February 15th, 2023

Ali Shaikh
Technical Advisor
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU,
X0B 1J0

Sent via Email: ali.shaikh@nwb-oen.ca

Re: Water License 2AM-DOH1335 – Notice of Construction for Doris Vent Raise and Crown Pillar Surface Water Diversion Infrastructure

Dear Mr. Shaikh,

This letter represents Agnico Eagle Mines (**Agnico**) written notification to the Nunavut Water Board (**NWB**) regarding the planned construction of surface water diversion infrastructure near the Doris Vent Raise and Crown Pillar Recovery Trench area. This notification is being provided to the NWB prior to commencement of work, as required under the Type A Water License 2AM-DOH1335 Part D Item 1.

The purpose of this infrastructure is to mitigate surface water inflows into the underground workings by diverting flows. In previous years, a significant volume of water has been observed to be flowing into the underground mine via the Doris Vent Raise shaft, and via the Doris Crown Pillar Recovery Trench backfill area. Surface water that enters the mine must then be managed as contact water, placing additional demands on Hope Bay's water treatment and storage infrastructure.

A design overview and stamped construction drawings are provided in Attachment 1.

Should you have any questions please feel free to contact me at Brennan.jay@agnicoeagle.com

Sincerely,

Brennan Jay

Geotechnical EIT - Agnico Eagle Mines Limited - Hope Bay Mine

Cc:
Licensing (NWB)

Attachments
Attachment 1: Doris Vent Raise Surface Water Management - Design Overview

srk consulting

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Memo

To	Brennan Jay, AEM	**Client**	Agnico Eagle Mines Limited
From	Peter Luedke, PEng, Mark Sumka PEng John Kurylo, PEng	**Project**	CAPR002283
		Date	February 14, 2023
Subject	Doris Vent Raise Surface Water Management - Design Overview		

File name: Doris_VentRaise_SWInfra_DesignMemo_CAPR002283_20230214_final.docx

1 Introduction

SRK Consulting (Canada) Inc. was retained by Agnico Eagle Mines Limited (Agnico Eagle) to develop a detailed design for surface water management infrastructure in near the Doris Vent Raise and Doris Crown Pillar Recovery Trench (Doris CPRT) at the Hope Bay mine in Nunavut. This memo documents the design and supports the notice of construction.

2 Project Purpose

Inflows of surface water have been observed at the Doris Vent Raise and the backfilled Doris Crown Pillar Recovery Trench over the recent past spring and summer seasons, with significant inflows observed during freshet and following heavy rain events. The purpose of this project is to construct diversions upstream of the infrastructure to reduce these surface water inflows and direct the water to the Doris Lake (the historic receiving body for this catchment).

3 Hydrologic Design Basis

3.1 Catchment Area

The Doris Vent Raise and CPRT are located southeast of the Doris Camp, along the TIA access road. The catchment area is defined by a bedrock ridge and the Doris Mesa to the north west, which historically flowed to the southwest into Doris Lake and Doris Creek. The maximum catchment area reporting to the proposed Doris Vent Raise culvert is estimated to be 8.2 ha.

3.2 Hydrology

The design basis for the proposed surface water infrastructure uses the site-specific intensity-duration-frequency (IDF) curves adjusted for climate change using RCP4.5 for the 2050s (SRK 2022) and

distributed using an alternating block storm hyetograph (Chow, Maidment, & Mays 1988). In accordance with the Agnico Eagle Corporate Standards (AEM 2021), infiltration losses (i.e. runoff coefficient of 1.0) and time of concentration were not considered.

The average 30-day snowmelt was applied to consider freshet conditions. Snowmelt was distributed equally over 30-days.

The resulting design events are summarized in Table 1 below.

Table 1: Doris Vent Raise Design Event

Return Period (yr)	24-hour Precipitation (mm)	24-hour Snowmelt (mm)	24-hour Precipitation + snowmelt (mm)	30-day Snowmelt (mm)
100	**62.3**	**56.1**	**118.4**	**307**
50	**51.8**	**53.3**	**105.1**	**289**
20	**41.1**	**49.1**	**90.2**	**262**
10	**32.9**	**45.4**	**78.3**	**237**
5	**27**	**40.9**	**67.9**	**207**
2	**19.4**	**32.2**	**51.6**	**151**

4 Culvert Sizing

Based on the site inventory, Corrugated Steel Pipe (CSP) with diameters of 600 mm were considered for this design.

Culvert sizing was completed using the HY-8 culvert analysis program (FHA 2021) for both the 10-year and 100-year design flow, and for both a two- and three-barrel design. A single barrel design was excluded due to the maintenance issues associated with freezing conditions and aufeis. The results of the analysis are shown in Table 2.

Table 2: Culvert Sizing

Culvert Type	Barrels	10-yr Design Flow (m^3/s)	10-yr Event Minimum Freeboard (m above culvert)	100-yr Design Flow (m^3/s)	100-yr Event Minimum Freeboard (m above culvert)
600 mm CSP	2	0.81	0.29	1.58	2.8
600 mm CSP	3	0.81	-[1]	1.58	0.97

Notes:

[1] Flow is fully contained within the culverts (i.e., no back water)

Due to the location of the culvert, an upstream diversion berm will be constructed on the east side of the upstream ditch alignment, toward the vent raise. This will help to contain overtopping or back water during large flow events. Where the backwater exceeds the elevation of the TIA access road, the grade will be field fit to direct excess water flow over the berm and road, toward the downstream ditch, or toward the vent raise until the flow subsides.

5 Diversion Ditch and Berm

5.1 Diversion Sizing

Diversion ditches are proposed upstream of the Vent Raise and CPRT to direct flow through the culverts and convey the flow from the culverts to the downstream outlet ditch/channel. The diversion ditch sizing is provided below.

