

## CONSTRUCTION SUMMARY (AS-BUILT) REPORT FOR BERM3 MELIADINE PROJECT, NUNAVUT



PRESENTED TO

### **Agnico Eagle Mines Ltd.**

DECEMBER 2017
ISSUED FOR USE
TETRA TECH PROJECT NUMBER: 28920
AGNICO EAGLE DOCUMENT NUMBER: 6515-E-132-007-132-REP-015



### **EXECUTIVE SUMMARY**

Tetra Tech was retained by Agnico Eagle Mines Limited (Agnico Eagle) to prepare a construction summary (asbuilt) report for Berm3 at the Meliadine Gold Project, Nunavut. Tetra Tech previously prepared the construction drawings and specifications as well as the design report for Berm3 (AEM N° 6515-E-132-007-132-REP-005).

Tetra Tech was not involved in the construction of Berm3. The information presented in this report was provided by Agnico Eagle.

The construction of Berm3 was completed in September 2017. The construction monitoring and quality assurance was managed by Agnico Eagle.

This report summarizes the construction as-built information for Berm3.



### **TABLE OF CONTENTS**

1.0	INTRO	ODUCTION	1
2.0	SUMN	MARY OF THE CONSTRUCTION	2
	2.1	Site Location Plan	.2
	2.2	Construction Schedule	.3
	2.3 F	Berm3 Characteristics	.3
	2.4	Drawings and Photographs	. 4
3.0	DOCU	JMENTATION ON FIELD DECISIONS THAT DEVIATE FROM ORIGINAL PLANS	4
4.0	CONS	STRUCTION MONITORING	5
5.0	LIMIT	ATIONS OF REPORT	6
6.0	CLOS	SURE	6

### **APPENDICES**

Appendix A	As-Built Drawings of Berm3
Appendix B	Survey Drawings of Berm3
Appendix C	Photographs of Berm3
Appendix D	Construction Summary of Berm3
Appendix E	Particle Size Summary for Key Trench Foundation
Appendix F	Particle Size Summary for Till Backfill Material



### 1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) retained the services of Tetra Tech to carry out the planning and design works associated with the Water and Environment and the Civil Works components of the Meliadine Project, a gold mine located approximately 25 km north from Rankin Inlet, and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. Tetra Tech previously prepared the design report and drawings for construction of the Berm3.

The Berm3 is required to temporarily retain water under an extreme rainfall event during peak flooding and is located southeast of Portal #1, around a UTM (NAD83, Zone 15) coordinate of 540,000E and 6,988,500N. As part of the scope of work, Agnico Eagle asked Tetra Tech to:

- Conduct a detailed design for the Berm3, as part of the 2017 civil work construction schedule
- Produce construction drawings and specifications for the Berm3
- Prepare design and construction summary reports of the Berm3

As required by the Water Licence A (No. 2AM-MEL1631), this report summarizes the construction work of the Berm3. Included in this report is:

- A summary of the characteristics of the Berm3
- Documentation on field decisions that deviate from original plans
- As-built drawings
- A survey drawing conducted after the construction of the Berm3
- Photographs of the Berm3
- A construction summary of Berm3
- Particle size summaries for key trench foundation and till backfill material

