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Memo

To: Oliver Curran, VP Environmental Affairs Client: TMAC Resources Inc.

From: Ryan Williams, Senior Consultant, PEng Project No: 1CT022.051

Reviewed By: Cameron Hore, Senior Consultant, PEng Date: April 1, 2020

Subject: Hope Bay Project: Construction Summary of the Lined Waste Re-handling Area at the Madrid

North Portal Pad

1 Introduction

1.1 General

TMAC Resource Inc. (TMAC) is currently undertaking Phase 2 of the Hope Bay Project (the Project). The Project is located 705 km northeast of Yellowknife and 153 km southwest of Cambridge Bay in Nunavut Territory. Phase 2 includes mining and infrastructure at Madrid and Boston located approximately 10 and 60 km due south from Doris, respectively. As part of the development at Madrid, a mine portal will be developed at the Madrid North site to facilitate underground mining activities.

The portal location was previously proposed to be constructed on top of a bedrock outcrop as shown by the Madrid North surface infrastructure layouts in the Final Environmental Impact Statement (FEIS) developed by SRK Consulting (Canada) Inc. (SRK) (SRK 2017a). In 2019, TMAC elected to relocate the portal approximately 100 m northeast so that it could be developed on the side of the bedrock outcrop instead of on top. As a result, rockfill pads were designed in front of the portal location on areas of permafrost overburden in order to provide a laydown area for mining equipment and supporting infrastructure.

The pads were designed in accordance with other pads designed and constructed at Hope Bay, which generally consist of a minimum 1 m thickness to protect underlying permafrost overburden and constructed from geochemically suitable rockfill (SRK 2017b, 2017c). As surface infrastructure pads are not considered water or waste management facilities, Issued for Construction (IFC) drawings were not submitted to the Nunavut Water Board prior to construction.

1.2 Field Decisions and Design Changes

Construction of the portal pad began in September 2019. At the same time as construction of the pad commenced, TMAC reviewed the operational strategy for management of waste rock coming from the portal development. The intended operating strategy was for underground loaders to

bring waste rock to the Madrid North waste rock pile (WRP), as is the strategy at the Doris mine where underground trucks deliver ore and waste rock to the relevant stockpiles at Doris.

However, since the haul distance from the Madrid North portal to the WRP is approximately 1 km, TMAC decided it would be preferable for underground trucks (CAT R1300) to temporarily place waste rock on the portal pad and instead allow larger haul trucks (CAT 740 or Volvo A60H) to collect the waste rock and haul it to the WRP. Based on this decision, the dedicated area of the portal pad where the transfers would occur requires contact water management. A field decision was made to line one area of the pad with geomembrane to create a temporary waste rock storage and re-handling area that could manage potential contact water during daily operations. Underground trucks will place waste rock in a temporary stockpile within the lined re-handling area whilst a front end loader transfers the waste rock from the re-handling area to surface haul trucks to haul it to the WRP.

SRK produced a design for the lined waste rock re-handling area to facilitate construction in the field. The design included standard material specifications and thicknesses for transition and bedding material to protect the liner, as well as lined berms to create sufficient storage capacity for containment of the design storm event. The lined re-handling area was graded to the northeast corner where a sump is installed for collection of contact water and transfer to the Doris pollution control pond or TIA as per the existing site Water Management Plan (TMAC 2017). The size of the re-handling area was designed to accommodate underground waste from the portal development for at least one day of operations.

SRK provided input to the portal pad design and design of the lined re-handling area but did not provide design input for the portal.

1.3 Memo Objectives

The objectives of this memo are to provide a factual summary of the construction activities since the lined re-handling area within the portal pad is now considered a waste management facility i.e. to temporarily store waste rock and to manage potential contact water. The As-built Drawings are provided in Attachment A and a Photo Log of the construction activities is provided in Attachment B. Only construction activities relating to the lined re-handling area are reported on within this memo, construction activities related to other parts of the pad or to the portal itself are not included.

2 Design Summary

The lined re-handling area within the portal pad was designed in accordance with the current construction technical specifications (SRK 2018) and other SRK designed lined infrastructure at the Hope Bay site, such as the existing Reagent Pad. The liner system consists of a 1.5 mm (60 mil) high-density polyethylene (HDPE) liner, sandwiched between two layers of non-woven geotextile (12 oz) for protection. In addition, the subgrade below the liner is designed with a minimum of 0.5 m of transition material and 0.15 m of bedding material i.e. on top of the run of quarry (ROQ) or run of mine (ROM) material. To facilitate heavy equipment traffic above the liner, a minimum of 0.3 m of bedding material followed by 0.6 m of surfacing material is required for a

total fill thickness of 0.9 m above the liner. The liner layer system is the same design as used in other areas at Hope Bay requiring heavy equipment to traffic above the liner, for example at the existing Reagent Pad.

The dimensions of the lined re-handling area are approximately 20 m wide by 50 m long for a total area of 1,000 m². This area was considered sufficient to store the estimated 100 to 200 tonnes per day of waste rock from the Madrid portal development as well as providing enough working space for equipment and truck maneuverability. Considering a loose waste rock density of 1.8 t/m³ and the maximum expected tonnage of 200 tonnes per day, the maximum waste rock storage volume is approximately 100 m³. This volume could be stored within an area 10 m by 10 m with a stockpile height 1 m, though the actual area would be slightly larger to account for sloping of the material at angle of repose.

The lined re-handling area design includes two ramps into and out of the area; one from the portal side for underground truck access and one from the Madrid South All-Weather Road for surface haul trucks. Both ramps are designed with a triple HDPE liner system for additional contingency since the fill material above the liner within the top of the ramp is only 0.6 m. An additional contingency liner is also incorporated into the design for the area between the portal and the lined re-handling area. The contingency liner is approximately 50 m long and sloped back towards the portal so that surface water within this area is directed and managed underground.

The hydrotechnical design for the lined re-handling area considered a design storm event equal to the 1 in 100-year, 24-hour flood (55 mm) plus the maximum daily snowmelt (18 mm) as per SRK's hydrology analysis for the site (SRK 2017d). The maximum design flood event is therefore 73 mm or 0.073 m and is consistent with other low consequence structures at Hope Bay e.g. the Madrid North contact water pond (SRK 2019a). The lined re-handling area includes berms on all four sides and therefore the potential catchment area is equal to the size of the bermed re-handling area. As a result, the design containment depth is equal to the design flood depth i.e. 0.073 m. The design provides a containment depth between the top of the liner system and the top of the trafficking surface equal to 0.2 m.

The design drawings used for construction are provided in Attachment C.

3 Construction Summary

3.1 Timeline

Construction of the bulk fill placement for the Madrid portal pad commenced in September 2019, though construction of the lined re-handling area did not commence until October 2019. Installation of the liner system was completed between October 23 to November 7, 2019. The remaining fill placement above the liner was completed in November 2019.

3.2 Participants

The participants involved with the construction of the Madrid North portal pad are listed in Table 1.

Table 1: Construction Participants

Role	Company		
Client / Owner	TMAC Resources Inc.		
Design Engineer	SRK Consulting (Canada) Inc.		
Site Construction Quality Assurance (QA)	SRK Consulting (Canada) Inc.		
Offsite Laboratory Testing	Tetra Tech		
Site Surveyor	Sub-Arctic Geomatics Ltd.		
Construction Contractor and Earthworks Quality Control	Nuna Logistics Limited		
Liner Contractor and Liner Quality Control	A&A Technical Services		

As is the case with other construction projects at Hope Bay involving installation of HDPE, the liner contractor is responsible for the quality control (QC) of the liner. A&A Technical Services (A&A) completed the liner installation and their installation report is provided in Attachment D, which documents the installation and QC testing.

SRK was on site to provide construction quality assurance (QA) between 22nd to 31st of October. During that time, SRK provided CQA for preparation of the liner subgrade, placement of geotextile and HDPE liner, and backfill of the first 0.3 m of bedding material over the contingency liner. Due to weather and construction delays, SRK was not on site during placement of the liner backfill within the re-handling area or for the remaining placement of backfill over the contingency liner.

Nuna Logistics Limited (Nuna) completed the earthworks for the construction and provided QC for material production and placement. Earthworks activities were overseen by the Nuna site supervisor as well as by TMAC site personnel.

3.3 Construction Documentation

SRK prepared Issued for Construction (IFC) drawings specifically for the lined re-handling area within the portal pad. Table 2 summarizes the IFC drawings prepared and copies of the drawings are provided in Attachment C. Technical specifications for materials, liner, and material placement are detailed in the latest revision of the Technical Specifications (Revision H) and were used for construction (SRK 2018).

Table 2: Issued for Construction Drawings

Drawing Number	I ITID		Date of Issue
MN-NP-01	Site Overview (with orthophoto)	0	September 27, 2019
MN-NP-02	Existing Conditions (Orthophoto)	0	September 27, 2019
MN-NP-03	Existing Conditions	0	September 27, 2019
MN-NP-04	Portal Pad Infrastructure	1	October 10, 2019
MN-NP-05	Portal Pad Infrastructure Sections Sheet 1/2	1	October 10, 2019
MN-NP-06	Portal Pad Infrastructure Sections Sheet 2/2	0	September 27, 2019
MN-NP-07	Typical Details	0	September 27, 2019

3.4 Construction Materials

A variety of materials were used in constructing the lined re-handling area within the Madrid North portal pad. The ROQ rock and bedding and transition materials were produced on-site by quarrying and crushing, and ROM was produced from the Naartok East Crown Pillar Recovery (CPR). All HDPE and geotextile materials were sourced from off-site manufacturers. A summary of the construction materials used is presented below.

Run-Of-Quarry and Run-of-Mine Material

All ROQ material used as bulk fill material for the portal pad was quarried on-site from Quarry D by drilling and blasting methods. Quarry D was developed prior to the start of construction and has been identified as a source of geochemically suitable construction rock (SRK 2008). ROM waste rock material was used to supplement the portal pad fill when available. ROM waste rock from the Naartok East CPR has been identified as an alternative source of construction rock and geochemical characterization of outcrop from within the Naartok East CPR boundaries indicates that arsenic content and risk for neutral pH leaching is low (SRK 2019b).

Oversize material was sorted during the loading of the haul trucks. ROQ and ROM was subject to visual QA/QC only and was generally noted to be well graded with very few oversize pieces (greater than 1 m diameter) as outlined in the Technical Specifications (SRK 2018).

Transition Material

Transition material was produced by the on-site crusher using the primary jaw circuit only. The 200 mm minus material was used as a transition layer between the bedding material and the ROQ/ROM material to help mitigate particle migration and to protect the liner. This material was subject to visual QA/QC only. The transition material was stockpiled near the crusher in Quarry #2 (located at Doris) and hauled to the portal pad lined re-handling area when required.

Bedding Material

The 25 mm minus bedding material for protection above and below the liner was produced to meet the particle size envelope stated in the Technical Specifications (SRK 2018). One sample of this material was collected for QA testing which confirmed it generally met the specified gradation limits (see Figure 1). Results of the QA testing shows approximately 9% of the bedding material was greater than 25 mm; however, no material was greater than 37.5 mm. Although not technically meeting the specified gradation limits, the material is still considered acceptable and site observations of the bedding material during construction confirmed this conclusion. Bedding material was stockpiled in Quarry #2 (located at Doris) and hauled directly to the portal pad lined re-handling area as necessary.

HDPE Geomembrane Liner

The 1.5 mm (60 mil) HDPE liner was manufactured by SOLMAX. Liner rolls were generally transported to the portal pad immediately prior to use; however, they were permitted to be

temporarily stored outside with an appropriate protective covering. QC testing was performed by A&A Technical Services. Visual QA of liner placement and backfill was performed by SRK for the time SRK was present on site. A&A's liner installation report and summary of QC testing is provided in Attachment D. The liner product datasheet is provided in Attachment E.

Non-woven Geotextile

The 12 oz/yd² non-woven geotextile was manufactured by TITAN. Geotextile rolls were generally transported to the portal pad immediately prior to use; however, they were permitted to be temporarily stored outside with an appropriate protective covering. Only visual QA/QC was performed which found that the geotextile installation was as per the technical specifications. Generally, the purpose of the non-woven geotextile is to protect the HDPE geomembrane line. The geotextile product datasheet is provided in Attachment F.

3.5 Construction Equipment

Conventional earth moving equipment was used in construction of the Madrid North portal pad lined re-handling area, including:

- Bulldozers (CAT D6, D8);
- Backhoe excavators (CAT 308, 325, 345);
- Articulating haul trucks (CAT 740, 725);
- Vibratory drum compactor (CAT CS-74B);
- Front end wheeled loader (CAT 950M);
- Crane (Grove RT-625) with spreader bar assembly; and
- Skid steer loader (CAT 262B).

3.6 Survey Control

Survey control and reporting was performed by Sub-Arctic. Surveying was performed with Leica GPS / GNSS equipment using the UTM zone 13 coordinate system and NAD83 datum. All survey data was processed on site by Sub-Arctic personnel. Interim as-built surveys were generally sent to SRK periodically or after completion of specific activities. The survey data was used to check grades and minimum thicknesses of materials, as well as to prepare the as-built drawings (Attachment A). Typical accuracy of the system is within ±5 cm.

3.7 Construction Monitoring

TMAC conducts regular monitoring during all construction activities to assess the impact to water bodies and surrounding tundra. All fill materials were monitored to ensure they were sourced from geochemically suitable run-of-quarry (ROQ) or run-of-mine (ROM) rock. A minimum of 31 m buffer to any water body was maintained at all times for construction activity and equipment

storage. The terrain and water flow paths were monitored to minimize water pooling, erosion, and sediment release into any water body. Dust monitoring was completed on an on-going basis.

