MVLWB

Guidelines for Developing a Waste Management Plan

March 31, 2011

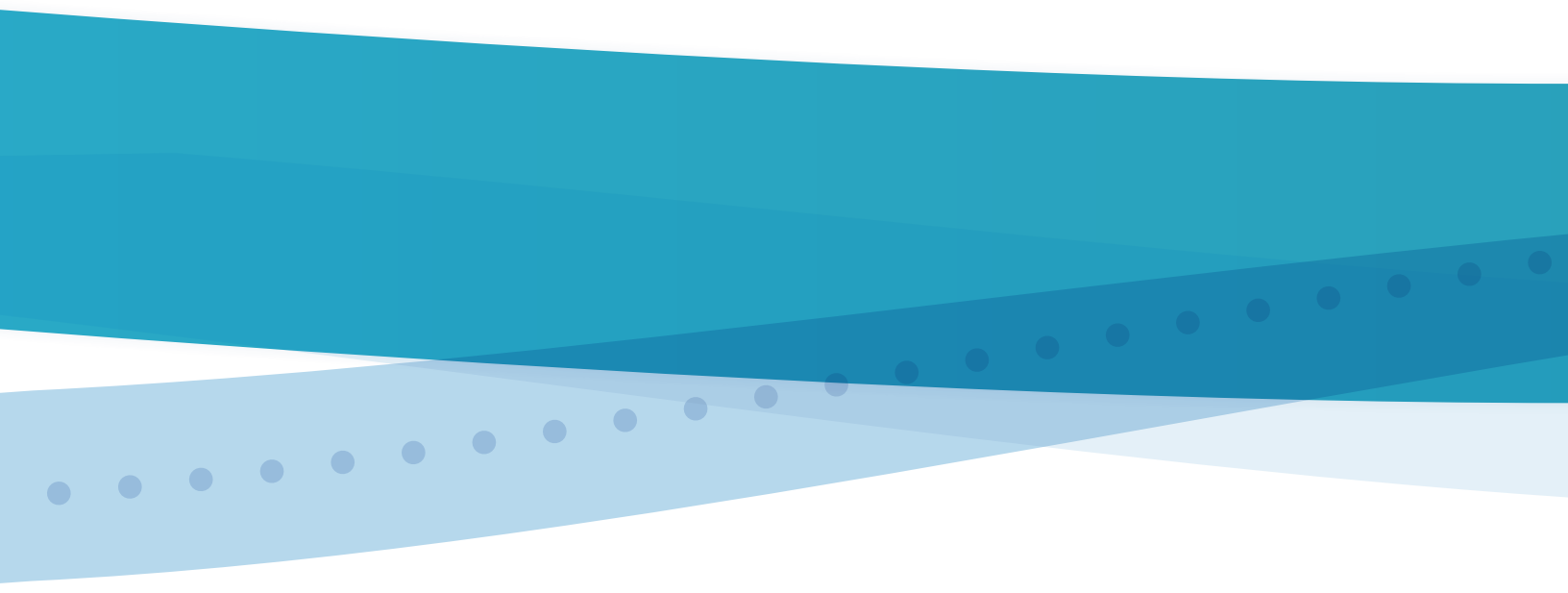
Mackenzie Valley Land and Water Board

SAHTU LAND & WATER BOARD

GWICHYIN LAND AND WATER BOARD

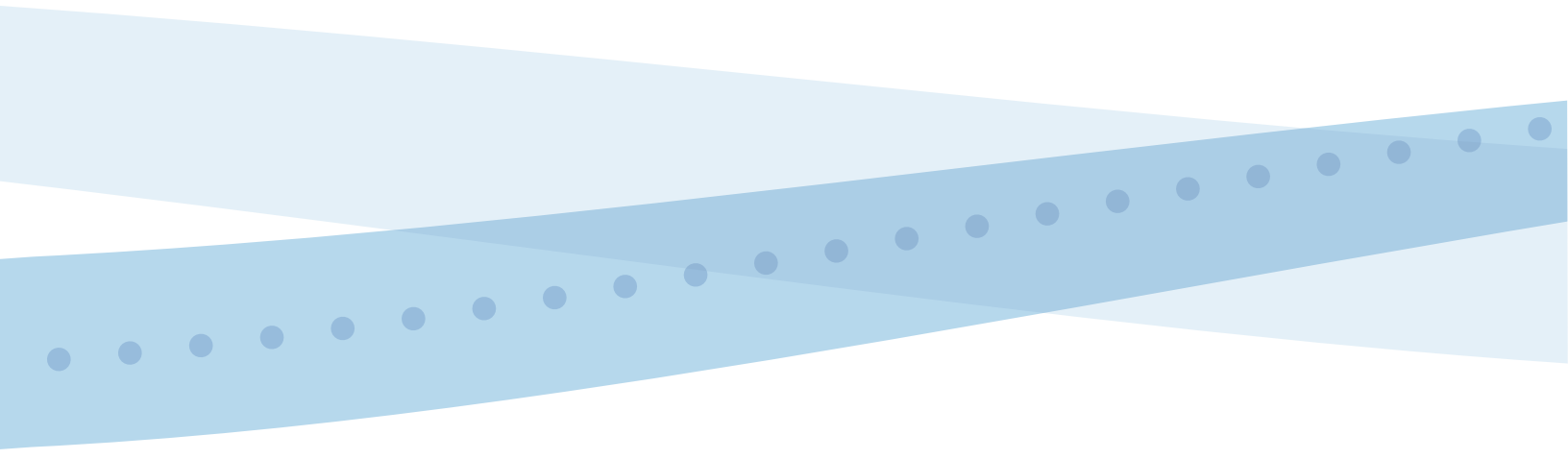
Wek'èezhìı Land and Water Board

Mackenzie Valley Land and Water Board



MVLWB

"Sharing responsibility—working together to make the best decisions for the land. water, and people."



