Town of Norman Wells
Solid Waste Disposal Facility
Operations and Maintenance Plan

August 22, 2018

Prepared for:

Town of Norman Wells

Prepared by:

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Yellowknife, NT

Project Number:
144930099

Revision History and Conformity Table

Revision	Description	Author	Approved By
August 2018	Original Plan (Revision 0)	Stantec Consulting Ltd.	Town of Norman Wells

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Executive Summary

The Solid Waste Disposal Facility Operations and Maintenance (O&M) Plan is intended to provide a framework for staff of the Town of Norman Wells (Norman Wells) to operate and maintain its Solid Waste Disposal Facility (SWDF) in a manner that will protect public health and prevent adverse environmental impacts.

This O&M Plan has been developed for the operation of Norman Wells' SWDF to comply with the requirements outlined in Water Licence (No. S07L3-002), issued by the Sahtu Land and Water Board (SLWB). Aspects of the operation and maintenance of the facility must not contravene the terms and conditions outlined in the Water Licence.

The community of Norman Wells (65° 17' N and 126° 50'W) is located in the Sahtu region of the Northwest Territories (NT) on the east bank of the Mackenzie River, approximately 685 km northwest of Yellowknife, NT. The current population of Norman Wells is estimated at 803 residents and is expected to decrease over the next decade.

The SWDF is located approximately five kilometres northeast from the town centre. The current facility has been in use since 1997 but was converted to a modified landfill using the depression method in 2008. The SWDF is divided into an active landfill cell area (with three active phases) and eight sorting areas for bulky waste disposal, including: vehicles (including cars, truck, tanker trucks and transport trailers), scrap metal, above-ground storage tanks and ATCO trailers, compressed gas cylinders, tires, furniture, appliances, wood debris, and three temporary hazardous waste areas. The development of the SWDF was planned over 41 years in five phases. Based on the current rate of waste deposited at the SWDF (estimated at 4.8 kg/capita/day), the active Phases I, II and III of the SWDF will reach capacity in 2024, at which point the facility will need to expand to Phases IV and V.

Norman Wells has an organized waste collection program. Residential municipal solid waste is collected weekly from centralized neighbourhood blue bins. Residents are responsible for bringing their non-hazardous solid waste to the bins. Separate bins are available for collection of commercial and industrial solid waste. Norman Wells currently retains Green Enterprises NWT to empty the residential, commercial and industrial bins weekly and bring the waste to the SWDF. The waste received at the SWDF is divided in three categories: non-hazardous waste, hazardous waste, and unaccepted waste.

This O&M Plan outlines procedures for waste management, landfilling operations, emergencies, environmental control, inspections and monitoring (including the required Surveillance Network Program), record-keeping and closure and post-closure planning.

Glossary and Acronyms

Airspace	Volume designated to receive solid waste within the active cells of the SWDF
ASTs	Above-Ground Storage Tanks
AZR	Airport Zoning Regulations
Cover Materiel	Soil used to cover solid waste
ENR	Environment and Natural Resources
cm	centimetre
GNWT	Government of the Northwest Territories
ha	hectare
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*" (MVLB 2011)
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	High-Density Polyethylene
kg	kilogram
km	kilometre
Leachate	Contaminated water that has extracted harmful substances from stored waste while permeating through it
m^3	cubic metre
Maximum Lift Thickness	Maximum thickness of solid waste that can accumulate before being compacted
m	metre
mm	millimetre
m ASL	metres Above Sea Level
MVWLB	Mackenzie Valley Land and Water Board
NT	Northwest Territories
Phase	The different sections of the active cell area used to dispose of solid waste via the depression method. Can also be referred to as cells.
ODS	Ozone Depleting Substances
Outer Surface	A 4,000 m radius circle around the airport's reference point (i.e., centre of the airstrip), as per the federal Norman Wells Airport Zoning Regulations
O&M	Operations and Maintenance
Solid Waste	"G*arbage or rubbish that normally originates in a private home. Domestic waste may contain a significant amount of toxic or hazardous waste*" (MVLWB 2011)
SLWB	Sahtu Land and Water Board
SNP	Surveillance Network Program
SWDF	Solid Waste Disposal Facility

TDG	Transportation of Dangerous Goods
Waste Carrier	An individual or business approved to transport waste, including hazardous waste
Waste Generator	The individual or business producing waste
WHMIS	Workplace Hazardous Materials Information System
WM	Waste Management

1.0 INTRODUCTION

The Solid Waste Disposal Facility Operations and Maintenance (O&M) Plan is intended to provide a framework for staff of the Town of Norman Wells (Norman Wells) to operate and maintain its solid waste disposal facility (SWDF) in a manner that will protect public health and prevent adverse environmental impacts.

This O&M Plan has been developed for the operation of Norman Wells' SWDF to comply with the requirements outlined in their Water Licence (No. S07L3-002), issued by the Sahtu Land and Water Board (SLWB). Aspects of the operation and maintenance of the SWDF must not contravene the terms and conditions outlined in the Water Licence.

The content of this O&M Plan is based on the March 2018 document *Operation and Maintenance Plan Template for Municipal Licenses: Solid Waste Disposal Facility* developed by the Mackenzie Valley Land and Water Board (MVWLB) and the Government of the Northwest Territories (GNWT). Table 1-1 illustrates where each section of the referenced template is addressed in this O&M Plan.

Table 1-1 Cross-reference between the MVLWB/GNWT (2018) O&M Plan Template and this O&M Plan for the Norman Wells Solid Waste Disposal Facility

Required Sections from the MVLWB/GNWT (2018) O&M Plan template supplied by the SLWB	Corresponding Sections in this O&M Plan
Site description	2.0
SWDF staff	2.4
Security and control	4.1.1
Facility operations	2.1 and 4.1
Facility design	2.1
Accepted materials	3.1 to 3.2
Waste generation and site capacity	2.2
Community waste collection and handling	2.3
Waste screening	3.0
Unacceptable wastes	3.3 and 3.4
Record-keeping for unacceptable wastes	6.0
Landfilling operations	4.0
Litter and wildlife control	4.3
Surface water management	4.1.7
Record-keeping	6.0
Inspection and monitoring	5.0

Table 1-1 Cross-reference between the MVLWB/GNWT (2018) O&M Plan Template and this O&M Plan for the Norman Wells Solid Waste Disposal Facility

Required Sections from the MVLWB/GNWT (2018) O&M Plan template supplied by the SLWB	Corresponding Sections in this O&M Plan
Hazardous waste management	3.0
Tipping fees	3.5
Closure and post-closure plan	7.0
Surveillance network program	5.1

2.0 SITE DESCRIPTION

The community of Norman Wells (65° 17' N and 126° 50' W) is located in the Sahtu region of the Northwest Territories (NT) on the east bank of the Mackenzie River (Figure 2-1),approximately 685 km northwest of Yellowknife, NT. Based on the 1981 to 2010 Canadian Climate Normals, the average annual precipitation in Norman Wells is 294.4 millimetres (mm), including 171.7 mm as rain and 161.5 centimetres (cm) as snow (Government of Canada 2018). As outlined in Table 2-1, the average daily temperature for January is -26.1°C (the coldest month) and July is 17.1°C (the warmest month; Government of Canada 2018).

Table 2-1 Climate for Norman Wells, NT (Government of Canada 2018)

Month	Average Daily Temperature (°C)	Precipitation (mm)
January	-26.1	15.6
February	-24.0	14.9
March	-18.4	10.7
April	-5.1	11.1
May	6.4	19.0
June	15.0	42.7
July	17.1	41.8
August	13.8	41.8
September	6.6	33.1
October	-4.7	26.7
November	-18.7	18.7
December	-23.4	18.2

In 2016, the population of Norman Wells was estimated at 803 residents representing less than two percent of the population of the Northwest Territories (GNWT 2018). The population change of Norman Wells was estimated at -0.3% per year between 2004 and 2016, and the decline is anticipated to continue through to 2035. The population projections for Norman Wells are presented Table 2-2 (GNWT 2018).

Table 2-2 Population Projection for Norman Wells, NT (GNWT 2018)

Year	Population
2016	803
2020	803
2025	795
2030	795
2035	796

Site Description
August 22, 2018

The community of Norman Wells is located within the Norman Range low subarctic ecoregion of the Taiga Plains ecozone. As described for the ecoregion by the Ecological Classification Group (2009), the geology of this ecoregion consists of dolomite and limestone bedrock overlain by fine to medium textured tills. Brunisolic and Luvisolic soils are most common in the Norman Wells area. Vegetation is dominated by trembling aspen, paper birch and spruce (white and black). Norman Wells is also located in a zone of extensive discontinuous permafrost with 50 to 90% ice content (Natural Resources Canada 1993). The active layer thickness ranges from 0.5 to 2 metres (m) below ground surface (UMA Engineering Ltd 2008).

LEGEND:

- SNP STATION LOCATIONS
- FACILITY LOCATION BOUNDARY

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE SHOWN.
2. MAP WAS ACQUIRED FROM GOOGLE EARTH.
3. THIS MAP IS A USER GENERATED STATIC OUTPUT FROM AN INTERNET MAPPING SITE AND IS FOR REFERENCE ONLY.
4. DATA LAYERS THAT APPEAR ON THIS MAP MAY OR MAY NOT BE ACCURATE OR CURRENT.
5. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

0 500
Scale: 1: 10 000 (metres)

CLIENT: TOWN OF NORMAN WELLS

Stantec

Solid Waste Disposal Facility
Operation and Maintenance Plan

NORMAN WELLS MUNICIPAL FACILITIES
AND SURVEILLANCE NETWORK PROGRAM
STATION LOCATIONS

PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
144930099	YK	GM	GM	0	FIGURE 2-1
DATE: JULY 2018	SHEET No. 2 of 2	DWN JN	APP -	STATUS 0	

2.1 FACILITY DESCRIPTION

The SWDF is located approximately 5 km northeast of the town centre. The facility has been in use since 1997 and was converted to a modified landfill in 2008, using the depression method as per Clark 2003. The conversion was completed to meet more recent guidelines and legislation (AECOM 2017). The SWDF covers an area of approximately 5.6 hectares (ha) (250 m x 225 m) and is south-sloping (Figure 2-2). The SWDF is surrounded by a chain link fence and electric fence. There are two main entrances on the north side and an alternate gate on the south corner (Photo 1 to Photo 2, Appendix A).

The SWDF operates without an engineered liner and does not have a leachate collection system (AECOM 2017). As outlined by AECOM (2017), such a system was not included at the planning stage of the modified landfill because of: the small population (i.e., less than 1,000 residents), small projected quantity of waste produced (approximately 4,781 m^3/year), low annual precipitation (approximately 290 mm annually), and the low mean annual near-surface ground temperature (-5°C). These conditions cause slow biodegradation of solid waste. Drawings of the SWDF are provided in Appendix B.

The SWDF is divided in an active landfill cell area (with three active phases) and eight sorting areas for bulky waste disposal: vehicles (including cars, truck, tanker trucks and transport trailers) and scrap metal, above-ground storage tanks (ASTs) and ATCO trailers, compressed gas cylinders, tires, furniture, appliances, wood debris, and temporary hazardous waste areas (see Figure 2-2).