Mitigation efforts included assessment of site topography and field fitting of culverts to minimize ponding of water on the tundra. Two culverts were installed at the two entrances to the portal pad as shown on the As-built Drawings (Attachment A). Downstream water flow and sediment runoff was mitigated through the use of coco matting and silt fencing in key flow paths as required. Runoff samples were collected and tested for total suspended solids (TSS) as well as for oil and grease. Dust suppression was completed by spraying water on road surfaces from approved water sources. To mitigate any disturbances to nesting birds, a pre-construction bird nesting survey was completed for areas where construction commenced during nesting season.

4 Close Out

This memo presents a summary of the construction activities at the Madrid North portal pad specifically in relation to the construction of the lined waste rock re-handling area within the pad. The portal pad was originally designed as a rockfill only pad to provide a laydown area for equipment and infrastructure to support the Madrid North portal development. During construction of the pad, a field decision was made to line an area within the pad to act as a temporary waste rock re-handling area and provide containment for contact water resulting from runoff in contact with the waste rock. This decision was based on the need to improve safety during operations for underground haul trucks.

SRK, already assisting TMAC with the portal pad design, was requested to provide a design for lining one area of the portal pad. The design includes a HDPE and geotextile liner system with berms on all four sides to provide containment for the design storm event. The re-handling area is graded a minimum 1% to the northeast corner where a sump is constructed to allow collection and removal of contact water. The design adopts typical liner design elements used for other construction projects at Hope Bay such as a minimum 0.9 m liner cover thickness for heavy equipment and triple HDPE lining on access ramps into the lined area.

SRK was present on site to provide CQA during preparation of the lined re-handling area subgrade and placement of non-woven geotextile and liner system. SRK confirms that the subgrade was prepared in accordance with the design in terms of material specifications and achieving a minimum grade towards the sump area. Placement of the liner system was generally in accordance with the Technical Specifications (SRK 2018) and QC testing was provided by A&A Technical Services. Due to weather and construction delays, SRK was not on site for placement of backfill above the liner. Therefore, SRK has relied on information from others in preparing the as-built drawings and this as-built summary.

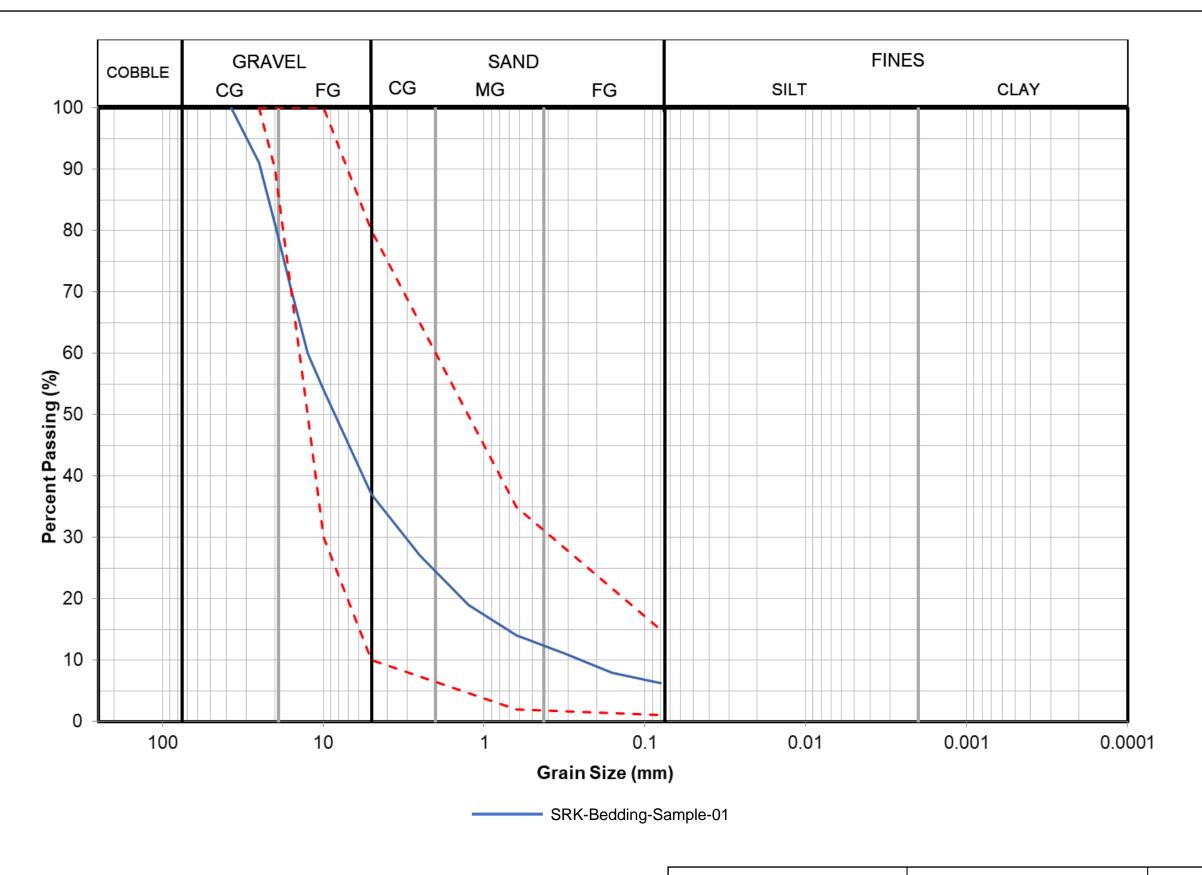
5 References

SRK Consulting (Canada) Inc., 2008. Geochemical Characterization of Quarry Materials for the Doris-Windy All-Weather Road, Hope Bay Project. Report Prepared for Hope Bay Mining Ltd., 1CH008.000. August 2008.

- SRK Consulting (Canada) Inc., 2017a. Hope Bay Project: Madrid North Surface Infrastructure Preliminary Design. Memo Prepared for TMAC Resources Inc. 1CT022.013. November 2017.
- SRK Consulting (Canada) Inc., 2017b. Geotechnical Design Parameters and Overburden Summary Report, Hope Bay Project. Report Prepared for TMAC Resources Inc. 1CT022.013. November 2017.
- SRK Consulting (Canada) Inc., 2017c. Hope Bay Project: Thermal Modelling to Support Run-of-Quarry Pad Design. Memo Prepared for TMAC Resources Inc. 1CT022.013. November 2017.
- SRK Consulting (Canada) Inc., 2017d. Hope Bay Project: Climate and Hydrological Parameters Summary Report. Report Prepared for TMAC Resources Inc. 1CT022.013. November 2017.
- SRK Consulting (Canada) Inc., 2018. Technical Specifications Earthworks and Geotechnical Engineering, Hope Bay Project. Prepared for TMAC Resources Inc., 1CT022.031.

 April 2018. Revision H Issued for Construction.
- SRK Consulting (Canada) Inc., 2019a. Hope Bay Project: Detailed Design of the Contact Water Pond Berm at Madrid North. Memo Prepared for TMAC Resources Inc. 1CT022.043. March 2019.
- SRK Consulting (Canada) Inc. 2019b. Classification of Waste Rock in Support of Segregating Construction Rock from Naartok East Crown Pillar Recovery, Madrid North, Hope Bay Project. Report prepared for TMAC Resources Inc. Project No.: 1CT022.037. August 2019.
- TMAC Resources Inc. (TMAC), 2017. Doris and Madrid Water Management Plan, Hope Bay. November 2017.





Note: Technical specification limits for bedding material as per SRK (2018) are shown as red dashed lines.

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Madrid North Portal Pad: Lined Re-handling Area

RESOURCES

Bedding Material Particle Size

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TMAC Resources Inc.

Date: March 2020

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Figure 1



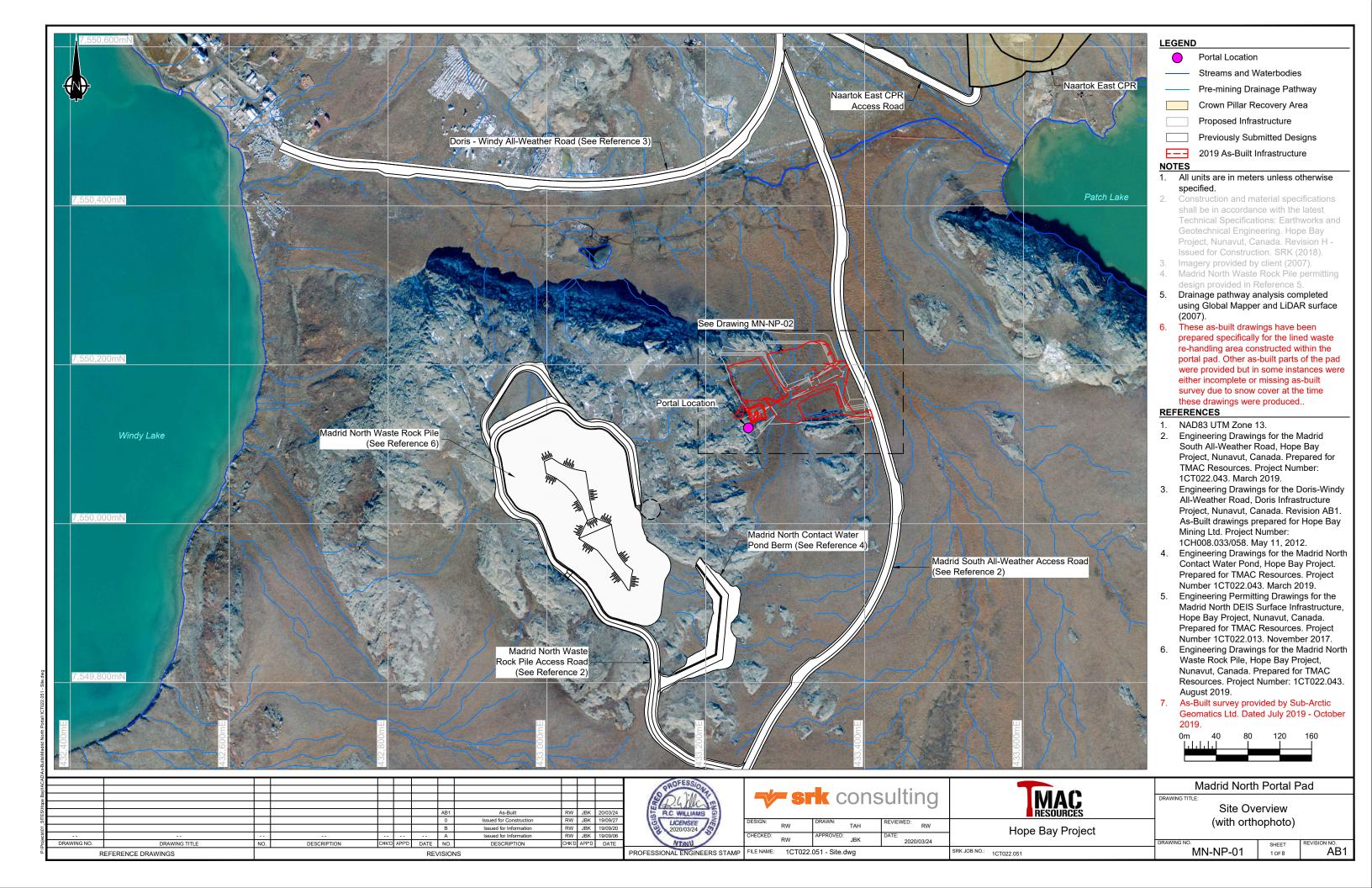
Engineering Drawings for the Lined Waste Re-handling Area at the Madrid North Portal Pad Hope Bay Project, Nunavut, Canada

