West 40 Landfill

Closure and Reclamation Plan

The City of Iqaluit

Project number: 60658262

October 12, 2021

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AECOM: 2015-04-13

Quality information

Prepared by	Checked by	Approved by
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S.D. JOHNSON
LICENSEE
NWT/NU
2021

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AECOM CANADA LTD.
Signature
Date 15 October 2021
PERMIT NUMBER: P 639
NWT/NU Association of Professional Engineers and Geoscientists

Revision History

Revision	Revision date	Details	Name
0	July 09, 2021	Draft For Comment	Jim Clare
1	October 1, 2021	Final	Jim Clare
2	October 12, 2021	Final Rev 1	Jim Clare

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1. Introduction

1.1 Background

In 2020, AECOM Canada Ltd. (AECOM) conducted an airspace analysis to determine the remaining life of the landfill. Based on the results of the report, the facility is nearing capacity and is expected to reach closure by 2024. AECOM was retained by The City of Iqaluit (The City) to develop a Closure Plan for the West 40 Landfill (The Landfill) in preparation for this closure. It is important to note that this closure plan will require updating once the landfill reaches actual closure to reflect the actual waste surfaces at time of closure. The purpose of this report is to provide a proposed landfill cap design including grading and site drainage based on the design top of waste developed to provide waste surface airspace until 2024.

1.2 Site Description

The West 40 Landfill is located on the south end of Baffin Island, on Frobisher Bay at 64°44'11" N latitude and 68°32'14" W longitude. The facility serves the City of Iqaluit, the largest community in Nunavut, Canada. The City is located approximately 4 kilometres (km) from the waste management facility. Annual precipitation in the Iqaluit area is approximately 255 centimetres (cm) of snowfall and 19.2 cm of rainfall. Average annual temperatures range from a low in January of approximately -29.7 degrees Celsius (°C) to a high of approximately 11.4 °C in July.

Originally built in 1995, the landfill was expanded in 2001 and 2006 to extend the life of the facility and provide run-off surface water management. The facility accepts a variety of waste including plastic, paper, wood, organic waste, construction and demolition (C&D) materials and recyclable materials such as scrap metal and tires, electronic waste and household hazardous waste (HHW). Waste is compacted and covered with soil. From October 2017 to August 2020, approximately 48,990 cubic metres (m^3) of waste is estimated to have been placed in the landfill. As of 2020,approximately 99,875 m^3 of airspace remains until the landfill capacity is reached.

Surface water is currently managed by a series of perimeter berms that collect and contain run-off water within the Landfill footprint. On-site run-off is collected in ponding and pumping areas to the east, west and south of the landfill. These areas are then pumped to two off-site retention areas for storage and settlement. The water is discharge to surface where it eventually flows to Koojesse Inlet after a period of retention.

1.3 Regulatory

The Territory of Nunavut does not currently have regulations for the closure of waste management facilities. The Nunavut Water Board (NWB) provides the approval for any proposed closure. The NWB License requires that a closure plan be submitted to the NWB for approval as per Clause J.

The Northwest Territories (NWT) Guidelines for the Planning, Design, Operations, and Maintenance of Modified Solid Waste Sites [2001-1330] (NWT, 2003) document regulations defines closure as the period after the landfill has reached capacity. When this occurs, the construction of a final cover for an area facilitates the long-term protection of the environment. The NWT guideline also specifies that the final cover system shall be capped with a minimum of 600 millimeters (mm) of material preferably clay and graded to positive drainage. It also specifies that the site should be stabilized with soil or equivalent to prevent erosion of the cap materials. Considering the absence of Nunavut landfill regulations, the NWT guidelines will be taken into consideration for the design of the West 40 Landfill closure cap.

