January 20, 2005 Project No.: LFM (1.14)

VIA E-MAIL (LICENSING@NWB.NUNAVUT.CA)

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

Dear Ms. Beaulieu:

RE: Water Use Licence Application for the Landfill Monitoring at the former CAM-M, Cambridge Bay DEW Line Site

UMA Engineering Ltd. is submitting the enclosed water use licence application for the landfill monitoring at the former CAM-M, Cambridge Bay DEW Line Site. The application is being submitted on behalf of Defence Construction Canada and the Department of National Defence.

If you have any questions or comments, please do not hesitate to contact the undersigned at 403-270-9220.

Sincerely,

UMA ENGINEERING LTD.

Eva Schulz, P.Ag.
Environmental Scientist
eschulz@umagroup.com

Encl. Water Use Licence Application
Post - Construction Landfill Monitoring Program

cc: Phil Warren, DCC

P.O. BOX 119
GJOA HAVEN, NU X0E 1J0
TEL: (867) 360-6338
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NUNAVUT IMALIRIYIN

WATER LICENCE APPLICATION FORM

Application for: (check one)

✓**New** ___ **Amendment** ___**Renewal** ___**Assignment**

LICENCE NO:
(for NWB use only)

1. NAME AND MAILING ADDRESS OF APPLICANT/LICENSEE

Phil Warren, P.Eng
Environmental Officer
Defence Construction Canada Ltd.
Constitution Square, Suite 1720
350 Albert Street
Ottawa, Ontario K1A 0K3

Phone: 613-998-7288
Fax: 613-998-0468
e-mail: Philip.Warren@dcc-cdc.gc.ca

as administered by:
Eva Schulz, P.Ag., Environmental Scientist
2540 Kensington Road NW
UMA Engineering Ltd.
Calgary, Alberta T2N 3S3

Phone: 403-270-9200
Fax: 403-270-0399
e-mail: eschulz@umagroup.com

2. ADDRESS OF CORPORATE OFFICE IN CANADA (if applicable)

Phone:_____
Fax: _____
e-mail: _____

3. LOCATION OF UNDERTAKING (describe and attach a topographical map, indicating the main components of the Undertaking)

The CAM-M Cambridge Bay DEW Line site is located on the southern coast of Victoria Island. The community of Cambridge Bay is located approximately 3 km east of the site.

Latitude: 69°07'N Longitude: 105°07'W NTS Map No.____ Scale 1:50,000

4. DESCRIPTION OF UNDERTAKING (attach plans and drawings)

The purpose of the project is to collect sufficient information to assess the performance of the landfills from a geotechnical and environmental perspective. The landfill monitoring plan specifies the requirements for visual inspection, and chemical and thermal monitoring of landfills.

5. TYPE OF UNDERTAKING (A supplementary questionnaire must be submitted with the application for

undertakings listed in **"bold"**)

___ Industrial
___ **Mine Development**
___ **Advanced Exploration**
___ **Exploratory Drilling**
___**Remote/Tourism Camps**
___ **Municipal**
___ Power
✓ Other (describe): landfill monitoring, including the collection of soil and groundwater samples.

6. WATER USE

___To obtain water
___ To modify the bed or bank of a watercourse
To alter the flow of, or store, water
___ To cross a watercourse
___To divert a watercourse
___ Flood control
✓ Other (describe): to obtain groundwater samples

7. QUANTITY OF WATER INVOLVED (litres per second**,** litres per day or cubic metres per year, including both quantity to be used and quality to be returned to source)

It is anticipated that the contractor will use commercial accommodations and will not require any water.

8. WASTE (for each type of waste describe: composition, quantity, methods of treatment and disposal, etc.)

Sewage
✓ Solid Waste
Hazardous
Bulky Items/Scrap Metal
Waste oil
Greywater
Sludges
Other (describe):_____

Because of the short duration required for the work, it is anticipated that the contractor will stay at a commercial facility in Cambridge Bay. Any solid wastes generated during the work program will be disposed of in the Cambridge Bay municipal landfill.

9. PERSONS OR PROPERTIES AFFECTED BY THIS UNDERTAKING (give name, mailing address and location; attach if necessary)

Land Use Permit

DIAND Yes ✓ No If no, date expected _____

There are no triggers in the work program for a land use permit, therefore, it is not required.

Regional Inuit Association ___ Yes No If no, date expected _____

Commissioner ___ Yes No If no, date expected _____

10. PREDICTED ENVIRONMENTAL IMPACTS OF UNDERTAKING AND PROPOSED MITIGATION MEASURES (direct, indirect, cumulative impacts, etc.)

NIRB Screening ✓ Yes ___ No If no, date expected.

Submitted to NIRB and currently under review.

11. INUIT WATER RIGHTS

Will the project or activity substantially affect the quality, quantity, or flow of water flowing through Inuit Owned Lands and the rights of Inuit under Article 20 of the Nunavut Land Claims Agreement?

N/A

11. (Continued)

If yes, has the applicant entered into an agreement with the Designated Inuit organization to pay compensation for any loss or damage that may be caused by the alteration. If no compensation agreement has been made, how will compensation be determined?

N/A

12. CONTRACTORS AND SUB-CONTRACTORS (name, address and functions)

The contract for the next phase of this work has not yet been tendered or awarded. Therefore, the names, addresses and functions of the contractors and sub-contractors are not available at this time.

13. STUDIES UNDERTAKEN TO DATE (list and attach copies of studies, reports, research, etc.)
A site investigation was completed in 1996, and the clean up of the site was completed in 1999. An environmental screening report was submitted to the NIRB in 1998 for all of the DEW Line sites in Nunavut.

14. THE FOLLOWING DOCUMENTS MUST BE INCLUDED WITH THE APPLICATION FOR THE REGULATORY PROCESS TO BEGIN

Supplementary Questionnaire (where applicable: see section 5) Yes ✓ No If no, date expected _____

Inuktitut/English Summary of Project ✓ Yes No If no, date expected _____

Application fee $30.00 (c/o of Receiver General for Canada) Yes ✓ No If no, date expected. Because the application is being submitted in behalf of a federal proponent, no application fees are required.

15. PROPOSED TIME SCHEDULE

___ Annual (or) ✓ Multi Year

Start Date: July 2005 Completion Date: October 2020

Eva Schulz	**Environmental Scientist**		**January 20, 2005**
Name (Print)	**Title (Print)**	**Signature**	**Date**

For Nunavut Water Board use only

APPLICATION FEE **Amount: $_____** **Receipt No.:**

WATER USE DEPOSIT **Amount: $_____** **Receipt No.:**

Defence Construction Canada

Landfill Monitoring Program

CAM-M, Cambridge Bay

Landfill Monitoring at CAM-M

Prepared by:

UMA Engineering Ltd.
2540 Kensington Road NW
Calgary, AB T2N 3S3

January 2005

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1.0 Post-Construction Monitoring Program

1.1 INTRODUCTION

The following summary is being provided for the post-construction landfill monitoring program as described in the DND-NTI Environmental Cooperation Agreement for the former CAM-M, Cambridge Bay DEW Line site. Information on both the development and review process for the program, as well as the specific components of the program are included.

1.2 BACKGROUND

The Department of National Defence (DND), in cooperation with Nunavut Tunngavik Incorporated (NTI), developed a landfill monitoring plan to address post closure monitoring requirements for the landfills at the DEW Line Sites (DND/NTI Cooperation Agreement – Environmental Provisions). Defence Construction Canada (DCC) is managing the cleanup and monitoring programs on behalf of DND.

The objective of the landfill monitoring program is to collect sufficient information to assess the performance of the landfills from a geotechnical and environmental perspective. The landfill monitoring plan specifies the requirements for visual inspection, and chemical and thermal monitoring of landfills at the DEW Line sites under DND's jurisdiction.

1.3 PROGRAM COMPONENTS

The post-construction landfill monitoring program consists of four main components to measure the performance of the landfills, depending on the remedation plan for each landfill. These components are visual, soil, active layer water and thermal monitoring. Details on each of the monitoring components are provided below.

Visual Monitoring: The physical integrity of the landfill is inspected and reported using hand-drawn sketches. Documented observations include:

- Evidence of settlement, ponding, frost action, erosion, and lateral movement.
- Sloughing of berms/covering layers, thermal contraction cracks, etc.

Photographic records are to be provided to document the general condition of the landfill and to substantiate all recorded observations. The location of all photographic viewpoints will be referenced to existing monuments.

Soil and Active Layer Water Monitoring: The soil and active layer water monitoring program consists of baseline/background assessment and contaminant evaluation. Background conditions

represent soil and water quality from an area not impacted by the landfill. Background (naturally occurring) values are obtained from samples collected from areas that were not directly influenced by activities at the DEW Line site, but are indicative of the prevailing geochemistry. These samples are taken hydraulically upgradient and at some distance from the landfill. Baseline conditions refer to existing soil and water quality at the landfill area, prior to any remediation and/or construction work being carried out. These samples are generally collected from areas both up and downgradient of the landfill.