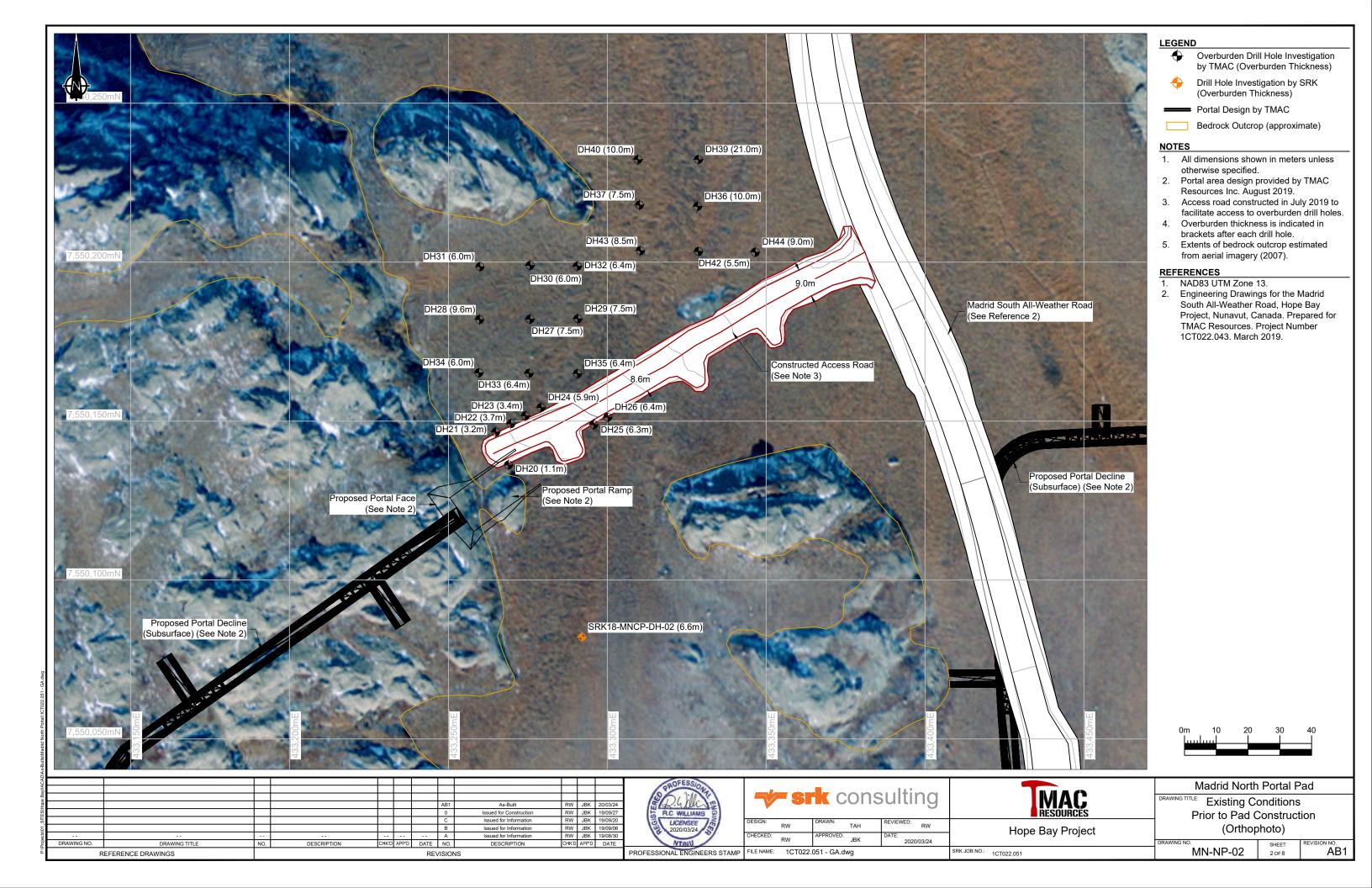
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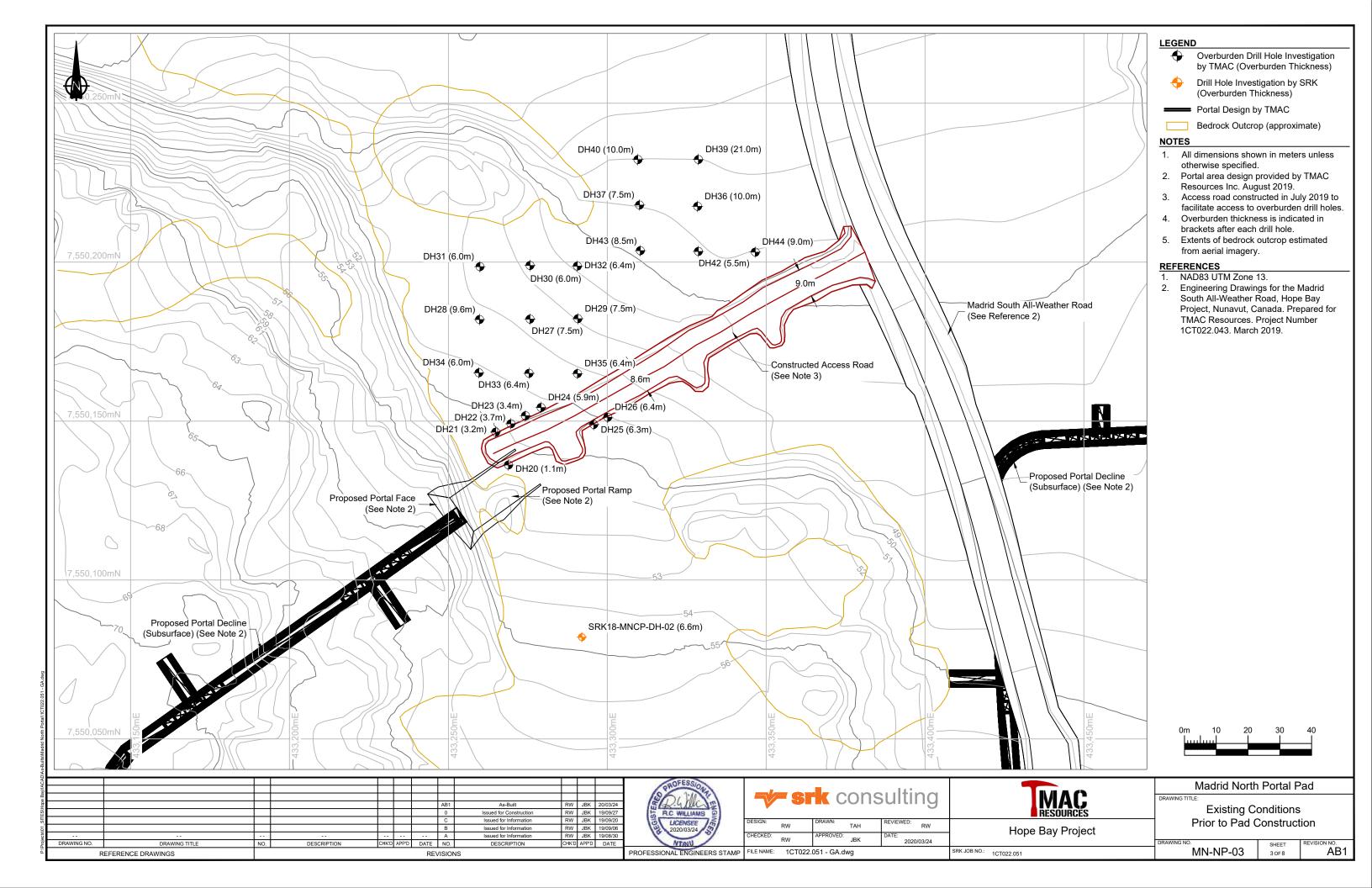
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MN-NP-02	Existing Conditions Prior to Pad Construction (Orthophoto)	As-Built	2020/03/24	AB1
MN-NP-03	Existing Conditions Prior to Pad Construction	As-Built	2020/03/24	AB1
MN-NP-04	Portal Pad Infrastructure	As-Built	2020/03/24	AB1
MN-NP-05	Portal Pad Infrastructure Sections Sheet 1/2	As-Built	2020/03/24	AB1
MN-NP-06	Portal Pad Infrastructure Sections Sheet 2/2	As-Built	2020/03/24	AB1
MN-NP-07	Typical Details	As-Built	2020/03/24	AB1
MN-NP-08	As-Built Liner Layout	As-Built	2020/03/24	AB1