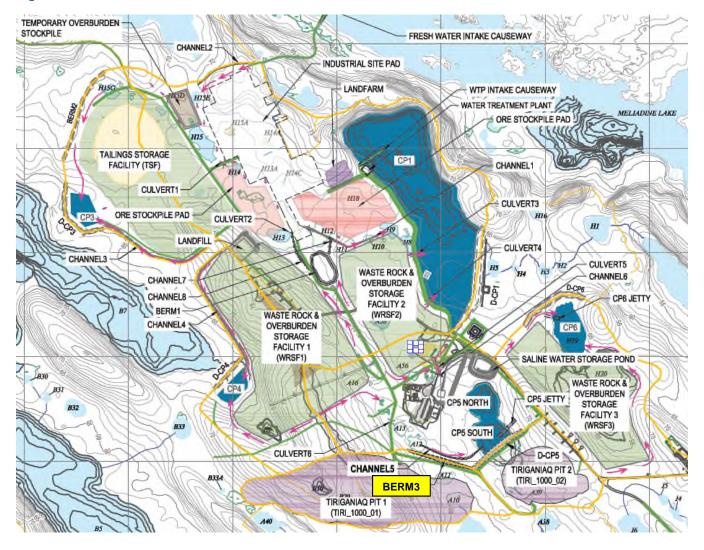


### 2.0 SUMMARY OF THE CONSTRUCTION

### 2.1 Site Location Plan

The figure below presents a site location plan for the Berm3.

Figure 2.1: Site Location Plan





### 2.2 Construction Schedule

The construction for the Berm3 was completed according to the following milestones, shown in Table 2.1 below:

**Table 2.1: Construction Milestone dates** 

Item	Date
Site Preparation Including Temporary Access Road Upstream of Berm 3	August 3 <sup>rd</sup> to 10 <sup>th</sup>
Excavation and Backfill of Key Trench	August 10 <sup>th</sup> to 21 <sup>st</sup>
Till Placement and Compaction	August 22 <sup>nd</sup> to 29 <sup>th</sup>
Erosion Protection Material Placement	August 30 <sup>th</sup> to September 9 <sup>th</sup>
Tie-in on D-CP5 and Completion	September 9 <sup>th</sup>

### 2.3 Berm3 Characteristics

The Berm3 characteristics and as-built in-place quantities are presented in Tables 2.2 and 2.3 respectively.

Table 2.2: Berm3 As-Built Characteristics

Characteristics							
Item	Berm3						
Length	314.5 m						
Berm Height, Maximum	2.76 m						
Berm Side Slopes (avg.)	3H:1V						
Berm Crest Width (avg.)	4.4 m						
Berm Crest Elevation at Top of Unfrozen Till (min.)	67.37 m						
Key Trench Bottom Width (avg.)	2.5 m						
Key Trench Excavation Depth (avg.)	1.0 m						
Key Trench Side Slope (avg.)	2H:1V						

Table 2.3: Berm3 As-Built Material Quantities

Material Quantities							
Item	Berm3						
Key Trench Excavation Volume	1 420 m³						
Selected Unfrozen Till Fill	5 212 m³						
Class A Esker Material (0-600 mm)	2 470 m <sup>3</sup>						
TOTAL (Fill Material)	7 682 m³						



### 2.4 Drawings and Photographs

As-built drawings are presented in Appendix A.

Survey drawings conducted during and after the construction of the Berm3 can be found in Appendix B.

Photographs of the Berm3 after construction is shown in Appendix C.

# 3.0 DOCUMENTATION ON FIELD DECISIONS THAT DEVIATE FROM ORIGINAL PLANS

This section documents variations from original design which were approved by the designer and/or the field engineer on site. The designed intent of the structure was not compromised with any of the changes to the original design.

A construction summary was prepared for the Berm3 by the Agnico Eagle construction team. This summary is available in Appendix D.

The construction of Berm3 is different from the original design on these following points:

- The construction work led to slight variations from the original design in the geometry of Berm3:
  - o The length was shortened by 4.5 m to a total length of 314.5 m.
  - o The maximum berm crest height is reduced by 0.24 m to a height of 2.76 m.
  - The berm side slopes were maintained at a slope of 3H:1V
  - The average width of the berm crest is 4.4 m which is an increase of 0.4 m from the original 4 m design.
  - The minimum elevation of the berm crest was raised by 0.07 m to a minimum elevation at top of the unfrozen till fill of 67.37 m.
- The erosion protection material was designed to be placed on the side slopes of the berm. An additional layer of Class A Esker Material was placed at the crest of the berm to prevent erosion.
- The original material specified for the exterior erosion protection on the side slopes was Run of Mine (0-600mm). Due to the unavailability of the material on site at the time of Berm3 construction, it was replaced by a granular Class A material (0-600 mm) sourced at both the Meliadine and Emulsion Eskers.