LEGEND

1. TIRES
2. TEMPORARY HAZARDOUS AREA (LINED AND BERMED) - WOODEN CRATES OF UNKNOWN MATERIAL
3. TEMPORARY HAZARDOUS AREA (LINED AND BERMED) - DRUMS, PAINT, SUSPECTED WASTE OIL TOTES
4. TEMPORARY HAZARDOUS AREA (LINED AND BERMED) - LEAD-ACID BATTERIES, DRUMS, UNKNOWN MATERIAL IN TOTES
5. FURNITURE
6. APPLIANCES
7. WOOD
8. COMPRESSED GAS CYLINDERS
9. AST'S AND ATCO TRAILERS
10. SCRAP METAL AND VEHICLES

BOUNDARY

GENERAL NOTES:

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STAMP

CLIENT

Solid Waste Disposal Facility Operation and Maintenance Plan

SORTING AREA AT THE NORMAN WELLS SWDF

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PROJECT No.	OFFICE	DES	CKD	REV	DRAWING
144930104	YK	EB	CH	0	FIGURE 2-2
DATE:	SHEET No.	DWN	APP	STATUS	
JULY 2018	1 of 1	JN	-	0	

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2.2 WASTE GENERATION AND SITE CAPACITY

Over the next decade (i.e, 2018 to 2028), it is anticipated the SWDF will require disposal space (i.e., "airspace") for approximately 56,000 m^3 of municipal solid waste within the active landfill cells. This value was calculated with the *Operation and Maintenance Plan Template for Municipal Licenses: Solid Waste Disposal Facility* template (MVWLB 2018) and is based on:

- Daily per capita waste generation rate of 4.8 kg
- Recommended ratio of waste to cover material of 1:5 (MVLWB 2018)
- Recommended compaction density of 300 kg/m^3 (MVLWB 2018)
- Current community population estimate of 803 residents (in 2016) plus future population projection (795 residents in 2025) (GNWT 2018)

The daily per capita waste generation rate of 4.8 kg was calculated based on the volume of compacted waste deposited at this facility between 2007 and 2015, which was estimated at 4,707 m^3/year (AECOM 2017), or 1,430 tonnes/year assuming a compaction density of 300 kg/m^3, which is the recommended compaction density by MVLWB (2018).

As outlined in Table 2-2, the development of Norman Wells SWDF was planned over 41 years in five phases, each with a projected volume of airspace. Phases I, II and III are currently in use as the active landfill cells and are located at the southeast end of the SWDF while the undeveloped Phases IV and V are planned for 2024 and beyond and are anticipated to be located south of the current SWDF boundary (Figure 2-2 and Drawing 00-CM-1002, Appendix B). AECOM (2017) has calculated available airspace for each Phase base on a at a semi-compacted waste density of 500 kg/m^3 and waste to cover soil ratio of 4:1.

Table 2-3 Master Plan for Norman Wells' Solid Waste Disposal Facility (adapted from AECOM 2017)

Phases or Cells	Years	Projected Airspace Volume Available (m^3)[1]	Remaining Net Waste Airspace Volume (m^3) for Waste Disposal[1,2]	Remaining Net Waste Airspace Weight for Waste Disposal (tonnes)[1]	Remaining lifespan (years)
I	1997-2008	13,772	45,366	22,683	10.36
II	2008-2024	27,604			
III		27,332			
IV	2024-2031	39,396	31,517	15,758	7.20
V	2031-2038	32,555	26,044	13,022	5.96
TOTAL	**41 years**	**140,659**	**102,927**	**51,463**	**23.52**

ASSUMPTIONS:
1. At a semi-compacted waste density of 500 kg/m^3
2. Waste disposal volume available without the space required for soil cover at a waste to cover soil ratio of 4:1

As outlined by AECOM (2017), disposal of solid waste in Phase I (1997 to 2008) occurred too close to the road on the east side of the SWDF (Drawing 00-CM-1005, Appendix B) and was located within the 90 m setback distance from public roads outlined in Section 28 (a) of the *Public Health Act and General Sanitation Regulations (R.R.N.W.T. 1990,c.P-16)*. As of 2017, it is estimated that 12,000 m^3 of waste requires relocation within Phases II or Phase III (AECOM 2017).

The remaining net airspace available in the active landfill cells (Phases I, II and III) is estimated at 45,366 m^3 (Table 2-2) and is insufficient for waste disposal over the next decade. It is estimated that approximately 56,000 m^3 of airspace will be required for municipal solid waste disposal from 2018 to 2028 and Phases I, II and III are expected to reach capacity in 2024. Additional space for solid waste disposal is available in Phase IV (31,517 m^3) and Phase V (26,044 m^3) of the SWDF (Table 2-2). The development of Phases IV and V will require an expansion of the SWDF beyond the facility's existing boundary (AECOM 2017; see Figure 2-2).

As the current SWDF has been grandfathered in to the federal Norman Wells Airport Zoning Regulations (SOR/82-296), which were enacted in June 2009, the facility's expansion will require an exemption to these regulations. The SWDF is located within the airport's "outer surface" zone, which is a 4,000 m radius circle around the airport's reference point (i.e., centre of the airstrip). Within this outer surface zone, activities and land uses that pose a risk to aviation safety are prohibited. As per Section 6 of the regulations, this includes the disposal of waste that is edible by or attractive to birds.

2.3 COMMUNITY WASTE COLLECTION AND HANDLING

Norman Wells has an organized waste collection program. Residential municipal solid waste is collected in centralized neighbourhood blue bins and residents are responsible for bringing their non-hazardous solid waste to the bins. Norman Wells currently retains Green Enterprises NWT to empty the bins and transport the waste to the SWDF weekly. Bins are also available at business locations for the disposal of commercial and industrial solid waste, and Green Enterprises NWT also provides weekly collection and transportation service for these commercial and industrial bins. Generators of bulky waste are responsible for bringing it to the SWDF and disposing of it in the designated sorting area.

Returnable beverage containers and electronic waste are collected on a voluntary basis at the Recycle Depot, which is located at 39 Mackenzie Drive (GNWT 2016 and 2017). This facility is open on Wednesdays from 15:00 to 18:00 and Saturdays from 12:00 to 15:00. The GNWT is responsible for this recycling program.

Compost and other recyclable items (e.g., plastic, tin cans, cardboard, mixed paper, glass) are not separated from municipal solid waste.

There is no program for collecting hazardous waste.

2.4 STAFF AND TRAINING

Norman Wells is responsible for the management of solid waste in the community. SWDF personnel should to be trained in the operation of the SWDF such that it is operated in a safe and environmentally responsible manner and in accordance with applicable regulations, such as the *NWT Safety Act* (S.N.W.T. 2015, c.30) and associated regulations (Table 2-3). Responsibilities for the management of the SWDF has been divided among personnel (Table 2-3). The required safety training and responsibilities of SWDF personnel is presented Table 2-3 while the organization structure for the Norman Wells SWDF is outlined in Figure 2-3. HRN Contracting has been hired to assist with the equipment operations, and planning and development of the landfill while the municipal Landfill Operator position is vacant.

Table 2-4 Safety Training and Responsibilities of SWDF Municipal Personnel (as of June 2018)

Title	Name	Phone Number	Email	Safety Training[6]						Responsibilities (cited from AECOM 2009, p. 4–7)
				ODS[1]	TDG[2]	WHMIS[3]	WM[4]	First Aid	HAZWOPER[5]	
Senior Administrative Officer	Catherine Mallon	(867) 587-3700 ext 1001	SeniorAdministrativeOfficer@normanwells.com	✓	e	e	✓	✓	x	• Planning and Development • Regulatory Compliance • Public Communication • Acting Public Works Foreman as-needed
Public Works Foreman	Jordon Balanuik	(867) 445-9334	PublicWorksForeman@normanwells.com	x	e	e	x	e	x	• Planning and Development • Regulatory Compliance • Acting Landfill Operator as-needed
Landfill Operator	Vacant position									• Gate Operations • Vehicle Spotting and Waste Screening • Site Maintenance • Equipment Operations • Planning and Development of the landfill • Regulatory Compliance • Administrative Duties • Safety

NOTES:

1. Ozone Depleting Substances
2. Transportation of Dangerous Goods
3. Workplace Hazardous Materials Information System
4. Waste Management
5. Hazardous Waste Operations and Emergency Response
6. ✓ = current, (e) = expired and x = missing

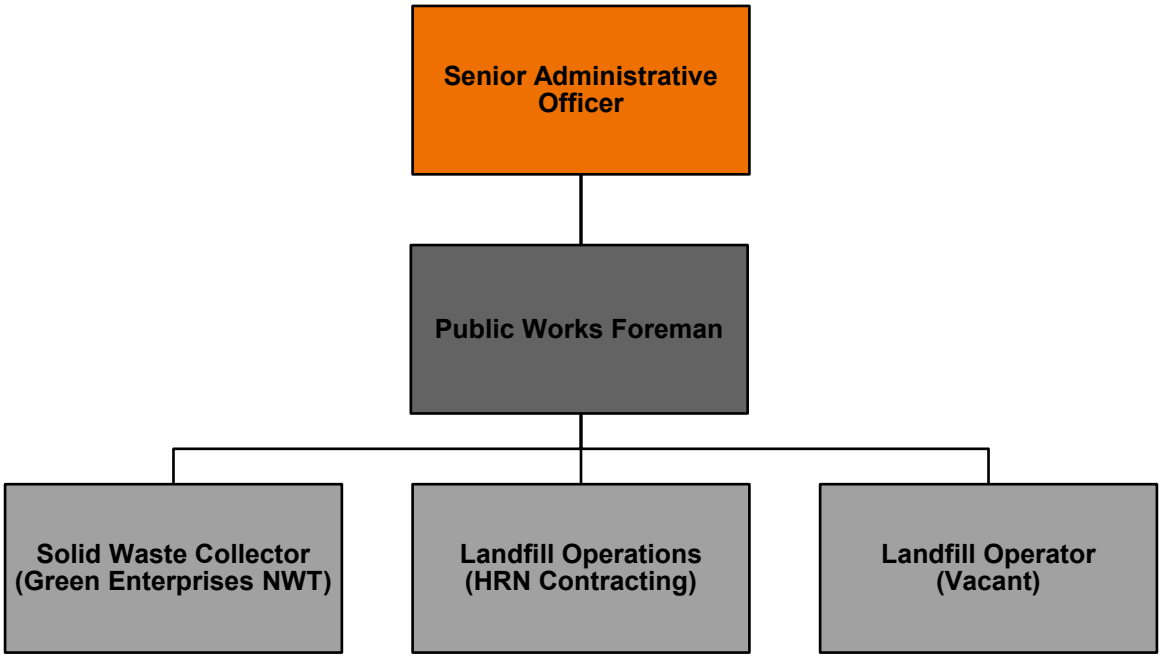

Figure 2-3 SWDF Organization Structure

3.0 WASTE MANAGEMENT

Solid waste entering the SWDF includes three general categories: non-hazardous waste, hazardous waste, and unaccepted waste. Each of these are described further in Section 3.2 to Section 3.4 of this O&M Plan, respectively. Waste disposal may also be subject to tipping fees, as described in Section 3.5 of this O&M Plan.

3.1 WASTE SCREENING

Prior to entering the SWDF, waste should be screened by the Landfill Operator. The waste screening procedure is described below as per AECOM 2009 (p. 19 to 20):

> "Among the most important duties of the Landfill Operator are to ensure that wastes are properly and thoroughly screened, and if any unacceptable wastes are found, that they are safely managed. The community must be aware of the screening activities and their results."