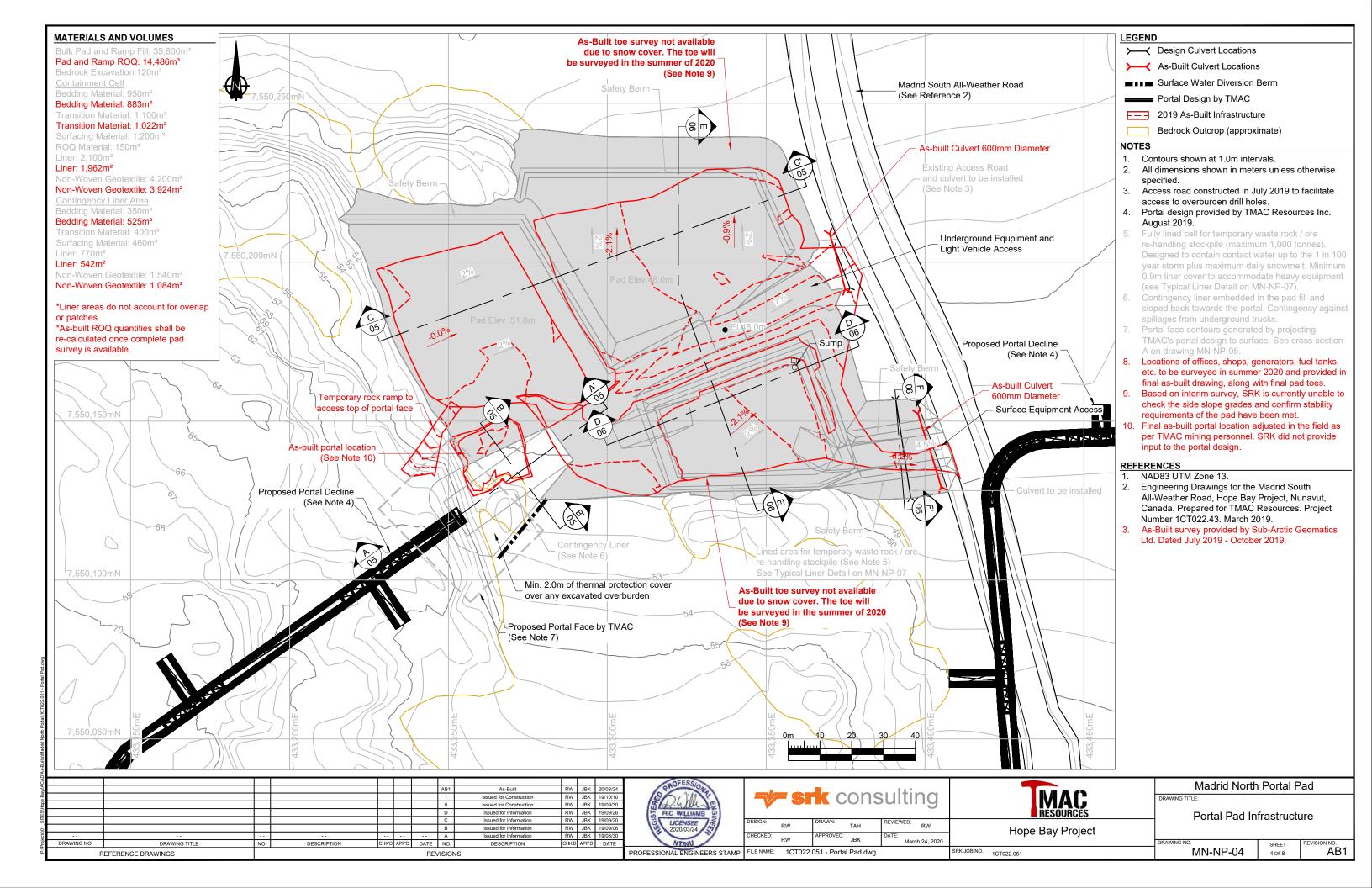


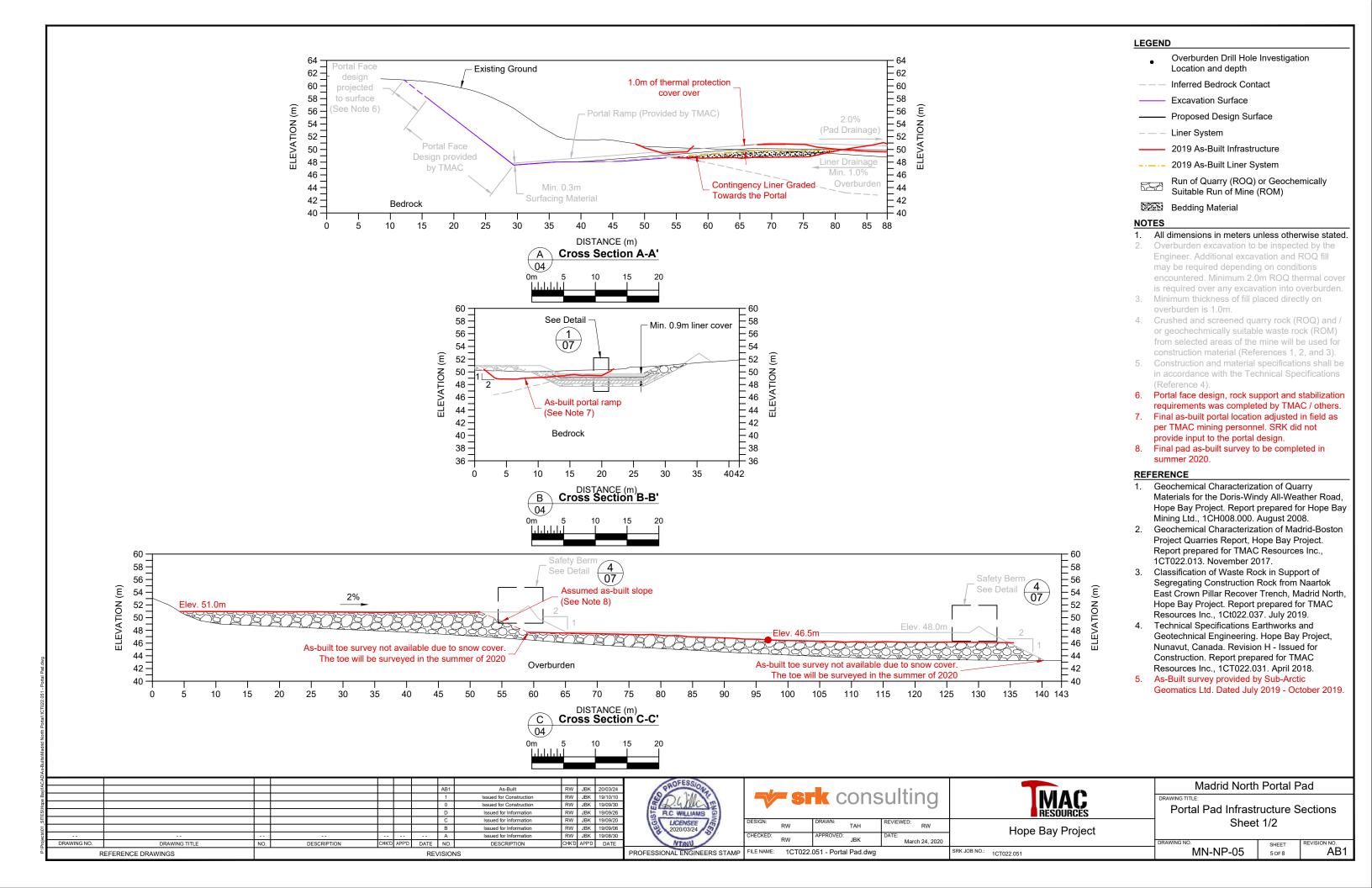


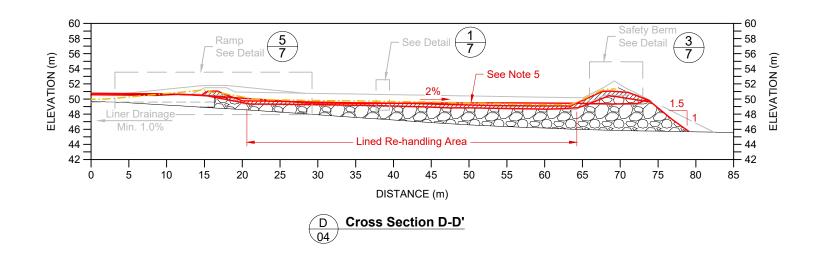


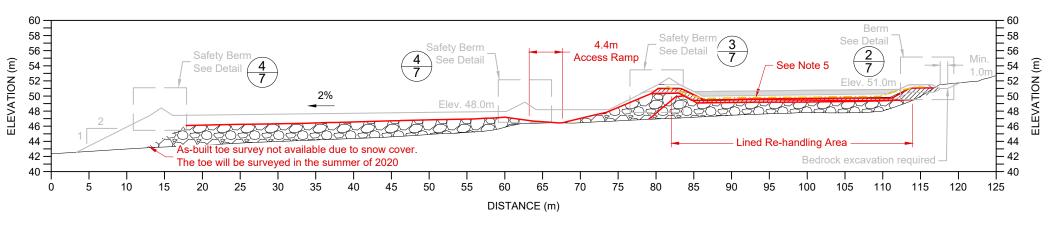




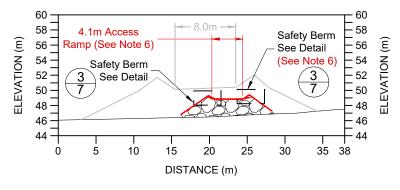








Cross Section E-E' 04



Cross Section F-F'

LEGEND

- Proposed Design Surface
- - Liner System
- Excavation Surface
- 2019 As-Built Infrastructure
- ---- 2019 As-Built Liner System
 - Run of Quarry (ROQ) or Geochemically
 - Surfacing Material
- Transition Material

NOTES

All dimensions in meters unless otherwise stated.

Suitable Run of Mine (ROM)

- Minimum thickness of fill placed directly on overburden is 1.0m.
- Crushed and screened quarry rock (ROQ) and/or geochemically suitable waste rock (ROM) from selected areas of the mine wil be used for construction material (References 1, 2, and 3).
- Construction and material specifications shall be in accordance with the Technical Specifications (Reference 4)
- As-built data above liner was unavailable at the time of as-built drawing updates.
- As-built survey of access road from waste re-handling area to Madrid South All-Weather Road to be re-surveyed in summer 2020 to confirm minimum design road width and berm heights are met.

REFERENCE

- 1. Geochemical Characterization of Quarry Materials for the Doris-Windy All-Weather Road, Hope Bay Project. Report prepared for Hope Bay Mining Ltd., 1CH008.000. August 2008.
- 2. Geochemical Characterization of Madrid-Boston Project Quarries Report, Hope Bay Project. Report prepared for TMAC Resources Inc., 1CT022.013. November 2017.
- Classification of Waste Rock in Support of Segregating Construction Rock from Naartok East Crown Pillar Recover Trench, Madrid North, Hope Bay Project. Report prepared for TMAC Resources Inc. 1Ct022.037. July 2019.
- Technical Specifications Earthworks and Geotechnical Engineering. Hope Bay Project, Nunavut, Canada. Revision H -Issued for Construction. Report prepared for TMAC Resources Inc., 1CT022.031. April 2018.
- As-Built survey provided by Sub-Arctic Geomatics Ltd. Dated July 2019 - October 2019.



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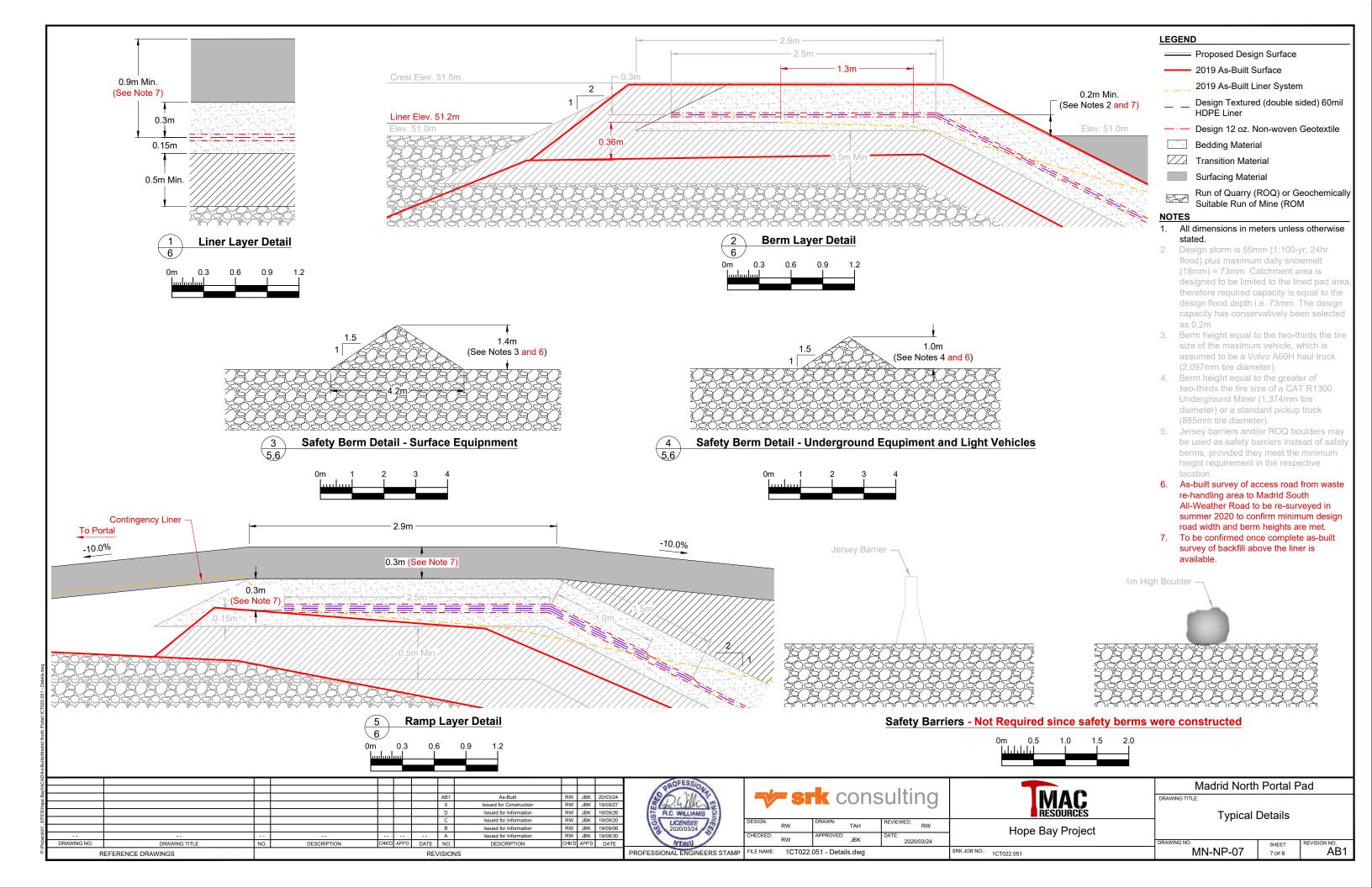


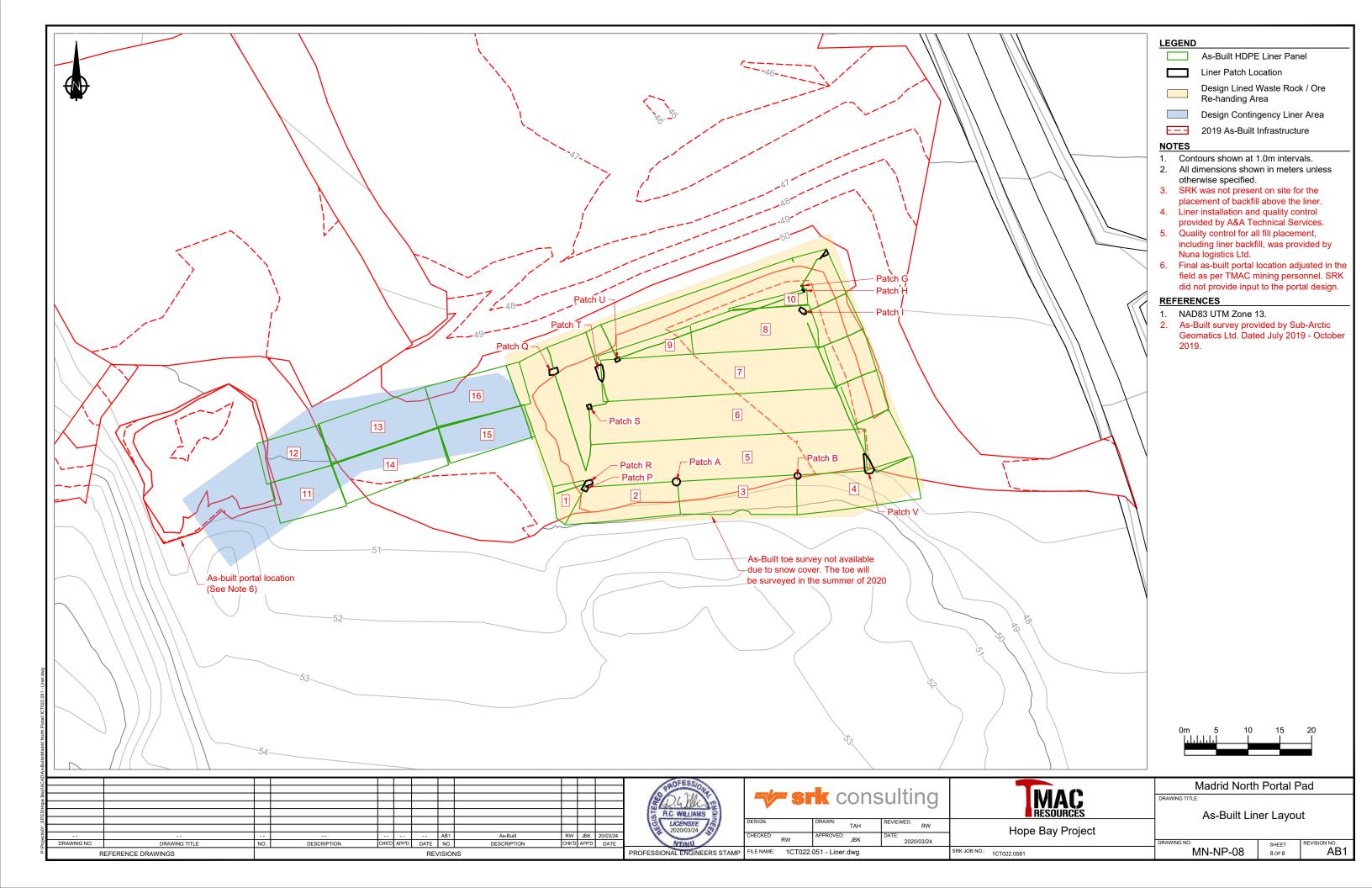
Madrid North Portal Pad

Portal Pad Infrastructure Sections Sheet 2/2

MN-NP-06

AB1















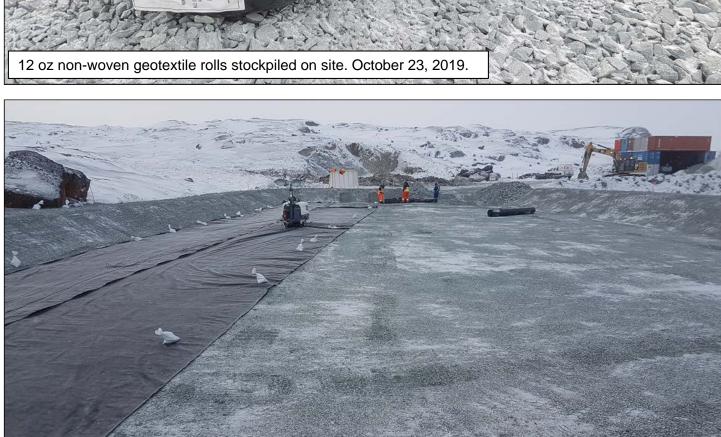


Madrid North Portal Pad

Lined Waste Re-Handling Area: Liner Subgrade Preparation

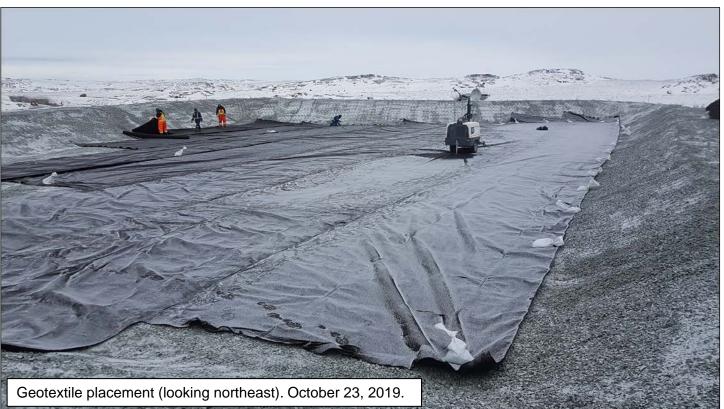
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Geotextile placement (looking west towards portal). October 23, 2019.