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Definitions and Acronyms

TERM	DEFINITION
Boards	Land and Water Boards of the Mackenzie Valley, as mandated by the ***Mackenzie Valley Resource Management Act***
CCME	Canadian Council of Ministers of the Environment
domestic waste	also called household waste, which can include garbage or rubbish and normally originates in a private home. Domestic waste may contain a significant amount of toxic or hazardous waste
engineer	a professional engineer registered to practice in the Northwest Territories in accordance with the ***Engineering and Geoscience Professions Act***, S.N.W.T. 2006, c.16
freeboard	the vertical distance between the water line and the effective water containment crest on a dam or dyke's upstream slope
GLWB	Gwich'in Land and Water Board
greywater	all liquid wastes from showers, baths, sinks, kitchens, and domestic washing facilities but does not include toilet wastes
hazardous waste	a waste which, because of its quantity, concentration, or characteristics, may be harmful to human health or the environment when improperly treated, stored, transported, or disposed
landfarm	comprises the area and associated engineered infrastructure designed to contain and treat contaminated soils
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	***Mackenzie Valley Resource Management Act***
NWTWA	***Northwest Territories Water Act***
NWT	Northwest Territories
project	any activity that requires a water licence or land use permit
proponent	applicant for water licence and/or land use permit

receiving environment	the natural environment that, directly or indirectly, receives any deposit or discharge of waste (as defined in the ***NWT Waters Act***), from a project
SLWB	Sahtu Land and Water Board
sewage	all toilet waste (black-water) and greywater
stakeholders	includes industry, federal agencies, the territorial government, Aboriginal governments and organizations, communities, landowners, and other interested parties
tailings	material rejected from the mill after the recoverable valuable minerals have been extracted
tailings containment area	comprises engineered structures designed to contain tailings
toilet waste	all human excreta and associated products (i.e., black-water) but does not include greywater
waste	any garbage, debris, or chemical or toxic material to be used, stored, disposed of, or handled on land, and also as defined in section 2 of the ***Northwest Territories Waters Act*** [1]
waste rock	all unprocessed rock materials that are produced as a result of mining operations
waste disposal facilities	all facilities designated for the disposal of waste, and includes a sewage disposal facility, solid waste disposal facility, and a landfill
WLWB	Wek'èezhìi Land and Water Board

[1] ""Waste" (Section 2, ***NWT Waters Act***, 1992) is defined as:

(a) any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of the water to an extent that is detrimental to its use by people or by any animal, fish or plant, or

(b) water that contains a substance in such a quantity or concentration, or that has been so treated, processed or changed, by heat or other means, that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water to the extent described in paragraph (a),

and, without limiting the generality of the foregoing, includes

(c) any substance or water that, for the purposes of the ***Canada Water Act***, is deemed to be Waste,

(d) any substance or class of substances prescribed by regulations made under subparagraph 33(1)(***b***)(i),

(e) water that contains any substance or class of substances in a quantity or concentration that is equal to or greater than a quantity or concentration prescribed in respect of that substance or class of substances by regulations made under subparagraph 33(1)(***b***)(ii), and

(f) water that has been subjected to a treatment, process or change prescribed by regulations made under subparagraph 33(1)(***b***)(iii).

1.0 INTRODUCTION

1.1 Purpose

The Land and Water Boards of the Mackenzie Valley regulate the use of land and water and the deposit of waste through the issuance of land use permits and water licences. The purpose of these guidelines is to outline the expectations of the Boards with respect to waste management plans for projects requiring land use permits and/or water licences. These guidelines provide a template for proponents to write a plan and a benchmark for reviewers to evaluate a proponent's plan, thus ensuring that waste management plans are submitted and reviewed in a consistent way. This document is not meant to be a prescriptive guide for the management of waste; however, references to relevant guidance have been provided.

1.2 Authority

The Boards' authority to develop this guideline document is granted under sections 65, 102, and 106 of the ***Mackenzie Valley Resource Management Act*** (MVRMA). The Boards' authority to regulate the management of waste is described in subsection 26(1) of the Mackenzie Valley Land Use Regulations and sections 9 and 15 of the NWTWA.

1.3 How These Guidelines Were Developed

This document was developed by the Plan Review Process and Guidelines Working Group, one of the Standard Procedures and Consistency Working Groups established by the Land and Water Boards in 2008. This document is based on input from Board staff, consultants, industry representatives, and Aboriginal governments gained during two separate stakeholder reviews of the document which took place in November 2009 and July 2010. This document was created such that it may be useful to other regulators who grant land use permits and water licences within the NWT.

1.4 Application

This document will be applied by the following Boards:

- Mackenzie Valley Land and Water Board
- Gwich'in Land and Water Board
- Sahtu Land and Water Board
- Wek'èezhìi Land and Water Board

Proponents must submit a waste management plan to the appropriate Board as part of their application for both land use permits and water licences in order for the application to be deemed complete. The only exception to this requirement applies to municipal water licence applications, where waste management may be addressed in the Operation and Maintenance Plan.

If the application is approved, land use permits and water licences may contain conditions that require a proponent to update their waste management plan for approval.

