Landfill
Design And Management Plan
Doris North Gold Mine, Nunavut

Submitted to:

Miramar Hope Bay Limited

North Vancouver, British Columbia

Submitted by:

AMEC Earth & Environmental,
a division of AMEC Americas Limited

Burnaby, BC

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IMPORTANT NOTICE

This report was prepared exclusively for Miramar Hope Bay Limited by AMEC Earth & Environmental, a wholly owned subsidiary of AMEC Americas Limited. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Miramar Hope Bay Limited, the Nunavut Water Board, the Kitikmeot Inuit Association and the regulatory agencies involved in reviewing the water license application for the Doris North Project only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any other third party is at that party's sole risk.

EXECUTIVE SUMMARY

The Landfill Design and Management Plan provides pre-construction information on how inert industrial wastes will be handled in a safe and environmentally sound manner at the Miramar Hope Bay Limited (MHBL) Doris North Gold Mine (Doris North) in Nunavut. This plan was developed in support of MHBL's application for a water licence from the Nunavut Water Board (NWB) to operate Doris North.

All solid non-combustible, non-hazardous waste will be disposed of in a portion of the rock quarry (Quarry #2) immediately west of the camp. An area approximately 100 m x 100 m will be dedicated to landfill operations. The area for landfilling will be prepared by removing surface debris, large rocks, and brush. The final quarry configuration will consist of a flat surface, graded at approximately 1% in the down slope direction, adjoining a steeper angled rock surface that forms the transition to natural ground on the ridge above. Storm and melt water will be diverted away from the landfill by small 0.5 m berms on the upslope edges of the excavation.

Upon closure, the disposal site will receive a final cover of clean rock, the surface will be re-graded to blend in with the surrounding terrain, and surface drainage will be directed away from the site. As this landfill does not contain any hazardous waste its closure plan does not require infiltration or thermal control.

1.0 INTRODUCTION

1.1 Overview

The Landfill Design and Management Plan provides pre-construction information on how inert industrial wastes will be handled in a safe and environmentally sound manner at the Miramar Hope Bay Limited (MHBL) Doris North Gold Mine (Doris North) in Nunavut. This plan was developed in support of MHBL's application for a water licence from the Nunavut Water Board (NWB) to operate Doris North.

Doris North is located on the Canadian mainland in the West Kitikmeot region of Nunavut approximately 110 km southwest of Cambridge Bay and 75 km northeast of Umingmaktok. The Project is located on Inuit Owned Land at 68 09' N x 106 40' W, 5 km south of the head of Roberts Bay, an extension of Melville Sound which connects with Bathurst Inlet about 80 km west of the Project.

During construction, the mine will have on site a maximum of approximately 120 including MHBL employees and contractors. This number will increase to a maximum of approximately 175 during operations, and the number of people on site will reduce once the closure phase is entered. The proposed landfill is relatively small, consistent with the mine size and underground operations mode, but designed to be expandable to the extent required to accommodate all inert industrial waste anticipated to be generated during the life of mine. The quarry location is large enough to accommodate industrial waste from an expanded mine, should additional reserves be proven and the Doris North mine continue operation beyond the current projection of two years.

The proposed landfill is designed to operate in a safe, efficient and environmentally sound manner. All wastes and drainage will be contained and environmental control will be straight forward. No hazardous wastes will be placed in the industrial landfill. Management procedures for hazardous wastes are discussed in the Hazardous Materials Management Plan for the Doris North Project.

1.2 Cross Reference to Plans and Procedures Quoted in the Landfill Design and Management Plan

- MHBL Hazardous Materials Management Plan 2006
- MHBL Tailings Waste Management Plan 2006
- MHBL Water Management Plan 2006
- MHBL Landfarm Design and Management Plan 2006