Table 3: Diversion Ditch Sizing

Ditch Alignment	Assumed Design Catchment (ha)	10-yr Design Flow (m^3/s)	10-yr Flow Depth (m)	100-yr Design Flow (m^3/s)	100-yr Flow Depth (m)
Alignment 1 (U/S of Vent raise)	5.2	0.51	0.27	1.00	0.39
Alignment 2 (U/S of TIA Access road and CPRT)	2.4	0.24	0.17	0.46	0.26
Alignment 3 (D/S of culvert)	8.2	0.81	0.35	1.58	0.49

5.2 Ditch and Berm Armoring and thermal protection

The diversion ditches will be excavated and lined with non-woven geotextile. Clean run-of-quarry material / spalls is recommended for armoring the ditches, with a grain-sizes ranging from 25 mm – 250 mm. The armoring layer will be 0.5 m thick to serve as thermal protection where the ditch is excavated in permafrost.

6 Construction Considerations

The proposed construction in along the Secondary Road which is the only access to the TIA. This requires a few important construction considerations:

- Construction is expected to take place using a phased approach.
  - Construction of Phase 1 channels is expected to occur prior to freshet.
  - Construction of remaining infrastructure (if required) will take place after freshet.

  - After Phase 1, additional infrastructure will be constructed based on the evaluated effectiveness of the Phase 1 infrastructure. (i.e. Phase 1 channels will be lengthened if required to capture surface water flow).
- Duration of restricted access to the TIA shall be kept to a minimum, by completing the culvert installation in an expedient manner.
- All pipelines and utilities shall be located and flagged prior to the start of construction in the area.
- Exposed or disturbed permafrost overburden remaining after construction shall be minimized, and covered by a minimum of 0.5 m of ROQ fill (thermal protection) to the extent practicable. Maintenance will be completed as necessary following construction.
- Construction traffic shall be maintained within the ultimate construction footprint of the proposed works, so as to minimize disturbance to the tundra.
- All surface runoff for the duration of construction will be managed according to water license 2AM-DOH1335 Part D, Item 9.

7 Environmental and Monitoring Considerations

- Best practices for construction and erosion control measures will be implemented and license requirements for construction will be adhered to.
- For the first year, periodic inspections will be completed prior to and during freshet, and following any notable rain events.
- All surface runoff for the duration of construction will be sampled according to water license 2AM-DOH1335 Part D, Item 9.

8 Closure

It you have any questions or concerns regarding the design or notice of construction, please contact Agnico Eagle (Brennan.jay@agnicoeagle.com) or SRK (pluedke@srk.com, jkurylo@srk.com)

Regards,
SRK Consulting (Canada) Inc.

Peter Luedke PEng
Senior Consultant

Mark Sumka PEng
Senior Consultant

Reviewed by

John Kurylo PEng
Principal Consultant

Attachments:

Attachment 1 Drawings

SRK Consulting (Canada) Inc. has prepared this document for Add client name, our client. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this document have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

References

AEM (Agnico Eagle Mines Ltd). (2021). RMMS Corporate Standard – Water Management. July 12, 2021

Chow, V., Maidment, D., & Mays, L. (1988). Applied Hydrology. New York: McGraw-Hill Book Company.

[FHA] Federal Highway Administration. (2021). HY-8 Culvert Hydraulic Analysis Program version 7.70.1.

SRK Consulting (Canada) Inc. (2022). Hope Bay Climate Update. Technical Memo prepared for Agnico Eagle Mines Ltd. Project number 1CT022.066

Attachment 1 Drawings

Engineering Drawings for
Vent Raise Surface Water Management
Hope Bay, Nunavut, Canada

Active Drawing Status

Drawing Number	Drawing Title	Issue	Date	Revision
VRP-WM-100	General Arrangement	Issued for Permitting	February 8, 2023	A
VRP-WM-101	Existing Conditions	Issued for Permitting	February 8, 2023	A
VRP-WM-102	Site Plan	Issued for Permitting	February 8, 2023	A
VRP-WM-200	Diversion Ditch 1 Segment A Plan and Profile	Issued for Permitting	February 8, 2023	A
VRP-WM-201	Diversion Ditch 1 Segment B Plan and Profile	Issued for Permitting	February 8, 2023	A
VRP-WM-202	Diversion Ditch 2 Plan and Profile	Issued for Permitting	February 8, 2023	A
VRP-WM-300	Typical Sections	Issued for Permitting	February 8, 2023	A
VRP-WM-400	Typical Details	Issued for Permitting	February 8, 2023	A

AGNICO EAGLE

REGISTERED PROFESSIONAL ENGINEER
J.B. KURYLO
LICENSEE
2023/02/10
NT/NU

srk consulting

Project Number: CAPR002283

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LEGEND

- Existing Infrastructure
- Estimated Catchment Area
- Proposed Infrastructure

NOTES

1. All units are in meters unless otherwise specified.
2. Contours are shown at 0.5 m intervals.

REFERENCES

NAD83 UTM Zone 13.
World Imagery retrieved from Global Mapper, July 2021.
Pre-mining contours (2008) provided by client.

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DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issue for Permitting	PDL	JBK	2023/02/08

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FILE NAME: CAPR002283 - Vent Raise Surface Water Mgmt - GA.dwg

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Hope Bay

SRK JOB NO.: CAPR002283

Vent Raise Surface Water Management

General Arrangement

DRAWING NO.: VRP-WM-100
REVISION NO.: A

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LEGEND

- Existing Infrastructure
- Existing Pipelines and Utilities (See Note 3 and 4)
- Existing Vent Raise Area

NOTES

1. All units are in meters unless otherwise specified.
2. Contours are shown at 1.0 m intervals.
3. Existing infrastructure and utility alignments provided by client in site as-constructed file. Utilities/Pipelines must be located and identified prior to construction.
4. Existing tailings and water pipelines will need to be temporarily moved, relocated, cut, and /or modified to complete construction and installation of the culvert through the existing road.