These guidelines can be applied to a wide range of projects, such as exploration camps, mines, etc. The level of detail within the waste management plan should be tailored to suit the specific project. A larger project will most likely have a separate management plan for each substantial waste stream. Proponents are encouraged to contact the appropriate Land and Water Board staff prior to preparing their waste management document(s).

It is important to engage federal agencies, the territorial government, Aboriginal governments and organizations, and other interested parties throughout the waste management planning process. It is the responsibility of the proponent to be aware of, and comply with, all legal requirements (i.e., applicable legislation) within the jurisdiction in which their activities will occur as well as the Boards' requirements regarding community engagement.

Wherever possible, this document was developed to be consistent with other regulators' requirements.

Unless specifically adopted by the Board, guidelines and technical documents are referenced here for information purposes only. It is the responsibility of the proponent to assess the technical accuracy and jurisdictional applicability of these materials.

1.5 Monitoring and Performance Measurement for this Guidelines

Mechanisms will be required to monitor and measure performance and to evaluate the effectiveness of these guidelines. In accordance with the principles of a management systems approach (e.g., plan-do-check-act), the MVLWB will develop a performance measurement framework. The guidelines will be reviewed and amended as necessary within that framework. The framework will also describe how stakeholders will be involved in the review process.

1.6 Structure of this Document

The content of this document is as follows:

(a) section 1 provides an introduction;

(b) section 2 discusses waste management planning and outlines the waste management hierarchy;

(c) section 3 outlines a template for a proponent's waste management plan; and

(d) Appendix A provides background information on various types of waste management.

2.0 Waste Management Planning

Regardless of the scope and size of a project, there will always be some amount of waste produced. It is the Boards' responsibility to ensure, through terms and conditions of a land use permit and/or water licence, that the proponent manages their waste properly so that the receiving environment is protected.

Waste management is an activity that is practiced by most proponents seeking, or currently holding, a land use permit and/or water licence, regardless of the project (e.g., mining, oil and gas production, municipal, exploration, etc.). Common waste management activities include: reduction and substitution; waste collection, handling, separation, and storage; recycling and reuse; waste treatment; waste transfer and transport; and waste disposal.

Waste management typically begins with developing a waste management plan. A waste management plan is a document that outlines the activities and methods of waste management from waste generation to final disposal. The information that is required in a proponent's waste management plan is outlined in section 3 of this document.

2.1 Waste Management Hierarchy

In accordance with the Guiding Principles of the Boards' ***Water and Effluent Quality Management Policy*** [i] and the Canadian Council of the Ministers of the Environment's non-degradation policy, proponents are expected to minimize and, where technically and economically feasible, to prevent pollution from entering the receiving environment. To this end, the Boards expect proponents to demonstrate how their planning processes have considered the following pollution prevention/minimization hierarchy [ii]. That is, source reduction as the most preferred method, followed by reuse, recycle/recovery, treatment, and the least preferred method being disposal as depicted in the following flow chart:

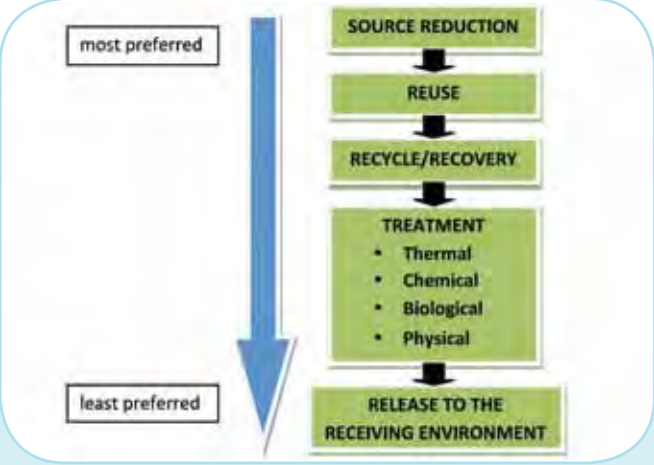

Figure 1: Flow chart of the waste management hierarchy

Summaries of each component of the hierarchy have been provided below to help parties understand the Boards' perspective on the waste management hierarchy.

2.1.1 Source Reduction

Source reduction is the elimination or decrease of the volume/mass or toxicity of waste generated by using alternative materials or processes [2]. This may be the most effective, proactive, and potentially cost-reducing method of waste management as it reduces the amount of waste that has to be managed. This can be accomplished by, but not limited to:

(a) material elimination;

(b) inventory control and management;

(c) material substitution;

(d) process modification; and,

(e) improved housekeeping, maintenance, and/or training.

2.1.2 Reuse

Reuse is the use of a product more than once for the same or different purpose, either on site or off site. An example is the reuse of used oil as fuel for space heating (note that the oil will require testing before being used in an approved burner). If the waste product has an alternative application, it could be shipped off-site for reuse in another industry. Prior to the reuse of any type of waste, it should be verified that the reuse of the waste is appropriate and will not cause a negative effect to the environment.

2.1.3 Recycle/Recovery

Recycle/recovery is the process by which materials otherwise destined for treatment or disposal are collected, processed, and/or remanufactured into the same or different products either onsite or offsite. An example of recycle/recovery is scrap metal that is separated from a waste source, consolidated, and shipped from site for reprocessing to make a new product. Backhauling of recyclable material on an empty truck, barge, or plane is encouraged.

2.1.4 Treatment

Treatment of waste is a method which reduces the volume, mass and/or toxicity prior to disposal. Common methods of treatment are thermal, physical, chemical, and biological processes.