Screening the Waste

Vehicles delivering waste to the landfill are required to report to the Landfill Operator. The first point of on-site contact is at the gate, which allows for an initial screening process. It is not possible to screen the contents of packer trucks and transfer vans at the gate. Screening of these vehicles' contents must be done at the working face.

The second point of on-site contact is at the disposal cell where vehicles are unloaded. The Landfill Operator will visually inspect loads. The Landfill Operator should look for any waste that does not fall within any of the acceptable waste types.

Special waste that has received prior approval for shipment to the landfill should be inspected to verify that it fits the description provided by the generator. The waste load should be inspected and clearly classified prior to being pushed or compacted.

Know Your Generators and Haulers

It is important to know the potential sources of prohibited wastes from the service area. Some examples are:

- Automotive industry: generates solvents, paint wastes, lead acid batteries, grease and oil
- Dry-cleaning industry: generates filters containing dry cleaning solvents
- Medical clinics, hospitals, vet clinics: generate bio-medical wastes; and
- Individuals cleaning up garages can bring in batteries, paint, herbicides, oils, etc.

Be cautious in accepting wastes from unknown, unlicensed, or otherwise questionable haulers.

The Landfill Operator will also identify suspicious wastes based upon visual and olfactory characteristics. Indicators of suspicious wastes may include:

- Hazardous placarding or markings
- Liquids
- Powder or dusts
- Sludge
- Bright or unusual colours
- Drums or commercial size containers
- Chemical odours; and
- Smoke

General information obtained from the waste hauler shall include:

- Time and date of visit to the landfill
- Vehicle identification/license number; and
- Source and nature of the waste disposed of."

3.2 NON-HAZARDOUS WASTE

Municipal solid waste received at the SWDF from residents or industry is currently disposed in the active Phases I, II and III (Photo 3 to Photo 5, Appendix A). Bulky waste received at the SWDF from residents or industry is disposed in sorting areas (Figure 2-2, and Photo 6 to Photo 8, Appendix A). Animal carcasses are buried upon arrival at the SWDF due to the biohazardous nature of the waste. The generators of animal carcass waste are to coordinate with the on-site heavy machinery operator at the SWDF for immediate burial. The only non-hazardous waste accepted from outside the community is construction waste and this is examined by the Landfill Operator on a case by case basis. The types of non-hazardous wastes accepted at the SWDF are outlined in Table 3-1.

Table 3-1 Non-hazardous Waste Accepted at the SWDF

Accepted materials	Accepted[1] Sectors			Collection Method	Disposal location
	Residential	Commercial /Industrial	Outside the community		
Municipal solid waste	✓	✓	x	Centralized or industrial bins collected by Green Enterprises NWT weekly	Phases I, II, III
Construction, renovation and demolition waste	✓	✓	✓	Waste generators are responsible for disposal at the SWDF	Sorting areas
Scrap metal	✓	✓	x		
Reusable goods	✓	✓	x		
Appliances[2]	✓	✓	x		
Tires	✓	✓	x		

Table 3-1 Non-hazardous Waste Accepted at the SWDF

Accepted materials	Accepted[1] Sectors			Collection Method	Disposal location
	Residential	Commercial /Industrial	Outside the community		
Clean wood and trimmings	✓	✓	x	Waste generators are responsible for disposal at the SWDF	Sorting areas
Food and yard waste	✓	✓	x		
Animal carcasses	✓	✓	x		Phases I, II, III and buried upon arrival

NOTES:
1. ✓ = accepted, x = not accepted
2. Refrigerants are drained by a third-party contractor annually, crushed and added to the active Phase of the SWDF.

Norman Wells is presently not accepting contaminated soil at the SWDF (as of July 2018) but is considering accepting remediated soil (meeting the Tier 1—industrial guidelines for the Northwest Territories [GNWT 2003]) to use as cover material as a cost saving measure. Prior to entering the SWDF, remediated soil will be subject to approval by Norman Wells and will be required to meet specified requirements. Norman Wells will share its requirements and procedure for accepting remediated soil with the SLWB once it is developed.

Open burning of non-hazardous waste is currently not used at the SWDF. Should open burning be used in the future, Norman Wells may require an amendment to their Water Licence and should follow the GNWT Department of Environment and Natural Resources (ENR) document *Municipal Solid Wastes Suitable for Open Burning* (ENR 1993), as well as other federal and territorial regulations. Only an employee of the Town of Norman Wells, or a person with written consent from Norman Wells' Fire Chief, may burn material at the SWDF.

3.3 HAZARDOUS WASTE

The Norman Wells SWDF accepts only two types of hazardous waste: asbestos and vehicles. Other types of hazardous waste are currently stored at the SWDF: these are a legacy from unauthorized disposal from residents and local businesses. The types of hazardous waste accepted and/or currently stored at the SWDF are outlined in Table 3-2. A definition of each hazardous waste item is provided in Appendix C.

Table 3-2 Hazardous Waste Accepted and Present at Norman Wells' Solid Waste Disposal Facility

Accepted materials	Accepted Sectors[1]			Present at the SWDF due to unauthorized dumping[2]	Containment	
	Residential	Commercial /Industrial	Outside the community		Primary	Secondary
Asbestos	✓	✓	✓	n/a	Buried in the active Phase of the SWDF	
Vehicles	✓	✓	x	n/a	None	None
Lead-acid batteries	x	x	x	✓	Wooden pallets, or plastic 1,000 L tote	Bermed area lined with a HDPE liner (temporary areas)
Waste anti-freeze/glycols	x	x	x	✓	Drum or tote	
Oily debris	x	x	x	✓	Drum or tote	
Paint	x	x	x	✓	Wooden crates	
Drums	x	x	x	✓	Drums	
Used oil	x	x	x	✓	1,000 L totes, or 205 L drums	
Waste fuel	x	x	x	✓	1,000 L totes, or 205 L drums	
Hydrocarbon-contaminated soil, snow or water	x	x	x	—	n/a	n/a
Mercury-containing equipment	x	x	x	?	n/a	n/a
Ozone-depleting substances	x	x	x	✓	Appliances	none
Compressed gas cylinders	x	x	x	✓	Cylinders	None
Residue fuel tanks	x	x	x	✓	Tanks and drums	None

NOTES:
1. ✓ = yes/accepted, x = no/not accepted
2. ✓ = yes/present, — = not present, ? = potentially present, n/a = not applicable

Hazardous waste received at the SWDF from residents or industry is deposited in sorting areas. Generators of hazardous waste are responsible for bringing it to the SWDF and disposing of it in the designated sorting area. There are six sorting areas that contain hazardous waste: vehicles and scrap metal, ASTs and ATCO trailers, compressed gas cylinders, and three temporary hazardous waste areas. The temporary hazardous waste sorting areas are bermed and lined with a high-density polyethylene (HDPE) liner (Figure 2-2 and Photo 9 to Photo 13, Appendix A).

There is no maximum quantity for hazardous waste stored on-site. The long-term management strategy for the hazardous waste currently stored at the SWDF is to ship it to an approved facility by an approved waste carrier. Norman Wells retained KBL Environmental to transport hazardous waste from the SWDF to KBL's Yellowknife facility in March 2018. Over this period, approximately 30,000 L of hazardous waste was removed from the Norman Wells SWDF. Another shipment is planned for the 2019 winter road season (Photo 14, Appendix A). The long-term objective is to remove all unauthorized hazardous waste from the SWDF.

Specific measures have been implemented for certain types of hazardous waste. Fluorescent light bulbs are collected and stored by the Town's Public Works Department. They are broken down annually with a drum-top bulb-crusher supplied by GNWT-ENR. Ozone-depleting substances (i.e., refrigerants) are drained annually by a third-party contractor, retained by the Town. Generators of vehicles are asked to remove hazardous materials such as batteries, fluids, mercury switches prior to disposal.

Additional precautions should be implemented for the disposal of asbestos. Asbestos is currently buried in the active phase of the SWDF. Norman Wells' SWDF should become registered to receive asbestos waste and comply with the *GNWT Guidelines for the Management of Waste Asbestos* (2004). As per these guidelines, asbestos waste should be buried immediately upon receival with 50 cm of cover material in an area(s) where it will not be disturbed, and signage should be posted to indicate its presence.

As outlined in Table 3-3, spills of hazardous waste or other materials are to be reported immediately to the 24-Hour NWT/NU Spill Report Line at **(867) 920-8130**, or email. Spill report forms can also be completed by filling out an online form, available at http://www.enr.gov.nt.ca/en/services/spills/reporting-spills. If a spill should occur, the Spill Contingency Plan should be activated. Canutec, the Canadian Transport Emergency Centre, can also assist in emergencies involving dangerous goods, they can be contacted at (613) 996-6666 or *666 on a cellular phone.

Table 3-3 Emergency Contact Numbers

Resource	Name	Contact
Spill Notifications	NWT 24-Hour Spill Line	(867) 920-8130
	Spill Form	http://www.enr.gov.nt.ca/en/services/spills/reporting-spills
Emergencies involving dangerous goods	Canutec	(613) 996-6666 or *666 on a cellular phone

3.4 UNACCEPTABLE WASTES

Unacceptable wastes include honey bags, biohazardous waste from the health centre, hazardous waste except for vehicles and asbestos, and waste from outside the municipal boundaries except for construction, renovation, and demolition waste.

Unacceptable waste should not be stored at the SWDF and should be disposed of at an appropriate disposal facility in accordance with federal and territorial legislation.

Industrial, commercial, and institutional generators are required to transport their hazardous waste, via a licenced waste carrier, to registered receiving facilities according to the guideline for the *General Management of Hazardous Waste in the NWT* (GNWT 2017b).

As outlined in Table 3-4, the local GNWT-ENR office, or GNWT-ENR Environmental Protection division (1-867-873-7654), can assist in dealing with unacceptable wastes.

Table 3-4 Assistance Contact Numbers

Resource	Contact
Local GNWT-ENR office	(867) 587-3500
	jeff_walker@gov.nt.ca
GNWT-ENR Environmental Protection Division	(867) 873-7654

3.5 TIPPING FEES

Only non-residents are subject to tipping fees. These waste generators are charged a fee of $600 per tonne of waste, as per Schedule C of the Town of Norman Wells By-Law No. 17-09 (2017).

4.0 LANDFILLING OPERATIONS

The operating procedures for the SWDF have been prepared to provide a framework for effective and economical operation, and in compliance with the Water Licence. Table 4-1 outlines the landfilling operations recommended by Environment Canada and Climate Change (ECCC 2017).

Table 4-1 Recommended Landfilling Operations (adapted from ECCC 2017)

Landfilling Operation	Sections Where Details Are Provided	Recommended Frequency					
		Daily	Weekly	Monthly	Bi-annually	Annually	As-needed
Screening waste	3.0	✓					
Segregating and processing waste	4.1.4 and 4.1.5	✓					
Compacting waste	4.1.4	✓					
Covering compacted waste	4.1.6		✓				
Cleaning spills	4.2	✓					
Recording wildlife incidents	4.3	✓					
Picking up windblown litter	4.3				✓		
Managing surface water	4.1.7			✓[1]			
Testing water quality	5.1				✓		
Maintaining access roads	4.1.3						✓
Record-Keeping and annual reporting	6.0	✓				✓	

NOTES:
1. Monthly during periods of flow

4.1 BASIC LANDFILL OPERATION

4.1.1 Security and Control

The SWDF is surrounded by a chain link fence and an electric fence. There are two main entrances on the north side and an alternate gate in the south corner. The two main entrances are never closed or locked, while the alternate gate is always closed and locked. There are no designated hours of operation and the Landfill Operator position is currently vacant, but the municipal Public Works Foreman visits the SWDF daily. As a result, it is possible that unauthorized disposal of waste, including hazardous and unacceptable waste, may occur in the absence of the Public Works Foreman or Landfill Operator.