Soil and active layer water samples (where required) are collected prior to construction/closure of a landfill, to represent background as well as baseline conditions. The results of subsequent landfill monitoring events are compared to these baseline and background values to evaluate any potential changes in environmental conditions.

In general, one monitoring well was installed upgradient and two to three wells were installed downgradient of each landfill during the construction phase. Using water elevation data from a minimum of three wells allows assessment of the hydraulic gradient and flow velocities. Review of analytical data from water samples collected from wells up and down gradient allows evaluation of potential impacts associated with the landfill. Soil samples are collected from the toe of the landfill, generally from the same locations as the monitoring wells. Contamination in soil samples at the toe of the landfill reflects chronic input from water that may have infiltrated the landfill, and is an important factor of contaminated leachate.

Prior to collection of samples from a monitoring well, the well is purged and allowed to reach equilibrium. Physical measurements are collected prior to and after purging and are referenced to the top of the monitoring well pipe. The measured physical parameters include:

- Water elevation;
- Total depth of water;
- Presence of hydrocarbons;
- Hydrocarbon layer thickness (if appropriate);
- Colour, odour;
- pH;
- Conductivity; and
- Temperature.

Thermal Monitoring: Geothermal analysis were carried out as part of the design to predict the length of time required for permafrost aggradation through landfills requiring leachate containment, including the Tier II Soil Disposal Facility. These analyses also provided information on the long and short term thermal regime in the ground, and the depth of the active layer in the cover material.

A thermal monitoring system provides measurement of sub-surface ground temperatures, which allows comparison to and verification of the predicted ground temperatures. The thermal monitoring system consists of installation of thermistor strings, with thermistor beads at selected intervals to provide ground temperature profiles at various locations within the landfill. The thermistor strings are attached to automated data-loggers that allow for remote data collection. In general, a minimum of three thermistors are installed at each landfill where permafrost aggradation through the landfill contents is an integral part of the design.

1.4 FREQUENCY

The landfill monitoring program consists of three phases, as described in detail below.

1.4.1 Phase I

Phase I involves monitoring of conditions to confirm that equilibrium is achieved. The frequency of monitoring events during Phase I monitoring is dependent on the closure or remediation design at specific landfills. The Main Landfill – North, Main Landfill – South and the Tier II soils disposal facility have been monitored on an annual basis for the last four years and are in the last year of Phase I monitoring. The five-year term was selected on the basis that ground-temperature thermal regimes at these specific landfills will require three to five years to reach equilibrium.

The South Shore Landfill, West Landfill and Airstrip Landfill were regraded, and the Phase I monitoring was carried out over a reduced frequency in the first, third and fifth years following construction.

An evaluation of all Phase I data will be carried out at the end of five years to confirm that thermal and chemical equilibrium had been achieved, and that no stability issues had been identified. The Phase I monitoring program may be extended, if required, to provide sufficient data to establish equilibrium conditions.

The first year of the Phase I post-construction monitoring is completed by the Environmental Sciences Group (ESG) of the Royal Military College of Canada, who are part of the DEW Line Clean Up Project Team. Subsequent landfill monitoring events are carried out by independent contractors, who successfully win the competitive tender.

1.4.2 Phase II

Phase II monitoring is the verification of equilibrium conditions established in Phase I. The monitoring frequency in Phase II is downgraded from Phase I and will be carried out according to the following schedule, year 7, year 10, year 15 and year 25. Year 25 marks the end of Phase II monitoring.

1.4.3 Phase III

Phase III involves the monitoring for long-term issues such as liner integrity, permafrost stability, and significant storm events. At the end of the Phase II program, 25 years after construction, a re-evaluation of the landfill monitoring program will be carried out prior to initiating any Phase III program. The scope of the Phase III monitoring program is not included here, but is anticipated to be based on a 10 year monitoring interval.

1.5 REVIEW AND EVALUATION PROCESS

An Environmental Working Group (EWG) was established to provide a technical report and to support to the DLCU Steering Committee. This working group is comprised of qualified engineering and environmental scientists with expertise in environmental remediation and clean up in northern climates. The EWG has four designated representatives, two from each of the Owner (DND) and the Inuit (through the NTI), respectively.

During the monitoring program, the EWG reviews the results of the monitoring program in accordance with the methodology as described previously. The results of the review and any recommendations regarding changes to the monitoring plan and/or remediation requirements are reported to the DND/NTI Steering Committee.

The requirement for further monitoring after 25 years is evaluated. Monitoring may be terminated if the performance of the landfill was satisfactory over the period of monitoring from an environmental, geotechnical and thermal perspective, as appropriate. The assessment of satisfactory performance is carried out jointly by the NTI and DND.

2.0 Detailed Landfill Monitoring Requirements

The following sections provide a summary and the detailed monitoring requirement for each landfill at CAM-M.

2.1 MAIN-LANDFILL – NORTH

The Main Landfill – North is located to the east of the main station facilities, and encompasses an area of approximately 10,000 m^2. Based on the evaluation of the landfill as a source of

contamination, potential pathways, and receptors, consistent with the Landfill Evaluation Matrix, the Main Landfill - North was classified as moderate potential environmental risk. The remediation for this landfill included installation of a leachate containment system along the toe of the landfill and regrading with the placement of additional granular fill sufficient to cause permafrost aggradation through the landfill contents.

The long term monitoring plan consists of visual monitoring for signs of settlement, collection of soil and groundwater samples to evaluate the effectiveness of the leachate containment system, and monitoring of sub-surface ground temperatures along the toe and in the main body of the landfill. Table 1 provides the coordinates of the monitoring stations, while Table 2 provides the detailed monitoring requirements at the Main Landfill - north. See Figure CAM-M.2 for details.

Table 1: Monitoring Station Coordinates at the Main Landfill - North

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
MW-4 (soil & groundwater)	10232	10568	14.0
MW-5 (soil & groundwater)	10294	10634	8.9
MW-6 (soil & groundwater)	10336	10571	10.0
MW-7 (soil & groundwater)	10420	10453	10.9
MW-8 (soil & groundwater)	10254	10427	16.5
ITN1 (temperature)	10374.6	10503.3	13.1
ITN2 (temperature)	10313.7	10549.9	12.2
VT1 (temperature)	10337.2	10521.6	13.7
VT2 (temperature)	10284.2	10568.8	15.3
VT3 (temperature)	10365.7	10418.3	15.7

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations. Monitoring well and thermistor coordinates are as provided by the cleanup contractor's survey.

Table 2: Detailed Monitoring Requirements at the Main Landfill – North

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
MW-4 → MW-8	Groundwater	Once per year in years 5, 7, 10, 15, 25 post-construction	Total Arsenic
			Total Cadmium
			Total Chromium
			Total Cobalt
			Total Copper
			Total Lead
			Total Nickel
			Total Zinc
			Total Mercury
			PCBs
			Total Petroleum Hydrocarbons (C_6-C_{32})
MW-4 → MW-8	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C_6-C_{10})
			TPH as F2 (C_{10}-C_{16})
			TPH as F3 (C_{16} to C_{34})
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury
ITN1, ITN2, VT1, VT2, VT3	Thermal	Once per year in years 5, 7, 10, 15, 25 post-construction	Temperature

2.2 MAIN LANDFILL - SOUTH

The Main Landfill – South is located to the east of the main station facilities, and encompasses an area of approximately 15,000 m^2. Based on the evaluation of the landfill as a source of contamination, potential pathways, and receptors, consistent with the Landfill Evaluation Matrix, the

Main Landfill – South was classified as moderate potential environmental risk. The remediation for this landfill included installation of a leachate containment system along the toe of the landfill and regrading with the placement of additional granular fill sufficient to create permafrost aggradation through the landfill contents.

The long term monitoring plan consists of visual monitoring for signs of settlement, collection of soil and groundwater samples to evaluate the effectiveness of the leachate containment system, and monitoring of sub-surface ground temperatures along the toe and in the main body of the landfill. Table 3 provides the coordinates of the monitoring stations and Table 4 provides the detailed monitoring requirements at the Main Landfill – South. See Figure CAM-M.3 for details.

Table 3: Monitoring Station Coordinates at the Main Landfill - South

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
MW-1 (soil & groundwater)	10009	10340	10.2
MW-2 (soil & groundwater)	10034	10448	-
MW-3 (soil & groundwater)	10114	10515	-
MW-9 (soil & groundwater)	10140	10180	20.4
MW-14 (soil & groundwater)	10020	10389	8.0
ITS1 (temperature)	10110.8	10447.7	-
ITS2 (temperature)	10061.7	10398.7	-
VT4 (temperature)	10111.2	10384.6	16.5
VT5 (temperature)	10055.9	10400.8	11.5

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations. Monitoring well and thermistor coordinates are as provided by the cleanup contractor's survey.