Thermal

Thermal treatment is the application of heat to waste. Combustion can transform the waste into ash (and gases) and therefore reduce the volume of waste to be disposed. A further example of thermal treatment is the incineration of waste to extract/remove contaminants. This requires the use of an incinerator that is optimized to have a controlled burn and temperature to facilitate complete combustion of contaminants and which is equipped to control emissions.

Chemical

Chemical treatment is the process of transforming waste into another form or reducing the toxicity through a chemical process. An example of chemical treatment is the addition of lime to acidic mine waters to neutralize the water and precipitate metals.

Biological

Biological treatment is the process of transforming waste to another form or reducing the toxicity through a biological process. Landfarming and phytoremediation are examples of biological treatment that involve reduction of contaminant concentrations from impacted soil by microorganisms and plants.

Physical

Physical treatment is the process of transforming waste into another form or reducing the toxicity through a physical process such as filtration, flotation, gravity separation, adsorption, and other techniques. Whereas

[2] "Minimizing or avoiding the creation of pollutants and waste can be more effective in protecting the environment than treating them, or cleaning them up after they have been created." - Canadian Council of the Ministers of the Environment.

biological, thermal, and chemical treatments often destroy the toxic chemical constituents of waste, physical treatment does not. Instead, physical treatment typically results in a waste stream that is easier to manage. For example, the removal of suspended particles in water within a settling pond may result in the release of cleaner decant water. The sludge remaining within a settling pond may need to be managed further as a waste product that is generated within the physical treatment process.

2.1.5 Release to the Receiving Environment

In general, a release to the receiving environment is the least favourable option for waste management and is the last resort after source reduction, reuse, recycle/recover, and treatment. Disposal is commonly associated with the final storage location for waste on land. In the case of domestic waste, a landfill may be the final storage location. In the oil and gas industry, a sump may be the final storage location for drill cuttings. At a mine site, final storage of tailings may be in a tailings pond or containment area. Discharge of liquid waste by release to the environment is normally controlled by site-specific effluent quality criteria (EQC) as specified in a water licence.

Generators of waste outside of a community should note that disposal of waste at a community landfill may not be an acceptable practice. Community facilities typically are not designed, funded, or operated to manage waste streams originating from industrial projects. Proponents must not transfer responsibility for waste disposal to a third party without prior consent, and must ensure they have an agreement (between the waste generator and the community/territorial government) that details the terms and conditions of any transfer of responsibility for waste disposal.

2.2 Logistical Considerations

Effective waste management requires appropriate planning as well as management and operational personnel to execute the plan. The types and amount of waste generated are specific to the project and each waste type generated may have a unique way of being managed. For example, hazardous waste may involve transporting to a licensed facility (off-site) for disposal, whereas domestic waste may be disposed of in an on-site landfill. How each waste type is managed depends on various factors, such as: waste characteristics (e.g., solid, liquid, toxicity, etc.), volume/mass generated, site conditions, location, and costs.

These guidelines do not detail all specific aspects of waste management planning (e.g., waste collection, handling and separation, records, etc.) since these will vary from project to project. It is the responsibility of the proponent to sufficiently detail all components of waste management planning within their waste management plan, and demonstrate that these activities can be completed according to industry best-practices and applicable law. Further, proper waste management practices will help to reduce wildlife attraction and human safety issues.

Proponents should recognize that there may be requirements outside of the jurisdiction of the Boards related to maintenance of waste inventories and records. For example, hazardous waste generators are required to document the movement of hazardous waste off site to a location for final disposal through the use of a movement document, called a waste manifest, which is administered by the Government of Northwest Territories, Environment and Natural Resources. Depending on the destination of the hazardous waste, Environment Canada's ***Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*** may apply (http://www.ec.gc.ca/gdd-mw/default.asp?lang=En &n=8BB B8B31-1). Further, hazardous waste must be transported in accordance with the appropriate transport authority's requirements (e.g., Transportation of Dangerous Goods Regulation). Additional details regarding hazardous waste management may be found

in Guidelines for the ***General Management of Hazardous Waste in the NWT*** [iii](1998). It remains the proponent's responsibility to comply with requirements from other regulatory agencies.

Proponents are encouraged to consider alternative and new technologies in their waste management planning.

3.0 Developing a Waste Management Plan

Subsections 3.1–3.4 outline a template that serves as a starting point for proponents developing a waste management plan to submit as part of their application for a land use permit and/or water licence. Additional requirements may be necessary depending on the type and scope of development and the specific direction issued by the respective Board.

The template for waste management planning can be scaled to suit the specific project undertaken by a proponent. It is recognized that the type of project will have unique waste types and management practices. For larger projects like a mine, there may be a requirement to plan for numerous waste types. In contrast, a small exploration camp may have fewer waste types and less waste generated. Regardless of the size of the project, planning for waste management is required through the completion of a waste management plan.

Due to the complexity of larger projects, such as a mine, a distinct management plan to address a specific waste type may be required. For example, proponents may need to develop a hazardous materials management plan, a tailings management plan, a waste rock management plan, or a sewage treatment management plan if the scope of the project requires it. There is no need to repeat the contents of these specific management plans within a central waste management plan; instead, these more detailed plans addressing specific waste types should be properly referenced within the main waste management plan so parties know where this additional information is provided.

In contrast, small projects may only need to submit a single waste management plan that can appropriately detail all of the requirements listed in 3.1–3.4. Proponents are encouraged to adhere to the following template; however, if there is additional or alternative information that may be more useful, proponents are encouraged to include this information along with a rationale for any deviations from the template.