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Madrid North Portal Pad

Lined Waste Re-Handling Area: Geotextile (Below Liner) Placement

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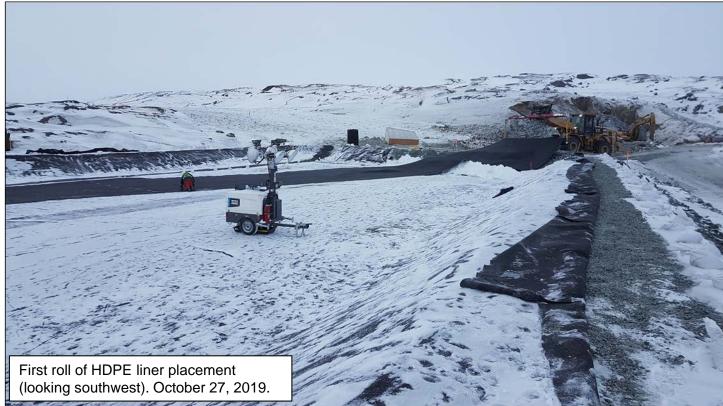
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Madrid North Portal Pad

Lined Waste Re-Handling Area: HDPE Liner Placement (1 of 2)

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Madrid North Portal Pad

Lined Waste Re-Handling Area: HDPE Liner Placement (2 of 2)

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Madrid North Portal Pad

Lined Waste Re-Handling Area: Geotextile (Above Liner) Placement

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Madrid North Portal Pad

Contingency Liner Area: Liner Subgrade Preparation

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Liner panel installation (looking east). October 30, 2019.



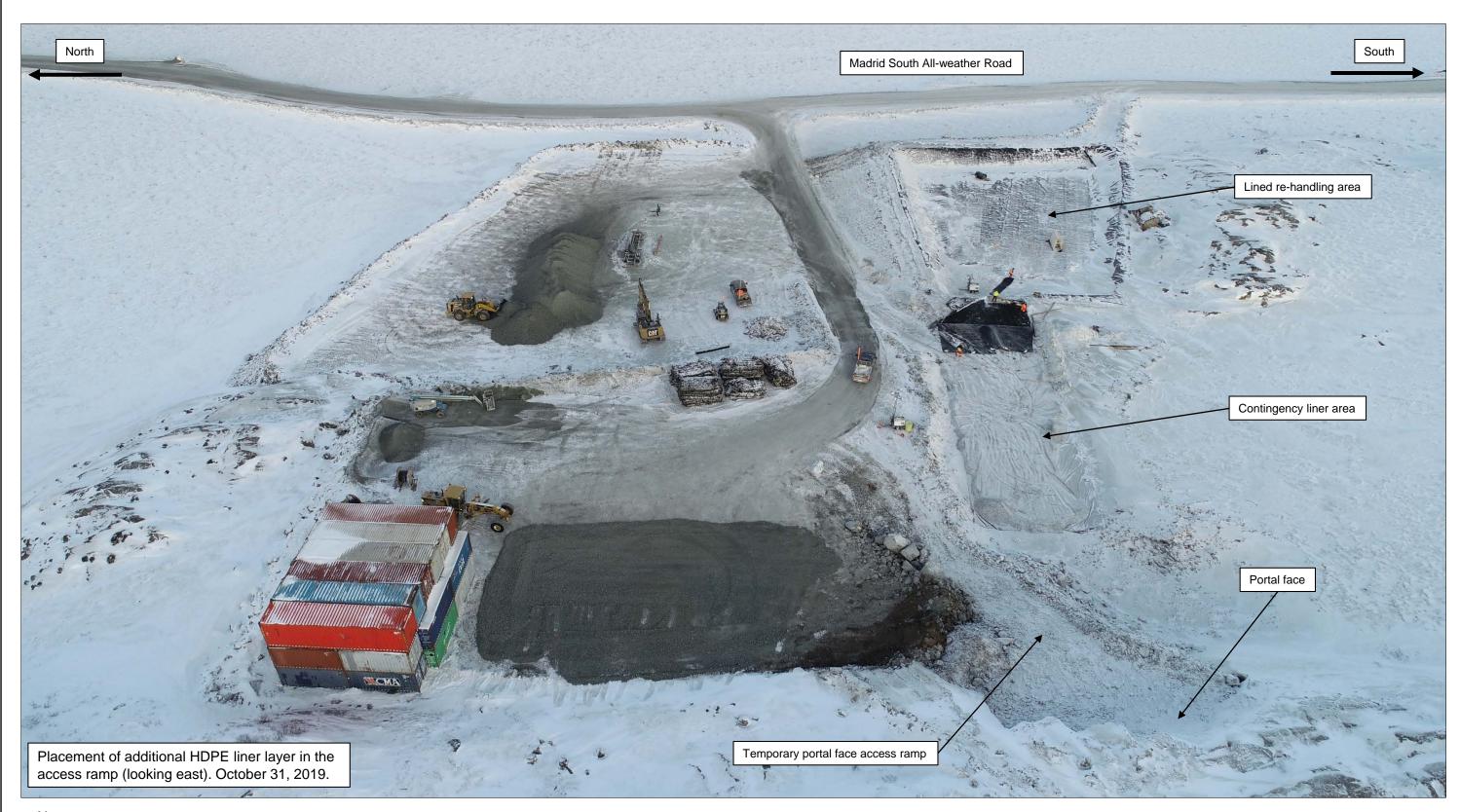




Madrid North Portal Pad

Contingency Liner Area: HDPE Liner Placement & Backfill

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- Drone photo provided by TMAC.
- Figure markups and notes added by SRK.



Madrid North Portal Pad

Lined Waste Re-Handling Area: Ramp Liner Installation

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- Photos provided by TMAC.Figure markups and notes added by SRK.



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Madrid North Portal Pad

Lined Waste Re-Handling Area: Final Liner Welding & Liner Backfill

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- Drone photo provided by TMAC.Figure markups and notes added by SRK.



Madrid North Portal Pad

Lined Waste Re-Handling Area: Liner Backfill

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- Drone photo provided by TMAC.Figure markups and notes added by SRK.



Madrid North Portal Pad

Lined Waste Re-Handling Area: Completion of Liner Backfill

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Engineering Drawings for the Madrid North Portal Surface Infrastructure Pad Hope Bay Project, Nunavut, Canada

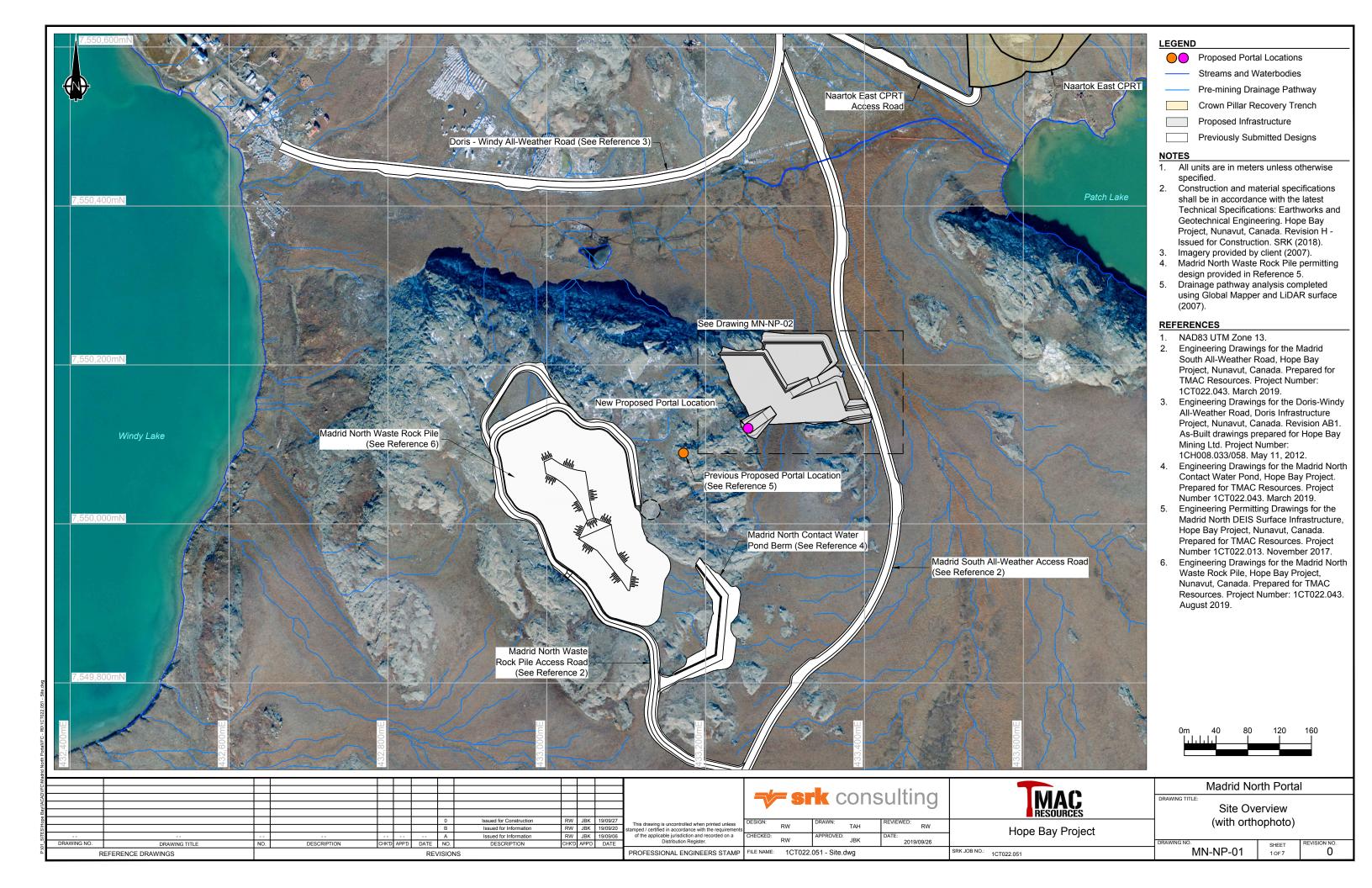
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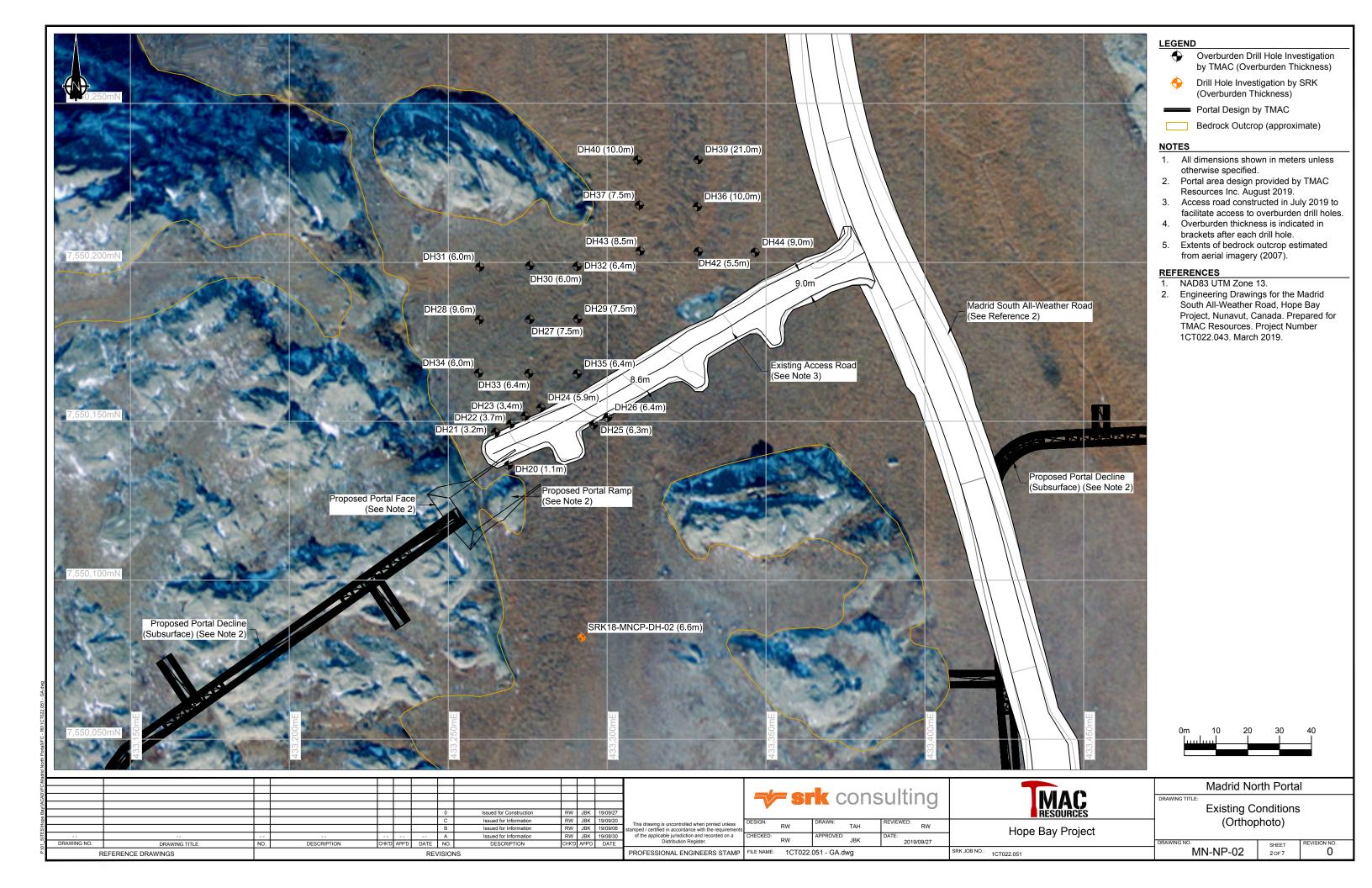
Drawing Number	Drawing Title	Issue	Date	Revision
MN-NP-01	Site Overview (with orthophoto)	Issued for Construction	2019/09/27	0
MN-NP-02	Existing Conditions (Orthophoto)	Issued for Construction	2019/09/27	0
MN-NP-03	Existing Conditions	Issued for Construction	2019/09/27	0
MN-NP-04	Portal Pad Infrastructure	Issued for Construction	2019/10/10	1
MN-NP-05	Portal Pad Infrastructure Sections Sheet 1/2	Issued for Construction	2019/10/10	1
MN-NP-06	Portal Pad Infrastructure Sections Sheet 2/2	Issued for Construction	2019/09/27	0
MN-NP-07	Typical Details	Issued for Construction	2019/09/27	0