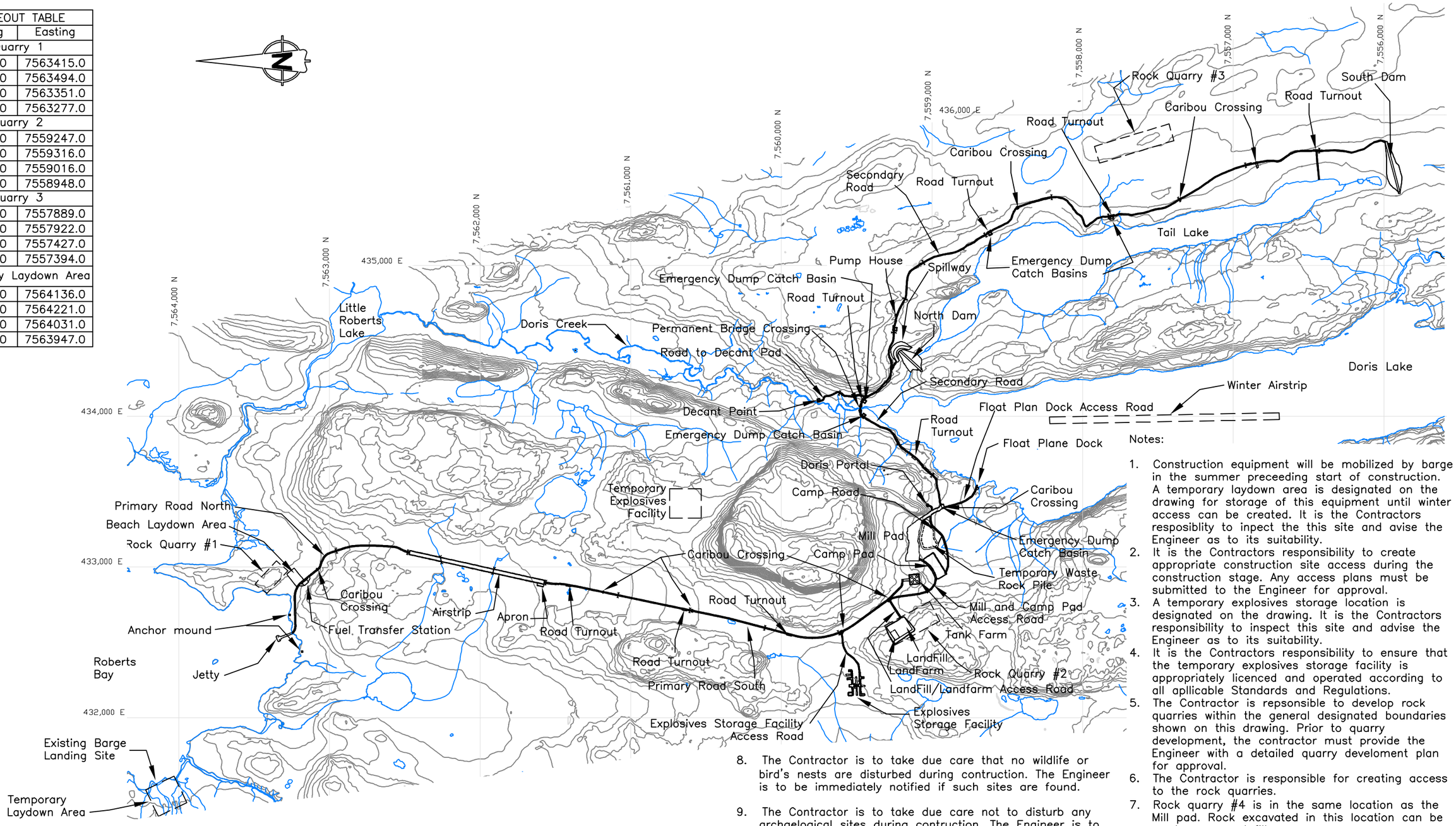
1.3 Location of Facilities

The industrial landfill will be located in Quarry 2 once broken rock production is complete. Figure 1 shows the location of the Quarry at Doris North.

1.4 Responsibility

- Mine General Manager - The mine general manager has overall responsibility for this management plan and will be the party to provide the mine site resources to develop and manage the landfill facility;
- Surface Superintendent - The mine's surface superintendent will have mine site responsibility for the implementation of this management plan and will provide the on-site resources to operate and manage the landfill facility in accordance with the plan; conduct regular inspections of the landfill; and provide input to the mine management team on modifications in design and operational procedures to improve operational performance of this facility; and
- Environmental Manager – The site environmental manager has responsibility to: keep this management plan updated; provide technical expertise to the site operational personnel on the operation and maintenance of the landfill; sampling of runoff and leachate and assessment of whether this water has met applicable regulatory standards for release onto the tundra; provide operational personnel with direction as to when and where water from the landfill should be sent; conduct annual audit of the facility; and provide an audit report to Surface Superintendent and Mine General Manager.

STAKEOUT TABLE	
Northing	Easting
Quarry 1	
432825.0	7563415.0
432887.0	7563494.0
433040.0	7563351.0
432975.0	7563277.0
Quarry 2	
432482.0	7559247.0
432612.0	7559316.0
432772.0	7559016.0
432642.0	7558948.0
Quarry 3	
435680.0	7557889.0
435791.0	7557922.0
435939.0	7557427.0
435828.0	7557394.0
Temporary Laydown Area	
431346.0	7564136.0
431522.0	7564221.0
431613.0	7564031.0
431437.0	7563947.0



Notes:

1. Construction equipment will be mobilized by barge in the summer preceeding start of construction. A temporary laydown area is designated on the drawing for storage of this equipment until winter access can be created. It is the Contractors resposiblity to inpect the this site and avise the Engineer as to its suitability.
2. It is the Contractors responsibility to create appropriate construction site access during the construction stage. Any access plans must be submitted to the Engineer for approval.
3. A temporary explosives storage location is designated on the drawing. It is the Contractors responsibility to inspect this site and advise the Engineer as to its suitability.
4. It is the Contractors responsibility to ensure that the temporary explosives storage facility is appropriately licenced and operated according to all apllicable Standards and Regulations.
5. The Contractor is repsonsible to develop rock quarries within the general designated boundaries shown on this drawing. Prior to quarry development, the contractor must provide the Engineer with a detailed quarry develoment plan for approval.
6. The Contractor is responsible for creating access to the rock quarries.
7. Rock quarry #4 is in the same location as the Mill pad. Rock excavated in this location can be used as general fill.
8. The Contractor is to take due care that no wildlife or bird's nests are disturbed during contruction. The Engineer is to be immediately notified if such sites are found.
9. The Contractor is to take due care not to disturb any archaeological sites during contruction. The Engineer is to be immediately notified if such sites are found.