3.1 Introduction

This section of the waste management plan should provide background information that includes:

(a) Company name, site name and site location;

(b) Effective date of the plan;

(c) Environmental policy of the proponent and how it relates to waste management;

(d) Purpose and scope of the plan including detailed waste management goals and objectives; goals and objectives should consider the following:

   i. environmental factors such as: land, water, air, wildlife, fish, and vegetation;

   ii. social factors such as: aesthetics, land use, economic impacts, and public interests; and

   iii. regulatory factors such as compliance with all applicable acts, regulations, authorizations, land-use permits, and water licences).

(e) Description of the project for which the proponent is seeking or currently holds a land use permit and/or water licence;

(f) Proposed location for all waste management activities, on a map to scale with GPS coordinates. Where applicable, show on a map the locations of historical waste management areas; and

(g) Description of site physical, surface, and subsurface characteristics, site water management (i.e., flow/drainage patterns), and geotechnical characteristics.

3.2 Identification of Waste Types

In cases where proponents have waste types that require separate management plans, those plans should be referenced here so that the information isn't repeated. This section of the document should discuss the types of waste a proponent will generate. For each type of waste, the following information should be included:

(a) Description of its characteristics;

(b) Description of the source of generation;

(c) Estimation of the volume/mass to be produced; and

(d) Potential environmental effects.

Examples of different waste types that should be included in a waste management plan:

HAZARDOUS OR POTENTIALLY HAZARDOUS WASTES	NON-MINERAL WASTE*	MINERAL WASTE*
Ash or incinerator residue	Domestic refuse	Tailings
Lead acid batteries and alkaline batteries	Bulky metals (vehicles, equipment)	Waste rock
Equipment containing ozone depleting substances (e.g., refrigerators)	Scrap metal	Drill cuttings
Chemical wastes – liquids or solids (e.g. paint)	Inert waste	
Electrical equipment	Putrescible waste	
Sludges	Plastics	
Contaminated soils	Construction materials	
Used oil, fuels, lubricants, greases, oil filters, and solvents	Rubber products – tires and conveyor belts	
Asbestos	Sewage	

3.3 Management of Each Waste Type

For waste types that don't require a separate management plan, the following information should be included in this section:

(a) Description of the activities involved in the management (e.g., handling, storage, processing, collection, separation, transportation, treatment, disposal, etc.) from generation to disposal; and

(b) A rationale for the method(s) that will be employed to manage each waste type (e.g., source reduction, reuse, recycle/recover, treatment, and disposal) and an explanation of how the waste management hierarchy (as described in subsection 2.1) was considered for each waste type.

3.4 Infrastructure Required for Waste Management

The following types of waste management infrastructure are commonly used at projects in the NWT:

- landfarm
- waste storage or disposal facility
- sump
- tailings containment area
- waste rock disposal area
- sewage containment facility
- wastewater treatment and discharge facilities

For each type of waste management infrastructure (including any infrastructure not listed above), proponents should provide the following general information:

(a) Engineering analysis to demonstrate containment of waste and waters, which may include, but is not limited to: analysis of settlement, slope stability, groundwater seepage and contaminant transport, and liner performance;

(b) For any infrastructure required for waste management, an engineering design report with any supporting engineered drawings that accounts for all life stages of the infrastructure, from construction and operation to closure and decommissioning. Where applicable, the infrastructure design report is to include details of construction specifications and QA/QC requirements, as well as proposed monitoring requirements for each life stage of the infrastructure;

(c) Any studies to support the design and operation of the infrastructure; and

(d) An operation and maintenance plan if applicable.

Proponents should also provide information specific to the type of waste management infrastructure, as described below in subsections 3.4.1 through 3.4.8.

3.4.1 Landfarm

In addition to the general information described above in subsection 3.4, proponents should include the following information specific to an on-site landfarm:

(a) Details of a volume balance and landfarm sizing that consider expected amounts of contaminated soil and snow to be contained and landfarm configuration;

(b) A contingency plan in case the expected volumes of soil, snow, and runoff water exceed the landfarm capacity;

(c) Details of leachate management including, but not limited to: estimation of volume of leachate generated; means of leachate collection and disposal; identification of leachate components; and a comprehensive leachate sampling and monitoring strategy;

(d) Spatial and temporal monitoring of soil chemistry within the landfarm; and,

(e) The operation and maintenance plan should include at minimum: acceptable soil types that can be treated in the landfarm; details of onsite processing/treatment of materials; remediation standards, methods, and frequency of any soil manipulation to promote remediation; routine facility inspection; monitoring of annual volume/mass of soil entering and leaving the facility; leachate management and monitoring strategy; and facility maintenance.

3.4.2 Waste Storage or Disposal Facility

In addition to the general information described in subsection 3.4 above, proponents should include the following information specific to an on-site waste storage or disposal facility:

(a) Details of a volume/quantity balance and solid waste storage/disposal facility sizing that considers, but is not limited to: waste volume/quantity and density, cover material volume and density, material balance describing storage capacity, and description of type and quantity of material inputs and outputs;

(b) Details of leachate management including, but not limited to: secondary containment (in the case of temporary storage of hazardous waste); drainage management; estimation of leachate generated; leachate collection, treatment, and disposal; and an analysis of sampling and monitoring results;

(c) The operation and maintenance plan is to include, but is not limited to details of: acceptable waste types entering the facility; waste types leaving the facility; routine facility inspection; monitoring of annual volume/quantity (tonnes) of waste entering and leaving the facility and facility maintenance;

(d) Hazardous waste management plan including spill and emergency response; and

(e) Engineered design of a final cover that includes, but is not limited to, the details of a water balance, material characteristics, configuration and final slopes, and contouring so the cover is both geotechnically stable and minimizes water pooling and erosion.