REFERENCES

NAD83 UTM Zone 13.
World Imagery retreived from Global Mapper, July 2021.
Pre-mining contours (2008) provided by client.
As-constructed contours from survey, December 04, 2011.

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Vent Raise Surface Water Management

Exisiting Conditions

DRAWING NO. VRP-WM-101

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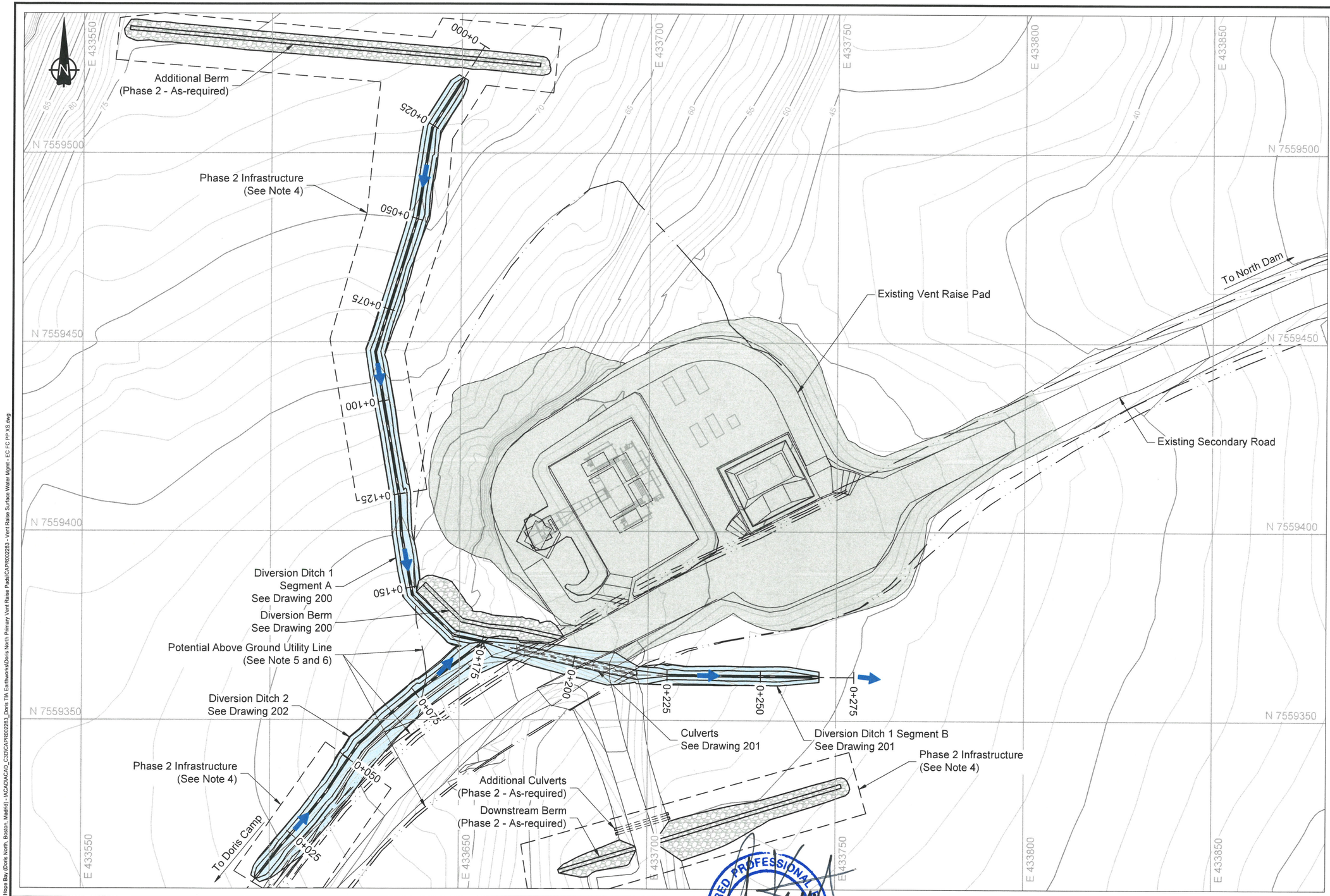

LEGEND

- Flow Direction
- Existing Infrastructure
- Existing Pipelines and Utilities (See Note 5 and 6)
- Diversion Berm
- Existing Vent Raise Area
- Surface Water Management Ditches and Culvert Trench

NOTES

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2. Contours are shown at 1.0 m intervals.
3. Construction of as-required infrastructure will be field-fit following the principles of the design. Addition of this infrastructure will be based on performance of the proposed infrastructure and documented in as-constructed reporting.
4. Phase 2 to be constructed as needed, based on the performance of Phase 1 infrastructure.
5. Existing infrastructure and utility alignments provided by client in site as-constructed file. Utilities/Pipelines must be located and identified prior to construction.
6. Existing tailings and water pipelines will need to be temporarily moved, relocated, cut, and/or modified to complete construction and installation of the culvert through the existing road.

REFERENCES

NAD83 UTM Zone 13.
Pre-mining contours (2008) provided by client.
As-constructed contours from survey, December 04, 2011.