1:12500 0 200 400 600 800 1000 Metres

Note: Drawings plotted to half scale

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	WATER LICENCE APPLICATION DESCRIPTION	CHK'D	APP'D	DATE
REVISIONS				

Stamped, signed and dated originals submitted to the Nunavut Water Board

PROFESSIONAL ENGINEERS STAMP

SRK Consulting Engineers and Scientists Vancouver

DESIGN:	DRAWN:	REVIEWED:
AT	JJH	EMR
CHECKED:	APPROVED:	DATE:
AT	EMR	Oct. 2006

FILE NAME: PLAN VIEW.dwg

MIRAMAR HOPE BAY LTD.

DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

DRAWING TITLE: FIGURE 1

DRAWING NO.	SHEET	REVISION NO.
G-02	2 OF 48	A

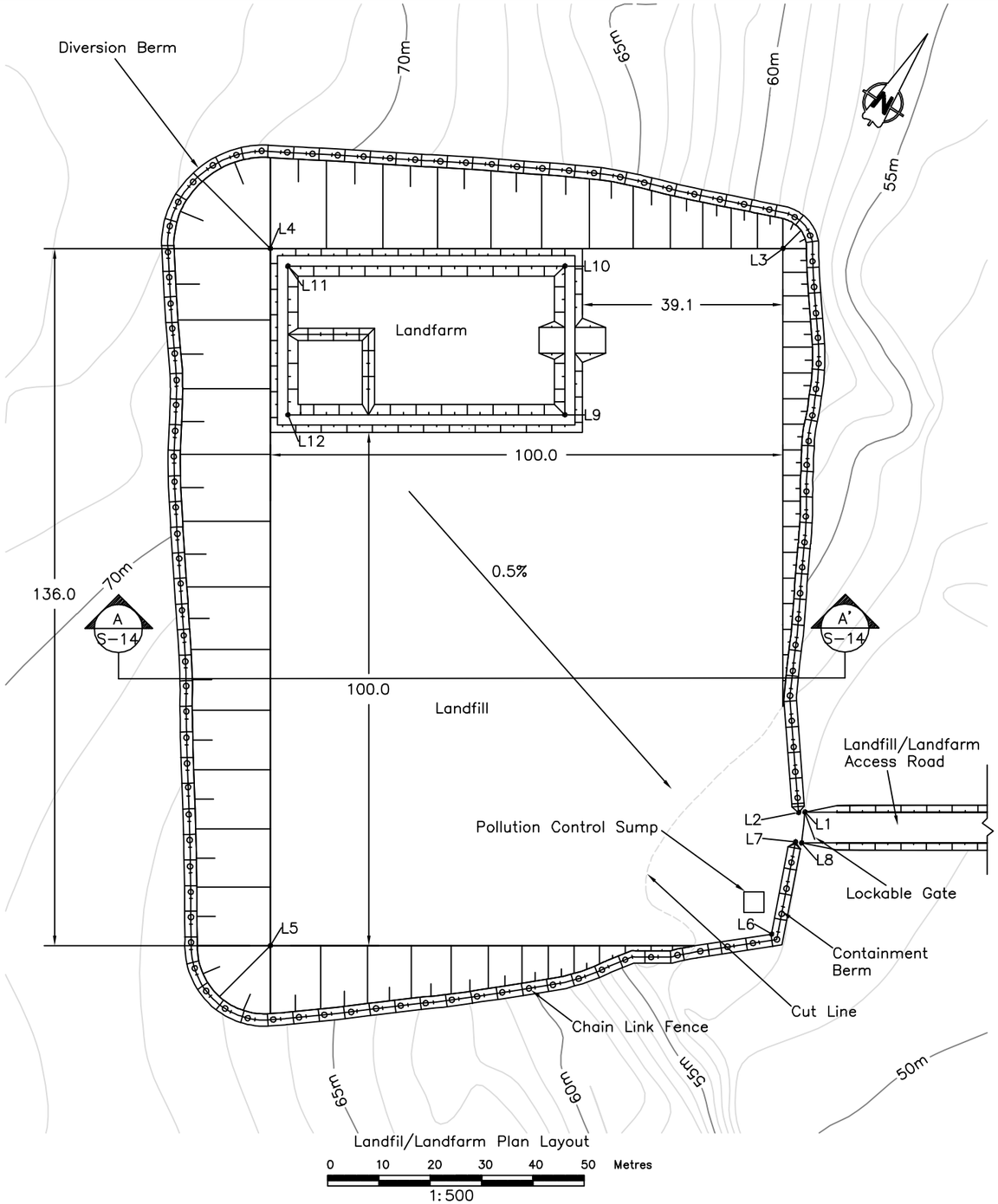
2.0 REGULATORY SETTING

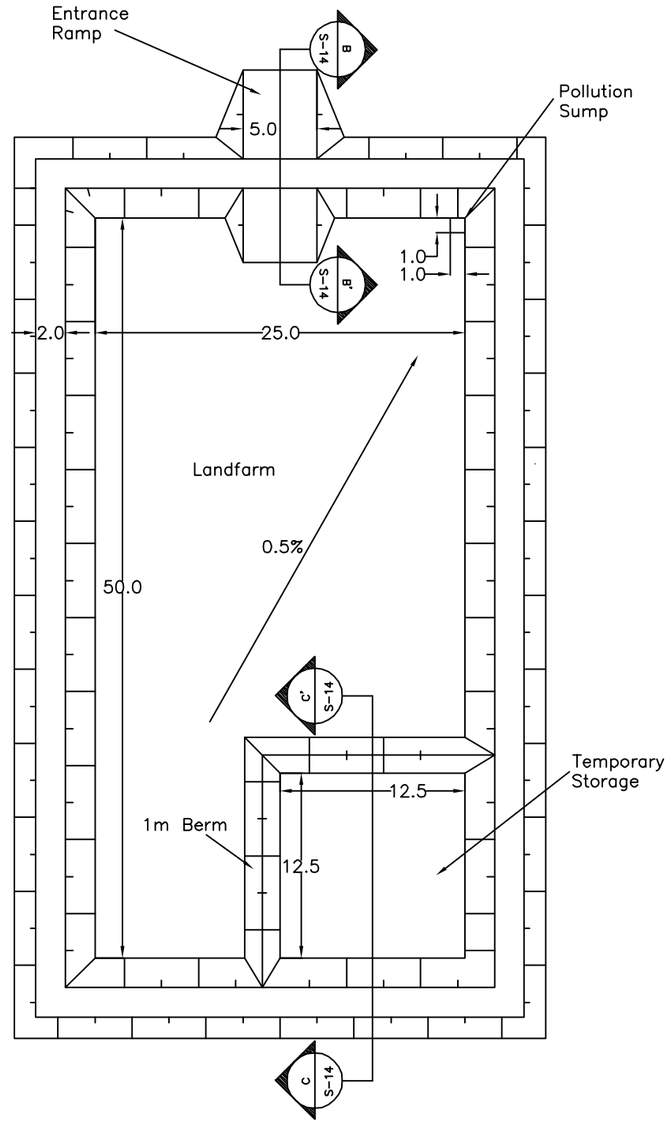
Waste management is regulated under the Nunavut *Public Health Act*, the Nunavut *Environmental Protection Act* and the federal *Environmental Protection Act*. In addition to mandatory requirements, a number of waste management guidelines are commonly used in the NWT. The most recent of these was developed for municipal solid waste, and is titled "Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT" (Ferguson Simek Clark, April 2003, on behalf of the Department of Municipal and Community Affairs, Government of Northwest Territories). While all of the recommendations provided in this guideline are not appropriate for the management of industrial waste such as those generated at a gold mine, those principals that are considered applicable have been adopted in the proposed waste management plan contained in the current document.

3.0 LANDFILL LOCATION AND CONSTRUCTION

All solid non-combustible, non-hazardous waste will be disposed of in a portion of the rock quarry (Quarry 2) immediately west of the camp (Figure 1). An area approximately 100 m x 100 m will be dedicated to landfill operations. Figure 2 shows a detail of the proposed location. The area for landfilling will be prepared by removing surface debris, large rocks, and brush. The final quarry configuration will consist of a flat surface, graded at approximately 1% in the down slope direction, adjoining a steeper angled rock surface that forms the transition to natural ground on the ridge above. Storm and melt water will be diverted away from the landfill by small 0.5 m berms on the upslope edges of the excavation (Figure 3).

A landfarm for treatment of petroleum-contaminated soil will also be located in the quarry but physically separated from the landfill such that cross contamination will not be possible. Further details are presented in the Landfarm Design and Management Plan (MHBL 2006a).