Table 4: Detailed Monitoring Requirements at the Main Landfill – South

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
MW-1 → MW-3, MW-9, MW-13	Groundwater	Once per year in years 5, 7, 10, 15, 25 post-construction	Total Arsenic
			Total Cadmium
			Total Chromium
			Total Cobalt
			Total Copper
			Total Lead
			Total Nickel
			Total Zinc
			Total Mercury
			PCBs
			Total Petroleum Hydrocarbons (C_6-C_{32})
MW-1 → MW-3, MW-9, MW-13	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C6-C10)
			TPH as F2 (C10-C16)
			TPH as F3 (C16 to C34)
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury
ITS1, IT22, VT4, VT5	Thermal	Once per year in years 5, 7, 10, 15, 25 post-construction	Temperature

2.3 TIER II SOIL DISPOSAL FACILITY

A DCC Tier II Soil Disposal Facility was constructed at the CAM-M site for the disposal of Tier II contaminated soils excavated during the cleanup. The location of the Tier II Soil Disposal Facility is approximately two kilometres northwest of the Station Area.

Consistent with Environmental Provisions of the Cooperation Agreement, monitoring of the Tier II soil disposal facility consists of visual monitoring for evidence of settlement, erosion, differential movement, collection of soil and groundwater samples from around the facility to monitor the effectiveness of the containment system, and monitoring of sub-surface ground temperatures in the berms and in the main body of the disposal facility.

Table 5 provides the coordinates of the monitoring stations and Table 6 provides the detailed monitoring requirements at the Tier II Soil Disposal Facility. See Figure CAM-M.6 for details.

Table 5: Monitoring Station Coordinates at the Tier II Soil Disposal Facility

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
MW-10 (soil & groundwater)	11976	8962	43.6
MW-11 (soil & groundwater)	12034	9096	35.1
MW-12 (soil & groundwater)	12078	9053	34.9
MW-13 (soil & groundwater)	12114	8976	35.3
TA1 (temperature)	12007.3	8993.5	43.8
TA2 (temperature)	12016.8	9037.1	43.4
TA3 (temperature)	12066.6	8984.7	43.0
TA4 (temperature)	12035.0	8953.8	44.2

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations. Monitoring well and thermistor coordinates are as provided by the cleanup contractor's survey.

Table 6: Detailed Monitoring Requirements at the Tier II Soil Disposal Facility

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
MW-10 → MW-13	Groundwater	Once per year in years 5, 7, 10, 15, 25 post-construction	Total Arsenic
			Total Cadmium
			Total Chromium

			Total Cobalt
			Total Copper
			Total Lead
			Total Nickel
			Total Zinc
			Total Mercury
			PCBs
			Total Petroleum Hydrocarbons (C_6-C_{32})
MW-10 → MW-13	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C6-C10)
			TPH as F2 (C10-C16)
			TPH as F3 (C16 to C34)
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury
TA1 → TA4	Thermal	Once per year in years 5, 7, 10, 15, 25 post-construction	Temperature

2.4 SOUTH SHORE LANDFILL

The South Shore Landfill is located approximately two kilometres east of the main facilities, near the POL Beach Staging area. No evidence of leachate was identified, nor was any contaminated soil detected in the area of the landfill. Based on the evaluation of the landfill as a source of contamination, potential pathways, and receptors, consistent with the Landfill Evaluation Matrix, the South Shore Landfill was classified as moderate potential environmental risk. However, based on discussions with residents of Cambridge Bay, representing the NTI, the risk potential of the landfill was re-assessed as low. The remediation for this landfill included regrading with the placement of additional granular fill.

The long term monitoring plan consists of visual monitoring for signs of settlement, and periodic collection of soil samples to monitor for the presence of leachate. Table 7 provides the coordinates of the monitoring stations, while Table 8 provides the detailed monitoring requirements at the South Shore Landfill. See Figure CAM-M.4 for details.

Table 7: Monitoring Station Coordinates at the South Shore Landfill

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
CM-1 (soil)	8820	10900	-
CM-2 (soil)	8850	11050	-
CM-3 (soil)	8800	11040	-
CM-4 (soil)	8730	10990	-

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations.

Table 8: Detailed Monitoring Requirements at the South Shore Landfill

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
CM1 → CM4	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C6-C10)
			TPH as F2 (C10-C16)
			TPH as F3 (C16 to C34)
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury

2.5 WEST LANDFILL

The West Landfill is located approximately 600 metres northwest of the main station facilities, and encompasses an area of approximately 4500 m^2. No evidence of leachate was identified in the area. Based on the evaluation of the landfill as a source of contamination, potential pathways, and receptors, consistent with the Landfill Evaluation Matrix, the West Landfill was classified as low potential environmental risk. The remediation for this landfill included regrading with the placement of additional granular fill.

The long term monitoring plan consists of visual monitoring for signs of settlement, and periodic collection of soil samples to monitor for the presence of leachate. Table 9 provides the coordinates of the monitoring stations and Table 10 provides the detailed monitoring requirements at the West Landfill. See Figure CAM-M.5 for details.

Table 9: Monitoring Station Coordinates at the West Landfill

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
CM-5 (soil)	10900	9140	-
CM-6 (soil)	10950	9160	-
CM-7 (soil)	10920	9220	-

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations.

Table 10: Detailed Monitoring Requirements at the West Landfill

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
CM5 → CM7	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C6-C10)
			TPH as F2 (C10-C16)
			TPH as F3 (C16 to C34)
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury

2.6 AIRSTRIP LANDFILL

The Airstrip Landfill is located southwest of the airstrip, along the edge of the West Arm of Cambridge Bay. The disturbed area associated with the landfill extends along the road over a length of two kilometres. Based on the available information, the landfill was classified as moderate potential environmental risk. To address the contributing risk factors, the remediation for this landfill included: removal of surface debris, excavation of contaminated soils, removal of pockets of buried materials that were associated with contaminated areas, regrading with the placement of additional fill material at remaining pockets of buried material.

The long term monitoring plan consists of visual monitoring for signs of settlement, and/or other disturbance, and periodic collection of soil samples to monitor for the presence of leachate. Table 11 provides the coordinates of the monitoring stations at the Airstrip Landfill. Table 12 provides the detailed monitoring requirements at the Airstrip Landfill. See Figure CAM-M.7 for details.

Table 11: Monitoring Station Coordinates at the Airstrip Landfill

Landfill Monitoring Station Coordinates	Coordinates		Elevation (masl)
	North (m)	East (m)	
CM-8 (soil)	9720	7610	-
CM-9 (soil)	9600	8000	-
CM-10 (soil)	9410	8280	-
CM-11 (soil)	9510	7860	-
CM-12 (soil)	9520	7570	-
CM-13 (soil)	9550	7270	-

NOTE: Coordinates are referenced to a local site grid and are approximate only for the soil sampling locations.

Table 12: Detailed Monitoring Requirements at the Airstrip Landfill

Location	Sample Type	Frequency	Parameters
Determined on site	Visual	Once per year in years 5, 7, 10, 15, 25 post-construction	N/A
CM8 → CM13	Soil	Once per year in years 5, 7, 10, 15, 25 post-construction	PCBs
			TPH as F1 (C6-C10)
			TPH as F2 (C10-C16)
			TPH as F3 (C16 to C34)
			Arsenic
			Cadmium
			Chromium
			Cobalt
			Copper
			Lead
			Nickel
			Zinc
			Mercury

LANDS - WATER LOTS OUTSIDE OF THE BOUNDARIES ARE UNDER GOVERNMENT OF NUNAVUT JURISDICTION WITHIN THE HAMLET OF CAMBRIDGE BAY (NOT ALL LANDOWNERS SHOWN)

491000M. E.

76 69000M. N.