MATERIALS LIST AND QUANTITIES

Phase 1 Ditches and Culvert Trench	
Excavation	830m^3
ROQ Armouring	262m^3
Culvert Bedding	212m^3
Culvert Backfill	177m^3
Diversion Berm	181m^3
Non-woven Geotextile	1,294m^2
Culvert Pipe (CSP - 600 mm Ø)	67m

Phase 2 Ditches and Culvert Trench	
Excavation	479m^3
ROQ Armouring	175m^3
Culvert Bedding	100m^3
Culvert Backfill	90m^3
Diversion Berm	810m^3
Non-woven Geotextile	568m^2
Culvert Pipe (CSP - 600 mm Ø)	30m

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Hope Bay

SRK JOB NO.: CAPR002283

Vent Raise Surface Water Management

Site Plan

DRAWING NO.: VRP-WM-102

REVISION NO.: A

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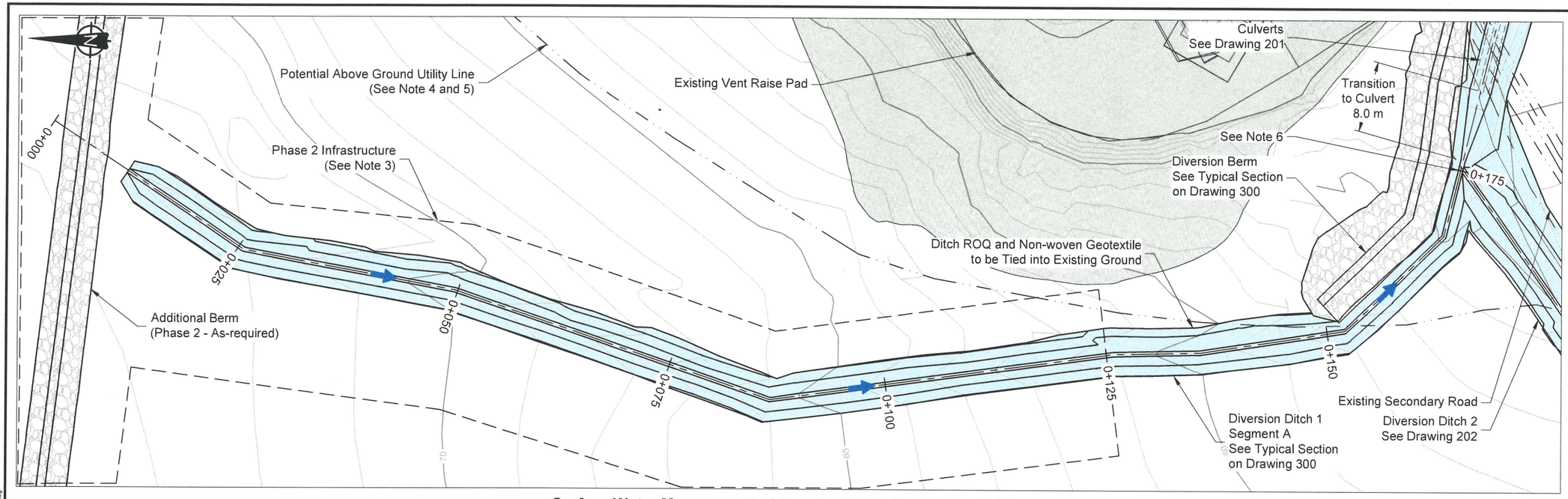
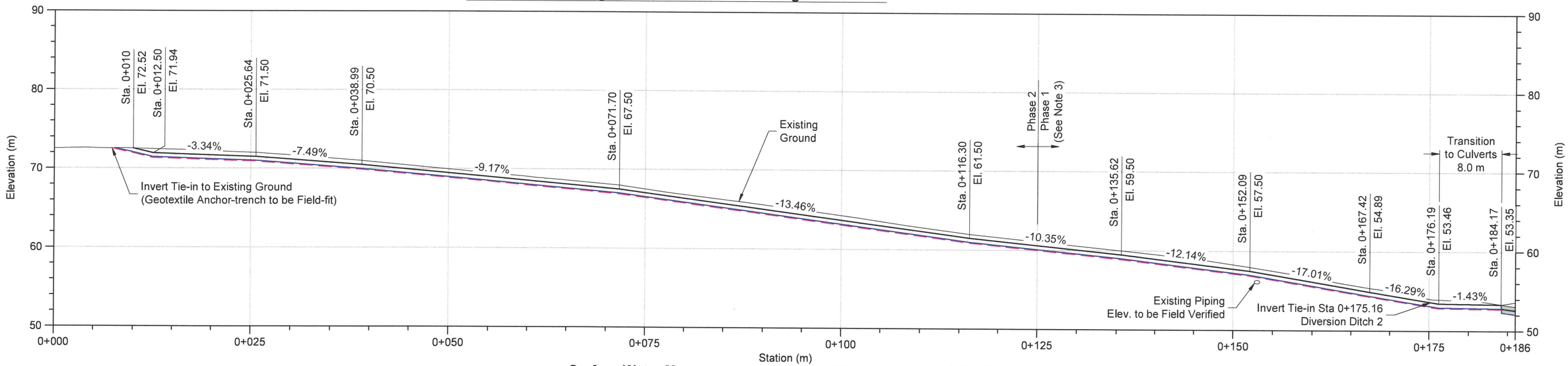


Surface Water Management - Diversion Ditch 1 Segement A Plan



Surface Water Management - Diversion Ditch 1 Segement A Profile

NOTES

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2. Contours are shown at 1.0 m intervals.
3. Phase 2 to be constructed as needed, based on the performance of Phase 1 infrastructure.
4. Existing infrastructure and utility alignments provided by client in site as-constructed file. Utilities/Pipelines must be located and identified prior to construction.
5. Existing tailings and water pipelines will need to be temporarily moved, relocated, cut, and/or modified to complete construction and installation of the culvert through the existing road.
6. Larger sized rockfill material (250 mm) should preferentially selected and used where the Ditch 1 and Ditch 2 intersects (Station 0+175 of Ditch 1) to provide additional energy dissipation and erosion protection.