STAKE OUT TABLE			
POINT	EASTING	NORTHING	ELEV.
LANDFILL			
L1	432660.5	7559209.3	53.0
L2	432659.6	7559208.6	53.0
L3	432597.3	7559299.3	53.0
L4	432513.3	7559245.1	53.0
L5	432587.1	7559130.8	53.0
L6	432668.0	7559185.8	53.0
L7	432662.1	7559203.4	53.0
L8	432663.2	7559203.9	53.0
LANDFARM			
L9	432579.2	7559249.0	54.2
L10	432563.4	7559273.4	54.2
L11	432518.1	7559244.1	54.2
L12	432533.8	7559219.7	54.2

Notes:

1. The landfill and landfarm will be constructed in the developed quarry. The final configuration of the landfill be determined once the quarry development plan has been finalized.
2. The landfill and landfarm must be founded predominantly on bedrock. If, after excavation to the lines and grades indicated on this drawing, sufficient bedrock is not exposed, the Engineer will instruct the Contractor to lower the level of excavation.
3. A nominal leveling layer of Surfacing material will be spread over the exposed bedrock surface before proceeding with the landfarm construction.
4. The bedrock cut highwall for the landfill and landfarm must be inspected by a qualified geotechnical Engineer to ensure safe operation within the landfill/landfarm area.
5. The Contractor may have to over excavate overburden on the highwall crest to ensure slope stability. The Engineer will confirm the slope finishing details on site.

Note: Drawings plotted to half scale

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
S-14	LANDFILL AND LANDFARM TYPICAL PLAN, SECTIONS		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	WATER LICENSE APPLICATION			

REVISIONS

Stamped, signed and dated originals submitted to the Nunavut Water Board

PROFESSIONAL ENGINEERS STAMP

SRK Consulting
Engineers and Scientists
Vancouver

DESIGN:	DRAWN:	REVIEWED:
AT	JJH	EMR
CHECKED:	APPROVED:	DATE:
AT	EMR	Oct. 2006

FILE NAME: LANDFILL VIEW.dwg

MIRAMAR HOPE BAY LTD.

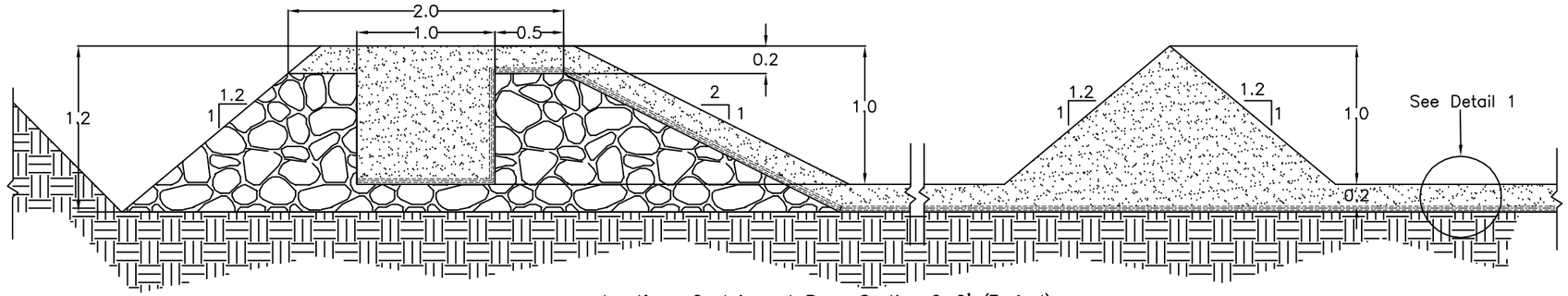
DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

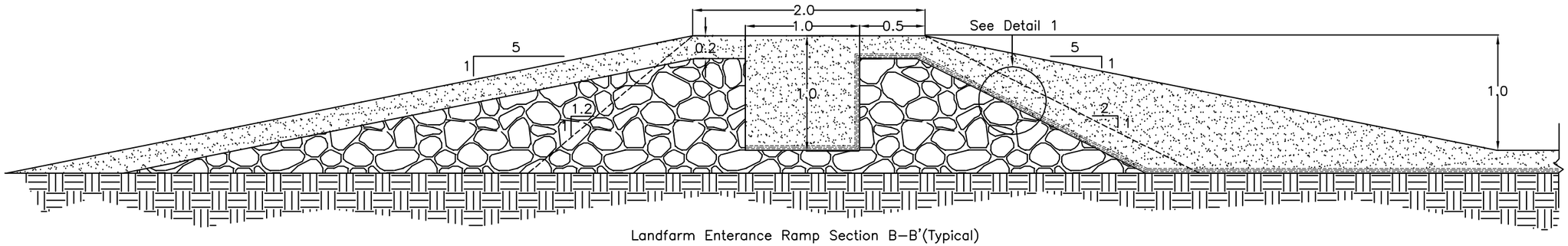
DRAWING TITLE:
Landfill and Landfarm Typical Plan, Sections and Details