3.4.3 Sump

In addition to the general information described in subsection 3.4 above, proponents should include the following information specific to an on-site sump:

(a) Description of waste generation volumes and waste types/properties;

(b) Details of a waste volume balance and sump sizing;

(c) Details of the local environmental conditions (e.g., local terrain, permafrost, drainage, etc.) at the proposed sump location;

(d) Details of the operations through construction, disposal, and closure; and

(e) Details of monitoring of the sump and local environment and an explanation of how environmental monitoring will be linked to any management response.

3.4.4 Tailings Containment Area

In addition to the general information described i n subsection 3.4 above, proponents should address the following information, specific to the on-site tailings containment area:

(a) Operation, maintenance, and surveillance plan as per CDA guidelines;

(b) Emergency preparedness plan as per CDA guidelines;

(c) Regular independent dam safety reviews as per CDA guidelines;

(d) Annual engineering inspections; and

(e) Facility freeboard limit, provisions to maintain the limit and contingencies as the limit is approached.

Proponents should expect to complete a tailings management plan as a separate report from the waste management plan—to describe how waste is managed by the tailings containment area.

3.4.5 Waste Rock Disposal Area

In addition to the general information described in subsection 3.4 above, proponents should include the following information specific to a waste rock disposal area:

(a) A complete operation, maintenance, and monitoring plan;

(b) A characterization of the rock types, geology, mineralogy, and quantity of the rock units to be placed within the area;

(c) The procedures for sampling and analyzing the rock units and a description of the geochemical criteria for the management and placement of potentially acid-generating waste rock;

(d) A schedule for the placement of rock units during construction, operations, and closure and reclamation;

(e) A description and site maps of each proposed ore and waste rock disposal area;

(f) A description of all types of waste with their expected quantities that are to be placed within the waste rock disposal area;

(g) An identification of potential sources of seepage; and

(h) Detailed proposals for the management of seepage.

Proponents should expect to complete a waste rock management plan—as a separate report from the waste management plan—to describe how waste rock is managed.

3.4.6 Sewage Disposal Facility

In addition to the general information described in subsection 3.4 above, proponents should include the following information specific to an on-site sewage disposal facility:

(a) Description of sewage generation volumes and raw wastewater quality;

(b) Engineering designs for treatment of the sewage disposal facility that include, but are not limited to: detail of a volume balance and treatment times; assessment of effluent discharge or wastewater quality; and assessment of receiving environment impacts from effluent discharge waters; and

(c) The operation and maintenance plan is to include, but is not limited to: sludge management; routine facility inspection; monitoring of annual volume of sewage entering and leaving the facility; sewage monitoring strategy; facility maintenance; and spill contingency planning.

3.4.7 Combustion Equipment

In addition to the general information described in subsection 3.4 above, proponents should include the following information specific to on-site waste combustion equipment (e.g., incinerator):

(a) A rationale for which technology was chosen;

(b) A residue management plan (e.g., fly ash and bottom ash); and

(c) Details of operator training, records management, and reporting.

3.4.8 Discharge Facilities

If discharge of waste is deemed necessary and appropriate, the Board will set limits in the water licence (i.e., effluent quality criteria) on the volumes and concentrations that can be discharged as well as the location of discharge. Please see the Boards' ***Water and Effluent Quality Management Policy*** for further information and direction on the setting of discharge limits, and licence and permit terms and conditions regarding waste discharge.

Proponents should discuss waste management infrastructure within the Closure and Reclamation Plan and the Spill Contingency Plan for the project. Proponents should follow Indian and Northern Affairs Canada's ***Guidelines for Spill Contingency Planning*** [iv] (2007), in developing spill contingency plans, as this document as been adopted by the Boards.

APPENDIX A

This appendix provides background information on waste management infrastructure commonly used within the Northwest Territories.

1 Landfarm

Landfarming is a soil bioremediation technique that is used commonly to treat petroleum hydrocarbon contaminated soil but has also been used to treat other contaminants. In general, landfarming involves the manipulation of soil conditions to promote volatilization and biodegradation of contaminants in the soil. Manipulation may involve, but is not limited to:

(a) Aeration through tilling;

(b) Adjustment of moisture content (i.e., the addition of water when required);

(c) pH adjustment using chemicals; and

(d) Soil conditioning, such as the addition of bulking agents, to assist in aeration and moisture retention, or chemicals to promote biological activity.

The success of contaminant degradation is dependent on numerous factors. Some of these include the environmental setting (e.g., average annual temperature), the soil and contaminant characteristics, and operations (e.g., the level of manipulation). For landfarms used to remediate petroleum hydrocarbon contaminated soil, proponents may elect to seek guidance on the location, design, operation, monitoring, sampling and analytical methods, decommissioning and closure, as well as, record keeping and reporting practices, by referencing the ***Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soil*** [v](2005) and ***Bioremediation of Petroleum Hydrocarbons in Soil and Groundwater under Cold Climate Conditions, A Review, Implications for Applications in Canada*** (2006).

2 Waste Storage or Disposal on Land

A solid waste storage or disposal facility consists of placement of solid waste within a controlled area on land, e.g., landfill, bulky metal disposal cell, landfarm, and temporary storage area for hazardous waste.