Custodian: DND

Transfer of Administration
Survey Plan 81022 CLSR 3120 LTO

Custodian: DIAND

Reserve 1853
Reserve requested by DND
Established by DIAND

Custodian: DIAND

Part of Original Reserve
Now part of Reserve 1853

RESERVE 1853

LOT 1006

LOT 1001

Custodian: Government of Nunavut (Airports)

Consolidation of Commissioner's Airport Lands Regulations. Survey Plan 67506 CLSR 1454 LTO

Custodian: Government of Nunavut (Airports)

Consolidation of Commissioner's Airport Lands Regulations. Survey Plan 57234 CLSR 733 LTO

LOT 9

LOT 1004

LOT 1007

Monument

ORIGINAL RESERVE

LOT 1005

Custodian: DND

Transfer of Administration
Survey Plan 81022 CLSR 3120 LTO

Custodian: DIAND

Original Reserve requested by DND 57/11/19
Established by DIAND 57/12/06
Absorbed within Reserve 1853

Custodian: Government of Nunavut (Airports)

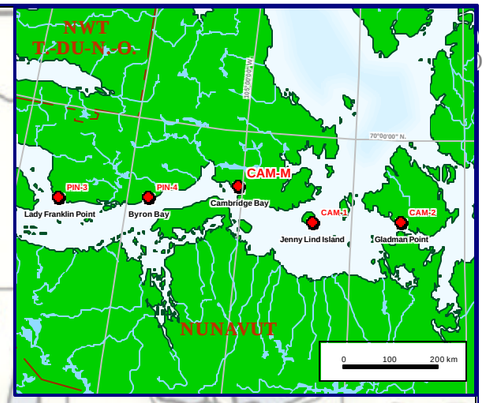
Consolidation of Commissioner's Airport Lands Regulations. Survey Plan 52449 CLSR 389 LTO

Custodian: DND

Waterlot
Transfer of Administration
Survey Plan 81022 CLSR 3120 LTO

491000M. E.

76 65000M. N.



Version 2.0

CAM-M

CAMBRIDGE BAY

FINAL

- Original Reserve / Réserve Originale
- Lot 9
- Lot 1001
- Lot 1004
- Lot 1005
- Lot 1006
- Lot 1007
- Reserve 1853 / Réserve 1853

The original reserve boundary was created using the USAF metes and bounds description. This description has inherent limitations (as demonstrated where it doesn't extend into the water). **The anomalies have been left on the map as the metes and bounds desc**ription was used to originally reserve the land for DND.

La limite de la réserve originale a été crée à partir de la description technique provenant de USAF. Cette description présente des anomalies évidentes comme le démontre les les parties ne rejoignant pas la côte. Ces anomalies ont été laissé sur la carte puisqu'elles proviennent de la description utilisée par le MDN afin d'établir l'emplacement réservé.

Not all landowners shown, especially outside of Reserve 1853 in the Community of Cambridge Bay. Not all of Reserve 1853 is shown as it covers approximately 103,600 hectares. Reserve 1853 created for the USAF Seismic Array and it is not a DewLine Facility .

Les propriétaires fonciers ne sont pas tous indiqués, spécialement ceux situés à l'extérieur de la Réserve 1853 dans la communauté de Cambridge Bay. La carte couvre seulement une partie de la réserve 1853 qui totalise approximativement 103 600 hectares. La Réserve 1853 a été créer pour le réseau sismique de USAF et ce n'est pas une installation du réseau DEW.

Carte de base : carte topographique 77 D/2 E (Échelle 1 : 50 000). Zone UTM 13. Publié par le service topographique de l'Armée, Corps royal du génie canadien, 1960.

Background information : Topographic map 77 D/2 E (Scale: 1: 50 000). UTM Zone 13. Produced by the Army Survey Establishment, Royal Canadian Engineers, 1960.

Scale / Échelle : 1 : 22 000

0 0,5 1 km

N W E S

This map is to be used for presentation purposes only.
This map is not a legal survey document.

Cette carte devrait être utilisé à des fins de présentation seulement.
Cette carte n'est pas un document d'arpentage légal.

Produced by: Real Property Geomatics Services, Real Property Services Branch, PWGSC, March, 2003.
Produit par: Services géomatiques immobiliers, Service des biens immobiliers, TPSGC, mars 2003

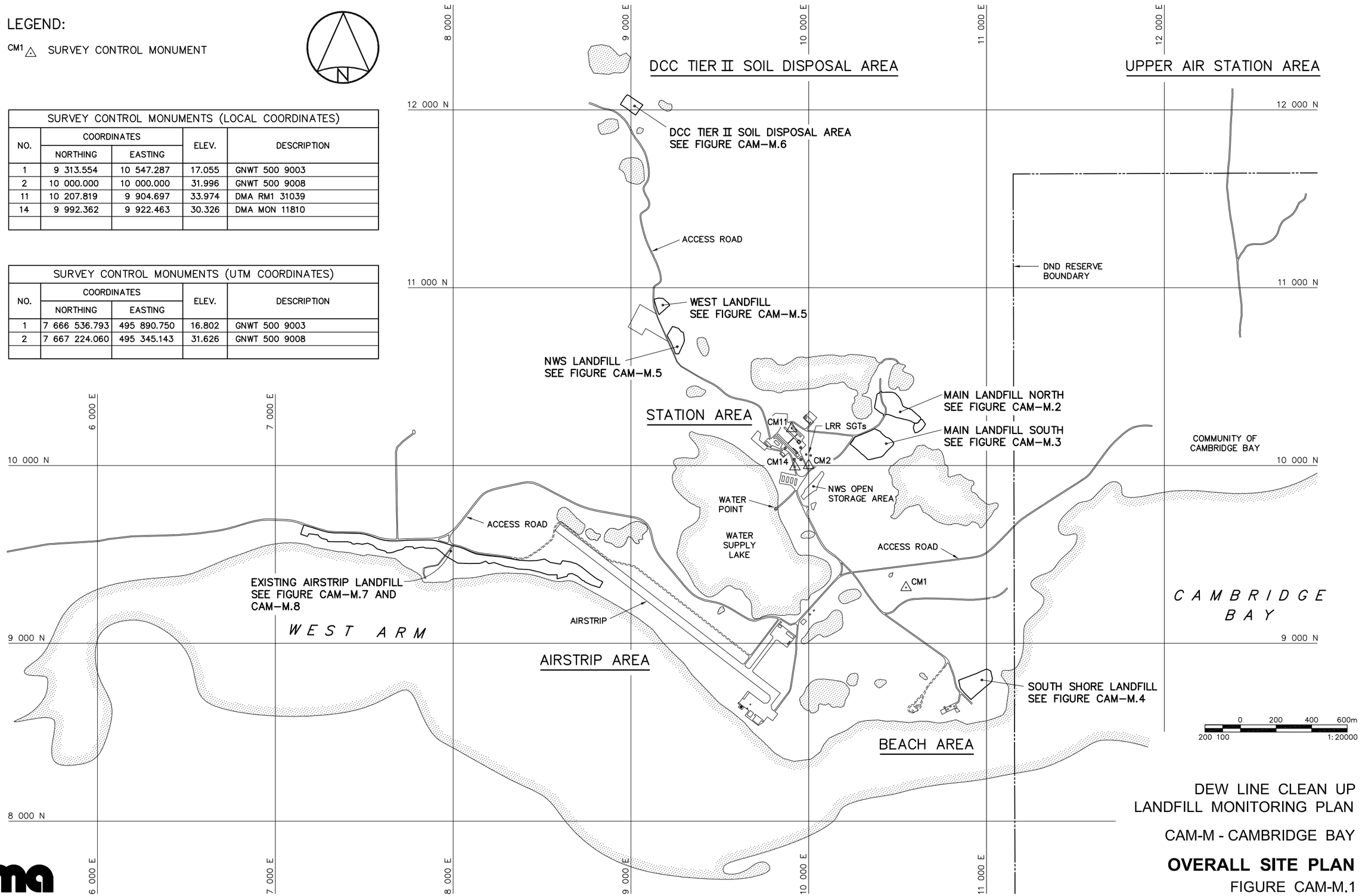
Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

LEGEND:

CM1 △ SURVEY CONTROL MONUMENT

SURVEY CONTROL MONUMENTS (LOCAL COORDINATES)				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
1	9 313.554	10 547.287	17.055	GNWT 500 9003
2	10 000.000	10 000.000	31.996	GNWT 500 9008
11	10 207.819	9 904.697	33.974	DMA RM1 31039
14	9 992.362	9 922.463	30.326	DMA MON 11810

SURVEY CONTROL MONUMENTS (UTM COORDINATES)				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
1	7 666 536.793	495 890.750	16.802	GNWT 500 9003
2	7 667 224.060	495 345.143	31.626	GNWT 500 9008



