Design Report and Drawings for Culverts at the PUMP Area, Meliadine Gold Mine, Nunavut

PRESENTED TO

Agnico Eagle Mines Limited

MARCH 20, 2025
ISSUED FOR USE
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TABLE OF CONTENTS

LIST OF TABLES IN TEXT

APPENDIX SECTIONS

FIGURES

APPENDICES

1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is operating the Meliadine Gold Mine (the Mine), located approximately 25 km north of Rankin Inlet and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Mine is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8''N, 92°13'6.42"W). A general location plan for the Mine is shown in Figure 1.

The current mine operation consists of mining the Tiriganiaq deposit with two open pits and an underground operation under the existing Nunavut Water Board Type A Water Licence (2AM-MEL1631). In November 2024, Agnico Eagle obtained approval of the amended Type A Water Licence which allows Agnico Eagle to mine the Wesmeg, Wesmeg North, Pump, FZone, and Discovery deposits that were included in the 2014 Final Environmental Impact Statement and Nunavut Impact Review Board Project Certificate No.006.

Under the amended Type A Water Licence, Agnico Eagle is planning to mine the ore deposits at Pump in 2025 and the following years (2025-2031). To facilitate the mine development at Pump, Tetra Tech Canada Inc. (Tetra Tech) was retained by Agnico Eagle to carry out the engineering design of water management infrastructure for surface runoff water at the Pump area. The water management infrastructure at the Pump area includes a diversion channel (Channel11), a water collection pond (Collection Pond 9 (CP9) formed by the Pump01 open pit), a water diversion berm (Berm 4), a thermal protection berm (CP9 Thermal Berm), and various culverts. The design and drawings of the water management infrastructure for Channel 11, CP9 Thermal Berm, and Berm 4 are documented in a design report (Tetra Tech 2024a).

This report covers the design of the proposed culverts at the Pump area and presents the site conditions, design considerations and criteria, hydraulic calculations, material specifications, other detailed design parameters, and Issued for Construction (IFC) drawings.

2.0 GENERAL SITE CONDITIONS

2.1 Climate and Meteorology

The Mine site lies within the Southern Arctic Climatic Region where daylight reaches a minimum of 4 hours per day in winter and a maximum of 20 hours per day in summer. The nearest weather station is Rankin Inlet A (Station 2303401), located approximately 25 km south of the Mine site. The closest long-term regional evaporation station operated by Environment Canada is in Churchill, Manitoba. The monthly mean air temperature is typically above 0°C for the months of June to September and is below 0°C between October and May. July is typically the warmest month and January the coldest. Winters are typically long and cold, while summers are short and cool. The mean annual temperature for the period of record from 1994 to 2023 was -9.8°C based on the measured air temperature data at Rankin Inlet.

The annual total precipitation under mean conditions at the Mine site is 394 mm/year and falls almost equally as snow and rainfall (Tetra Tech 2021). Average annual evaporation for small waterbodies in the Mine site is estimated to be 323 mm between June and September. The average annual loss of snowpack to sublimation and snow redistribution is estimated to vary between 46% and 52% of the total precipitation for the winter period and occurs between October and May (Golder 2013).

The region is known for high winds, which are due in part to the broad, flat, uninterrupted expanses offered to moving air masses. The wind blows generally from the northwest and north-northwest direction. The mean values for wind speed show that the north-northwest, together with northwest winds, have the highest speeds and tend to be the strongest. Mean monthly wind speeds are typically between 19 km/hour and 29 km/hour, with an average of 22.3 km/hour.

2.2 Environmental Setting

The dominant terrain in the Mine area comprises glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and lakes. A series of low relief ridges are composed of glacial deposits, oriented in a northwest-southeast direction, which control the regional surface drainage patterns. The Mine is about 60 m above sea level (masl) in low-lying topography with numerous lakes.

The surveyed lake surface elevations in the Mine area range from about 51 masl at Meliadine Lake to about 74 masl for local small, perched lakes. Lakes formed by glaciofluvial processes or glacial processes, are common throughout the Mine area. Most of the perched lakes at the Mine site are relatively shallow (less than 2 m water depth). Late winter ice thicknesses on freshwater lakes in the Mine area range between 1.0 m and 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring freshet typically begins in mid-June and is complete by early July (Golder 2012a).

2.3 Permafrost

The Mine site is located within the Southern Arctic terrestrial eco-zone which is one of the coldest and driest regions of Canada, in a zone of continuous permafrost. Continuous permafrost to depths of between 285 m to 430 m is expected based on ground temperature data from thermistors installed near Tiriganiaq, FZone, and Discovery deposits (WSP 2024a). The measured ground temperature data indicates that the active layer ranges from 1.0 m to 3.0 m in areas of shallow soils and areas away from the influence of lakes. It is anticipated that the active layer adjacent to lakes or below a body of moving water such as a stream could be deeper. The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 18 m) are in the range of -5.9°C to -7.0°C in the areas away from lakes and streams. The geothermal gradient ranges from 0.015°C/m to 0.02°C/m (WSP 2024a).

Open taliks (defined by the 0-degree isotherm) are predicted to be present beneath portions of each of the following lakes near the proposed open pits: Lakes B4, B5, B7, A6, A8, and CH6. Closed talik is interpreted below Lake D4 based on the 0-degree isotherm interpreted from the thermal model (WSP 2024b).