2. Closure Plan

2.1 Grading

The final landfill cap will be graded to facilitate drainage away from the landfill site. This will prevent pooling of surface water as well as infiltration and leachate generation. Based on estimated airspace requirements the final waste surface will have side slopes of 3H:1V and a 5% grade top deck directing drainage to the east and west. These grades dictate the final cap surface and provide drainage requirements. The historical waste pile presently has slopes that exceed the 3:1 desired final slope. Those areas of the historical waste pile that exceed these slopes will be regraded to provide the required slope or the final cover will be placed to achieve the desired final slope.

2.2 Cap Design

The final landfill cap/cover system is required to minimize the amount of leachate generated within the landfill and provide drainage from the landfill surface. The following cover design is proposed for the West 40 Landfill site (see Drawing C-4001).

- 300 millimetres (mm) leveling layer over waste
- Geosynthetic Clay Liner barrier layer
- 300 mm of 20 mm minus granular
- 350 mm of 75 to 150 mm granular

300 mm Leveling Layer

The leveling course provides the base for the installation of the overlaying geosynthetic clay liner (GCL). The material must be placed and compacted to provide a smooth surface free from waste and sharp objects that could damage the GCL. Ideally the material should be evenly graded with a high sand content. The material shall be 20 mm minus, evenly graded.

Geosynthetic Clay Layer

Due to the lack of clay materials in Iqaluit GCL will be used to provide the barrier layer. GCL has a hydraulic conductivity of $5x10^{-9}$ cm/sec. to $5x10^{-10}$ cm/sec generally accepted as comparable to 600 mm of compacted clay. The GCL can be installed by local forces and is less susceptible to damage than geomembranes.

300 mm – 20 mm Minus Layer

This layer next to the GCL will provide a protection layer to the GCL.

350 mm – 75 mm to 150 mm Layer

The final lift will provide a layer of granular that will provide erosion protection and provide a surface that will provide a blending to the natural terrain.

2.3 Surface Water Management

The existing surface water management system consists of run-off ponding areas that require pumping to an offsite storage area for settlement and retention prior to discharge. Once the cap is constructed, run-off water will no longer come into contact with waste and will be of suitable quality to drain to natural pathways without additional retention or need for testing. The cap will tie into the top of the existing perimeter berm on the west side effectively removing the existing run-off drainage pathways and pumping areas created by the berm. The top of cap on the berms will be graded for positive drainage to further prevent pooling and ponding of water. Along the east and south extents, the cap will tie into the base of

the existing berm. Additional fill will be added and graded at a 5% slope back from the top of berm to tie-in to the top of cap, to allow for positive drainage. Water will flow over the cap and berms to existing ground on either side of the landfill, allowing water to follow natural drainage pathways off site. The ponding areas located to the south of the landfill will be filled and graded to tie-in to the top of cap.

2.4 Site Reclamation

The closure of the landfill will also require a final clean-up and removal of operational facilities. These activities will involve the following:

- Removal of site entrance office and disconnect of power
- Removal of all storage containers
- General site clean-up to remove any accumulated litter and debris
- Final clean-up of scrap metal as required

2.5 Post Closure

During the Post-Closure care period, it is recommended that the final cover system be inspected at least once per year, and that an annual report be completed that includes:

- Results of cap inspection observations
- Record of maintenance and repairs completed
- Report of any remedial or corrective action required

An annual report should be submitted to the Nunavut Water Board.

The NWT guidelines specify that post closure monitoring should continue until the site is no longer releasing contaminants and/or the site has reached an equilibrium where contaminants no longer pose a risk to the environment. To mitigate the release of contaminants, the following activities need to take place during the Post-Closure care period at the West 40 Landfill:

- Protect and maintain the integrity of the final cover system and surface water management systems.
- Provide repairs to the final cover system as necessary to correct settlement, subsidence, erosion, leachate break-out.

2.6 Implementation Schedule

The West 40 Landfill will not be closed until the opening of a new waste transfer station. A new transfer station is not anticipated to be constructed and operational until the end of 2024. Therefore, the closure of West 40 Landfill is not expected until 2025 or later.