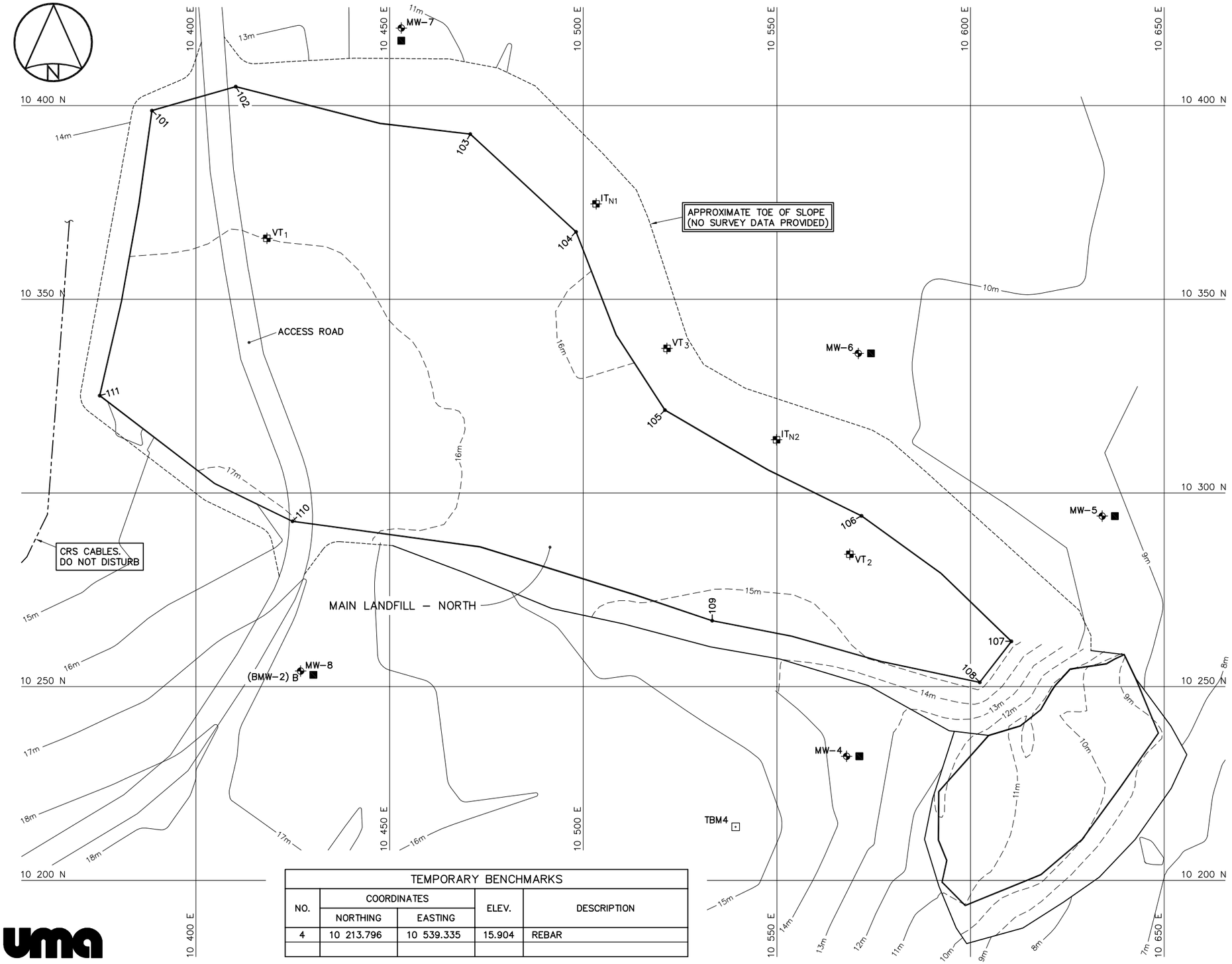
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

OVERALL SITE PLAN

FIGURE CAM-M.1

DOS NAME: CM-RD01.DWG CAE – 04/07/28



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- MONITORING WELL LOCATION
- VT — VERTICAL THERMISTOR
- IT — INCLINED THERMISTOR
- 101 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION

MONITORING WELLS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
MW–4	10 232	10 568	14.0
MW–5	10 294	10 634	8.9
MW–6	10 336	10 571	10.0
MW–7	10 420	10 453	10.9
MW–8	10 254	10 427	16.5

THERMISTORS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
ITN1	10 374.6	10 503.3	13.11
ITN2	10 313.7	10 549.9	12.23
VT1	10 365.7	10 418.3	15.68
VT2	10 284.2	10 568.8	15.27
VT3	10 337.2	10 521.6	13.73

COORDINATE POINTS			
NO.	COORDINATES		ELEV.
	NORTHING	EASTING	
101	10 398.7	10 388.6	15.4
102	10 404.9	10 410.3	15.0
103	10 392.6	10 470.8	15.6
104	10 367.4	10 498.1	15.9
105	10 321.4	10 521.1	15.6
106	10 294.1	10 571.8	15.2
107	10 261.7	10 610.6	15.4
108	10 251.1	10 602.4	15.5
109	10 267.0	10 533.3	14.8
110	10 292.7	10 424.9	17.0
111	10 325.1	10 375.1	16.6

0 10 20 30m
10 5 1:1000

TEMPORARY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
4	10 213.796	10 539.335	15.904	REBAR

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

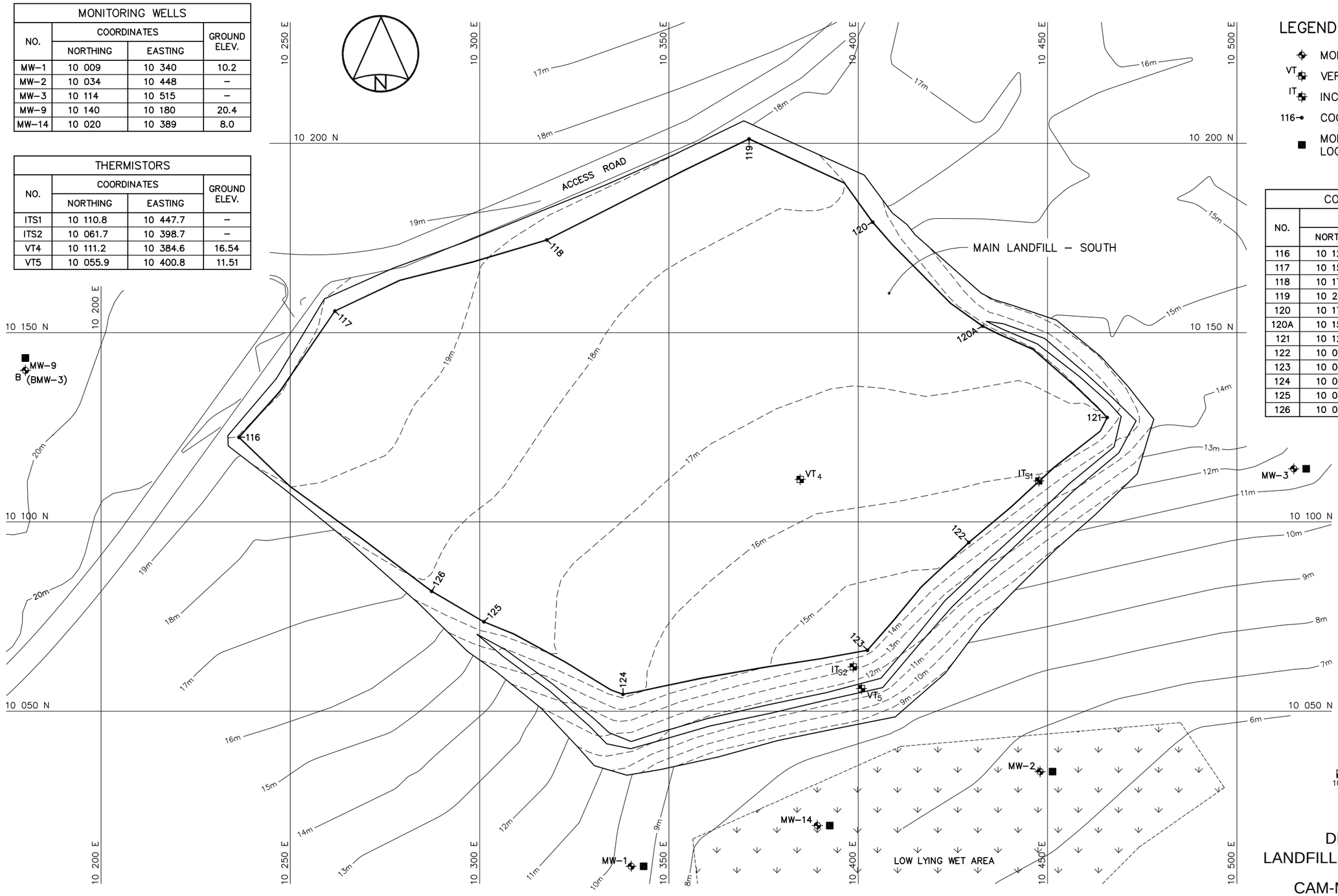
MAIN LANDFILL NORTH

FIGURE CAM-M.2

DOS NAME: CM-R002.DWG IC – 02/04/10

MONITORING WELLS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
MW–1	10 009	10 340	10.2
MW–2	10 034	10 448	–
MW–3	10 114	10 515	–
MW–9	10 140	10 180	20.4
MW–14	10 020	10 389	8.0