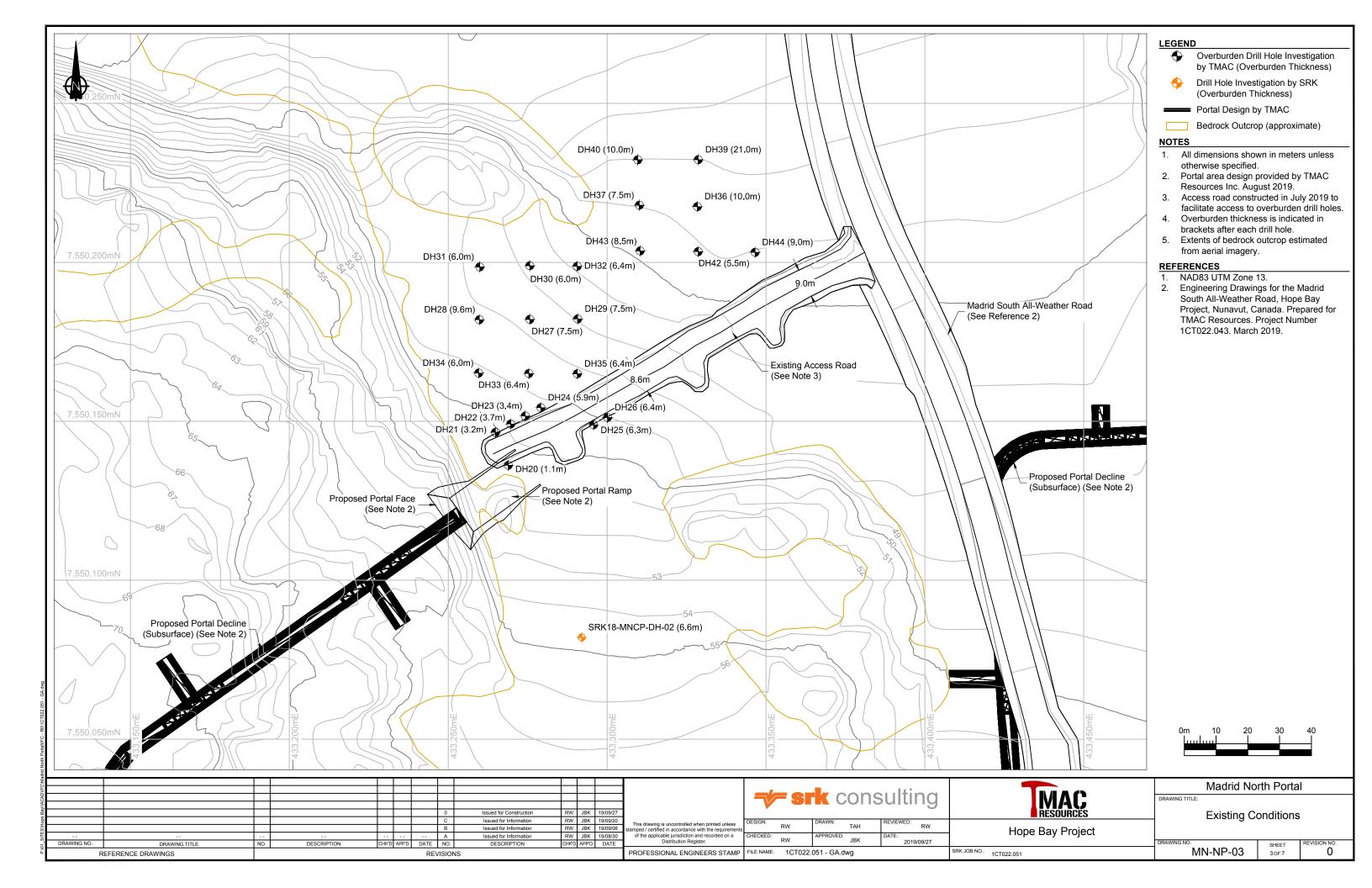


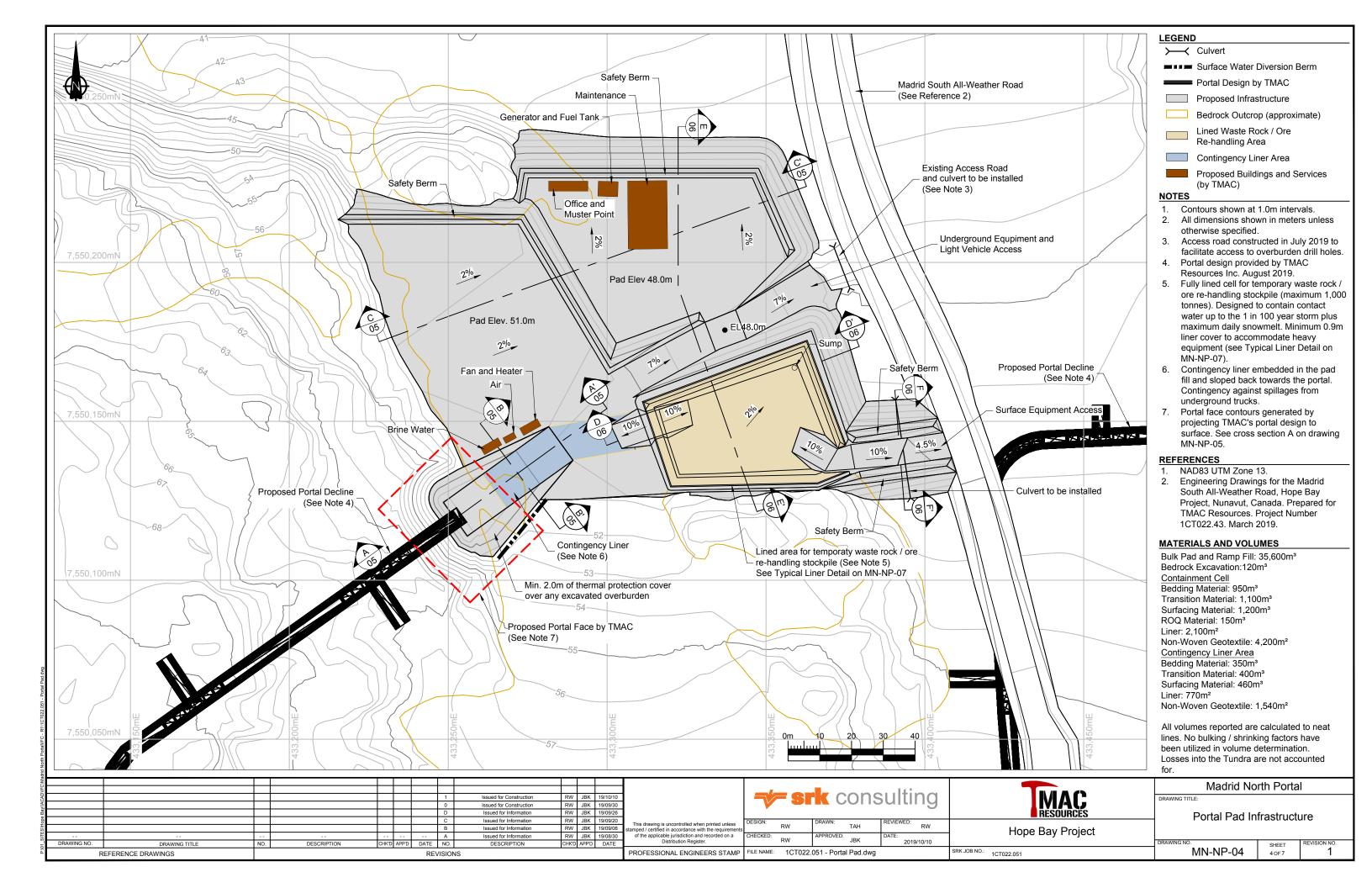


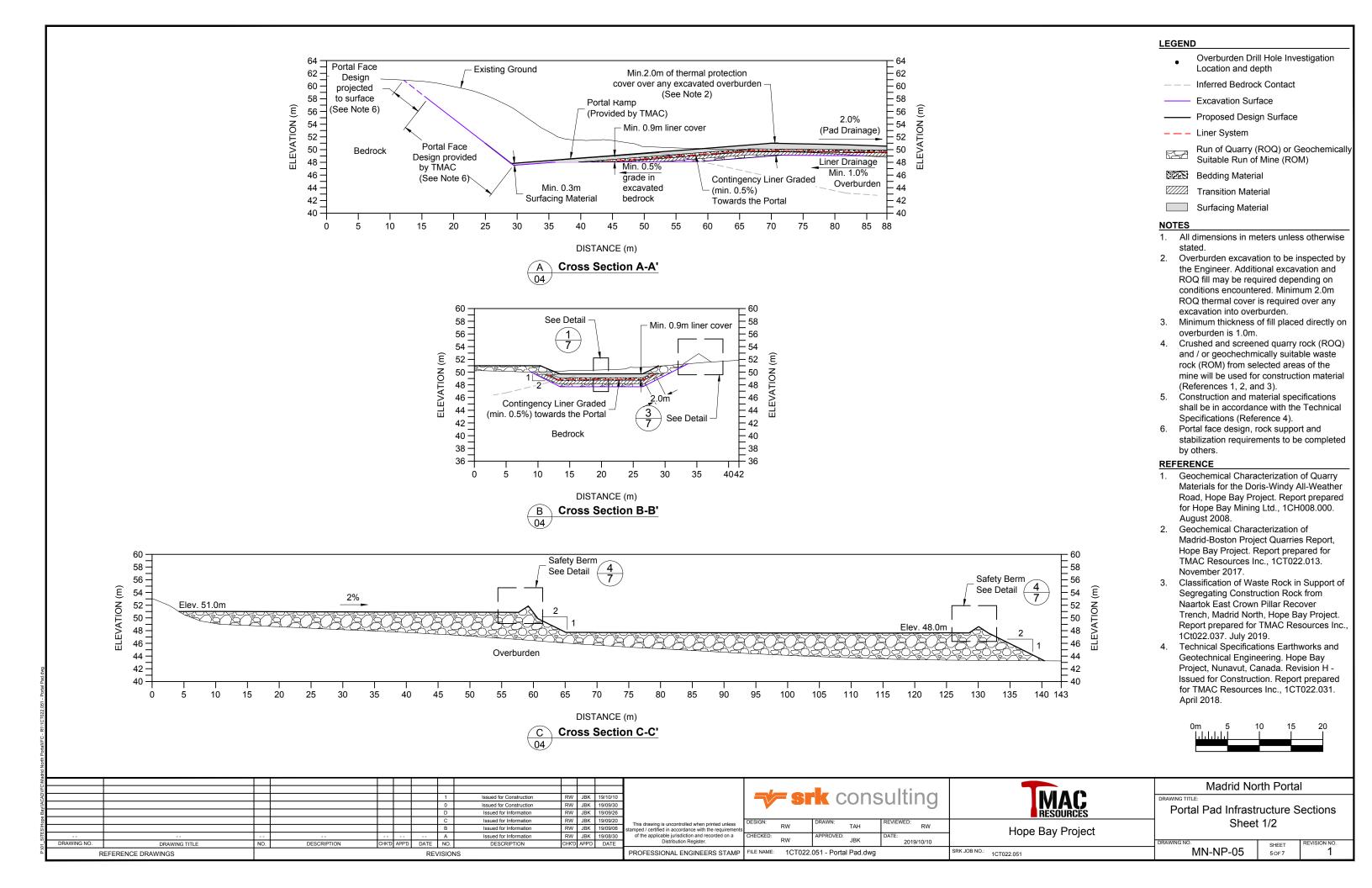
Project Number: 1CT022.051

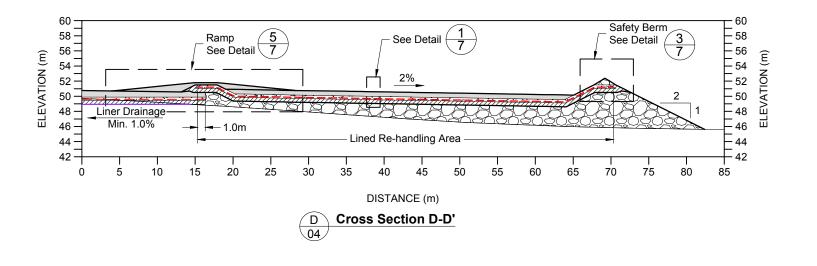


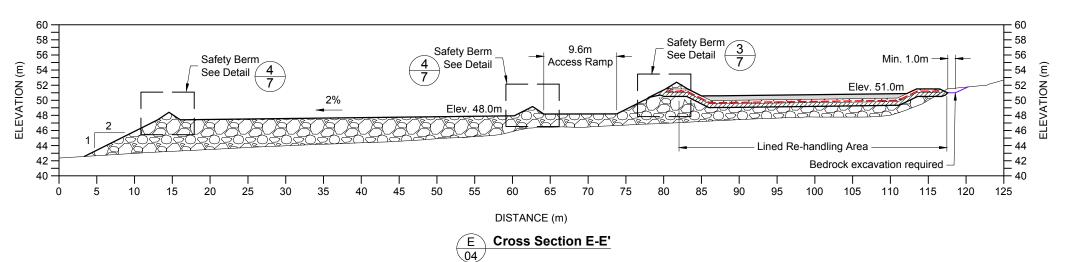


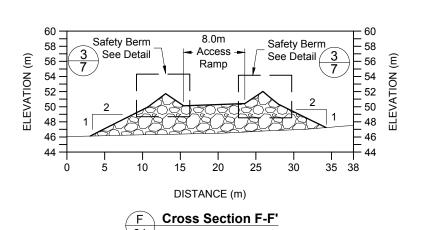












srk consulting SRK JOB NO.: 1CT022.051

MAC

Madrid North Portal

Portal Pad Infrastructure Sections Sheet 2/2

MN-NP-06

LEGEND

_ _ _ Liner System Excavation Surface

Surfacing Material

Transition Material

overburden is 1.0m.

Bedding Material

stated

REFERENCE

August 2008

November 2017.

April 2018.

1Ct022.037. July 2019.

— Proposed Design Surface

Run of Quarry (ROQ) or Geochemically

Suitable Run of Mine (ROM)

1. All dimensions in meters unless otherwise

be used for construction material (References 1, 2, and 3).

Specifications (Reference 4)

Minimum thickness of fill placed directly on

Crushed and screened quarry rock (ROQ) and/or geochemically suitable waste rock

(ROM) from selected areas of the mine will

Construction and material specifications shall be in accordance with the Technical

Geochemical Characterization of Quarry

Materials for the Doris-Windy All-Weather

Road, Hope Bay Project. Report prepared

for Hope Bay Mining Ltd., 1CH008.000.

Madrid-Boston Project Quarries Report, Hope Bay Project. Report prepared for TMAC Resources Inc., 1CT022.013.

Classification of Waste Rock in Support of

Report prepared for TMAC Resources Inc.,

Segregating Construction Rock from

Naartok East Crown Pillar Recover Trench, Madrid North, Hope Bay Project.

4. Technical Specifications Earthworks and

Geotechnical Engineering. Hope Bay Project, Nunavut, Canada. Revision H -Issued for Construction. Report prepared for TMAC Resources Inc., 1CT022.031.

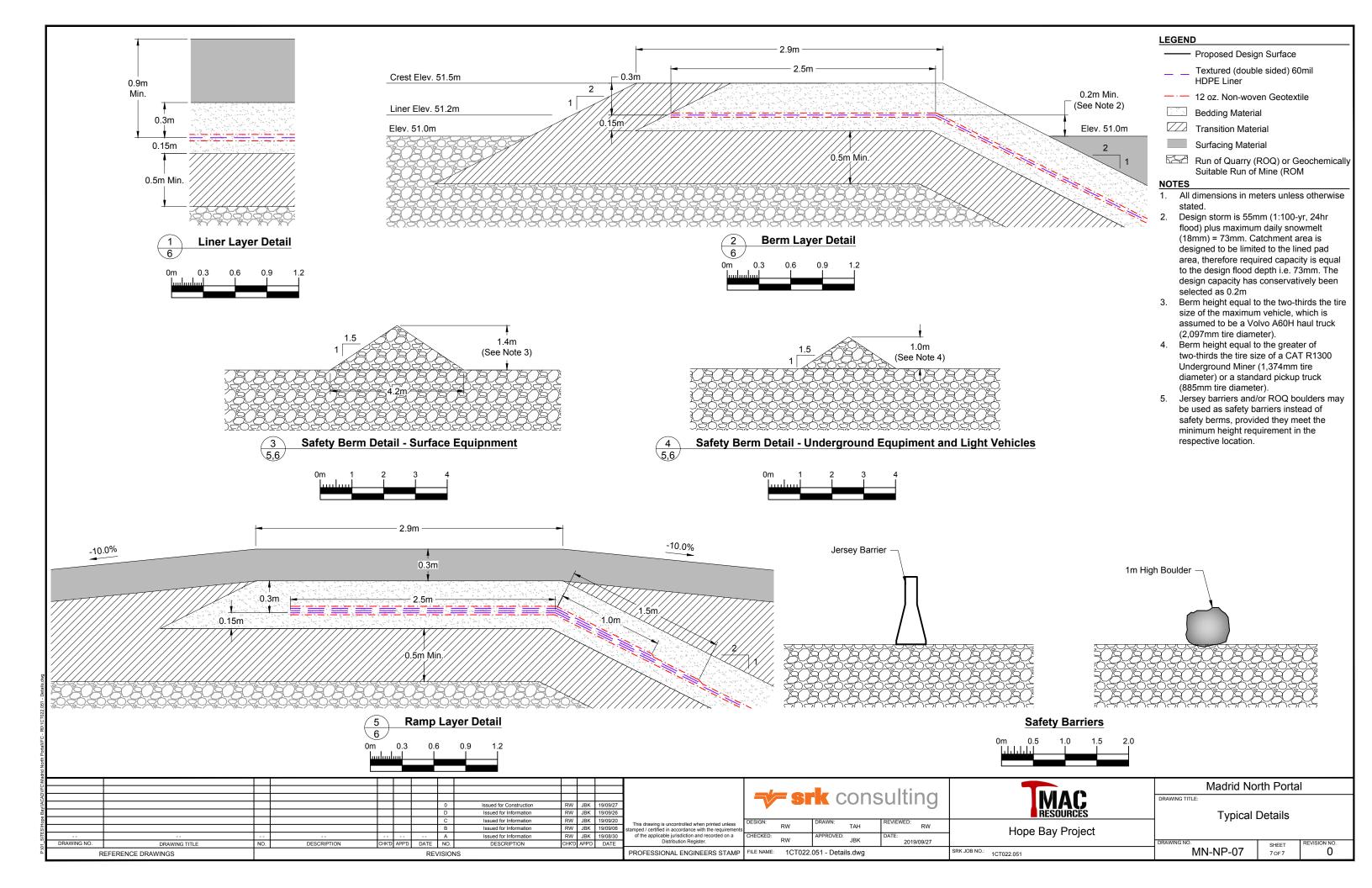
Geochemical Characterization of