DRAWING NO.	SHEET	REVISION NO.
2	21 OF 48	A



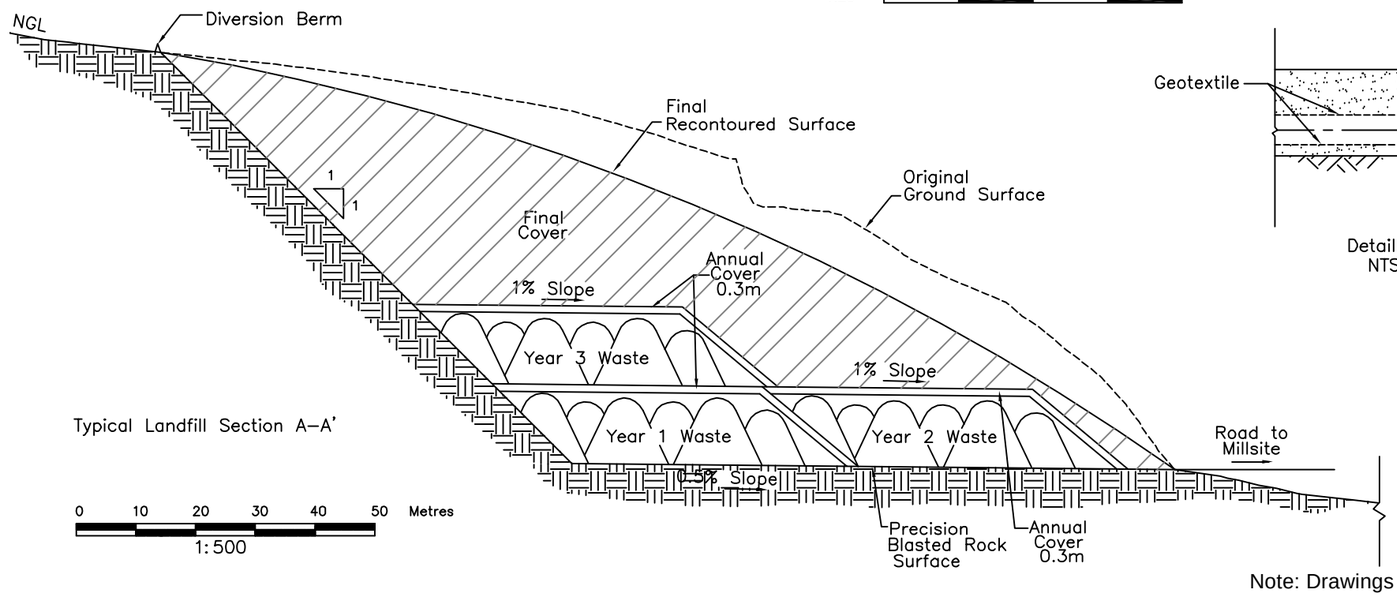
Landfarm Containment Berm Section C–C' (Typical)

1:20 0 5 10 15 20 Metres



Landfarm Enterance Ramp Section B–B'(Typical)

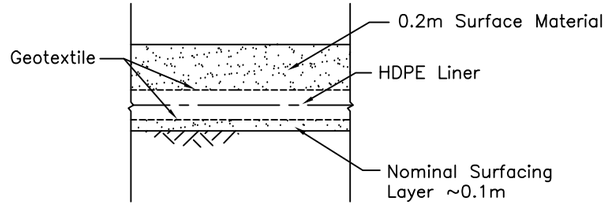
1:20 0 5 10 15 20 Metres



Typical Landfill Section A–A'

0 10 20 30 40 50 Metres

1:500



Detail 1
NTS

Note: Drawings plotted to half scale

Notes:

1. The Contractor is to take due care so as not to damage the liner during construction. Special temporary liner protection measures must be taken in the event that construction equipment must pass over a liner before the final protective cover has been placed. The Engineer is to be notified of these occurrences.
2. Modifications to the liner tuck trench will be allowed if equipment access is a problem. The details of any such modifications must be presented to the Engineer for approval.
3. The Contractor will be responsible to keep the landfill and landfarm area free of snow and ice during the construction period.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
S-13	LANDFILL AND LANDFARM TYPICAL PLAN, SECTIONS		

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	WATER LICENSE APPLICATION			

REVISIONS

Stamped, signed and dated originals submitted to the Nunavut Water Board

PROFESSIONAL ENGINEERS STAMP

SRK Consulting Engineers and Scientists Vancouver

DESIGN:	DRAWN:	REVIEWED:
AT	JJH	EMR
CHECKED:	APPROVED:	DATE:
AT	EMR	Oct. 2006

FILE NAME: LANDFILL VIEW.dwg

MIRAMAR HOPE BAY LTD.

DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

DRAWING TITLE:

Landfill and Landfarm Typical Section and Details

DRAWING NO.	SHEET	REVISION NO.
3	22 OF 48	A

Dwg Ref: Site-Plan® Key-S13.dwg

4.0 LANDFILL OPERATION

4.1 Types of Wastes

Table 4.1 provides a pre-construction estimate of the types of inert industrial wastes that are likely to be generated at Doris North.