3. Closure and Post Closure Costs

Based on the proposed final cap for West 40 Landfill and the changes to the run-off surface water system, the following closure capital costs are estimated in Table 1.

Table 1. West 40 Closure Cost Estimate

Item	Description	Unit	Unit Price ($)	Quantity Estimate	Estimated Amount ($)	Notes
1.	Mobilization and Demobilization	Lump Sum	100,000	100%	100,000	
2.	300 mm Leveling Layer	m^3	75	9,400	705,000	*20 mm Minus*
3.	Landfill Cap					
	Geosynthetic Clay Liner	m^2	32	39,900	1,276,800	
	GCL Shipping Cost per Container	Per	4,300	16	68,800	*Number of containers estimated for shipping GCL assuming a roll diameter of 0.5 m*
	300 mm 20 mm Minus	m^3	75	12,000	900,000	
	350 mm 75 - 150 mm	m^3	75	14,000	1,050,000	
4.	Ditches and grading	m	70	410	28,700	*Information only - Approximately m^3 required for fill, m3 cut*
5.	Site Reclamation	Lump Sum	100,000	1	100,000	
	Subtotal				4,229,300	
	Engineering (Construction)	Lump Sum		8	338,344	
	Contingency (20%)			20%	84,860	
	Total				5,414,000	

The post closure operational costs including annual costs as well as total cost over the post closure care period, are estimated in Table 2. It is assumed that the post closure period shall continue for a minimum of 25 years after the closure of West 40 Landfill.

Table 2. West 40 Post Closure Cost Estimate

Item	Description	Unit	Unit Price ($)	Quantity Estimate	Estimated Amount ($)
1.	Annual Inspections	Lump Sum	5,000	100%	5,000
2.	Annual Monitoring and Reporting	Lump Sum	20,000	100%	20,000
3.	Maintenance	Lump Sum	10,000	100%	10,000
	Subtotal				35,000
	Engineering (10%)			10%	3,500
	Contingency (20%)			20%	7,000
	Total				45,500
	Total for 25 years (3.7% Inflation Annually)				1,820,200

This Closure Plan is based on data generated up to 2020. This Closure Plan will require review and updating once the landfill is closed and as required by the NWB. The information and data presented in this report have been prepared for the sole use of the City of Iqaluit.

4. References

Northwest Territories 2003, Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories [2001-1330]. April 2003.

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Appendix A

Figures

DRAWING LIST

C-0000	Cover Sheet
C-0001	West 40 Landfill - Existing Conditions Plan
C-1001	West 40 Landfill - Final Capping Plan
C-2001	West 40 Landfill - Existing Ditch and Ponds - Grading Plan and Profile
C-3001	West 40 Landfill - Final Capping Sections
C-4001	Typical Details - Sheet 1 Of 1

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West 40 Landfill
Closure and Reclamation Plan