THERMISTORS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
ITS1	10 110.8	10 447.7	–
ITS2	10 061.7	10 398.7	–
VT4	10 111.2	10 384.6	16.54
VT5	10 055.9	10 400.8	11.51



LEGEND:

- MONITORING WELL LOCATION
- VT — VERTICAL THERMISTOR
- IT — INCLINED THERMISTOR
- 116 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION

COORDINATE POINTS			
NO.	COORDINATES		ELEV.
	NORTHING	EASTING	
116	10 122.3	10 236.4	19.9
117	10 155.7	10 261.8	19.8
118	10 174.5	10 317.7	18.5
119	10 201.2	10 371.2	18.6
120	10 179.2	10 403.8	17.6
120A	10 151.7	10 432.9	17.1
121	10 127.6	10 465.8	16.9
122	10 094.5	10 429.2	15.3
123	10 066.1	10 402.4	14.4
124	10 054.4	10 337.9	16.3
125	10 073.6	10 301.1	17.6
126	10 081.7	10 287.3	17.9

0 10 20 30m
10 5 1:1000

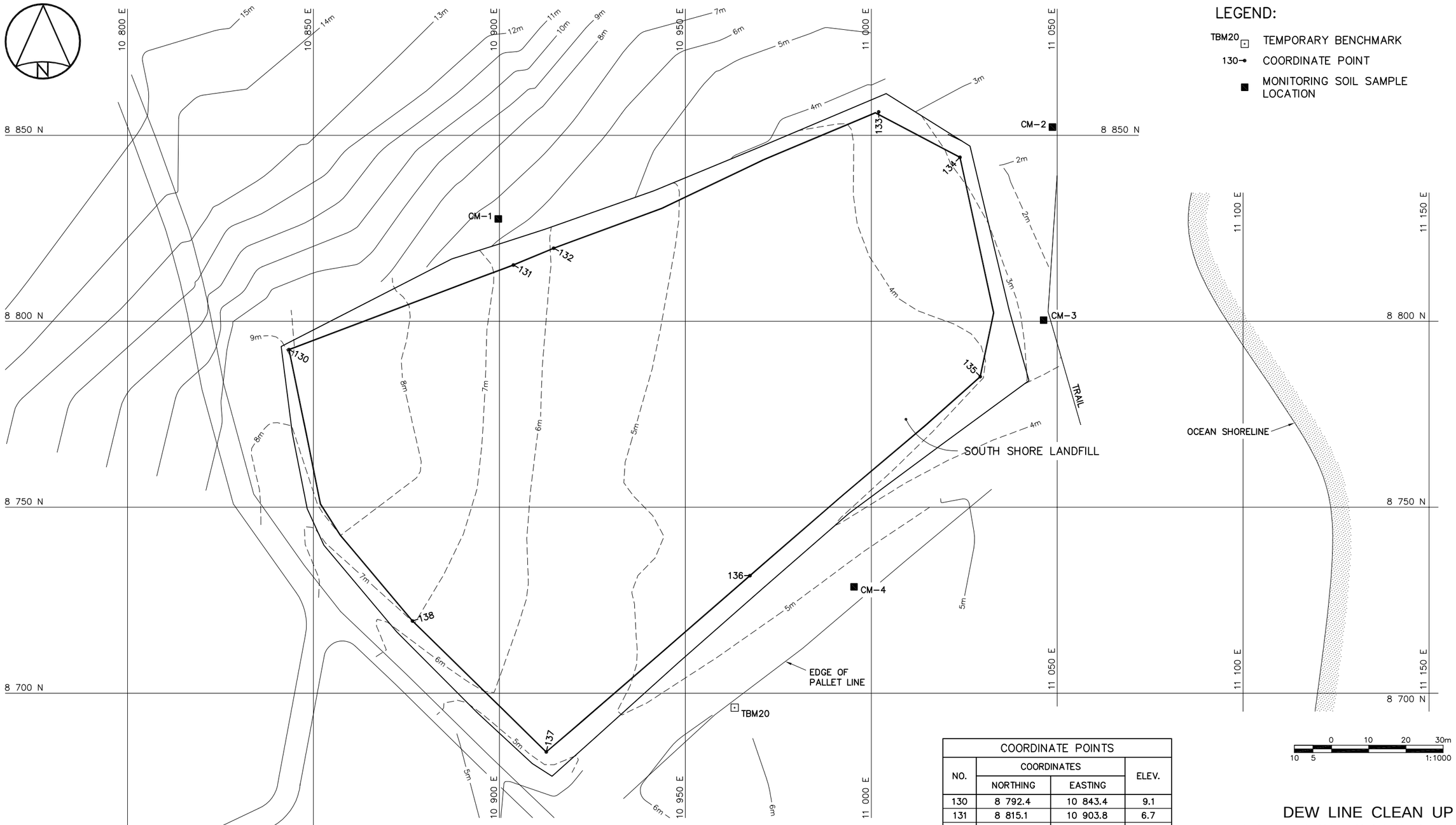
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

MAIN LANDFILL SOUTH

FIGURE CAM-M.3

DOS NAME: CM-R003.DWG IC – 02/04/10



TEMPORARY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
20	8 696.120	10 963.265	6.036	REBAR

COORDINATE POINTS			
NO.	COORDINATES		ELEV.
	NORTHING	EASTING	
130	8 792.4	10 843.4	9.1
131	8 815.1	10 903.8	6.7
132	8 819.6	10 914.6	5.9
133	8 856.3	11 002.0	3.9
134	8 844.1	11 023.9	2.8
135	8 785.1	11 029.3	4.1
136	8 731.6	10 967.4	4.7
137	8 684.2	10 912.6	5.5
138	8 719.4	10 876.6	7.0

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

SOUTH SHORE LANDFILL

FIGURE CAM-M.4

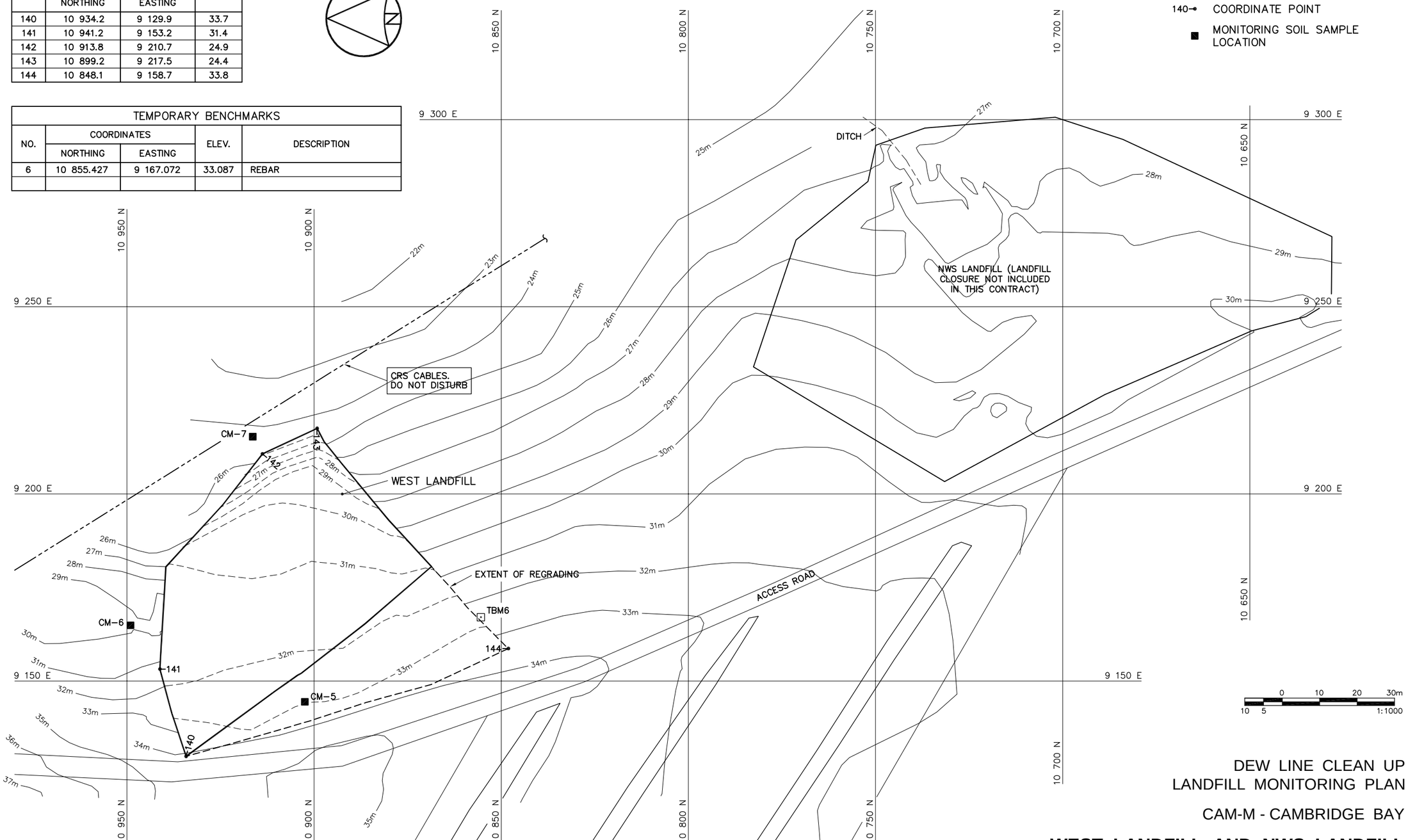
DGS NAME: CM-RD04.DWG IC - 02/04/10

COORDINATE POINTS			
NO.	COORDINATES		ELEV.
	NORTHING	EASTING	
140	10 934.2	9 129.9	33.7
141	10 941.2	9 153.2	31.4
142	10 913.8	9 210.7	24.9
143	10 899.2	9 217.5	24.4
144	10 848.1	9 158.7	33.8