Where applicable, a landfill must satisfy the requirements of the Northwest Territories ***Public Health Act, General Sanitation Regulations*** [3](1990). Proponents may elect to seek guidance in the siting, design, operation, monitoring, and closure of a solid waste disposal facility by referencing the ***Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories*** (2003) [vi], ***Background Report for Updating the Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories (2003)*** [vii], and the ***Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*** (1996) [viii].

Household and industrial hazardous waste is generated within communities and by industrial activities outside of communities. In the case of a municipality, unless specifically included in the design and management of a community solid waste disposal facility, the facility may not be suitable for acceptance of household hazardous waste or industrial hazardous waste. It is the responsibility of the waste generator to manage hazardous waste from its generation to final disposal; this may include, but is not limited to characterization, handling, storage, and transport. Proponents may elect to seek guidance on hazardous waste management by referencing the ***Guideline for the General Management of Hazardous Waste in the NWT (1998)*** [ix], ***Guideline for Industrial Waste Discharges in the NWT*** (1998) [x], CCME's ***National Guidelines for Hazardous Waste Landfills*** (2006) [xi], and ***Developing a Community Based Hazardous Waste Management Plan*** (2009) [xii]. Additional hazardous waste guidelines for specific types of waste are provided on the Government of Northwest Territories, Environment and Natural Resources' website

[3] General Sanitation Regulations, R.R.N.W.T. 1990, c.P-16

(www.enr.gov.nt.ca) and summarized in the reference section of these guidelines.

3 Waste Combustion Equipment

Incineration of waste may include the use of an incinerator. If incineration is employed, the incineration device must be designed and operated to treat the waste types and quantities. Further, proponents shall ensure that any on site incinerator meets the requirements of the ***Canada-wide Standards for Dioxins and Furans*** [xiii] and the ***Canada-wide Standards for Mercury Emissions*** [xiv]. Proponents who use incineration may be required to provide an incineration management plan and design and operate the facility in a manner that is consistent with Environment ***Canada's Technical Document for Batch Waste Incineration*** (2009) [xv] and may seek additional guidance on incinerator management by referencing ***Operating and Emission Guidelines for Municipal Solid Waste Incinerators*** (1989) [xvi].

4 Sump

A sump is used to contain waste and can be developed utilizing a natural depression or an excavation into the ground. Sumps have been used to contain drilling waste during exploratory or production drilling and sewage and greywater at remote camps; however, proponents are increasingly encouraged to consider other methods to manage drilling waste, such as deep well injection or transport to and disposal at an authorized treatment facility.

Utilizing best management practices, a sump should be engineered to take into account site conditions such as soil permeability and permafrost in order to effectively contain the waste in the context of climate change. Where necessary, the installation of a liner may be required to effectively contain the waste. Monitoring during operation and post-closure of a sump is required. Proponents may elect to seek guidance on the construction, monitoring, and use of sumps for drilling waste which can be found in the Energy Resources Conservation Board Directive 50 [xvii].

Chemical components within drilling waste materials may require both the drill cuttings and fluid to be contained within a sump for long-term disposal. It is common for sump design to include an engineered cap that may utilize excavated materials.

5 Tailings Containment Area

Tailings and waters from the processing facility at a mine are commonly managed by storing this waste in a tailings containment area. Typically, tailings are transported to the tailings containment area as slurry. In some cases, the tailings containment area also receives other fluid waste streams generated at the mine. A tailings containment area may be within a natural depression to contain waste and water, and/or it may incorporate the use of engineered control structures, such as a dam(s), to contain tailings and water. The Canadian Dam Association's (CDA) ***Dam Safety Guidelines*** (2007) [xviii] are to be followed in engineering any tailings dams and water control structures. Proponents may elect to seek guidance in the methods of tailings disposal, design, operation, and monitoring of a tailings containment area by referencing the ***Guidelines for Tailings Impoundment in the Northwest Territories*** (1987) [xix].

6 Waste Rock

Mining facilities are faced with the challenge of managing large volumes of waste rock material. The costs of managing this material and the management options that can be used vary widely depending on the mineral, so it is crucial for proponents to consider site-specific conditions and geochemical characteristics when deciding on the best waste rock management options.

Drainage waters from sulphidic geological materials can contain elevated concentrations of metals and other elements at any pH. This may lead to costly environmental management and remediation. Successful, cost-effective, proactive mitigation measures depend on an accurate prediction of future drainage chemistry and will minimize impacts

to adjacent land and watercourses. Proponents should refer to the ***Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials*** (2009) [xx], when determining which procedures and factors to consider for program planning, segregation, sampling, test-work design and data interpretation.

7 Sewage Disposal Facility

Sewage is a wastewater that consists of toilet waste and greywater. Depending on the specifics of the project, toilet waste and greywater can be managed as one or two waste streams. In general, management of sewage involves physical, biological, and/or chemical treatment to improve the water quality before discharge into the environment. There are numerous techniques that can be employed to treat sewage wastewater; select methods of treatment include the use of mechanical (e.g., rotating biological contactors) and/or natural systems (e.g., lagoon, wetland, etc.). Proponents must follow the Board's ***Water and Effluent Quality Management Policy*** for further information and direction on effluent discharges from a sewage disposal facility. Proponents may seek guidance on effluent wastewater quality by referring to ***Canada-wide Strategy for the Management of Municipal Wastewater Effluent*** (2009) [xxi] and ***Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories*** (1992) [xxii]. Proponents may seek guidance on the contents of a sewage disposal facility operations and maintenance plan by referencing ***Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*** (1996) [xxiii].

8 Wastewater Treatment and Discharge Facilities

Discharge is a disposal option for fluid waste streams, and/or effluent from waste facilities. Discharge, especially without prior treatment, is the least preferred of the waste management options outlined in the waste management hierarchy. More information about treatment is provided in subsection 2.1.4 of this document.