REFERENCES

NAD83 UTM Zone 13.
Pre-mining contours (2008) provided by client.
As-constructed contours from survey, December 04, 2011.

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Vent Raise Surface Water Management

Diversion Ditch 1 Segment A
Plan and Profile

DRAWING NO.: VRP-WM-200

REVISION NO.: A

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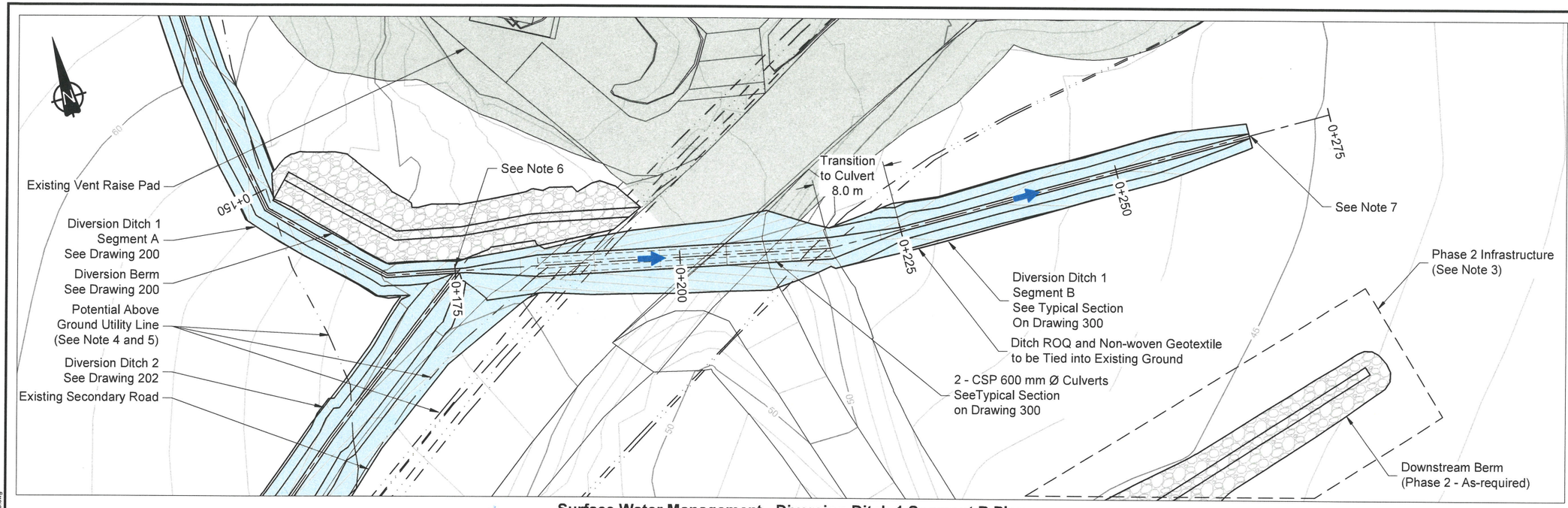
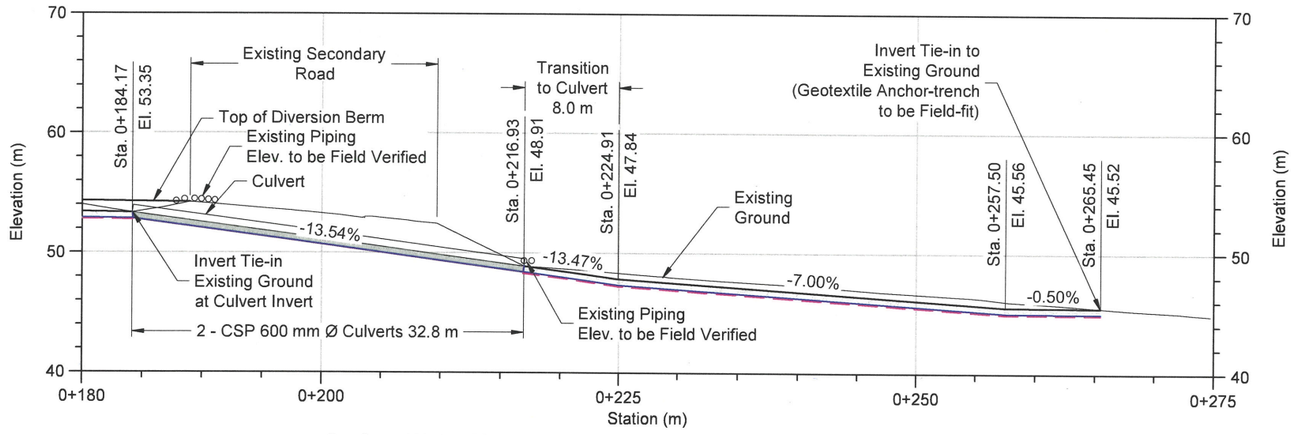


Surface Water Management - Diversion Ditch 1 Segment B Plan



Surface Water Management - Diversion Ditch 1 Segment B Profile

LEGEND

- Flow Direction
- Excavation
- Existing Infrastructure
- Existing Pipelines and Utilities (See Note 4 and 5)
- Non-woven Geotextile
- Culvert Bedding
- Diversion Berm
- Surface Water Management Ditches and Culvert Trench
- ROQ Armouring
- Vent Raise Pad Area (Existing)

NOTES

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3. Phase 2 to be constructed as needed, based on the performance of Phase 1 infrastructure.
4. Existing infrastructure and utility alignments provided by client in site as-constructed file. Utilities/Pipelines must be located and identified prior to construction.
5. Existing tailings and water pipelines will need to be temporarily moved, relocated, cut, and/or modified to complete construction and installation of the culvert through the existing road.
6. Larger sized rockfill material (250 mm) should preferentially selected and used where the Ditch 1 and Ditch 2 intersects (Station 0+175 of Ditch 1) to provide additional energy dissipation and erosion protection.
7. The diversion ditch and outlet shall be monitored during initial use, after freshet, and after any notable rainfall. After the first year of observation then the observation frequency may be reduced. Field observations to be collected during construction and based on post construction monitoring. If the outlet is excavated in ice rich overburden or excessive erosion is resulting then additional rock fill or erosion protection measures will be implemented in the ditch or downstream of the outlet.