TEMPORARY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
6	10 855.427	9 167.072	33.087	REBAR

LEGEND:

- TBM6 ⊡ TEMPORARY BENCHMARK
- 140 ⊸ COORDINATE POINT
- ■ MONITORING SOIL SAMPLE LOCATION



0 10 20 30m
10 5 1:1000

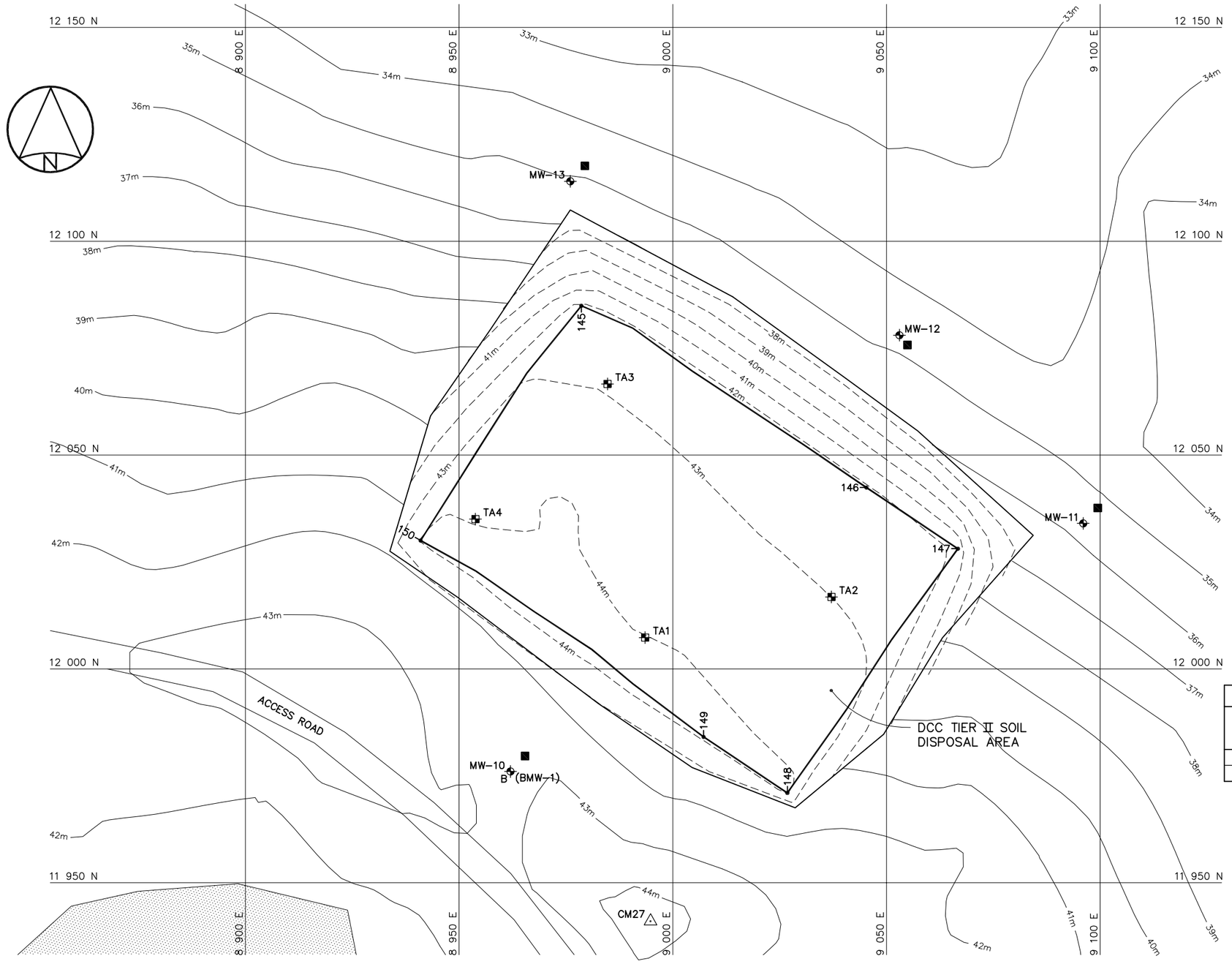
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

WEST LANDFILL AND NWS LANDFILL

FIGURE CAM-M.5

DGS NAME: CM-R005.DWG IC – 02/04/10



LEGEND:

- CM27 △ SURVEY CONTROL MONUMENT
- ⊕ MONITORING WELL LOCATION
- ⊕ THERMISTOR
- 145 • COORDINATE POINT
- ■ MONITORING SOIL SAMPLE LOCATION

MONITORING WELLS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
MW-10	11 976	8 962	43.6
MW-11	12 034	9 096	35.1
MW-12	12 078	9 053	34.9
MW-13	12 114	8 976	35.3

THERMISTORS			
NO.	COORDINATES		GROUND ELEV.
	NORTHING	EASTING	
TA1	12 007.3	8 993.5	43.8
TA2	12 016.8	9 037.1	43.4
TA3	12 066.6	8 984.7	43.0
TA4	12 035.0	8 953.8	44.2

COORDINATE POINTS			
NO.	COORDINATES		ELEV.
	NORTHING	EASTING	
145	12 084.9	8 978.6	42.4
146	12 042.4	9 045.3	42.2
147	12 028.1	9 066.7	41.8
148	11 971.0	9 026.8	44.1
149	11 984.1	9 007.2	44.1
150	12 030.0	8 941.0	44.1

SURVEY CONTROL MONUMENTS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
27	11 940.993	8 994.768	44.981	GNWT 500 9018

0 10 20 30m
10 5 1:1000

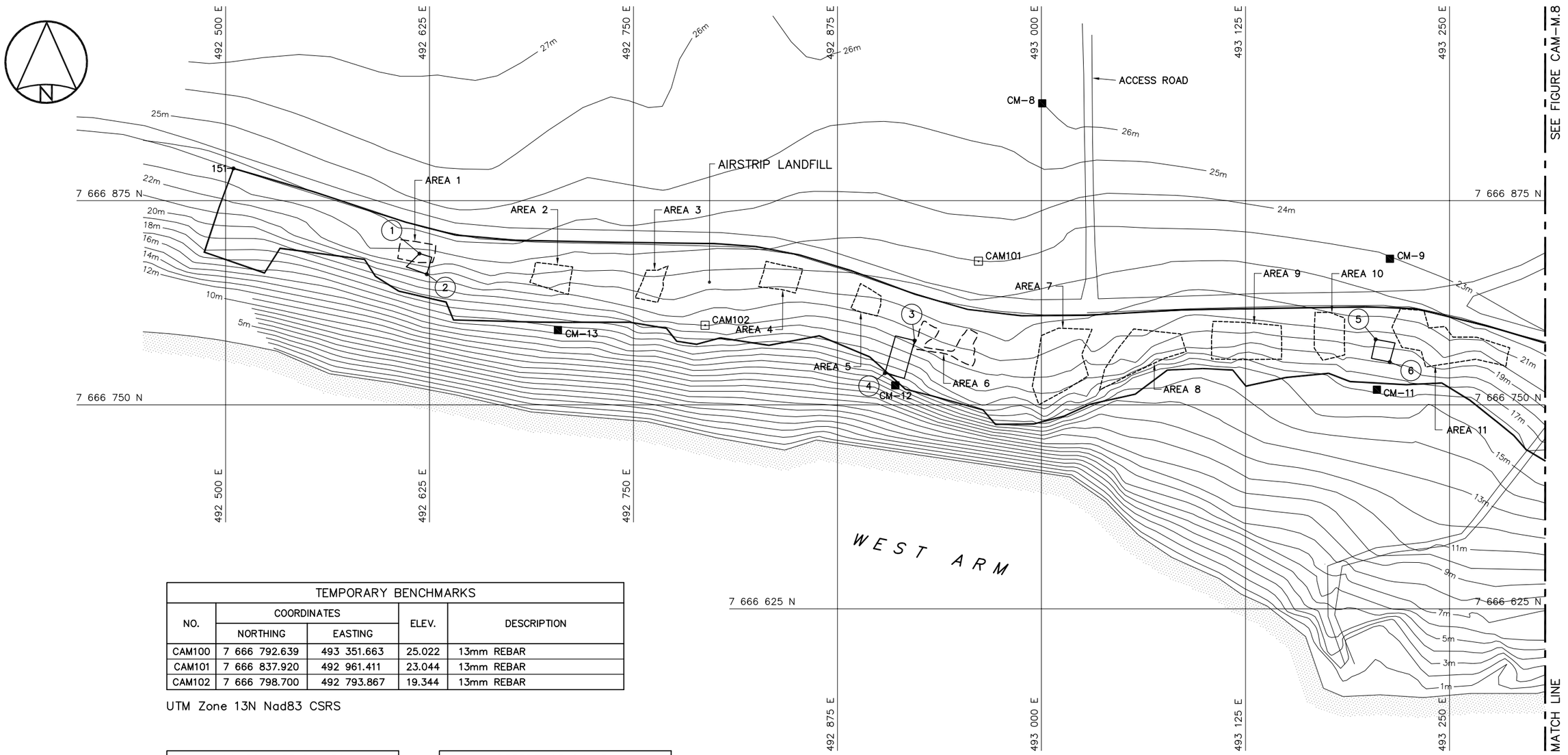
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