Signs posted at the SWDF entrance indicate the name of the facility and rules and restrictions. As shown in Photo 15 and Photo 16 (Appendix A), these include:

- No Hazardous or Toxic Waste Permitted
- Please Obey All Signage
- No Unauthorized Burning
- No Smoking Matches or Open Lights
- Wooden and metal structures such as sheds, trailers, etc., must be dismantled before being dumped
- Signs indicating where bulky waste should be disposed are also posted in the various sorting area (Photo 6 to Photo 8, Appendix A)

Signage indicating hours of operation, emergency phone numbers, and tipping fees should be added at the entrance to the facility. Vegetation growth should be controlled to prevent overgrowth from hiding or obscuring any signage.

Disposal procedures at the SWDF are also available on the Town's website at https://normanwells.com/news/disposal-procedures-municipal-landfill.

4.1.2 Equipment

A scale is present at the SWDF and is used to weigh incoming waste subject to the tipping fee (see Section 3.5). The SWDF has heavy equipment for spreading, compacting, and covering domestic solid waste disposed at the facility. Heavy equipment used on-site includes a D8 or D6 Cat dozer, a 980 or 950 loader, and a tri-axle rock truck for applying cover material. Equipment should be maintained and properly serviced, as per equipment operating specifications.

4.1.3 Access Road

The access road to the SWDF should be properly maintained at all times. The use of heavy equipment may cause the access road to deteriorate. Adequate road maintenance should include the following activities:

- Potholes can be filled with stockpiled granular material – the access road should be maintained relatively free of potholes
- Access road should be reshaped, as required, to provide and maintain proper drainage
- Soil amending material can be applied to provide a better driving surface, as needed
- Snow removal, as necessary, in winter
- Regular monitoring of access road conditions
- Any waste that may have fallen from the collection vehicles during hauling should be collected from the road and surrounding areas and disposed of in the SWDF
- In dry weather, the access road may be sprayed with water for control dust

4.1.4 Active Phase Operations

At present, solid waste is deposited into the active Phase I, II or III landfill cells by dump trucks, residents, or commercial and industrial waste generators. Norman Wells has retained HRN Contracting to spread solid waste weekly and compact solid waste monthly. A maximum lift thickness of waste has not been specified. The target compaction density is 300 kg/m^3.

4.1.5 Bulky Waste Area Operations

Bulky waste is not collected by the waste hauler during the regular weekly collection of domestic solid waste. These items must be directly disposed of at the SWDF by the waste generator. Each of these wastes should be deposited in their designated sorting area. Appliances and vehicles are also to be left in their respective designated areas. When possible, the Town should compact vehicles, drums and appliances and stack them in an organized manner. Hazardous materials associated with bulky waste, such as fuel or refrigerants, should be removed prior to disposal at the SWDF.

4.1.6 Cover Material

Two types of cover materials are used at the SWDF: intermediate and final. An intermediate soil cover is applied monthly after compaction. The waste to cover material ratio should follow the MVLWB (2018) recommend ratio of 5:1. For closure, the final cover includes a 600 mm thick clay barrier, compacted to 95% standard proctor density, followed by 300 mm of thick subsoil, and 200 mm of thick topsoil. This is applied to minimize water infiltration into the solid waste (AECOM 2017, Appendix B). The Norman Wells SWDF is located south of a quarry that can provide cover material (AECOM 2009).

4.1.7 Runoff Waters and Drainage

Surface water management is required at SWDFs to minimize surface water contact with waste and to reduce potential for erosion and ponding (MVLWB 2018). The main surface water management system at Norman Wells' SWDF is positive site drainage (10%) towards the south. The topography of the site varies from approximately 160 m above sea level (m ASL) at the north end of the SWDF, to 140 m ASL at the south end of the SWDF. Water draining from the SWDF is collected in road ditches (AECOM 2017). Surface drainage from the facility should be regularly monitored between June and October to confirm that ponding is minimized. The location of the surface water management structures at the SWDF is illustrated on Drawings 00-CM1003 and 00-CM1004 in Appendix B. The Mackenzie River located approximately 3.4 km south of the SWDF and is the closest fish-bearing water body.

4.2 EMERGENCY PROCEDURES

The Spill Contingency Plan should be activated in the event of a spill at the SWDF. All other emergency procedures are described below, as per AECOM 2009.

4.2.1 Emergency Response Plan

The following emergency response procedures should be triggered in the event of an emergency at the SWDF (AECOM 2009, p. 47 to 49):

> "The landfill emergency response plan sets out appropriate procedures to address foreseeable emergencies. The key elements of this plan are:
>
> 1. What is the nature and severity of the emergency?
> 2. What is to be done?
> 3. Who does it?

The emergency response plan addresses the following items:

- Fires
- Accidents and Medical Emergencies; and
- Environmental and Operations Contingencies

Emergency Plan Updates

The Department of Public Works of the Town of Norman Wells will review the emergency plan annually and following an emergency incident ensure that:

- Emergency response procedures for the landfill are effective and updated as necessary
- Appropriate individuals are appointed to manage emergency situations
- Regular fire prevention meetings are conducted with all landfill employees and the Fire Department; and
- Regular safety and emergency meetings are held with landfill employees

Emergency Organization

The key to success of the emergency plan is to assign a responsible person to take charge of an emergency situation. The Landfill Operator is designated to have the primary responsibility to manage emergency situations at the landfill.

The Landfill Operator will have complete commission for the duration of the emergency. This, together with proper training of operating personnel, practice drills to test emergency response activities, and continual review and updating of the plan, will be undertaken to ensure an efficient and effective response to any emergency that may occur.

Landfill Operator's Responsibilities

The Landfill Operator's responsibilities include:

- Declare an emergency
- Review and update the emergency response procedures
- Ensure that all emergency response procedures are appropriate
- Respond to all emergencies and contact appropriate emergency response agencies
- Establish control of the emergency prior to the arrival of appropriate emergency response agencies
- Direct personnel and site visitors to a safe marshalling area
- Liaise with the emergency response representatives upon their arrival
- Correct any potential emergency or unsafe situations; and
- Complete necessary documentation with respect to emergencies

The Landfill Operator will report any emergency or contingency situations to the Superintendent. The Superintendent will contact appropriate agencies to report incidents related to environmental or health and safety issues associated with the emergency or contingency activities.

Evacuation Procedures

In the event that an area or structure at the landfill must be evacuated due to a fire, gaseous, or other situations, landfill employees, customers, and site visitors will be evacuated. Employees and site visitors will exit buildings via the closest exit and will proceed to a designated marshalling area.

In the event of a fire or gaseous release from active areas of the landfill, the Landfill Operator will direct all staff and site visitors to immediately leave the area and proceed to the designated marshalling area. Visitors will be requested to remain at the marshalling area until otherwise notified.

The marshalling area is to be designated for each emergency situation according to the nature of the emergency, the location of the emergency, and the location of a safe exit route. A marshalling area must not be used when it is unsafe or is downwind of a fire or gaseous release.

Marshalling Areas

Marshalling areas are:

1. Primary: The parking area near the site building;
2. Secondary: Site main gate; and
3. An alternate area designated by the Landfill Operator.

When the evacuation is complete, the Landfill Operator will proceed to the marshalling area.

The prime consideration for the Landfill Operator is to ensure that all employees and site visitors are safely evacuated. The Landfill Operator will:

- Await appropriate emergency response personnel; and
- As required, establish perimeter security, conduct searches, and/or take other actions that may be warranted by specific circumstances.

It is imperative that all employees and visitors remain at the marshalling area until the Landfill Operator gives permission to return to the working cell areas or to leave the site."

4.2.1.1 Fire

The following management and emergency response procedures should be triggered in the event of a fire at the SWDF (AECOM 2009, p. 49 to 50):

"The landfill will be operated in a manner that will minimize the potential for landfill fires. Fire prevention techniques will include:

- Thoroughly compacting all waste
- Maintaining a comprehensive load checking program to prevent the dumping of hot/burning, explosives or combustible waste
- Maintaining a program of separating the dumping of ash barrels from general waste tipping face
- Maintaining a reservoir of dirt close to the active working face area for immediate action

- Site inspection, in particular of the working face, with regard to any trail of smoke before finishing work
- Maintaining area around burn pits to keep weeds and grass down to maintain a fire break area
- Training employees on early fire hazard recognition; and
- Conducting emergency response drills at least bi-annually, which are to be documented and reviewed with landfill staff

NOTE: For all fire occurrences an incident report must be completed and filed, with a copy sent to the safety officer

General Fire Response Procedures

Fires may occur at the following locations:

- Fires in the site building;
- Fires in the recycling storage area or hazardous waste storage compounds;
- Fires at the active landfill working face; or
- Fires in treed or grassed areas.

All fires will be treated as serious.

All fires will be reported as an emergency situation. Should an emergency occur, employees shall report to the primary marshalling area. Should the primary marshalling area be inaccessible, employees shall report to the secondary marshalling area or alternate safe site as directed by the Landfill Operator.

General Instructions

DO NOT PANIC. The greatest danger lies not in fighting the fire, but in the panic that arises from a fire. Spend a few minutes getting a handle on the situation. A landfill fire will not travel fast, so a 10-minute delay is not going to make any difference to the outcome of the fire. Go through the steps to notify the appropriate authorities and follow the basic steps in the fire control plan, including:

- Contact other nearby employees;
- Summon the appropriate landfill equipment;
- Notify the Firefighter Association and tell them the location and type of fire and whether or not it looks like it will spread out of the immediate area;
- Notify surrounding property owners, particularly if it appears that the fire could spread beyond the landfill;
- When the Firefighter Association arrives, follow their instructions;
- Do not fight fire alone; and
- Do not place yourself or others in danger while fighting the fire."

4.2.1.2 Medical Emergencies

The following emergency response procedures should be triggered in the event of a medical emergency at the SWDF (AECOM 2009, p. 53 to 54):

> "All injuries, even minor ones, should be considered important and should be reported as a safety incident to the Landfill Operator.

First Aid should be applied in a manner that is appropriate to the nature of the injury. If the injury requires medical assistance, the individual should be taken to a medical emergency centre or an ambulance service contacted.

A medical doctor should be consulted for all injuries that may result in infections as a result of working with waste materials. This includes injuries such as cuts and scrapes, skin punctures with sharp items, and fire or chemical burns.

If the person injured on-site is a customer or visitor, Landfill Operator employees are to provide any assistance necessary and will apply appropriate First Aid.

NOTE: For all medical emergency occurrences an accident/incident report must be completed and filed, with a copy sent to the safety officer."

4.3 ENVIRONMENTAL CONTROL

Measures have been implemented at Norman Wells' SWDF for environmental control. Litter is managed by fencing (Photo 17, Appendix A) and applying intermediate cover monthly. Windblown litter is also collected by the Public Works Foreman or designate on an as-needed basis. Norman Wells currently retains HRN Contracting to collect windblown litter on the adjacent road as part of their road maintenance contract.

There is also an electric wildlife fence that is activated in the spring when conditions are dry (to prevent the electrified fence from standing in water). The fence is deactivated in the fall when bears go into hibernation.