REFERENCES

NAD83 UTM Zone 13.
Pre-mining contours (2008) provided by client.
As-constructed contours from survey, December 04, 2011.

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Hope Bay

SRK JOB NO.: CAPR002283

Vent Raise Surface Water Management

Diversion Ditch 1 Segment B Plan and Profile

DRAWING NO.: VRP-WM-201

REVISION NO.: A

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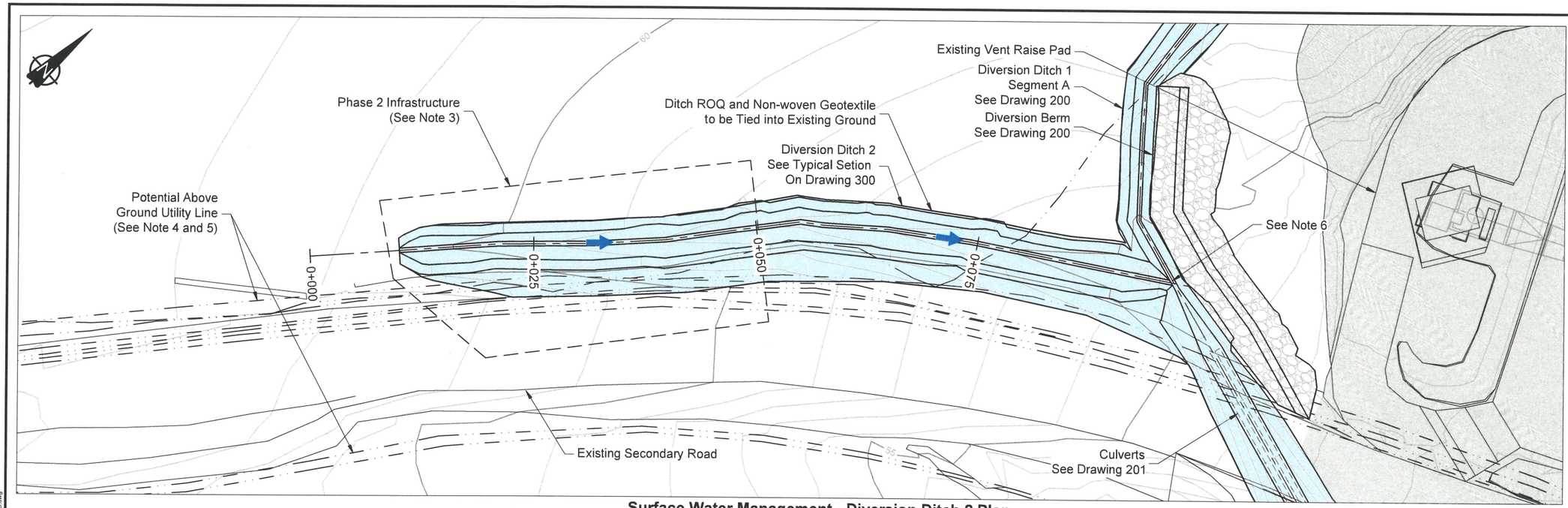
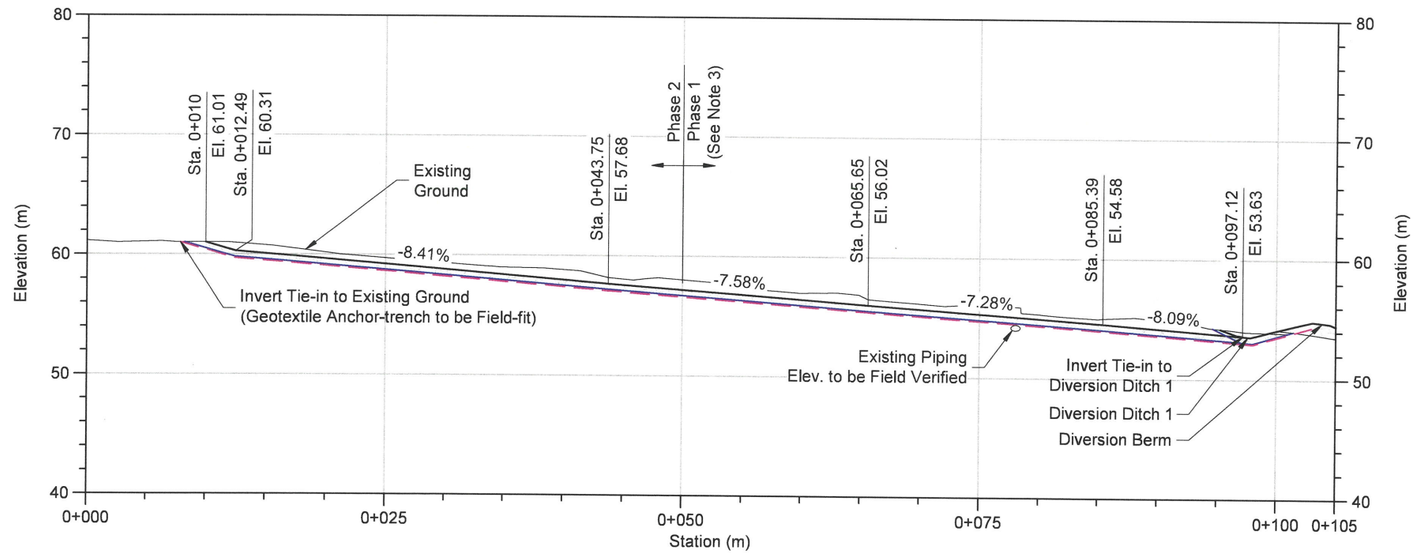