REFERENCES AND ADDITIONAL GUIDANCE DOCUMENTS

Applicable Government of Northwest Territories, Department of Environment and Natural Resources guidelines (available at http://www.enr.gov.nt.ca):

- Management of Biomedical Waste (May 2005)
- Waste Asbestos (April 2004)
- Contaminated Site Remediation (November 2003)
- Ambient Air Quality (December 2002)
- Agriculture Waste (May 1999)
- Dust Suppression (February 1998, under review)
- Ozone Depleting Substances (August 2007)
- Industrial Waste Discharges (April 2004)
- General Management of Hazardous Waste (February 1998)
- Waste Lead and Lead Paint (April 2004)
- Waste Solvents (September 1998)
- Waste Antifreeze (September 1998)
- Waste Paint (September 1998)
- Waste Batteries (September 1998)

Additional Government of Northwest Territories, Environment and Natural Resources guidelines and Municipal and Community Affairs guidance and related documents (available at http://www.enr.gov.nt.ca):

- Drum Disposal Protocol for Municipal Landfill (under review)
- Guide for Procurement of Environmentally Responsible Products and Services
- Backyard Composting
- Position Paper on the Burning and Demolition of Buildings and Fire Extinguisher Training

[i] Mackenzie Valley Land and Water Boards, 2009. Water and Effluent Quality Management Policy.

[ii] The waste prevention/minimization hierarchy as written above has been adapted from the following reference: F. Henry Habicht II. Memorandum: EPA Definition of Pollution PREVENTION. U.S. Environmental Protection Agency, May 28, 1992.

[iii] Government of Northwest Territories, 1998. ***Guidelines for the General Management of Hazardous Waste in the NWT***. Source: http://www.enr.gov.nt.ca

[iv] Water Resources Division Indian and Northern Affairs Canada, 2007. ***Guidelines for Spill Contingency Planning***. Source: http://www.ainc-inac.gc.ca/ai/scr/nt/ntr/pubs/SCP-eng.asp

[v] SAIC (Science Applications International Corporation), 2005. ***Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils***. Report submitted to Environment Canada.

[vi] Kent, R., Marshall, P., and Hawke, L. 2003. ***Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories***. Prepared for Government of Northwest Territories, Department of Municipal and Community Affairs. Source: http://www.enr.gov.nt.ca

[vii] Kent, R., Marshall, P., and Hawke, L. 2003. ***Background Report for Updating the Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories***. Prepared for Government of Northwest Territories, Department of Municipal and Community Affairs. Source: http://www.enr.gov.nt.ca

[viii] Duong, D. and Kent, R. 1996. ***Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories***. Prepared for Government of Northwest Territories, Municipal and Community Affairs Community Development. Source: http://www.enr.gov.nt.ca

[ix] Government Northwest Territories, Environment and Natural Resources, 1998. ***Guideline for the General Management of Hazardous Waste in the NWT***. Source: http://www.enr.gov.nt.ca

[x] Government Northwest Territories, Environment and Natural Resources, 1998. ***Guideline for Industrial Waste Discharges in the NWT***. Source: http://www.enr.gov.nt.ca

[xi] Canadian Council of Ministers of the Environment, 2006. ***National Guidelines for Hazardous Waste Landfills***. Source: http://www.ccme.ca/assets/pdf/pn_1365_e.pdf

[xii] Government Northwest Territories, 2009. ***Developing a Community Based Hazardous Materials Management Plan*** (IN DRAFT).

[xiii] Canadian Council of Ministers of the Environment, 2001. ***Canada-Wide Standards for Dioxins and Furans***. Source: http://www.ccme.ca/assets/pdf/d_and_f_standard_e.pdf

[xiv] ***Canadian Council of Ministers of the Environment, 2000. Canada-Wide Standards for Mercury Emissions***. Source: http://www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf

[xv] Environment Canada, 2009. ***Technical Document for Batch Waste Incineration***. Source: http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=F53EDE13-1

[xvi] Canadian Council of Ministers of the Environment, 1989. ***Operating and Emission Guidelines for Municipal Solid Waste Incinerators***. Source: http://www.ccme.ca/assets/pdf/pn_1085_e.pdf

[xvii] Directive 050: ***Drilling Waste Management***, 1996. http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_302_0_0_43/http;/ercbContent/publishedcontent/publish/ercb_home/industry_zone/rules__regulations__requirements/directives/directive050.aspx

[xviii] Canadian Dam Association, 2007. ***Dam Safety Guidelines***.

[xix] Northwest Territories Water Board, 1987. ***Guidelines for Tailings Impoundment in the Northwest Territories***. Source: http://www.nwtwb.com/Tailings_Impoundment_Feb.87.pdf

[xx] Mine Environment Neutral Drainage (MEND) Program, 2009. ***Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials***.

[xxi] Canadian Council of Ministers of the Environment, 2009. ***Canada-wide Strategy for the Management of Municipal Wastewater Effluent***. Source: http://www.ccme.ca/assets/pdf/cda_wide_strategy_mwwe_final_e.pdf

[xxii] Northwest Territories Water Board, 1992. ***Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories***. Source: http://www.nwtwb.com/Discharge_of_Treated_Municipal_Water__1990.pdf

[xxiii] Duong, D. and Kent, R. 1996. ***Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories***. Prepared for Government of Northwest Territories, Municipal and Community Affairs Community Development. Source: http://www.enr.gov.nt.ca

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