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SHEET TITLE

WEST 40 LANDFILL
SITE LOCATION PLAN

SHEET NUMBER

C-0001

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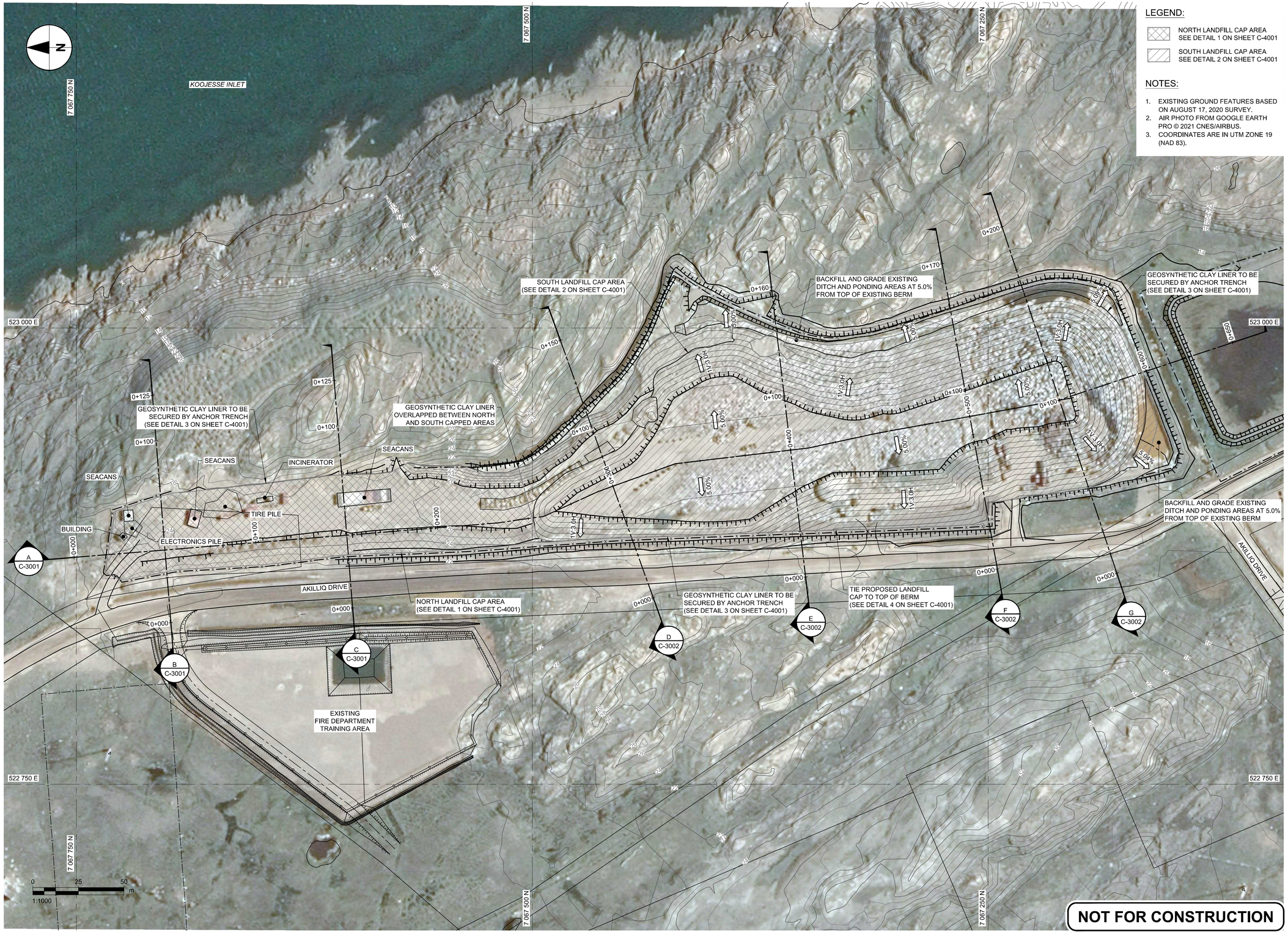
SHEET TITLE