Surface Water Management - Diversion Ditch 2 Plan



Surface Water Management - Diversion Ditch 2 Profile

LEGEND

- Flow Direction
- Excavation
- Existing Infrastructure
- Existing Pipelines and Utilities (See Note 4 and 5)
- Non-woven Geotextile
- Culvert Bedding
- Diversion Berm
- Surface Water Management Ditches and Culvert Trench
- ROQ Armouring
- Vent Raise Pad Area (Existing)

NOTES

1. All units are in meters unless otherwise specified.
2. Contours are shown at 1.0 m intervals.
3. Phase 2 to be constructed as needed, based on the performance of Phase 1 infrastructure.
4. Existing infrastructure and utility alignments provided by client in site as-constructed file. Utilities/Pipelines must be located and identified prior to construction.
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6. Larger sized rockfill material (250 mm) should preferentially selected and used where the Ditch 1 and Ditch 2 intersects (Station 0+175 of Ditch 1) to provide additional energy dissipation and erosion protection.

REFERENCES

NAD83 UTM Zone 13.
Pre-mining contours (2008) provided by client.
As-constructed contours from survey, December 04, 2011.

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issue for Permitting	PDL	JBK	2023/02/08

REVISIONS

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CHECKED: PDL	APPROVED: JBK	DATE: 2023/02/08

FILE NAME: CAPR002283 - Vent Raise Surface Water Mgmt - EC FC PP XS.dwg

AGNICO EAGLE

Hope Bay

SRK JOB NO.: CAPR002283

Vent Raise Surface Water Management

Diversion Ditch 2 Plan and Profile

DRAWING NO. VRP-WM-202

REVISION NO. A

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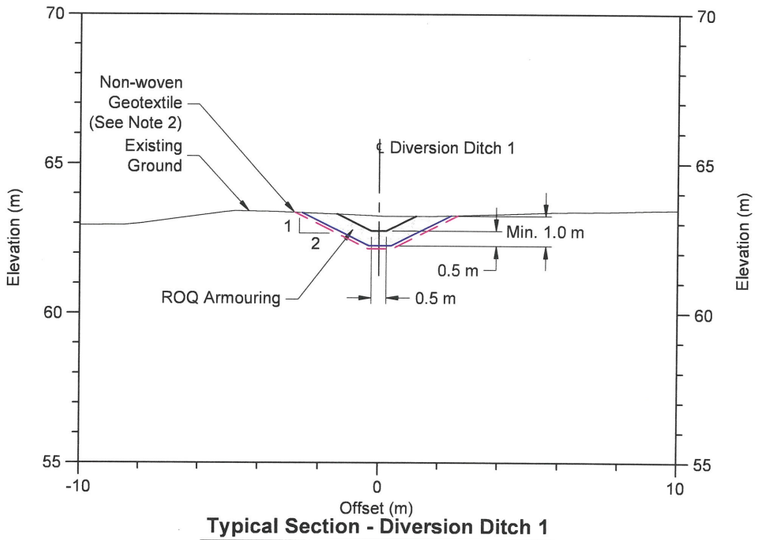
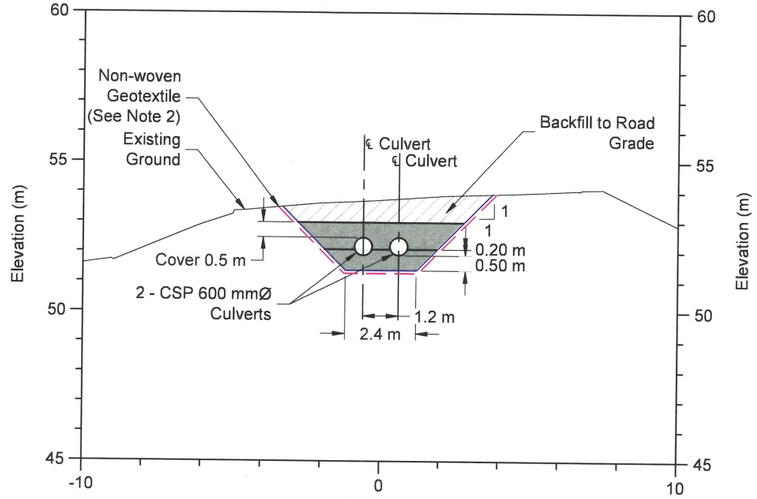
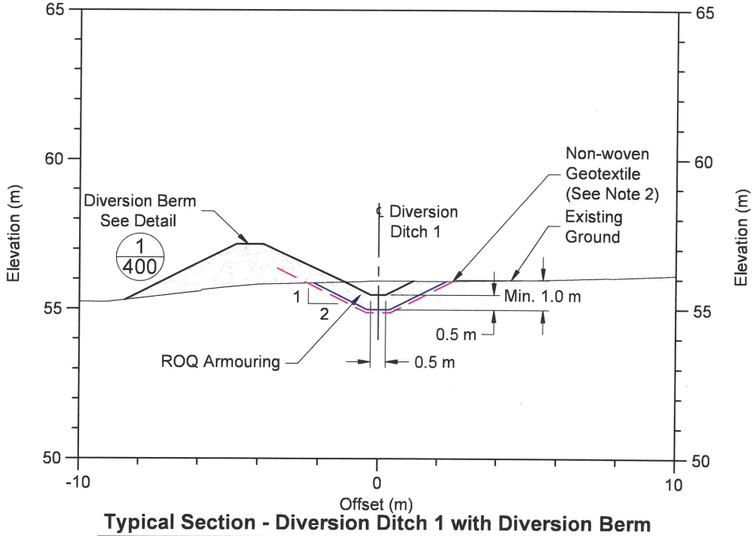