- The design specified the bottom of the key trench foundation was to be determined and approved by the field engineer under the criteria that all highly permeable sands, gravels, and rocks were removed and that the base soils consisted of low permeability, frozen till with no visible ice. A particle size analysis was conducted along the key trench alignment to confirm the foundation soil's suitability and can be found in Appendix E. The depth and bottom width of the key trench excavation was determined by either sieve analysis or examination by the AEM Resident Geotechnical Engineer, and lead to the following characteristics in the key trench:
  - The average bottom width of the key trench was 2.5 m, which is an increase of 0.5 m.
  - The average depth of the key trench excavation was decreased by 0.5 m to an actual average depth of 1.0 m.
  - o The key trench side slopes were maintained at a slope of 2H:1V.

The Berm3 geometry and characteristics were adjusted to site conditions. Table 3.1 below presents the changes between the proposed work and the actual work.

Table 3.1: Berm3 Proposed v. Actual Characteristics

GEOMETRY AND CHARACTERISTICS							
Item	Proposed	Actual	Difference				
Length	319 m	314.5 m	- 4.5 m				
Berm Height, Maximum	2.52 m	2.76 m	+ 0.24 m				
Berm Side Slopes (avg.)	3H:1V	3H:1V	-				
Berm Crest Width (avg.)	4 m	4.4 m	+ 0.4 m				
Berm Crest Elevation at Top of Unfrozen Till (min.)	67.3 m	67.37 m	+ 0.07 m				
Key Trench Bottom Width (avg.)	2.0 m	2.5 m	+ 0.5 m				
Key Trench Excavation Depth (avg.)	1.5 m	1.0 m	- 0.5 m				
Key Trench Side Slope (avg.)	2H:1V	2H:1V	-				

### 4.0 CONSTRUCTION MONITORING

The construction monitoring was managed by Agnico Eagle.



### 5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Agnico Eagle Mines Ltd. and their agents. Tetra Tech does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Agnico Eagle Mines Ltd., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement.

### 6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,

Tetra Tech

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.

O/A TETRA TECH
Signature

Doto

PERMIT NUMBER: P 1029

NT/NU Association of Professional Engineers and Geoscientists

Prepared by: 2017/12/1

Christopher Morin, Jr. Eng. Direct Line: 514.257.2427 x3240

Christopher.Morin@tetratech.com

Reviewed by:

cn

Josée Alarie, P.Eng.