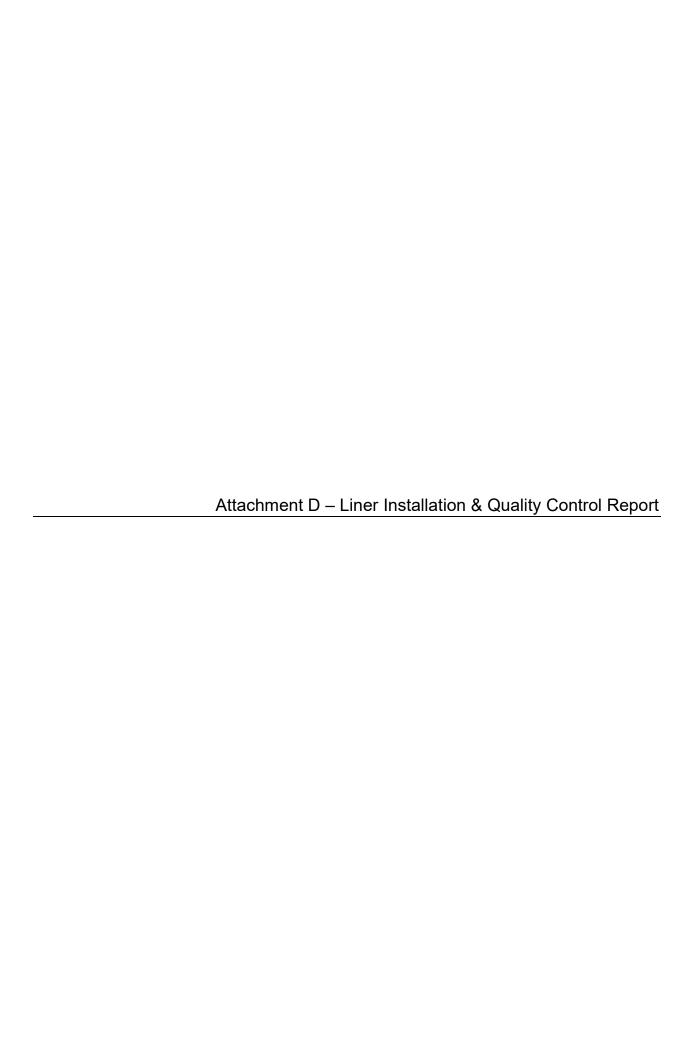
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Issued for Construction RW JBK 19/09/20 Issued for Information RW JBK 19/09/06 RW JBK 19/08/30 CHK'D APP'D DATE DRAWING TITLE REFERENCE DRAWINGS REVISIONS

This drawing is uncontrolled when printed unless amped / certified in accordance with the requirement of the applicable jurisdiction and recorded on a PROFESSIONAL ENGINEERS STAMP | FILE NAME: 1CT022.051 - Portal Pad.dwg

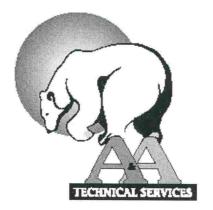
Hope Bay Project





Madrid Portal 60mil HDPE liner Installation October 23 – November 7, 2019

Client: TMAC Resources Inc.



Madrid Portal 60mil HDPE liner Installation October 23 – November 7, 2019

Client: TMAC Resources Inc.

August 25 – Oct 5, 2019

Page	Table of contents
1	Panel and seam layout drawing
2-5	Daily wedge/extrusion welder qualification data and destruct sample test results.
6	Non-destructive air pressure test data
7-8	International Association of Geosynthetic Installers (IAGI) Certified Welding Technician (CWT) certificates.
9	A&A Technical Services subgrade acceptance and warranty.



TMAC Resources Inc. Hope Bay NT Madrid Portal HDPE Liner

 $60 mil\ textured\ HDPE\ sandwiched\ between\ 540 g/m2\ non-woven\ geotextile.$ Panel layout drawing.



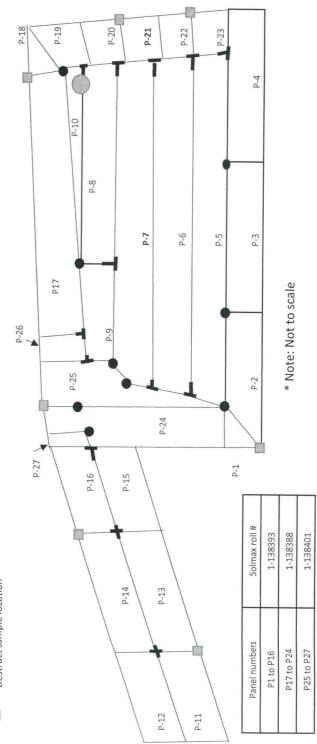
Extrusion Patch

Z

Extrusion T weld

Sump

Destruct sample location



A&A Technical Services Yellowknife NT October 22- November 7, 2019

TMAC Resources

Hope Bay - Madrid Portal Solmax 60mil single textured HDPE Daily wedge and extrusion welder qualification and destruct sample tests.

Test welds were completed in ambient conditions at site. Peel and shear tests were conducted inside Madrid office trailer at room temperature for prequalification of welders and destruct test samples.

Portable hoarding was used for all wedge and extrusion welding.

