be constructed. The area is fairly flat and does not appear to slope towards the ocean.

As discussed in Section 4.3 the approximate footprint of land required for a 20 year modified landfill in Clyde River is 170 m by 170 m or 29,000 m2. The modified landfill site would consist of the following:

- Designated areas for placing municipal waste, hazardous wastes, construction debris, and bulky wastes.
- The existing bulky waste area would continue to operate and would be incorporated into the site and expanded.
- A gravel road system would be constructed within the site.
- Granular cover materials would be stock piled on site.
- Fencing would be constructed around the site
- Soil berms could be constructed around the site.
- The landfill berms and fencing could be constructed in two phases (two 10 year cells) to reduce immediate capital costs of constructing berms and fencing.
- The existing municipal waste landfill site would be closed and covered.



DILLON CONSULTING

PROJECT	CLYDE RIVER SOLID WASTE FACILITY SITING STUDY
TITLE	PROPOSED LANDFILL SITE OPTIONS
PROJECT NUMBER	02-0116
DATE	MARCH 2002
FIGURE NUMBER	FIGURE 5-3
SCALE	1:15,000

5.4.3 Option 3 - Expand Existing Landfill Site to Modified Landfill

Option 3 involves planning and constructing a 20 year modified landfill in the vicinity of the existing open dump/landfill site.

The existing open dump/landfill site is located on the south side of the access road. This site is approximately 600 m from the ocean and slopes towards the ocean. The existing landfill site is bound on the west by the sewage lagoon and the north by the access road however it could be expanded to the south towards the ocean and to the east.

As discussed in Section 4.3 the approximate footprint of land required for a 20 year modified landfill in Clyde River is 170 m by 170 m or 29,000 m2. The modified landfill site would consist of the following:

- Designated areas for placing municipal waste, hazardous wastes, and construction debris.
- The existing dump/landfill area would be incorporated into the new site and the landfill site would be significantly expanded.
- A gravel road system would be constructed within the site.
- Granular cover materials would be stock piled on site.
- Fencing would be constructed around the site
- Soil berms could be constructed around the site.
- The landfill berms and fencing could be constructed in two phases (two 10 year cells) to reduce immediate capital costs of constructing berms and fencing.
- The existing bulky waste landfill site could be closed and covered and an area could be designated within the new site OR the bulky waste site could continue to operate as a separate facility

5.4.4 Option 4 - Modified Landfill Northwest of Existing Waste Sites

Option 4 involves planning and constructing a 20 year modified landfill northwest of the existing waste sites. There are a couple suitable areas northwest of the existing sites which would involve extending the existing access road approximately 450 m to 700 m depending on the exact area which is selected.

This area is further from the community however this option would involve disturbing an area of land which is currently not impacted.

As discussed in Section 4.3 the approximate footprint of land required for a 20 year modified landfill in Clyde River is 170 m by 170 m or 29,000 m2. The modified landfill site would consist of the following:

- Designated areas for placing municipal waste, hazardous wastes, and construction debris.
- The existing access road would be extended 450 m to 700 m to the chosen site.
- A gravel road system would be constructed within the site.
- Granular cover materials would be stock piled on site.

- Fencing would be constructed around the site
- Soil berms could be constructed around the site.
- The landfill berms and fencing could be constructed in two phases (two 10 year cells) to reduce immediate capital costs of constructing berms and fencing.
- The existing bulky waste landfill site could be closed and covered and an area could be designated within the new site OR the bulky waste site could continue to operate as a separate facility.
- The existing open dump/landfill would be closed and covered.