FESS/

J.M.I.F. ALARIE

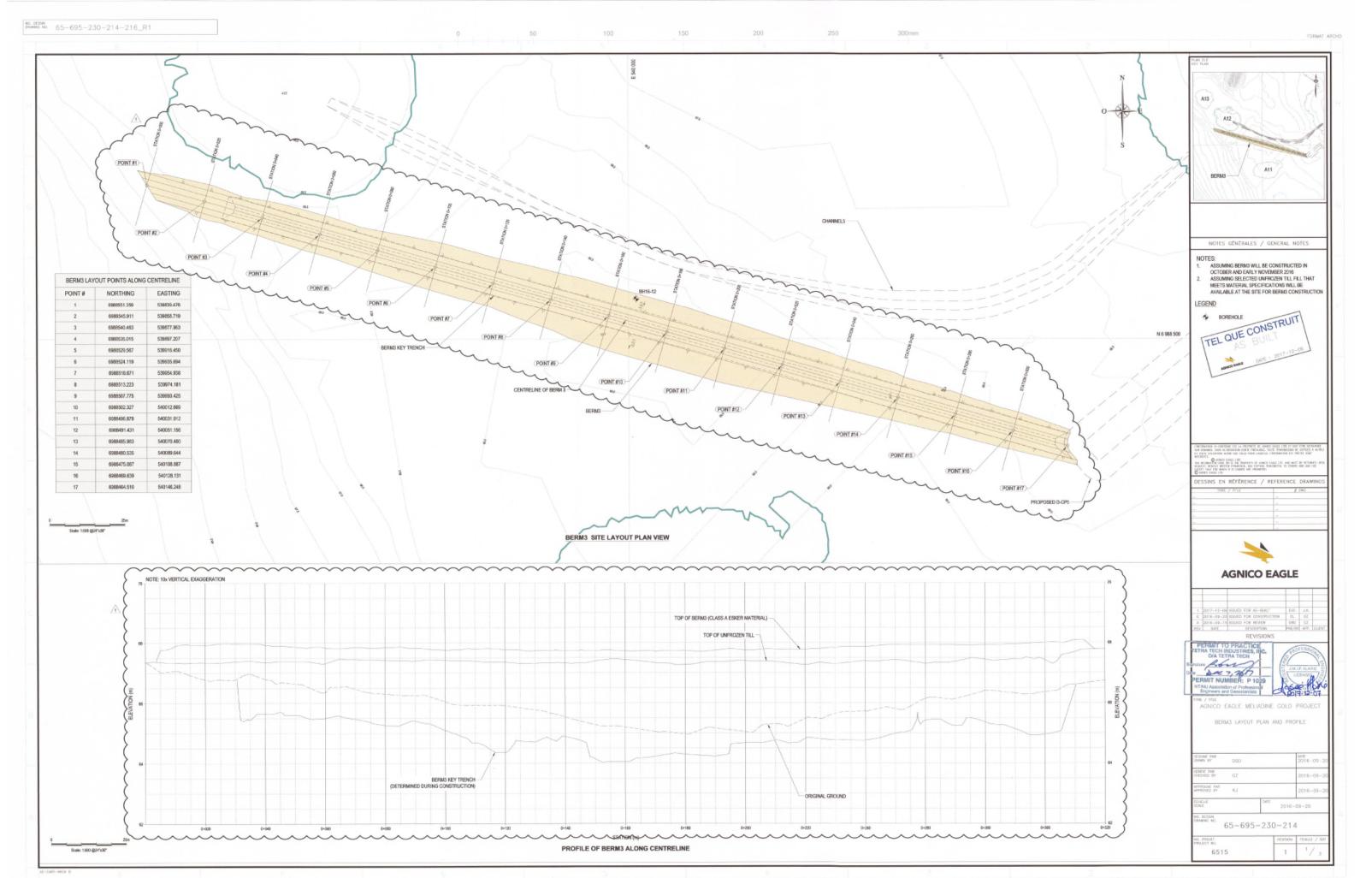
LICENSEE

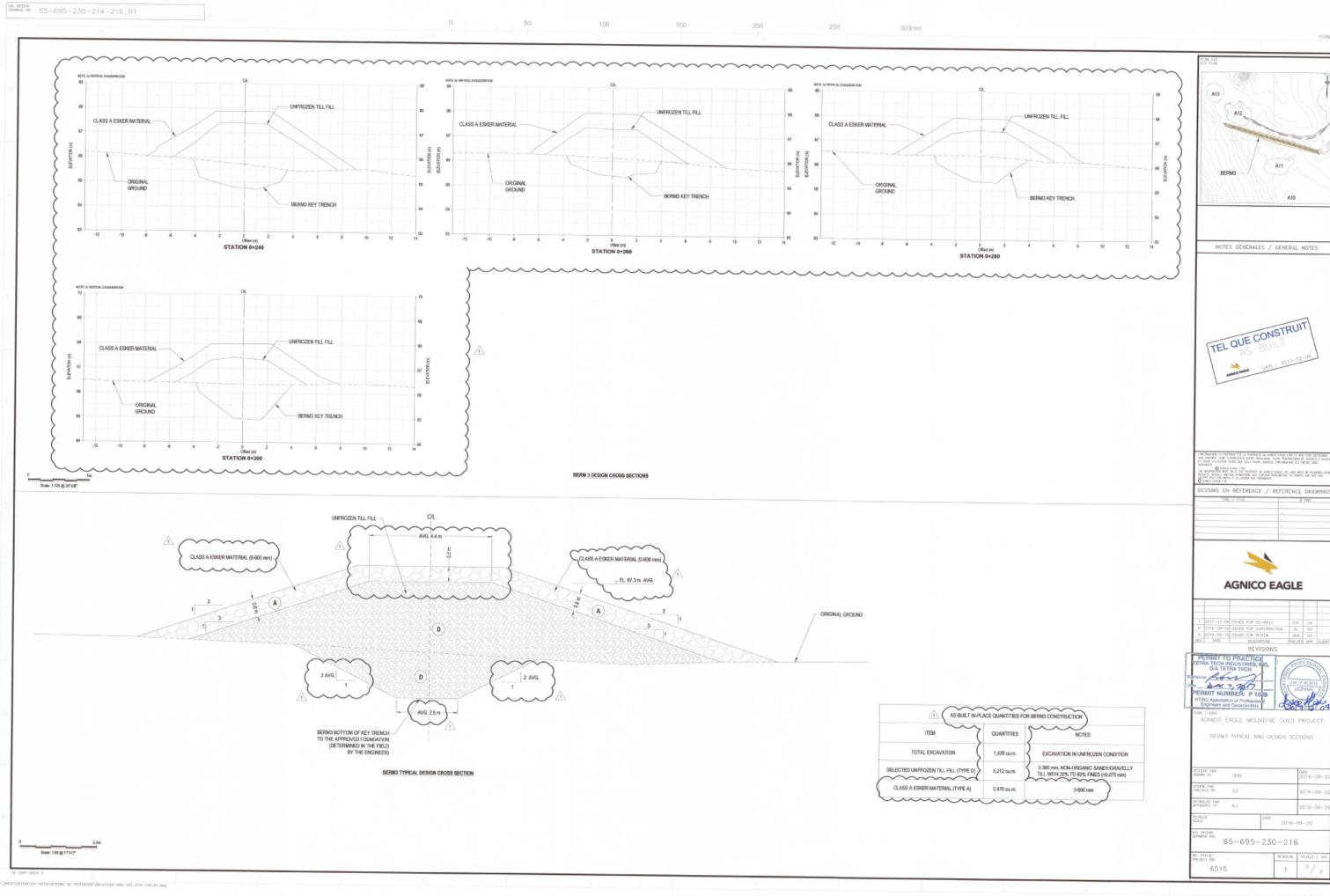
Direct Line: 514.257.2427 x3323 Josee.Alarie@tetratech.com

# APPENDIX A

**As-Built Drawings** 



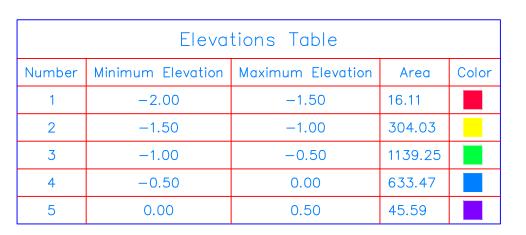




# **APPENDIX B**Survey Drawings









AGNICO EAGLE

COORD. SYSTEME:

UTM15 NAD83

EXC QUANTITY BERM 3 1420 M3

WORK EXECUTION DATE 2017-08-17

EMISSION DATE: 2017-10-18

R.CLOUATRE

1420 M3
PLAN NO.:

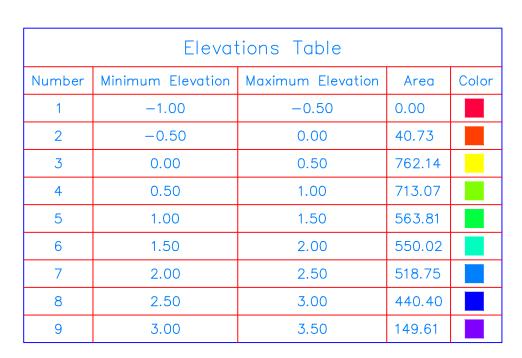
APPROVED BY:

SCALE: 1:1000

695-AB-BERM3

Y. HAMEL







WORK EXECUTION DATE 2017-08-17AGNICO EAGLE

PLAN NO.:

EMISSION DATE : 2017 - 10 - 18

COORD. SYSTEME: UTM15 NAD83

TILL QUANTITY BERM 3 *5212 M3* 

DRAWN BY: R.CLOUATRE

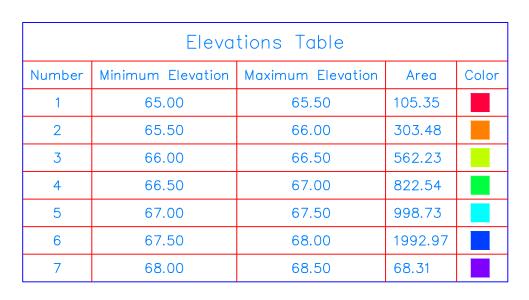
SCALE: 1:1000

695-AB-BERM3

APPROVED BY:

Y. HAMEL







AGNICO EAGLE COORD. SYSTEME:

CL/A QUANTITY BERM 3 2470 M3

WORK EXECUTION DATE 2017-08-17

EMISSION DATE : 2017 - 10 - 18DRAWN BY:

R.CLOUATRE

UTM15 NAD83 SCALE: PLAN NO.:

APPROVED BY:

1:1000 695-AB-BERM 3 Y. HAMEL

# APPENDIX C Photographs of Berm3











# **APPENDIX D**

Construction Summary of Berm3



### **Construction Summary – Berm 3**

All construction completed by Inukshuk Contracting Ltd.

### 1. Site Preparation (August 3 – August 10)

- Temporary road access along north side constructed of Class A esker material
- Existing temporary Berm 3 (consisting of till excavated during Channel 3 excavation 2016) required removal (see Photos July 2017)

### 2. Key Trench Excavation and Backfilling (August 10 – August 21)

- Design drawings specify bottom of key trench to the approved foundation to be determined in the field by the engineer
- The acceptance criteria used for field evaluation of the foundation soils were a visible confirmation that all highly permeable sands, gravels and rock were removed and that the base soils consisted of low permeability, frozen till with no visible ice
- Particle size analysis was conducted along the key trench alignment to confirm the suitability of the foundation soils
- August 12 to August 15 depth of excavation determined by sieve analysis of the foundation soils
   approximately 15% of the key trench was backfilled during this time
- August 15 to August 21 depth of excavation determined by examination of foundation soils by AEM Resident Geotechnical Engineer
- Water ponding in key trench was used to speed excavation (left in trench to increase depth of thaw so that mechanical excavation could continue in areas where continued excavation was required)
- Water was then directed into low areas within the excavation and removed prior to backfilling with unfrozen till
- The excavation and backfilling process was staged so that backfilling occurred immediately following confirmation of suitable foundation soils
- Backfilling with approved unfrozen till (see particle size analysis) was conducted in accordance with the Technical Specifications for Civil Earthworks (6515-GNS-014). Placement occurred in controlled lifts established by survey (maximum lift height 0.5 m). Each lift was compacted with a 10 tonne vibratory drum roller prior to placement of the next lift.
- Compaction occurred to the satisfaction of the AEM Resident Geotechnical Engineer.

### 3. Till Core Placement (August 22 – August 29)

- Placed same as key trench backfill material (controlled lifts, compaction)
- Placed and compacted core material was then shaped to design slope before placement of erosion protection

#### 4. Erosion Protection Placement

- Class A esker material substituted for ROM
- The north side of the berm was covered with temporary road material
- Additional Class A esker material brought in to complete the berm

### 5. Tie in to D-CP5 (September 9)

- A field fit tie in between Berm 3 and the access road surrounding D-CP5 was completed Sept 9

### **Equipment Used for Construction:**

- CAT 345B Excavator
- CAT 320 Excavator
- CAT D6 Bulldozer
- CAT 735 Rock Truck
- Tandem dump trucks
- SD100 10 tonne vibratory drum compactor