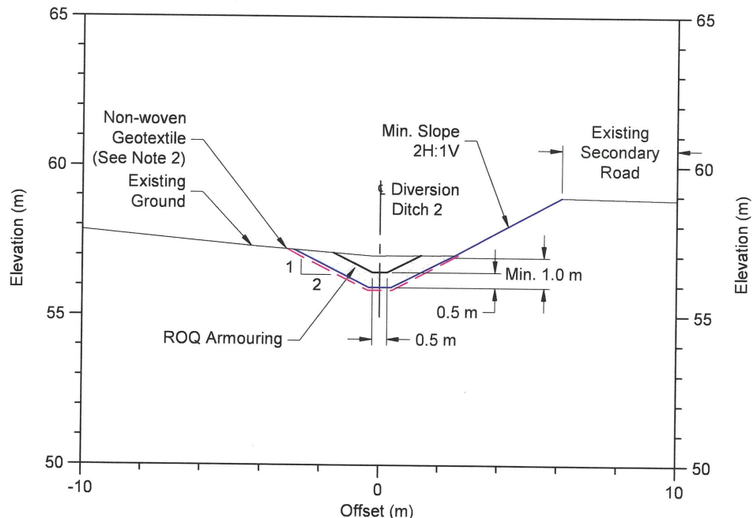
Typical Section - Diversion Ditch 1



Typical Section - Culvert Trench



Typical Section - Diversion Ditch 1 with Diversion Berm



Typical Section - Diversion Ditch 2

LEGEND

- Excavation
- Non-woven Geotextile
- Bedding
- Diversion Berm
- Fill
- ROQ Armouring

NOTES

1. All units are in meters unless otherwise specified.
2. All diversion ditches geotextile shall be tied into existing ground and covered by ROQ to limit exposed geotextile.
3. Bedding material to be compacted in 0.2 m lifts using a minimum of 4 passes with a plate tamper, or unit less than 1 cm of deflection is observed with each subsequent pass.
4. Road backfill may be compacted by plate tamper or bucket depending on material gradation. Maintenance may be required in summer to bring road back to grade.

REFERENCES

NAD83 UTM Zone 13.

0m 2 4 6 8

REGISTERED PROFESSIONAL ENGINEER J.B. KURYLO LICENSEE 2023/02/08 NT/NU

PROFESSIONAL ENGINEERS STAMP

REFERENCE DRAWINGS		REVISIONS									
DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
--	--						A	Issue for Permitting	PDL	JBK	2023/02/08

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DESIGN:	DRAWN:	REVIEWED:
PDL/MGS	RN	JBK
CHECKED:	APPROVED:	DATE:
PDL	JBK	2023/02/08

FILE NAME: CAPR002283 - Vent Raise Surface Water Mgmt - EC FC PP XS.dwg

AGNICO EAGLE

Hope Bay

SRK JOB NO.: CAPR002283

Vent Raise Surface Water Management

Typical Sections

DRAWING NO. VRP-WM-300

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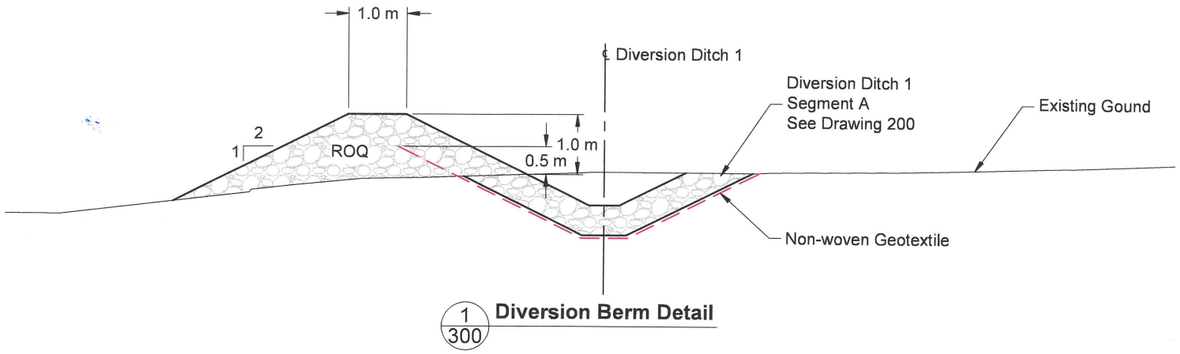

1/300 **Diversion Berm Detail**

LEGEND

- Excavation
- Non-woven Geotextile
- Bedding
- Ditch ROQ Base
- Diversion Berm
- Fill

NOTES

1. All units are in meters unless otherwise specified.
2. GCL Liner or compacted silty overburden may be used within the berm in addition to non-woven geotextile to limit flow through berm or in the foundation if foundation materials are generally clean sands and gravel.

REFERENCES

NAD83 UTM Zone 13.

0m 1 2 3 4

DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issue for Permitting	PDL	JBK	2023/02/08

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CHECKED:	APPROVED:	DATE:
PDL	JBK	2023/02/08

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Hope Bay

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Vent Raise Surface Water Management

Typical Details

DRAWING NO. VRP-WM-400

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