The various environmental controls in place at the Norman Wells SWDF are further described in the following sections.

4.3.1 Litter Control

The following litter control procedures should be completed to manage litter at and around the SWDF (AECOM 2009, p. 38):

"The **first level of litter control** involves actions to ensure that loads on vehicles hauling to the site are secured to prevent waste from falling or blowing onto roads leading to the site.

The **second level of control** is applied at the working face by directing vehicles to sheltered areas where possible, and by compacting and covering wastes.

The **third level of control** is provided by trapping litter in portable fence sections placed around the active landfill operations. Portable litter catchment fences are to be placed immediately downwind of the active working face. The perimeter fence also provides for containment of windblown litter.

The **fourth level of control** is retrieving litter that accumulates along roads leading to the site, on the site, or on adjacent lands.

The Landfill Operator is responsible for patrolling and either cleaning or arranging for cleaning of:

- Access road and road leading to the site
- On-site permanent and temporary roads
- The landfill property; and
- Adjacent lands around the perimeter of the landfill

Should any loads be "illegally" unloaded along roads leading to the site or at entrance gates or fence lines along the property, the waste load should be inspected for any identifying wastes (i.e. addressed envelopes, utility bills, etc.) and the Town of Norman Wells Bylaw Officer should be contacted. This waste must be cleaned up immediately to maintain a positive image of the site."

4.3.2 Dust Control

The following dust control procedures should be completed to manage dust at and around the SWDF (AECOM 2009, p. 38 to 39):

"Dust is generated by:

- Traffic dust on access roads
- Unloaded powdery or fine-grained wastes; and
- Soil blowing from stockpiles or soil cover

Dust blowing from wastes may be controlled by:

- Unloading in a sheltered area away from the public disposal areas
- Requiring the waste generator/hauler to moisten or wrap the waste prior to delivery to the landfill and
- Covering the waste with other waste or soil as soon as possible after unloading

Traffic dust may be minimized by:

- Reducing vehicle speed limits on gravel roads; and
- Applying water or dust suppressant to gravel road surfaces in hot dry weather

Soil stockpiles should be maintained to prevent blowing soil. This may require seeding of areas where soils may not be utilized for more than a year."

4.3.3 Noise Control

The following noise control procedures should be completed to manage noise at and around the SWDF (AECOM 2009, p. 39):

"The landfill is located in an isolated location away from any residential development and off-site noise is not anticipated to be of concern. Noise caused by operating equipment and vehicles may affect employee hearing, therefore, employees are encouraged to wear ear protection when working on or around equipment."

4.3.4 Odour Control

The following odour control procedures should be completed to manage odours at and around the SWDF (AECOM 2009, p. 39):

> "Odour issues can result in public complaints, negative public perception of the landfill operations, and nuisances to those who are most affected. Odours are more common in warm weather, during temperature inversions, and with breezes that carry odours from the site.
>
> Odours are caused by:
>
> - Decomposition of organic wastes
> - Disposal of waste products with strong odours (dead animals, sludges, etc.)
> - Chemical reactions in the landfill
> - Landfill gas emissions from the landfill; and
> - Stagnant water
>
> Odours may be controlled through:
>
> - Applying intermediate soil cover with the advance of the working face
> - Immediately covering any wastes that, by their nature, emit strong odours (cover either with soil or other wastes)
> - Working with waste generators to reduce odours at the source; and
> - Immediately correcting any leachate seeps that may develop."

4.3.5 Wildlife Control

The following wildlife control procedures should be completed to manage wildlife at and around the SWDF (AECOM 2009, p. 40):

> "An electrified fence has been constructed around the perimeter of the site. This fence should be inspected on a regular basis to determine if there has been any breach of the fence. Any breach of the perimeter fence should be reported to the Landfill Operator immediately.
>
> ***Animal and Insect Controls***
>
> Following are "best management" approaches to minimizing the potential of an animal and insect infestation:
>
> - Eliminate areas of ponded water other than designated retention ponds (insects and animals require water)
> - Maintain a small working face
> - Continue compaction of wastes
> - Apply intermediate cover as the working face advances; and
> - Apply soil or alternative cover where wastes will be exposed for more than 7 x 24 hours.

Should Landfill Operator notice any signs that may indicate a rodent infestation or bear activity, he/she shall take action immediately. If a rodent extermination program is necessary, expert advice should be consulted. In the event of bear issues, the Department of Environment and Natural Resources should be contacted at (867) 873-7654."

5.0 INSPECTIONS AND MONITORING

Regular monitoring of the SWDF will provide early identification of potential problems and indications if the facility is adhering to regulatory requirements. Performance monitoring should include periodic inspections of the site (e.g., completing a walkthrough the entire facility and recording potential deficiencies).

Specifically, the following items should be monitored and inspected on a monthly basis:

- Evidence of new hydrocarbon contamination
- Evidence of burrowing animals
- Evidence of facility use by large mammals/birds
- Access road conditions
- Condition of groundwater monitoring wells
- Ponded water throughout the facility (e.g., location, size, water depth)
- Condition of access control structures
- Dead plants or other changes to vegetation near active and historical SWDF cells
- General condition of signage
- Evidence of erosion on side slopes of active and closed cells
- Condition of surface water conveyance structures
- Presence of sedimentation and/or vegetation within water conveyance structures
- General condition and sorting/segregation efficiency of the temporary hazardous waste sorting areas, including the HDPE liner

The Public Works Foreman is responsible for monthly inspections of the items listed above and maintains records of these inspections.

5.1 SURVEILLANCE NETWORK PROGRAM

Groundwater quality is monitored through the Surveillance Network Program (SNP) and adheres to the requirements stated in the governing Water Licence (Annex A).

5.1.1 Sample Frequency and Locations

Two SNP stations (S07L3-002-4 and S07L3-002-5) are associated with the SWDF. GNWT—Municipal and Community Affairs (MACA) installed two groundwater monitoring wells below the south face of the SWDF during the winter of 2018 in the SNP station locations (S07L3-002-4 and S07L3-002-5) required by the Water Licence (Annex A). The two groundwater monitoring wells are locked by the GNWT. As of June 2018, Norman Wells was working on an agreement for sharing access to the two groundwater monitoring wells.

The SNP station description, sampling frequency, and required analytical parameters for each SNP station is outlined in Part B of the Annex A of the Water Licence and is also summarized in Table 5-1 and Figure 2-1.

Table 5-1 SNP Station Description, Location, Sampling Frequency and Analytical Parameters

SNP Station	SNP Station Description	Approximate Location (Latitude °N, Longitude °W)	Sampling Frequency			Analytical Suites/Parameters						
			Monthly[1]	Spring and Fall	Other	Standard[2]	Microbiology[3]	Major Ions[4]	Nutrients[5]	Petroleum Hydrocarbons[6]	Total Phenols	Total Metals[7]
S07L3-002-4	Groundwater monitoring well directly below south face of the SWF	65.294976°, -126.730765°8		✓		✓		✓		✓	✓	✓
S07L3-002-5	Groundwater monitoring well below south face of the SWF	65.295353°, -126.731991°8		✓		✓		✓		✓	✓	✓

NOTES:
1. Monthly during the periods of flow
2. Standard = pH, suspended solids and conductivity
3. Microbiology = fecal coliforms
4. Major Ions = calcium, magnesium, potassium, sodium, and sulphate
5. Nutrients = ammonia nitrogen, five-day biological oxygen demand (BOD_5), carbonaceous biological oxygen demand (CBOD), nitrate and nitrogen, total organic carbon, and total phosphate
6. Petroleum Hydrocarbons = oil and grease
7. Total Metals = silver (Ag), arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), iron (Fe), mercury (Hg), nickel (Ni), lead (Pb), thallium (Tl) and zinc (Zn)
8. The groundwater monitoring wells were installed in the winter of 2018 and were not sampled as of June 2018

There are no effluent quality criteria for these parameters specified in the Water Licence. Results of the SNP monitoring are provided to the SLWB in the Water Licence Annual Report (as per Part B, Item 1d of the Water Licence).

5.1.2 Sample Collection

One week prior to sampling, the Town will order sample supplies from Taiga Laboratory in Yellowknife, NT. On the day prior to collecting the samples, the Town will contact the Taiga Laboratory to confirm when the samples will be collected and their anticipated shipment date to the laboratory.

Prior to sampling, each of the laboratory-supplied bottles will be labelled. The labels will be completed with the Water License number, the SNP location identifier, the date and time, and “Norman Wells SNP” as the sample description. Due to the limited hold time of some of the samples (i.e., some samples “expire” soon after collection), the samples must be submitted within 24 hours of sample collection.

Sample collection procedures for the groundwater monitoring wells at the SWDF are further described in The Norman Wells SNP Manual (Town of Norman Wells 2015).

6.0 RECORD-KEEPING

The Landfill Operator, or designate, should maintain the following records for the SWDF:

- Dates of site work for material consolidation and addition of cover
- Monthly and annual quantities of domestic solid waste, and commercial, industrial, hazardous, and unacceptable waste received at the facility, or transported off-site from the facility.
- Modifications and/or major maintenance work carried out at the SWDF
- Operator training and communication exercises
- Spill records associated with any unplanned releases at the SWDF
- Closure and reclamation work completed
- Volumes of waste from external waste generators (i.e., those operating outside the municipal boundaries)

The information contained in these records is summarized in the Water Licence Annual Report that is submitted to the SLWB.

7.0 CLOSURE AND POST-CLOSURE PLAN

When the SWDF reaches capacity, a Closure and Post-Closure Plan for the facility will be required. A Closure Plan is a detailed document that describes the facility's closure design that will minimize effects to the receiving environment. A Post-Closure Plan describes a long-term plan to maintain and monitor the closed facility to verify whether the design features in the Closure Plan are operating as intended and protect the receiving environment. As per the Water Licence requirements, these plans need to be submitted to the SLWB for review a minimum of six months prior to carrying out any closure or post-closure work at the SWDF.

A Final Closure and Reclamation Plan will be developed closer to the end of life of the SWDF. This final plan will be prepared and provided to the SLWB in the timeline required (i.e., minimum of six months) before any closure work is carried out.