## **APPENDIX E**

Particle Size Summary for Key Trench Foundation



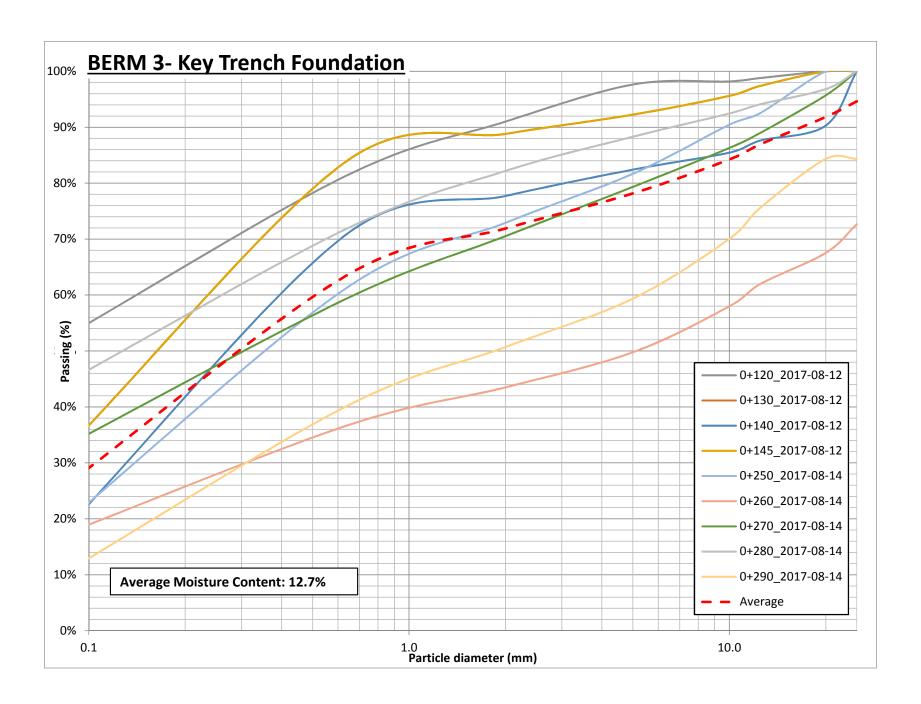


Table 1: Summary of Particle Size Analysis Results - Berm 3 Key Trench Foundation

No	Sample ID	Sieve Size (mm)							Moisture	
No.		25.00	20.00	12.50	10.00	5.00	2.00	0.63	0.08	Content
1	0+120_2017-08-12	100.0%	100.0%	98.8%	98.2%	97.6%	91.0%	81.2%	51.8%	12.52%
2	0+130_2017-08-12	100.0%	100.0%	97.4%	95.6%	92.2%	88.8%	83.7%	30.8%	12.70%
3	0+140_2017-08-12	100.0%	90.3%	87.6%	85.5%	82.4%	77.7%	70.6%	16.6%	12.72%
4	0+145_2017-08-12	100.0%	100.0%	97.4%	95.6%	92.2%	88.8%	83.7%	30.8%	15.02%
5	0+250_2017-08-14	100.0%	100.0%	92.5%	90.4%	81.7%	72.9%	61.1%	18.2%	17.02%
6	0+260_2017-08-14	72.6%	67.5%	62.0%	58.0%	49.8%	43.5%	36.5%	16.8%	9.74%
7	0+270_2017-08-14	100.0%	95.7%	89.0%	86.3%	79.3%	70.5%	59.2%	32.3%	8.73%
8	0+280_2017-08-14	100.0%	96.8%	94.1%	92.5%	88.3%	82.2%	71.7%	43.6%	13.13%
9	0+290_2017-08-14	84.3%	84.3%	75.6%	70.0%	59.4%	50.7%	40.0%	9.6%	12.56%
Average		94.6%	91.8%	87.0%	84.2%	78.2%	71.9%	63.3%	24.8%	12.70%