Wedge Welder - Demtech Prowedge #2

Tech: AH

Peel strength Temp. 420 C Speed 1.8m minute

27-Oct-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	142	145	91
2	138	136	91
3	145	142	91
4	139	141	91
27-Oct-19	Shear Strength		Minimum ppi (lbs/inch)
1	160		120
2	162		120

Wedge Welder - Demtech Prowedge #2

Tech: AH

Peel strength Temp. 420 C Speed 1.8m minute

30-Oct-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	144	135	91
2	146	150	91
3	148	151	91
4	146	149	91
30-Oct-19	Shear Strength		Minimum ppi (lbs/inch)
1	161		120
2	160		120

Wedge Welder - Demtech Prowedge #2

Tech: GH

Peel strength Temp. 420 C Speed 1.8m minute

02-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	140	145	91
2	142	150	91
3	139	142	91
4	135	142	91
02-Nov-19	Shear Strength		Minimum ppi (lbs/inch)
1	161		120
2	164		120

Wedge Welder - Demtech Prowedge #2

Tech: GH

Peel strength Temp. 420 C Speed 1.8m minute

St. 120 c Speed Light Himate			
03-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	137	141	91
2	139	145	91
3	144	138	91
4	140	148	91
03-Nov-19	Shear Strength		Minimum ppi (lbs/inch)
1	159		120
2	162		120



Wedge Welder - Demtech Prowedge #2

Tech: GH

Peel strength Temp. 420 C Speed 1.8m minute

04-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	139	148	91
2	144	140	91
3	142	139	91
4	136	139	91
04-Nov-19	Shear Strength		Minimum ppi (lbs/inch)
1	155		120
2	155		120

Extrusion welder daily prequalifications

Extrusion Welder- ProXL #1

Tech: AH

Hot air temp: - 260 C Extrudite temp: 250 C

27-Oct-19	Peel strength	Minimum ppi (lbs/inch)
1	138	78
2	144	78
3	132	78
4	138	78
27-Oct-19	Shear Strength	
1	158	120
2	152	120

Extrusion Welder- ProXL #1

Tech: GH

Hot air temp: - 260 C Extrudite temp: 250 C

trotan tempt 200 c Extradite temp. 250			30 0
30-Oct-19	Peel strength		Minimum ppi (lbs/inch)
1	141	144	78
2	132	135	78
3	140	131	78
4	136	136	78
30-Oct-19	Shear Strength		
1	158		120
2	160		120

Extrusion Welder- ProXL #1

Tech: GH

Hot air temp: - 260 C

Extrudite temp: 250 C

03-Nov-19	Peel strength	Minimum ppi (lbs/inch)
1	145	78
2	139	78
3	140	78
4	132	78
03-Nov-19	Shear Strength	
1	152	120
2	158	120



Destruct samples from wedge weld seams

Location: Top of seam panels 1 and 2.

Tech: AH

Peel strength

27.0 -+ 10	hand the second of	0	The state of the s
27-Oct-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	137	139	91
2	139	134	91
3	142	141	91
4	140	144	91
27-Oct-19			Minimum ppi (lbs/inch)
1	157		120
2	163		120

Location: S end of seam P11 and P13

Tech: AH

Peel strength Temp. 420 C Speed 1.8m minute

30-Oct-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	144	139	91
2	138	135	91
3	140	140	91
4	144	140	91
30-Oct-19	Shear Strength		Minimum ppi (lbs/inch)
1	167		120
2	155		120

Location: N end of seam P14 and P16

Tech: AH

Peel strength

	i cer strength		
30-Oct-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	144	144	91
2	144	138	91
3	142	141	91
4	136	145	91
30-Oct-19	Shear Strength		Minimum ppi (lbs/inch)
1	158		120
2	162		120

Location: Top of seam P17 and P-18

Tech: GH

Peel strength

	i cei sti ciigtii		
02-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)
1	141	132	91
2	140	145	91
3	137	135	91
4	138	139	91
02-Nov-19	Shear Strength		Minimum ppi (lbs/inch)
1	161		120
2	157		120



Location: Top of seam P20 and P21

Tech: GH

Peel strength

02-Nov-19			Minimum ppi (lbs/inch)	
1	139	144	91	
2	142	141	91	
3	136	139	91	
4	137	135	91	
02-Nov-19	Shear Strength		Minimum ppi (lbs/inch)	
1	161	120		
2	163		120	

Location: Top of seam P22 and P23

Tech: GH

Peel strength

. coron angui				
02-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)	
1	137	144	91	
2	141	142	91	
3	137	142	91	
4	144	142	91	
02-Nov-19	Shear Strength		Minimum ppi (lbs/inch)	
1	154		120	
2	159		120	

Location : Top of seam P24 and P25

Tech: GH

Peel strength

03-Nov-19	Inside weld	Outside weld	Minimum ppi (lbs/inch)		
1	144	142 91		142	91
2	142	145 91			
3	134	144	91		
4	149	142	91		
03-Nov-19	Shear Strength		Minimum ppi (lbs/inch)		
1	160	120			
2	165		120		

A&A Technical Services Yellowknife NT October 22- November 7, 2019



TMAC Resources

Hope Bay - Madrid Portal Solmax 60mil single textured HDPE

Non - Destructive air pressure testing of dual wedge weld seams. $% \label{eq:control_eq} % \label{eq:control_eq}$

Minimum 30 psi over 5 minutes with less than 4 psi loss in pressure = Pass

		5 minutes w		T		= Pass
Date	Technician	Seam location	Start psi	Finish psi	Pass/Fail	Comments
Oct. 27/19	AH	P-1 - P-2	30	30	Pass	
Oct. 27/19	AH	P-2 - P-3	35	35	Pass	
Oct. 27/19	AH	P-3- P-4	35	35	Pass	
Oct. 27/19	AH	P-4 - P-5	35	35	Pass	
Oct. 27/19	AH	P-3 - P-5	35	35	Pass	
Oct. 27/19	AH	P-2 - P-5	35	35	Pass	
Oct. 27/19	АН	P-8 -P-9	34	34	Pass	
Oct. 27/19	АН	P-5-P-6	34	34	Pass	
Oct. 27/19	AH	P-6-P-7	35	35	Pass	
Oct. 27/19	АН	P-7 - P-8	35	35	Pass	
Oct. 27/19	АН	P-8 P-10	35	35	Pass	
	Due to broke	n valve on air ta	ank, weather a	and time cons	traints additio	nal destruct samples
	were taken f	rom wedge we	ld seams inste	ad of air testin	ıg.	
		·				
						page 6

CERTIFIED WELDING TECHNICIAN



The International Association of Geosynthetic Installers Certifies:

ALAN HARMAN

hands-on skills, knowledge and experience in the welding and installation of polyethylene (PE) geomembranes, and As a Certified Welding Technician, in polyethylene wedge and extrusion welding, having demonstrated superior having basic mechanical aptitude for working with welders and equipment on the job site.

Registration number: CWT162010

Valid 07 June 2016 — 07 June 2021

International Association of Geosynthetic Installers

President, IAGI

1 1 1

Managing Director, IAG

CERTIFIED WELDING TECHNICIAN



The International Association of Geosynthetic Installers Certifies

GUY HORESAY

hands-on skills, knowledge and experience in the welding and installation of polyethylene (PE) geomembranes, and As a Certified Welding Technician, in polyethylene wedge and extrusion welding, having demonstrated superior having basic mechanical aptitude for working with welders and equipment on the job site. Registration number: CWT170010

Valid 07 June 2016 — 07 June 2021

International Association of Geographics Installers

President, IAGI

Man of the state o

Managing Director, IAGI

Madrid Portal 60mil HDPE liner Installation October 23 – November 7, 2019

Client: TMAC Resouces Inc.

Upon arrival to site the containment area to be lined was thoroughly inspected by A&A Technical Services installation supervisor and deemed to be a suitable surface on which to place the HDPE lining system. The Solmax 60 mil single textured HDPE was sandwiched between two layers of 540g/m2 non-woven geotextile. The lining system was placed over a compacted layer of -25mm crushed rock and backfilled with the same.

Warranties issued by A&A Technical Services shall cover only the cost of replacement and/or repair of defective installations, determined or agreed to be the responsibility of A&A Technical Services, provide that the warranty work will be performed to the same standards and scope of work set out in the contract documents. A&A's installation warranty shall commence upon acceptance of the individual geosynthetic components by the owner or its representative as such components are completed. The installation warranty period shall not exceed beyond 1 years. Our installation warranty is rendered null and void if the installed geosynthetics are subject to abuse by machinery, equipment or personnel not under the control of A&A, harmful chemicals or unusual weather conditions or catastrophic earthworks failures.

A&A Technical Services shall not be held liable for defects, damage and/or deficient materials and installations, either in whole or in part should the defects, damage or deficient materials and installations arise as the result from the use of poor quality and inappropriate or unsuitable earthworks material or site preparation. This limitation of liability extends to improper and/or construction techniques, and methods and equipment used to create the earthworks covering all or any portion of the completed geosynthetic installation.

Signed: Olon Harran

Dated: November 7, 2019

Al Harman President A&A Technical Services Yellowknife NT





TECHNICAL DATA SHEET

HDPE Series, 1.50 mm

Black, Top Side Single Textured

2801 Marie-Victorin Blvd. Varennes, Quebec Canada J3X 1P7 Tel: (450) 929-1234 Sales: (450) 929-2544 Toll free in North America:1-800-571-3904 www.Solmax.com www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY(1)	UNIT Metric	1022403
SPECIFICATIONS				
Nominal Thickness		-	mm	1.50
Thickness (min. avg.)	ASTM D5994	Every roll	mm	1.43
Lowest ind. for 8 out of 10 values			mm	1.35
Lowest ind. for 10 out of 10 values			mm	1.28
Asperity Height (min. avg.) (3)	ASTM D7466	Every roll	mm	0.40
Textured side		-		Тор
Melt Index - 190/2.16 (max.)	ASTM D1238	1/Batch	g/10 min	1.0
Sheet Density (8)	ASTM D792	Every 10 rolls	g/cc	≥ 0.940
Carbon Black Content (9)	ASTM D4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	Every 10 rolls	Category	Cat. 1 / Cat. 2
OIT - standard (avg.)	ASTM D3895	1/Batch	min	100
Tensile Properties (min. avg) (2)	ASTM D6693	Every 2 rolls		
Strength at Yield			kN/m	23
Elongation at Yield			%	13
Strength at Break			kN/m	23
Elongation at Break			%	150
Tear Resistance (min. avg.)	ASTM D1004	Every 5 rolls	N	200
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	N	535
Dimensional Stability	ASTM D1204	Certified	%	± 2
Stress Crack Resistance (SP-NCTL)	ASTM D5397	1/Batch	hr	500
Oven Aging - % retained after 90 days	ASTM D5721	Per formulation		
HP OIT (min. avg.)	ASTM D5885		%	80
UV Res % retained after 1600 hr	ASTM D7238	Per formulation		
HP-OIT (min. avg.)	ASTM D5885		%	50
Low Temperature Brittleness	ASTM D746	Certified	°C	- 77
SUPPLY SPECIFICATIONS (Roll d	imensions may vary ±1°	%)		
Roll Dimension - Width			m	8.00
Roll Dimension - Length		m	135.0	
Area (Surface/Roll)			m²	1080.0

NOTES

- 1. Testing frequency based on standard roll dimension and one batch is approximately 180,000 lbs (or one railcar).
- 2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
- 3. Lowest individual and 8 out of 10 readings as per GRI-GM13 / 17, latest version.
- 8. Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.
- 9. Correlation table is available for ASTM D1603 vs ASTM D4218. Both methods give the same results.
- * All values are nominal test results, except when specified as minimum or maximum.
- * The information contained herein is provided for reference purposes only and is not intended as a warranty of guarantee. Final determination of suitability for use contemplated is the sole responsability of the user. SOLMAX assumes no liability in connection with the use of this information.

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TE-12





Titan has provided the containment and erosions control industries with the highest quality geotextiles available. Our nonwoven needle punched geotextiles are manufactured using polypropylene fibers, which are formed into a dimensionally stable network which allows the fibers to maintain their relative position. These products resist ultraviolet deterioration, rotting, biological degradation, and are inert to commonly encountered soil chemicals.

TESTED PROPERTY	TEST METHOD	UNIT ENGLISH (METRIC)	VALUE ENGLISH (METRIC)		
Tensile Strength (Grab)	ASTM D 4632	lbs (N)	300 (1335)		
Elongation	ASTM D 4632	%	50		
CBR Puncture	ASTM D 6241	lbs (N)	825 (3671)		
Trapezoid Tear	ASTM D 4533	lbs (N)	115 (511)		
U.V. Resistance	ASTM D 4355	%/hrs	70/500		
Apparent Opening Size (AOS)*	ASTM D 4751	U.S. Sieve (mm)	100 (0.150)		
Permittivity	ASTM D 4491	sec ⁻¹	1.0		
Water Flow ASTM D 4491		gpm/ft ² (I/min/m ²)	75 (3055)		
TYPICAL ROLL DIMENSIONS					
Roll Dimensions		ft	12.5 x 360 15 x 300		
Roll Area		yd ²	500		
Estimated Roll Weight		lbs	375		

NOTES:

Mullen Burst ASTM D 3768 has been removed. It is not recognized by ASTM D 35 on Geosynthetics.

Puncture ASTM D 4833 has been removed. It is not recognized by AASHTO M288 and has been replaced with CBR Puncture ASTM D 6241.

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Toll Free: 1-866-327-1957 | Email: info@titanenviro.com | Web: www.titanenviro.com (Rev. April, 2018)

^{*}Maximum average roll value.