WEST 40 LANDFILL
EXISTING CONDITIONS PLAN

SHEET NUMBER

C-1000



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PROJECT NUMBER

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SHEET TITLE

WEST 40 LANDFILL
FINAL CAPPING PLAN

SHEET NUMBER

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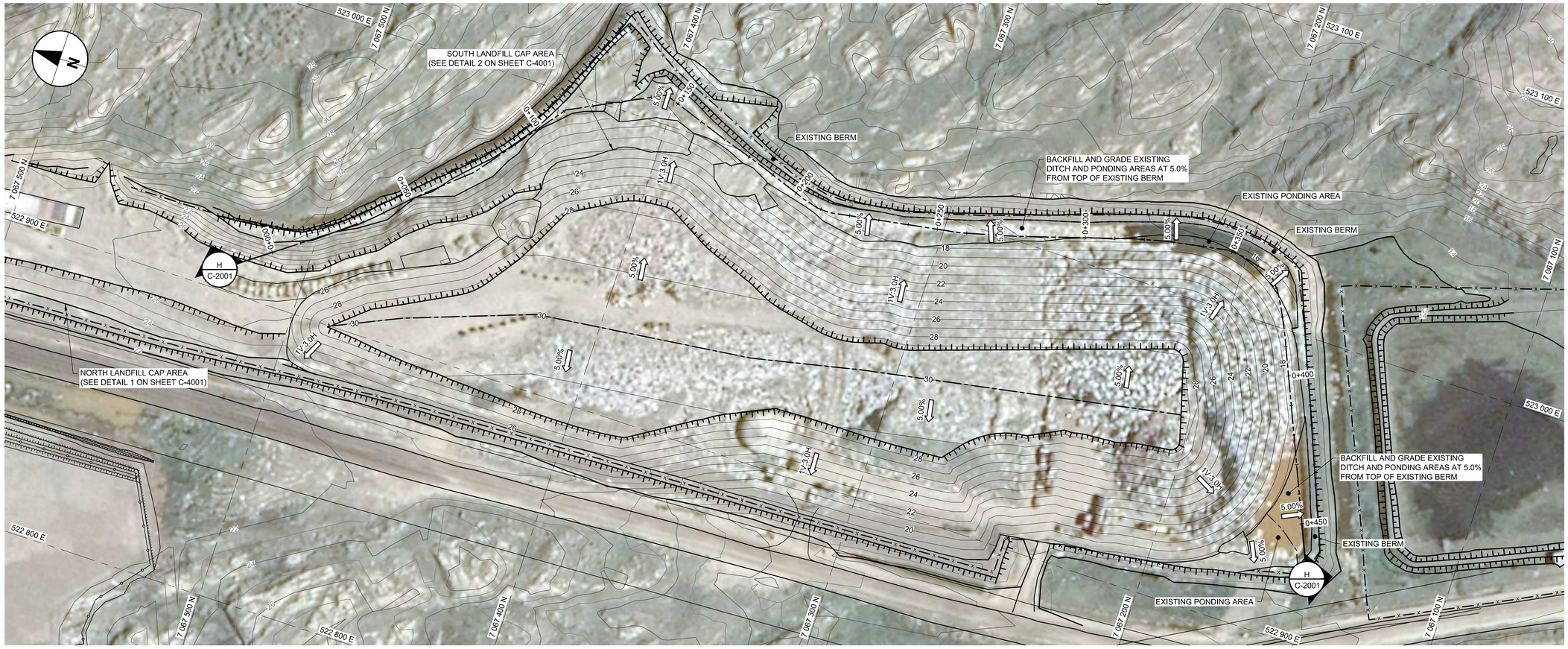