## **APPENDIX F**

Particle Size Summary for Till Backfill Material



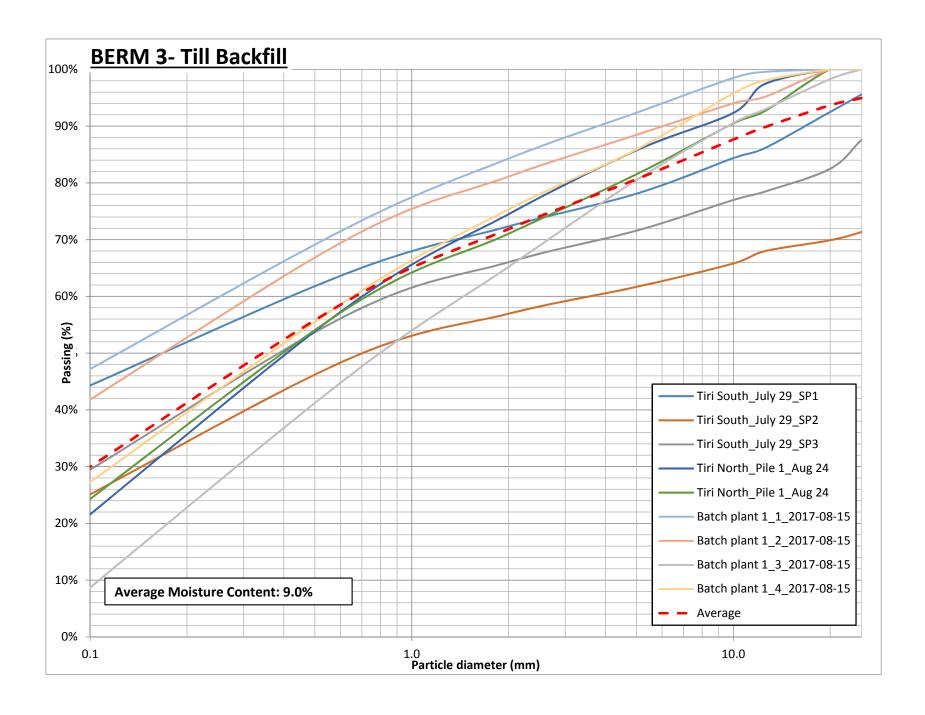


Table 2: Summary of Particle Size Analysis Results - Berm 3 Till Backfill

No.	Sample ID	Sieve Size (mm)						Moisture		
NO.	Sample 1D	25.00	20.00	12.50	10.00	5.00	2.00	0.63	0.08	Content
1	Tiri South_July 29_SP1	95.6%	92.5%	86.1%	84.4%	78.1%	72.3%	64.1%	41.9%	4.9%
2	Tiri South_July 29_SP2	71.3%	69.9%	68.0%	65.8%	61.7%	56.9%	48.9%	22.2%	5.8%
3	Tiri South_July 29_SP3	87.6%	82.5%	78.4%	77.0%	71.6%	66.0%	56.7%	26.1%	5.8%
4	Batch plant 1_1_2017-08-15	100.0%	100.0%	99.6%	98.5%	92.4%	84.3%	72.1%	44.2%	9.4%
5	Batch plant 1_2_2017-08-15	100.0%	100.0%	95.1%	94.0%	88.5%	81.1%	70.1%	38.3%	14.7%
6	Batch plant 1_3_2017-08-15	100.0%	98.3%	92.9%	90.5%	80.5%	65.2%	45.7%	4.2%	11.8%
7	Batch plant 1_4_2017-08-15	100.0%	100.0%	98.0%	95.8%	85.9%	75.3%	59.4%	23.4%	10.5%
8	Tiri North_Pile 1_Aug 24	100.0%	100.0%	97.4%	92.3%	85.7%	74.5%	58.1%	17.1%	9.3%
9	Tiri North_Pile 1_Aug 24	100.0%	100.0%	92.6%	90.5%	81.5%	71.0%	57.9%	20.2%	9.3%
Average		94.9%	93.7%	89.8%	87.6%	80.7%	71.9%	59.2%	26.4%	9.0%