8.0 REFERENCES

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APPENDIX A
PHOTO LOG

Stantec

Photographic Log

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 1

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
SE

Survey Date:
6/6/2018

Comments:
Fence along the southern edge of the SWDF at Norman Wells, NT

Photograph ID: 2

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
E

Survey Date:
6/6/2018

Comments:
Alternate gate of Norman Wells' SWDF, locked, and electric fence

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 3 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** NE **Survey Date:** 6/6/2018 **Comments:** South side of Phase I active landfill cell	
Photograph ID: 4 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** NE **Survey Date:** 6/6/2018 **Comments:** South side of Phase II active landfill cell	

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 5 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** NE **Survey Date:** 6/6/2018 **Comments:** South side of Phase III active landfill cell	
Photograph ID: 6 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** W **Survey Date:** 6/6/2018 **Comments:** Furniture sorting area and sign	

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 7

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
W

Survey Date:
6/6/2018

Comments:
Appliances sorting area and sign

Photograph ID: 8

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
W

Survey Date:
6/6/2018

Comments:
Tires sorting area and sign

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 9 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** SE **Survey Date:** 6/6/2018 **Comments:** 205 L drums in a temporary hazardous waste area with unknown content	
Photograph ID: 10 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** SW **Survey Date:** 6/6/2018 **Comments:** Lead-acid batteries in a temporary hazardous containment area	

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 11

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
W

Survey Date:
6/6/2018

Comments:
Compressed gas cylinders sorting area

Photograph ID: 12

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
SW

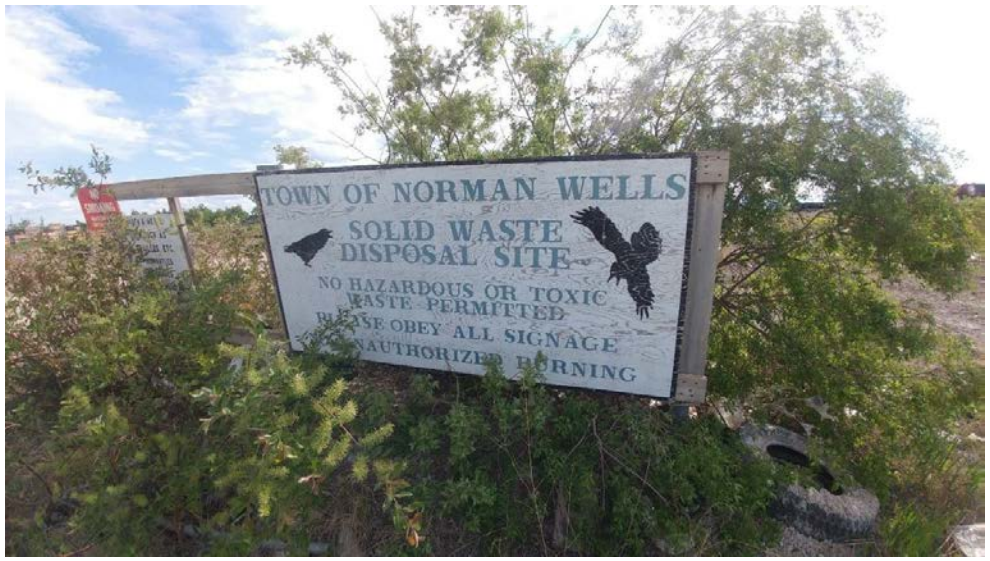
Survey Date:
6/6/2018

Comments:
ASTs sorting area

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 13 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** E **Survey Date:** 6/6/2018 **Comments:** HDPE liner and berm in a temporary hazardous waste containment area	
Photograph ID: 14 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** S **Survey Date:** 6/6/2018 **Comments:** A KBL container filled with hazardous waste and ready for shipping in the winter of 2019	

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 15 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** S **Survey Date:** 6/6/2018 **Comments:** Signage at one of the main entrances of the SWDF	
Photograph ID: 16 **Photo Location:** Solid Waste Disposal Facility - Norman Wells, NT **Direction:** N **Survey Date:** 6/6/2018 **Comments:** Signage at one of the main entrances of the SWDF	

Client:	**Town of Norman Wells**	**Project:**	**144930099**
Site Name:	**Solid Waste Disposal Facility**	**Site Location:**	**Norman Wells, NT**

Photograph ID: 17

Photo Location:
Solid Waste Disposal Facility - Norman Wells, NT

Direction:
E

Survey Date:
6/6/2018

Comments:
Fencing for windblown litter control

APPENDIX B
DRAWINGS

Town of Norman Wells
Municipal Landfill

2017 LANDFILL MASTER PLAN

LIST OF PROJECT DRAWINGS

00-CM-0000	Cover Sheet
00-CM-1001	2015 Existing Site Conditions and Layout
00-CM-1002	Proposed Site Development Plan
00-CM-1003	Proposed Final Waste Slopes
00-CM-1004	Proposed Landfill Phasing Plan
00-CM-1005	Sections and Details

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MUNICIPAL LANDFILL
2017 LANDFILL DEVELOPMENT

ISSUED FOR MASTER PLAN
May 1, 2017

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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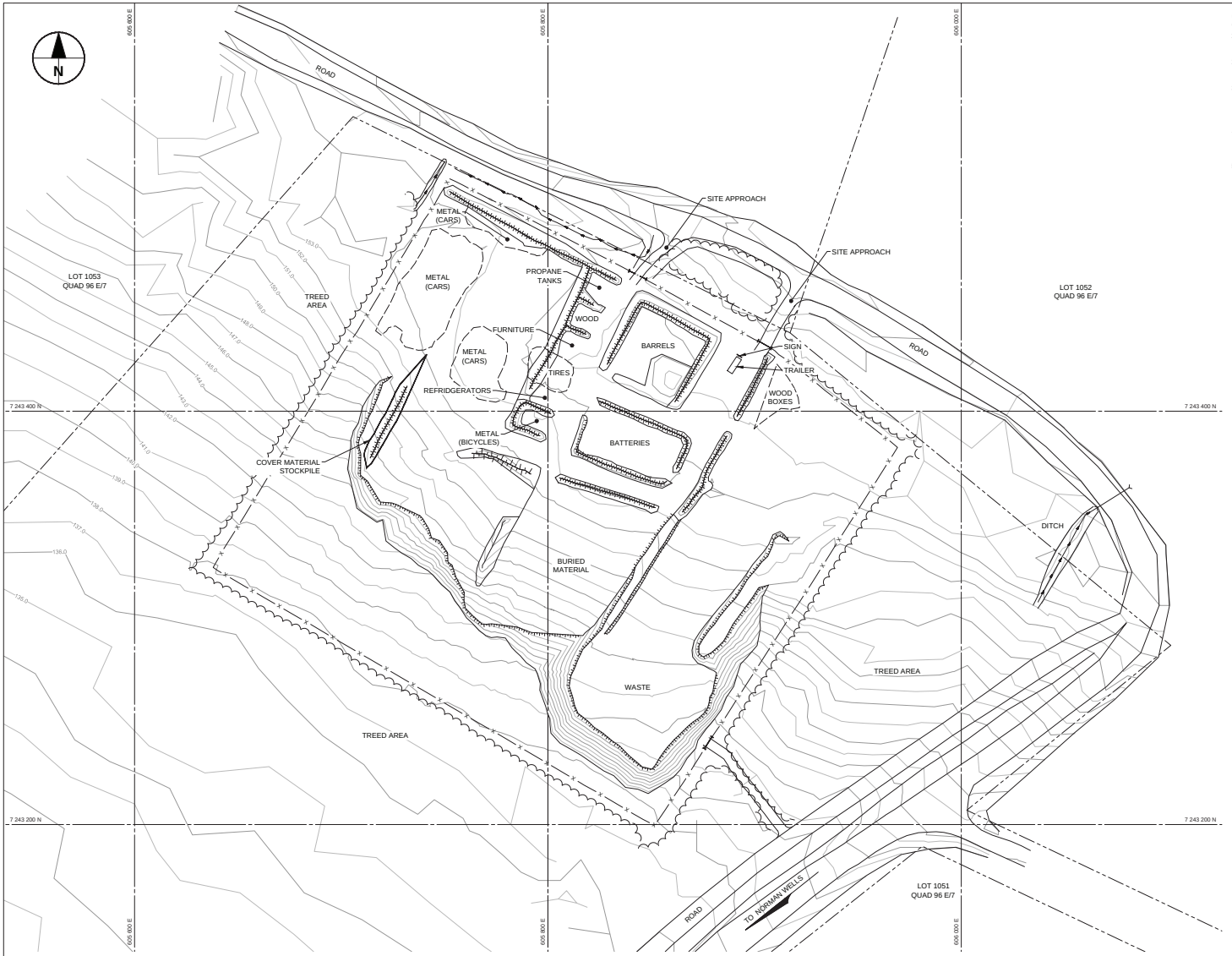

GENERAL NOTES:

1. ALL DIMENSIONS, COORDINATES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL COORDINATES ARE IN UTM ZONE 9 AND ELEVATIONS ARE BASED ON GEODETIC NAD 83 DATUM, .
3. ALL CONTOURS SHOWN DEPICT EXISTING GROUND AT AN INTERVAL OF 1.0m AND ARE BASED ON A SURVEY DATED JUNE 4, 2015. 2015 SURVEY HAS BEEN SUPERIMPOSED ONTO THE 2007 ORIGINAL GROUND SURVEY.
4. THE 2015 SURVEY WAS COMPLETED IN THE ABSENCE OF SURVEY CONTROL POINTS OR THE CONTROL POINTS COULD NOT BE LOCATED AND ARE THOUGHT TO BE DESTROYED.
5. THE 2015 SURVEY WAS ADJUSTED FOR A SLIGHT ELEVATION DISCREPANCY BY MATCHING THE SURVEYED 2015 UNDISTURBED AREAS OF THE LANDFILL WITH THE 2007 ORIGINAL GROUND AND AVAILABLE LIDAR SURVEY.

LEGEND:

- SITE GRID (200m INTERVAL, UTM NAD 83)
- PROPERTY LINE
- EXISTING GROUND CONTOUR (1.0m INTERVAL)
- EXISTING ROAD
- EXISTING FENCE LINE
- GATE
- LIMIT OF EXISTING WASTE
- EXISTING TREE LINE
- CULVERT

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PROJECT

Town of Norman Wells
Municipal Landfill
2017 Landfill Master Plan

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PROJECT NUMBER

60428071

SHEET TITLE

2015 Existing Site Conditions and Layout

SHEET NUMBER

00-CM-1001

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI D 864mm x 559mm

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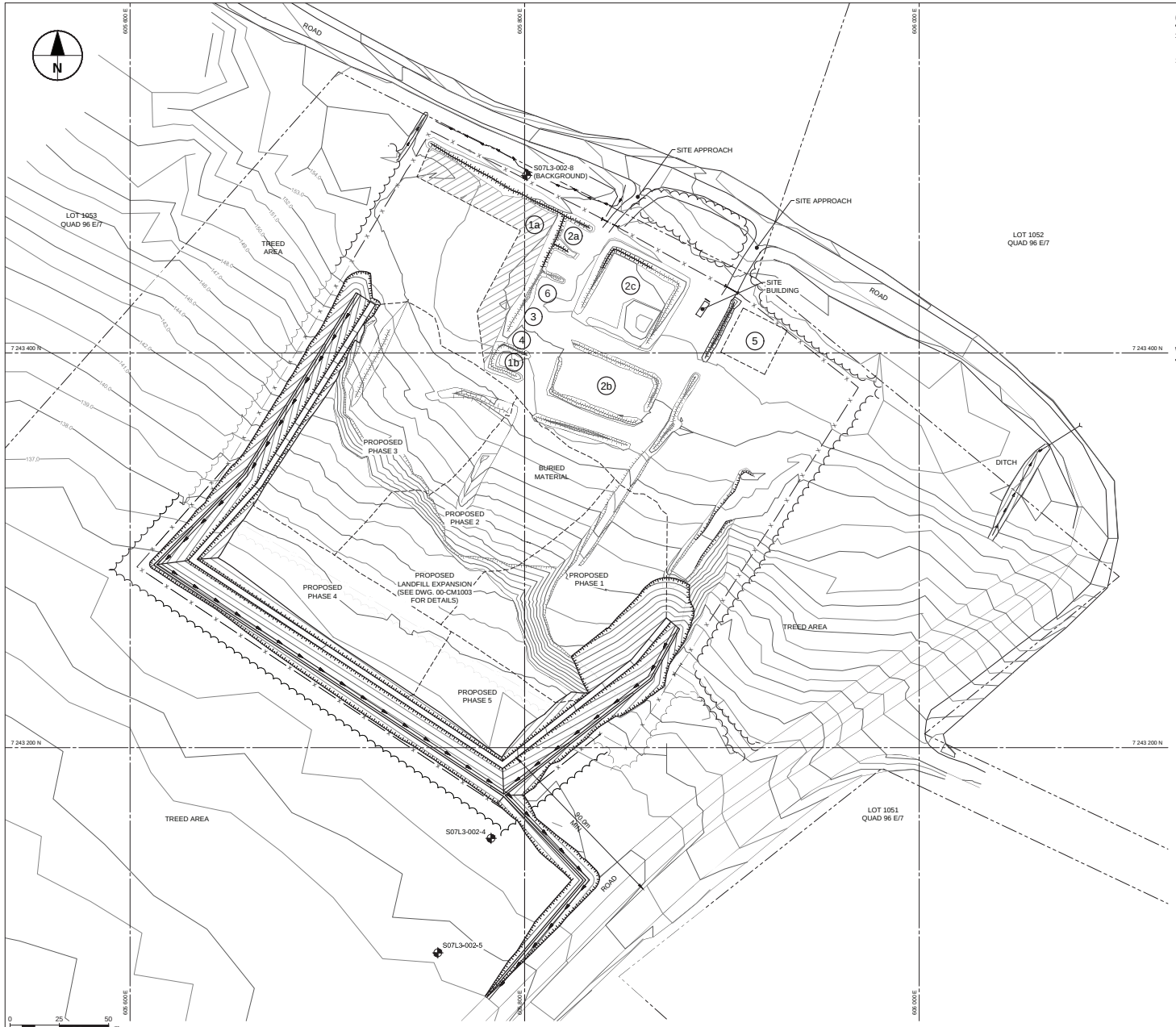