Table 4.1: Potential Types of Inert Industrial Waste

Waste Type	Examples
Scrap metal	Structural steel, equipment guards, plate steel, steel pilings, tanks (decommissioned), bins, cladding, doors, rebar, filing cabinets, cable tray, metal furniture, wheels
Rubble	Broken concrete, masonry
Wood products	Timber dunnage, plywood and lumber from formwork and camp modules
Rubber products	Tires, conveyor belting, floor mats
Construction	Construction and demolition debris
Glass	Cleaned bottles, jars, plate glass and mirrors
Piping	Steel and plastic piping (fuel and glycol piping clean), including insulation, heat trace cable and support brackets
Fabrics and liners	HDPE liner, woven geotextile, insulation (liners cut into strips for burial to prevent water containment)
Electrical	Cabling, cable support systems, electrical panels, switchgear, transformers (except oil-filled units)
Equipment (non-recyclable)	Non-hydrocarbon-contaminated and cleaned equipment: electric motors, boilers, fans, heaters, bearings, gearboxes, pumps, screens, truck parts, conveyor idlers and pulleys, truck shop equipment, appliances
Incinerator ash	Ash from the kitchen incinerator

4.2 Waste Reduction Opportunities

The remote location of the Doris North Project makes it difficult to recycle materials that otherwise will end up in the landfill. This is a similar problem for all of the communities within Nunavut and consequently very little of the total waste generated can be effectively recycled in a cost effective manner. However, MHBL has assessed its options and will approach this issue from three fronts:

- **Reduce Waste**: The cost of transporting any material to this remote site is expensive and so MHBL will work with its suppliers and employees to minimize the amount of material that they need to use to sustain their operations. This will have the added benefit of reducing the amount of waste generated on site. Organic materials from the camp kitchen (kitchen food wastes) will be segregated at source and incinerated to prevent them ending up in the landfill where they could attract wildlife;
- **Re-Use Material**: MHBL will work with their employees to encourage the re-use of materials wherever possible to avoid the high cost of transporting operating supplies to this remote site. Materials with potential for re-use be they lumber from packing or used piping components or machine parts will be segregated and held in a storage yard established for this purpose so that these materials are available for internal recycle thereby having the added benefit of reducing waste material that has to be placed into the landfill; and

- **Segregation and Removal of All Potentially Hazardous Materials**: MHBL will segregate all potentially hazardous wastes at their source of generation. This will include such items as waste batteries from vehicles, waste solvents, greases, antifreeze, etc. These will be segregated, packaged and shipped off-site with each annual sealift so that they can be sent to an appropriate recycling facility where possible. See the Hazardous Materials Management Procedures (MHBL 2006b) for additional information.

In this manner, the amount of waste placed into the landfill can be reduced.

4.3 Recyclables Stored on Site

The mine will establish a recyclable materials storage area adjacent to one of the laydown areas where equipment will be stored pending possible re-use at the mine site. The storage area location will be determined at the time of mine construction and will be sited 30 meters away from any water bodies and in a controlled drainage area.

Large tires (e.g. those for ore trucks) when no longer useable on trucks and, if not recyclable through truck tire dealers, could be used as roadside barriers which is typical of mine use for these items. Any tires used as barriers would be buried in the landfill on closure.

4.4 Liquid Wastes

Liquid waste will consist of the water component of the final mill tailings slurry and treated sewage effluent. Management plans for these two liquid materials are discussed in the following:

- Tailings Waste Management plan;
- Water Management Plan; and
- Snowmelt within the Landfill Area – Water will be collected within the landfill area after snow melts. Water samples will be collected and tested for the presence and absence of oil and grease after snowmelt season. If oil and grease are present in the samples, water contained within the landfill will be treated using water/oil filtration system before releasing onto the tundra.

5.0 LANDFILL MANAGEMENT

5.1 General

Annual landfill operation will involve clearing of snow prior to spring melt, placement of waste rock over the summer period, and placement of a graded cover prior to the winter period of snow accumulation. Wastes produced during the winter months would be stored temporarily in the solid waste disposal site and relocated to its final location following snow removal.

An area method of dumping will be used such that materials will be dumped in rows and covered as required. Wastes will be disposed of directly on the ground and compacted with heavy equipment against the berm or existing row. To the extent, practical dumped materials will be segregated in the strips so that each major type occupies a subsection of the operating cell.

5.2 Kitchen Wastes and Incinerator Ash

Putrescible kitchen waste will be incinerated on a daily basis in a small diesel fuel incinerator unit to prevent food waste from becoming a wildlife attractant. A good supply of spare parts including a spare burner unit will be kept on site to minimize the downtime for this unit. Incinerator ash will be drummed and transferred for storage to the landfarm facility within Quarry 2. The ash will be tested and if found to be uncontaminated will be mixed into any soil undergoing remediation within the landfarm. Once the combined soil-ash meets all regulatory standards for soil remediation; the soil will be used on site for remediation of disturbed lands. If the ash does not meet acceptable standards it will be placed underground in an appropriate area for permanent isolation from the surface environment where it will become encapsulated within the frozen ground upon final mine closure. Experience from the Windy Camp incinerator suggests that this ash will meet current soil standards for use in site remediation.