DCC TIER II SOIL DISPOSAL AREA

FIGURE CAM-M.6

DGS NAME: CM-RD06.DWG IC - 02/04/18



TEMPORARY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CAM100	7 666 792.639	493 351.663	25.022	13mm REBAR
CAM101	7 666 837.920	492 961.411	23.044	13mm REBAR
CAM102	7 666 798.700	492 793.867	19.344	13mm REBAR

UTM Zone 13N Nad83 CSRS

COORDINATE POINTS		
NO.	COORDINATES	
	NORTHING	EASTING
151	7 666 894.8	492 504.8

REFERENCE POINTS		
NO.	COORDINATES	
	NORTHING	EASTING
1	7 666 842.6	492 618.8
2	7 666 829.9	492 623.3
3	7 666 789.3	492 922.2
4	7 666 769.3	492 904.0
5	7 666 790.1	493 204.8
6	7 666 776.2	493 213.4

MONITORING LOCATIONS		
NO.	COORDINATES	
	NORTHING	EASTING
CM8	7 666 934.7	493 000.4
CM9	7 666 839.4	493 213.5
CM11	7 666 759.2	493 205.6
CM12	7 666 761.9	492 910.4
CM13	7 666 795.8	492 703.7

LEGEND:

- CAM101 — TEMPORARY BENCHMARK
- 1 — REFERENCE POINT
- 151 — COORDINATE POINT
- REGRADED AREAS
- EXCAVATED AREAS
- FORMER CONTAMINATED SOIL AREAS
- MONITORING SOIL SAMPLE LOCATION

0 25 50 75m
25 12.5 1:2500

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

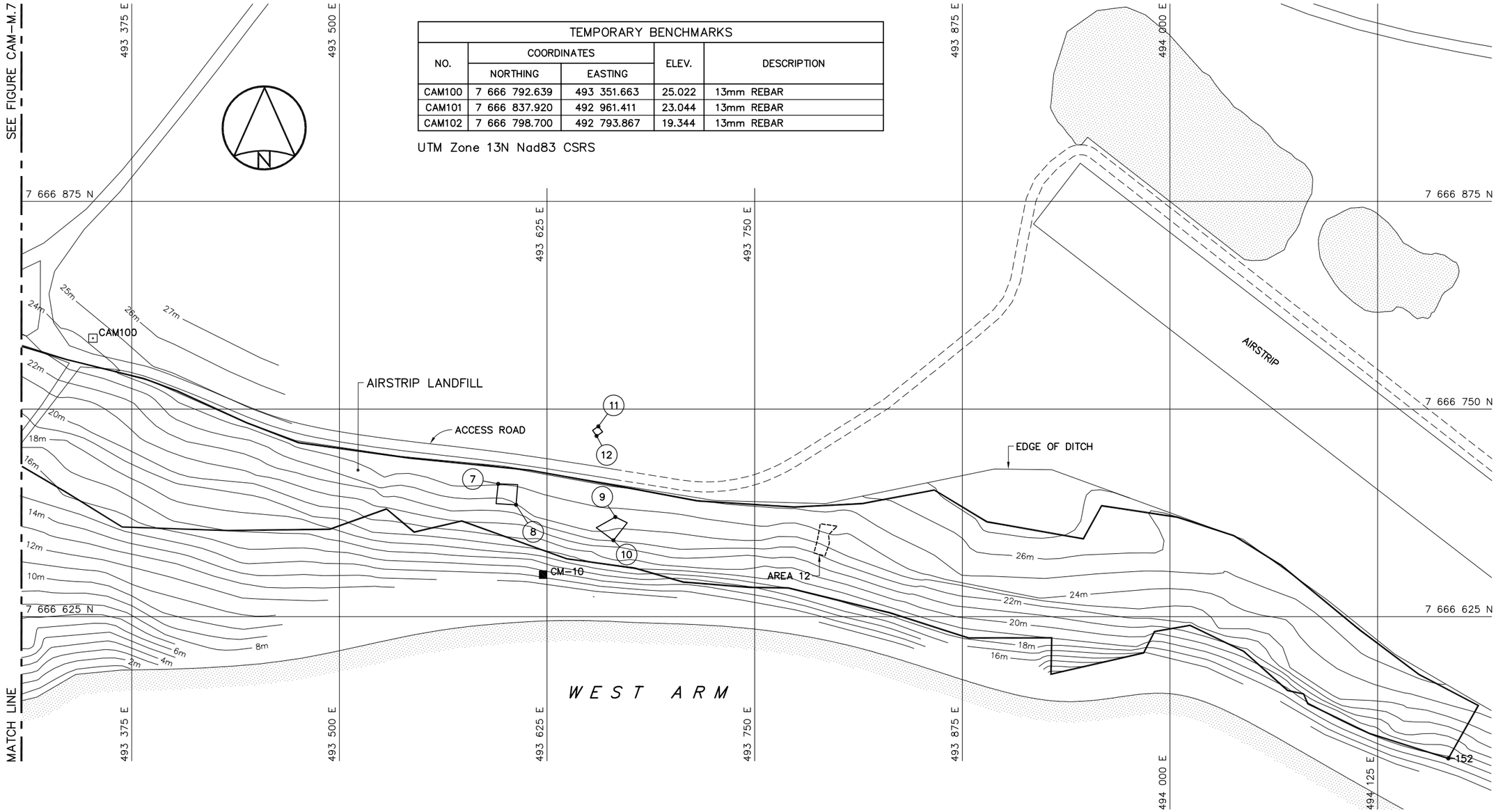
EXISTING AIRSTRIP LANDFILL

FIGURE CAM-M.7

DGN NAME: CM-RD07.DWG CAE – 04/07/27

TEMPORARY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CAM100	7 666 792.639	493 351.663	25.022	13mm REBAR
CAM101	7 666 837.920	492 961.411	23.044	13mm REBAR
CAM102	7 666 798.700	492 793.867	19.344	13mm REBAR

UTM Zone 13N Nad83 CSRS



COORDINATE POINTS		
NO.	COORDINATES	
	NORTHING	EASTING
152	7 666 539.5	494 167.6

MONITORING LOCATIONS		
NO.	COORDINATES	
	NORTHING	EASTING
CM10	7 666 650.3	493 622.7

REFERENCE POINTS		
NO.	COORDINATES	
	NORTHING	EASTING
7	7 666 704.9	493 595.6
8	7 666 692.3	493 606.4
9	7 666 685.0	493 666.2
10	7 666 670.9	493 665.0
11	7 666 739.5	493 655.9
12	7 666 733.7	493 654.8

LEGEND:

- CAM100 — TEMPORARY BENCHMARK
- 7 — REFERENCE POINT
- 152 — COORDINATE POINT
- REGRADED AREAS
- FORMER CONTAMINATED SOIL AREAS
- MONITORING SOIL SAMPLE LOCATION

0 25 50 75m
25 12.5 1:2500

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

CAM-M - CAMBRIDGE BAY

EXISTING AIRSTRIP LANDFILL

FIGURE CAM-M.8

DOS NAME: CM-RD08.DWG CAE - 04/07/27