GENERAL NOTES:

1. ALL DIMENSIONS, COORDINATES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL COORDINATES ARE IN UTM ZONE 9 AND ELEVATIONS ARE BASED ON GEODETIC NAD 83 DATUM.

LEGEND:

- SITE GRID (200m INTERVAL, UTM NAD 83)
- PROPERTY LINE
- EXISTING GROUND CONTOUR (1.0m INTERVAL)
- EXISTING ROAD
- EXISTING FENCE LINE
- GATE
- LIMIT OF PROPOSED WASTE
- EXISTING TREE LINE
- CULVERT
- PROPOSED STORMWATER DITCHING
- PROPOSED MONITORING WELL

WASTE MANAGEMENT FACILITIES:

1. SCRAP METAL STORAGE
   a. AUTOMOTIVE
   b. BICYCLES
2. HAZARDOUS WASTE STORAGE
   a. PROPANE TANKS
   b. BATTERIES
   c. OIL BARRELS
3. TIRE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
4. APPLIANCE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
5. SCRAP WOOD AREA
   - 25.0m x 25.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
6. FURNITURE

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PROJECT

Town of Norman Wells
Municipal Landfill
2017 Landfill Master Plan

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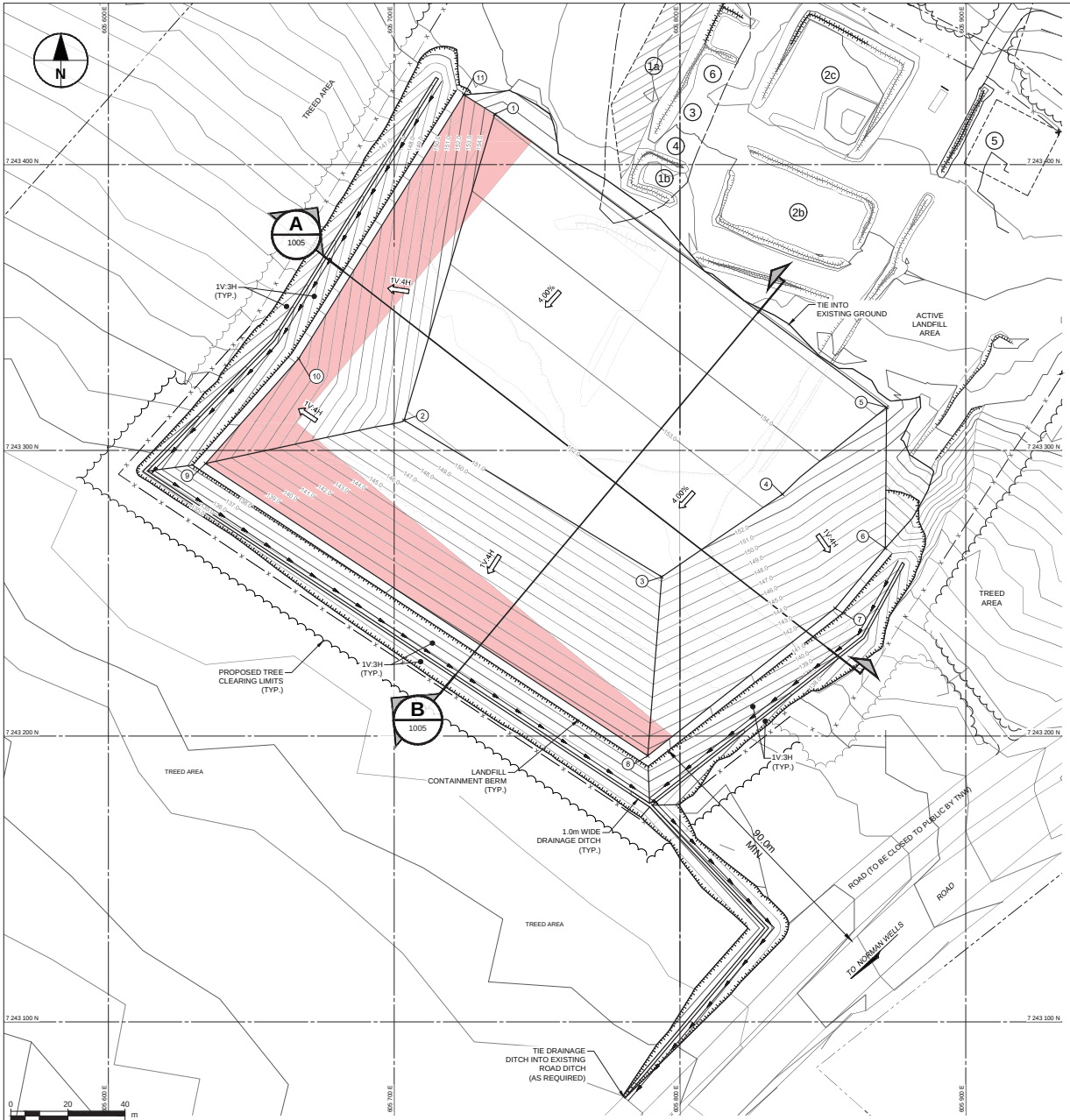
60428071

SHEET TITLE

Proposed Site Development Plan

SHEET NUMBER

00-CM-1002



LEGEND:

- SITE GRID (100m INTERVAL)
- PROPERTY LINE
- GROUND CONTOUR (1.0m INTERVAL)
- EXISTING ROAD
- EXISTING FENCE LINE
- PROPOSED FENCE LINE
- EXISTING TREE LINE
- PROPOSED TREE LINE
- COORDINATE POINT
- PROPOSED STORMWATER DITCHES
- AREA OF CAP RE-DESIGN BEYOND PREVIOUS MASTER PLAN (2007)

GENERAL NOTES:

1. ALL DIMENSIONS, COORDINATES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL COORDINATES ARE IN UTM ZONE 9 AND ELEVATIONS ARE BASED ON GEODETIC NAD 83 DATUM.
3. ALL CONTOURS SHOWN DEPICT EXISTING AND PROPOSED GROUND AT AN INTERVAL OF 1.0m AND ARE BASED ON SURVEYS DATED JUNE 4, 2015 AND OCTOBER 16, 2007. THE 2015 SURVEY HAS BEEN SUPERIMPOSED ONTO THE 2007 ORIGINAL GROUND SURVEY.EXISTING GROUND CONTOURS ARE BASED ON A SURVEY DATED OCTOBER 16, 2007.
4. ALL PROPOSED SIDE SLOPES OF BERMS AND DITCHES ARE 1V:3H UNLESS NOTED OTHERWISE ON DRAWINGS.

WASTE MANAGEMENT FACILITIES:

1. SCRAP METAL STORAGE
   a. AUTOMOTIVE
   b. BICYCLES
2. HAZARDOUS WASTE STORAGE
   a. BATTERIES
   b. OIL BARRELS
3. TIRE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
4. APPLIANCE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
5. SCRAP WOOD AREA
   - 25.0m x 25.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
6. FURNITURE

COORDINATE LISTING

NO.	NORTHING	EASTING	ELEVATION*
1	7243417.652	605735.188	155.045
2	7243310.527	605703.448	150.873
3	7243255.740	605793.591	151.359
4	7243284.670	605835.865	153.315
5	7243315.033	605872.252	155.172
6	7243265.732	605871.829	143.948
7	7243244.745	605854.293	142.061
8	7243193.084	605788.683	137.466
9	7243295.425	605634.014	138.393
10	7243332.122	605666.567	140.058
11	7243424.458	605724.303	151.835

(* TOP OF WASTE)

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Municipal Landfill
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PROJECT NUMBER