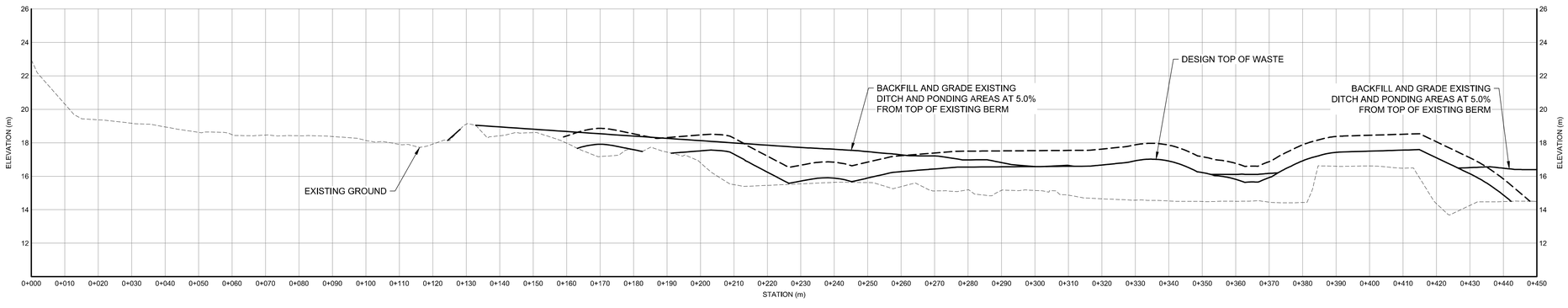

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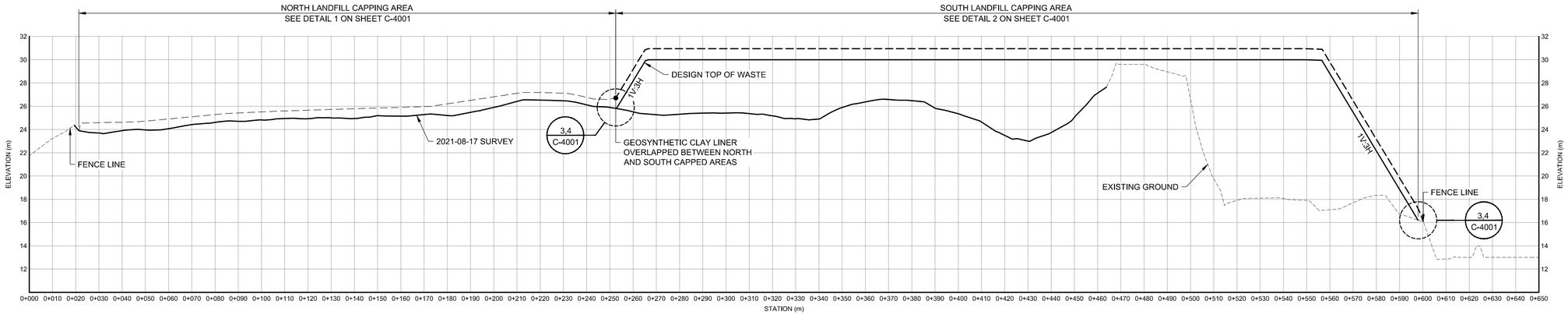
SHEET TITLE

WEST 40 LANDFILL
EXISTING DITCH AND PONDS FILL
GRADING PLAN AND PROFILE

SHEET NUMBER

C-2001



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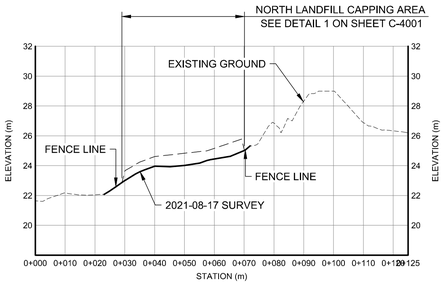

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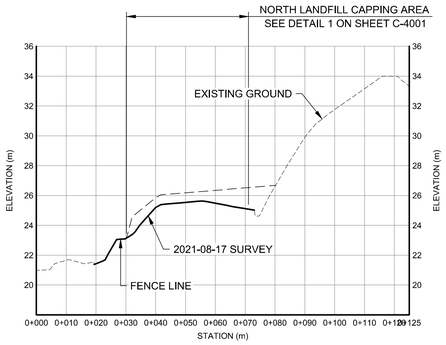

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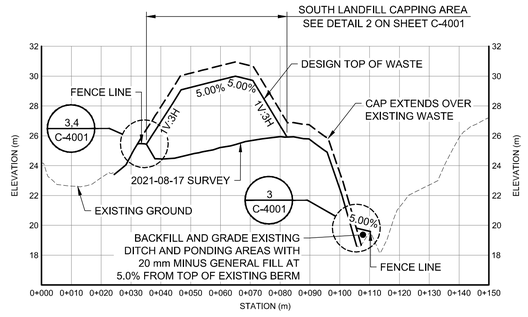