5.3 Waste Water Treatment Plant Sludge

During the construction phase of the Project the treated wastewater from the sewage treatment plant will be pumped overland and discharged approximately 200 m to 500 m to the northwest of the camp in a direction away from Doris Lake. The discharge technique would be similar to that used at the Windy exploration camp over the past several years where the treated wastewater is pumped into a small depression on the tundra in an area where the flow is not directed through an existing drainage swale directly into a lake or watercourse. In this manner the treated wastewater can be distributed across the tundra avoiding direct impact on the local lakes. During the operational phase of the project treated effluent and sludge will be pumped to the tailings impoundment as part of the tailings feed stream.

5.4 Equipment

Only clean equipment that cannot be recycled or reused will be landfilled. Burial on site of equipment that is drained of hydrocarbons is standard practice at mining operations.

Equipment containing petroleum hydrocarbons will be drained prior to landfilling. The waste petroleum products will be disposed of either through burning in the on-site waste oil burner or shipped off-site to the petroleum supplier or a licensed hazardous materials disposal contractor.

5.5 Clean Wood and Paper

Clean wood and paper will be burned at the landfill in a designated area where the fire can be controlled and well away from the perimeter of the landfill. Burning will only be done under the supervision of the surface superintendent. No petroleum-stained wood or paper will be burned at the landfill. Burning will only be conducted at times when winds are low or calm. Materials burning practices at Doris North will follow Nunavut guidelines, "Municipal Solid Wastes Suitable for Open Burning", attached for reference in Appendix A.

5.6 Inspection

Regular inspection of landfill operation will be the responsibility of the surface superintendent. The surface superintendent will report issues to the mine manager who will have the authority to ensure issues are addressed. On going issues, that need general cooperation at the mine to be resolved will be subject to discussion at senior management meetings.

Inspection by the surface superintendent will include but not limited to:

- berm integrity;
- cover integrity;
- housekeeping;
- evidence of unauthorized use of the landfill;
- evidence of ponding of water on berms, mounds or unused areas;
- any other items that may indicate problems with safe operation of the landfill.

Problems will be reported to the mine general manager for action. Issues will be ranked and addressed on a priority basis.

5.7 Closure

Upon closure, the disposal site will receive a final cover of clean rock, the surface will be re-graded to blend in with the surrounding terrain, and surface drainage will be directed away from the site. As this landfill does not contain any hazardous waste its closure plan does not require infiltration or thermal control.

6.0 PLAN REVIEW AND CONTINUAL IMPROVEMENT

This Landfill Management Plan will be reviewed at least annually by the mine environmental manager in consultation with the surface superintendent and mine manager. Suggestions for improvements will be solicited from employees through the Health and Safety Committee on an on-going basis. Improvements suggested through these reviews will be implemented in consultation with Nunavut Water Board and KIA.

7.0 LIMITATIONS AND CLOSURE

This report was prepared exclusively for Miramar Hope Bay Limited by AMEC Earth & Environmental, a wholly owned subsidiary of AMEC Americas Limited. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Miramar Hope Bay Limited, the Nunavut Water Board, the Kitikmeot Inuit Association and the regulatory agencies involved in reviewing the water license application for the Doris North Project only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any other third party is at that party's sole risk.

REFERENCES

Kent, R., P. Marshall and L. Hawke. 2003. Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT. Report prepared for Dept. Municip. and Commun. Affairs, GNWT by Ferguson Simek Clark.

MHBL. 2006a. Landfarm Design and Management Plan.

MHBL. 2006b. Hazardous Materials Management Plan.

APPENDIX A : Municipal Solid Wastes Suitable for Open Burning

Municipal Solid Wastes Suitable for Open Burning

Municipal solid wastes (MSW) that are conditionally suitable for open burning are paper products, paperboard packing and untreated wood wastes only.

Conditions for this burning are:

1. The principle of source reduction should be utilized to reduce, reuse and recycle materials otherwise bound for landfill.

2. The appropriate materials are segregated and burned in a controlled manner and at a controlled site which is separate from the working landfill so that the fire cannot spread.

3. Standard burning conditions shall apply, such as burning on days where winds are light and blowing away from the community.

4. Materials are burned in manageable volumes so that fires do not get out of control.

5. Having applicable permits for burning.

6. Managed by authorized, qualified personnel from the community.

7. The above conditions are also recommended in the NWT Municipal and Community Affairs Solid Waste Modified Landfill Guidelines, which have been adopted for Nunavut.

Building demolition wastes should not be burned unless they have been sorted to remove non-wood waste such as roofing materials, electrical wire, plastics, asbestos and other non-wood wastes.

Waste wood treated with preservatives such as creosote, pentachlorophenol or heavy metal solutions shall not be burned. Examples of treated wood materials include railroad ties, telephone/hydro poles, pilings, cribbing and foundations.

Following a review of the specific landfill location, additional local conditions or controls may be applied.

Where geographic conditions do not allow for the proper operation of a modified landfill, such as limited availability of cover materials and unsuitable ground conditions, communities may have to assess other alternatives of MSW management i.e.: balefill and/or incineration.

The open burning of non-segregated MSW remains an unacceptable option for the management of MSW. Continuation of this practice should not be allowed unless a site-specific assessment fails to identify a feasible and practical alternative. At this point, some form of segregation will be required.