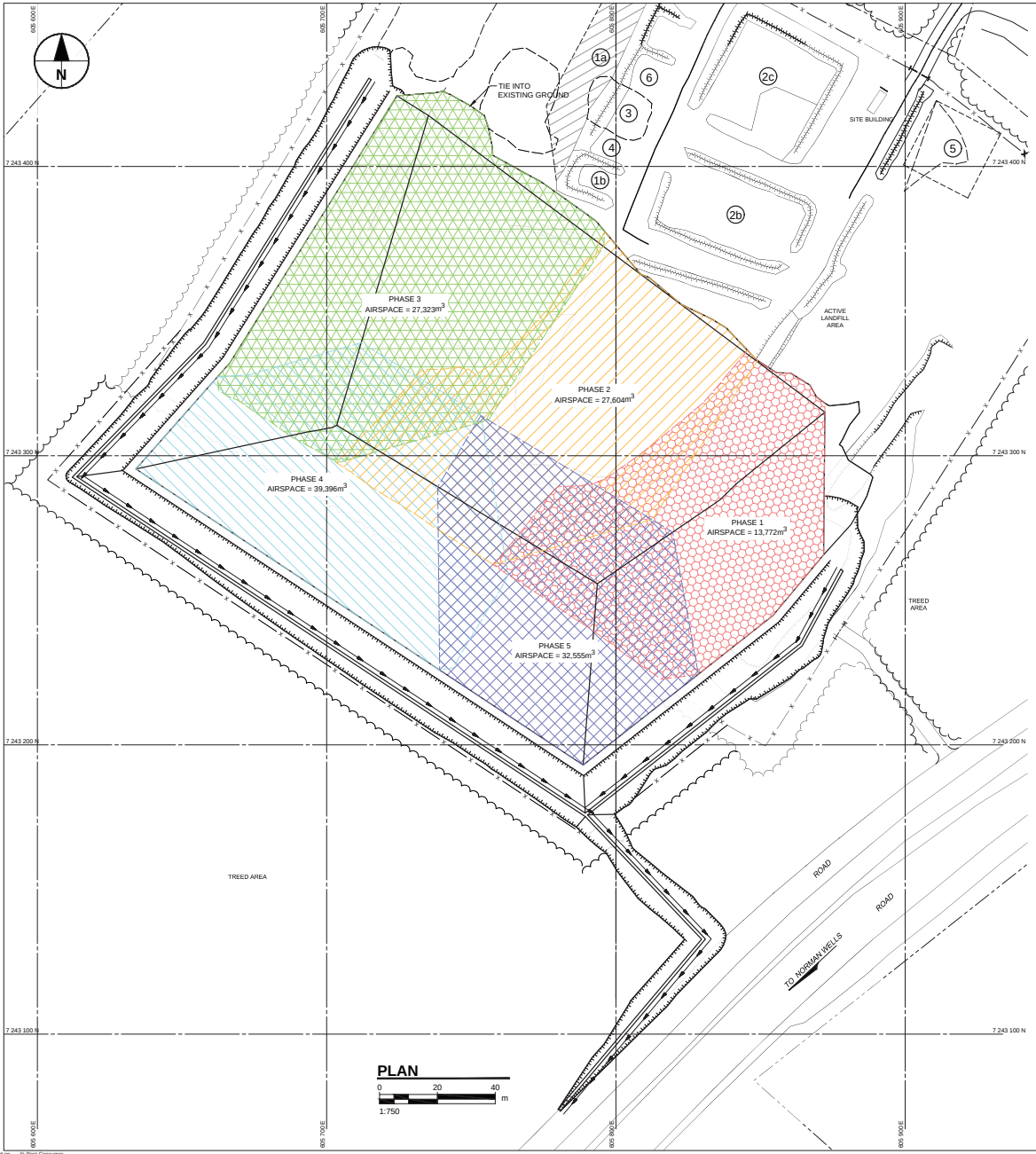
60428071

SHEET TITLE

Proposed Final Waste Slopes

SHEET NUMBER

00-CM-1003



PLAN

0 20 40 m

1:750

GENERAL NOTES:

1. ALL DIMENSIONS, COORDINATES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL COORDINATES ARE IN UTM ZONE 9 AND ELEVATIONS ARE BASED ON GEODETIC NAD 83 DATUM.
3. ALL PROPOSED SIDE SLOPES OF BERMS AND DITCHES ARE 1V:3H UNLESS NOTED OTHERWISE ON DRAWINGS.

LEGEND:

- SITE GRID (200m INTERVAL)
- PROPERTY LINE
- EXISTING ROAD
- EXISTING FENCE LINE
- PROPOSED FENCE LINE
- LIMIT OF EXISTING WASTE
- EXISTING TREE LINE
- PROPOSED TREE LINE
- PROPOSED STORMWATER DITCHES

WASTE MANAGEMENT FACILITIES:

1. SCRAP METAL STORAGE
   a. AUTOMOTIVE
   b. BICYCLES
2. HAZARDOUS WASTE STORAGE
   a. BATTERIES
   b. OIL BARRELS
3. TIRE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
4. APPLIANCE RECYCLING AREA
   - 15.0m x 15.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
5. SCRAP WOOD AREA
   - 25.0m x 25.0m ENCLOSED AREA
   - LOCK BLOCK BARRIER SYSTEM
6. FURNITURE

AIRSPACE REMAINING	
PHASE	APRIL 2017
I	13,772m^3
II	27,604m^3
III	27,332m^3
IV	39,396m^3
V	32,555m^3

NOTE: OVERFILL OF APPROXIMATELY 12,000m^3 TO BE RELOCATED INTO WASTE ENVELOPE.

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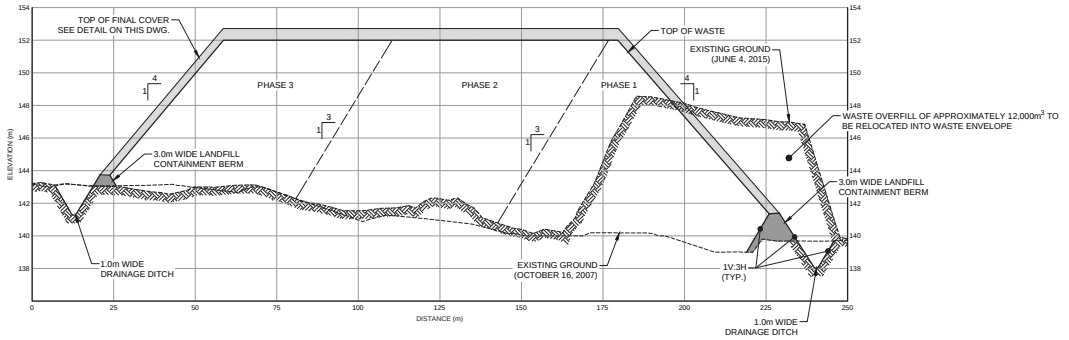
60428071

SHEET TITLE

Proposed Landfill Phasing Plan

SHEET NUMBER

00-CM-1004



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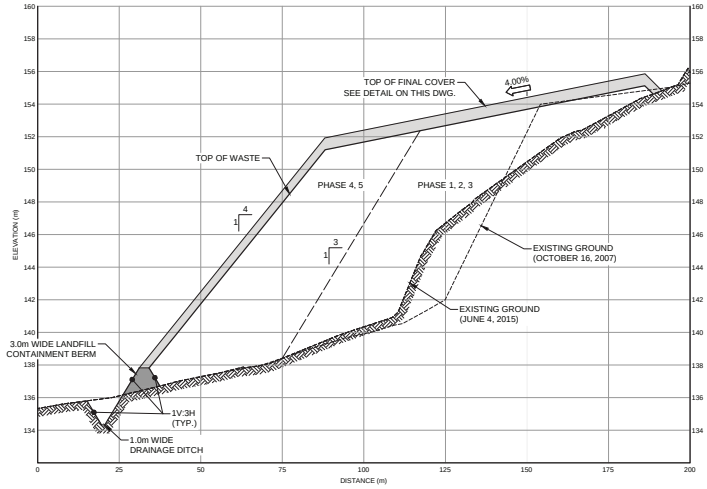
0 4 8 V=1:150



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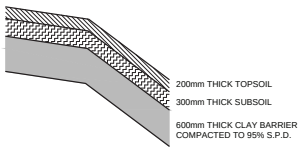

FINAL COVER DETAIL
SCALE: N.T.S.

0 20 40 m
1:750

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ANSI D 864mm x 559mm

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60428071

SHEET TITLE

Sections and Details

SHEET NUMBER

00-CM-1005

APPENDIX C
HAZARDOUS WASTE DEFINITIONS

Hazardous waste information

Asbestos: Exposed asbestos fibres from construction and demolition debris present a risk to human health. The risks to human health are lowered to safe levels when asbestos is properly packaged according to the conditions set by the Worker Safety and Compensation Commission. Once this has taken place, a hole must be dug in advance of acceptance and the asbestos needs to be buried immediately. The location needs to be documented to prevent future disturbance. Further details can be found in ENR's document *Guideline for the Management of Waste Asbestos*.

Lead-acid batteries are commonly found in vehicles. Both the lead and the acid are contaminants. Batteries in good condition can be stacked on pallets and banded or shrink-wrapped for transportation when enough have been collected to make shipping worthwhile. Store broken batteries in a pail or other container to prevent spills and avoid contact with battery acid. Further details can be found in ENR's document *Guideline for the Management of Waste Batteries*.

Glycols: Waste antifreeze (Ethylene Glycol) is generated from vehicle maintenance. Propylene glycol is more common to the industrial/commercial sector where it is used for heating larger buildings. Glycols can be stored in pails or drums until the quantity warrants shipping. Further details can be found in ENR's document *Guideline for the Management of Waste Antifreeze*.

Hydrocarbon-contaminated soil, snow, and water that result from spills or contaminated sites are managed as a hazardous waste in the NWT. Hydrocarbons include diesel, heating oil, gasoline, and other petroleum products. Communities wanting to store or treat contaminated soil, snow, or water may need to amend their water licence. Contact ENR for guidance on developing appropriate facilities.

Mercury is a severely toxic contaminant. Disposal needs to be reduced to levels as low as reasonably achievable. Thermostats, thermometers, mercury switches and fluorescent lamps all contain mercury. They can be safely stored in clearly marked pails. Drum-top crushing equipment can be used to remove the mercury from fluorescent bulbs. Other types of mercury-containing lights (i.e. street lamps or high intensity discharge lamps from the industrial/commercial sector) require specialized disposal methods and usually need to be transported to southern receiving facilities. For further information, see ENR's document *Guide to Recycling Mercury-Containing Lamps*.

Oily debris can consist of rags, sorbent material, or containers used to store or clean up oil. These materials are contaminants that cannot be added to a typical soil treatment facility, but need to be kept segregated from other waste.

Ozone depleting substances (ODS), also referred to as halocarbons, are chemicals mainly used in air conditioning and refrigeration equipment. The release of these substances depletes the ozone layer and is prohibited. Refrigerants need to be recovered by a trained technician prior to disposal of items containing refrigerants, including refrigerators, freezers and vehicles. Specific training is required for anyone servicing equipment containing ODSs and halocarbon alternatives. For more information, see ENR's document *Environmental Guideline for Ozone Depleting Substances (ODS's) and Halocarbon Alternatives*.

Paint: Paint can contain a number of hazardous chemicals, including lead. Whenever possible, paint should be used rather than disposed of. If it can't be used, the disposal method depends on the type of paint (check the label). Oil-based paint should be stored in approved 205 litre drums, ready for shipping. Latex paints can be landfilled after they are completely dried out (they can be spread out on a board or sheet to dry). Industrial/commercial paints usually need specialized treatment methods and should not be collected at the community SWDF. Check ENR's document *Guideline for the Management of Waste Lead and Lead Paint* for more information.

Propane tanks and aerosol cans are regulated as a dangerous good and are a potential explosion hazard at all times. Propane tanks can be returned to the retailer or supplier for safe storage and transport. Trained staff can safely evacuate the propane gas, making the tanks safe for scrap metal. Large propane tanks and other compressed gas canisters from the industrial/commercial sector should not be collected at the community SWDF.

Residue Fuel Tanks / Heating Oil Tanks / Residue Drums: Fuel storage tanks and drums often contain residue (e.g. sludge at the bottom), or may still contain flammable vapours. Tanks must be properly emptied prior to disposal as scrap metal. Empty drums need to be stored on their sides to prevent water from accumulating.

Used oil can be used as feedstock for a used oil furnace if the testing and other conditions in the *Used Oil and Waste Fuel Management Regulations Plain Language Guide* are met. Used oil can be stored in clearly labelled good quality tanks or drums. Do not let drums or pails be contaminated with glycol or solvents. Do not accept excessive volumes from the industrial/commercial sector.

Waste Fuel: Residents generate waste fuel from the use of gas-powered equipment and need a local disposal option. Waste fuel from residents can be bulked into UN-approved steel drums at Household Hazardous Waste collection events, or on a daily basis. The decision to accept waste fuel from residents on a daily basis requires appropriate screening methods to screen out incompatible materials from residents and excessive volumes of fuel or solvents from the industrial/commercial/institutional sector.

Vehicles: End-of-life vehicles contain antifreeze, batteries, fuel, mercury switches and other lubricating fluids that are considered hazardous waste and need to be removed. Once the hazardous materials are removed, the rest of the vehicle can be treated as scrap metal. Refrigerants from air conditioning systems will need to be removed by a trained technician.