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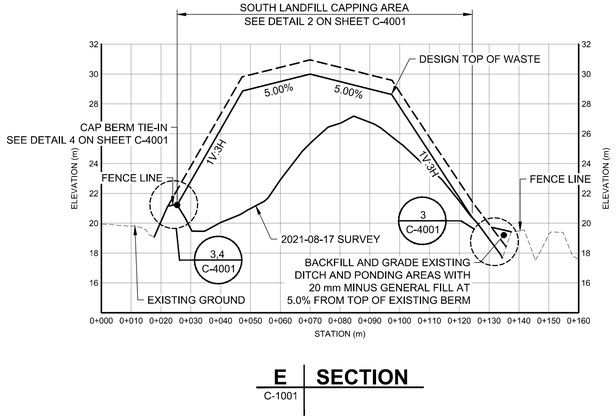

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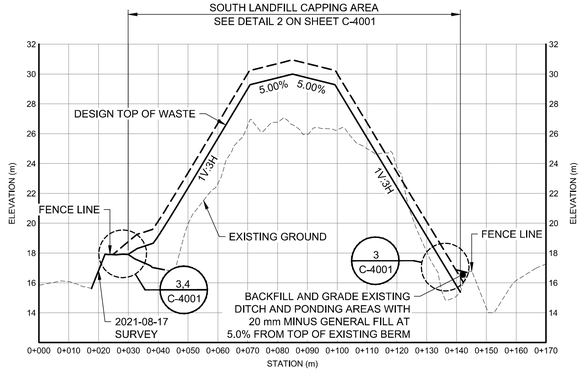

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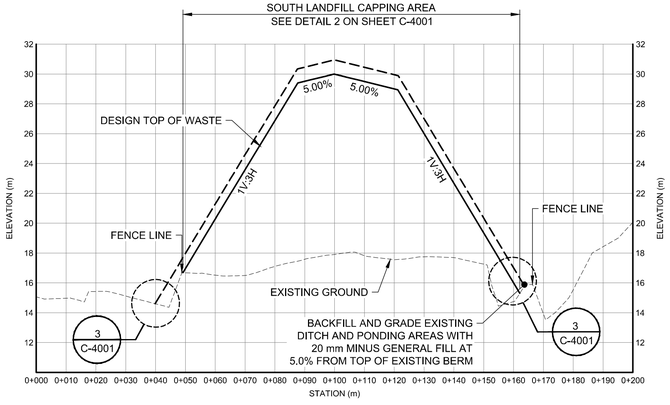

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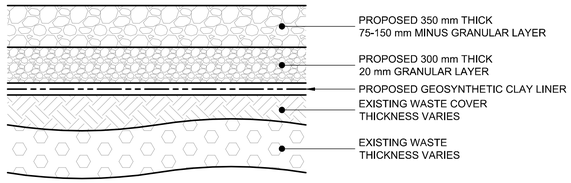
WEST 40 LANDFILL
FINAL CAPPING SECTIONS

SHEET NUMBER

C-3001



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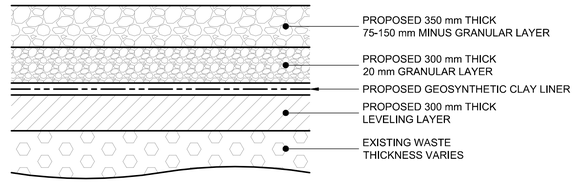

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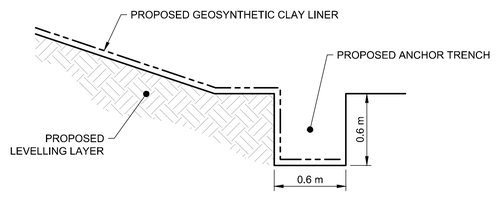

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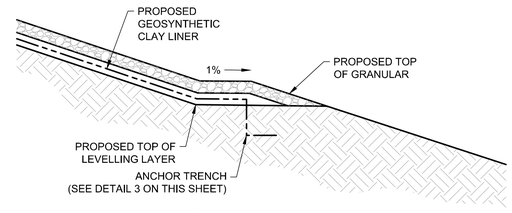

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