3.0 GENERAL WATER MANAGEMENT STRATEGY AT PUMP

One of the primary water management objectives for the Mine is to minimize potential impacts to the quantity and quality of surface water at the Mine and surrounding waterbodies. This objective will be achieved by construction of various water management infrastructure (e.g., dikes, collection ponds, channels, berms, and culverts) to divert clean (non-contact) water away, where possible, and separate surface contact water and saline water.

Figure 2 presents the general water management plan and site layout at Pump. Surface contact water from WRSF6 Phase 1 will be diverted either by Channel11 or water diversion Berm4 to prevent contact water from releasing to the outside receiving environment (e.g., Lake B59 and Lake B4). The contact runoff water will eventually be collected in CP9 (formed by the Pump01 open pit), from where the water will be directly or indirectly pumped into CP1 for treatment prior to discharge into Meliadine Lake.

Surface runoff from the north and southeast portions of WRSF6 Phase 1 will flow naturally by gravity or be rediverted by Berm 4 to the dewatered Lakes B38 and B37. Under baseline conditions, the water in Lake B38 flows naturally to Lake B37 and then to Lake B36. As per the current mine development plan, a haul road will be constructed across the narrow between former Lake B37 and former Lake B38; a culvert (Culvert 22 as shown in Figure 2) will be required in the haul road at the original water flow location to convey the water collected in the former Lake B38 to former Lake B37. Tetra Tech understands that the Lake B36 dewatering access road will no longer be used and a portion of road between former Lake B36 and dewatered Lake B37 will be excavated to base condition, so that the runoff water accumulated in Lake 37 can flow naturally to CP9. Further details on the water management plan at the Pump area can be found in the WRSF6 detailed design report (Tetra Tech 2024b).

Most of the Pump01 open pit footprint is within former Lake B36 which was dewatered in August/September 2024. The exposed lakebed area out of the Pump01 open pit footprint will be backfilled with waste rock to prevent water ponding around the open pit's perimeter and promote positive water flow from the surrounding area towards CP9. A haul road will be constructed out of the Pump01 pit for the hauling of excavated overburden and waste rock and a service ring road will be constructed around the perimeter of the Pump01 open pit for maintenance purposes. Based on the current mine operation plan, water that accumulates in low depression areas around the pit's perimeter will be diverted to CP9 by swales cutting through the service ring road. The proposed swale locations are presented in Figure 2.

The proposed culvert location and functionality are presented in Figure 2 and listed in Table 1 below.

Table 1: Proposed Culvert Location and Functionality

Culvert Name	Location and Functionality
Culvert 22	▪ At baseline water flow location from Lake 38 to Lake 37 ▪ To divert runoff water collected in the dewatered Lake B38 to dewatered Lake B37

4.0 CULVERT DESIGN

4.1 Design Considerations

The following considerations were adopted in the culvert design:

- In accordance with Agnico Eagle's Corporate Standard – Risk Management and Monitoring System – Water Management (2021), if appliable;
- Maximize the use of available construction materials at the site;
- Minimize overall environmental footprints and effects;
- Consider site specific geotechnical and climatic conditions (extreme rainfall and snow drifting), and site operation requirements (snow removal before freshet);
- Pass the selected extreme rainfall intensity under 1 in 50 wet year return period with certain freeboard or contingency;
- Structural stability under the maximum loading conditions; and
- No fish passage through the culverts.

4.2 Hydraulic Analysis and Peak Flow Calculation

The catchment areas for the crossing were delineated using the latest available survey data provided by Agnico Eagle. Hydrologic and hydraulic analyses were carried out to estimate the peak under the selected design rainfall intensity for the culvert.

The Rational Method, which is recommended for water crossings with catchment areas smaller than 40 ha, was adopted to calculate the peak flows in this study (Indiana Department of Transportation 2009). This method, which assumes the peak flow occurs when the entire catchment surface is contributing to runoff, may be simulated using a rectangular unit hydrograph. Under the Rational Method, the peak flow is given by the following equation.

$$Q = 0.00278.C.I.A$$

Where: Q is the maximum rate of runoff, (m^3/second)

C is the runoff coefficient representing a ratio of runoff to rainfall, (unitless)

I is the average rainfall intensity for a duration and a selected return period, (mm/hour)

A is the drainage area tributary to the design location, (ha)

Given the site's proximity to Rankin Inlet, the intensity duration frequency (IDF) for Rankin Inlet under the Coupled Model Intercomparison Project Phase 6 (CMIP6) Shared Socio-economic Pathway (SSP2-4.5) climate change scenario was developed using the Computerized IDF CC Tool (idf-cc-uwo.ca). The developed rainfall intensities at Rankin Inlet under various return periods are summarized in Table 2.

A 1 in 50-year rainfall intensity for a duration equivalent to the time of concentration (T_C) of the catchment was used to determine the design peak flows for the culvert crossing. The design criteria are aligned with Agnico Eagle's Water Management Corporate Standard. A runoff coefficient of 0.85 was assumed for the natural ground and 0.35 for disturbed ground (i.e., WRSF6 and backfilled Lake B36) to estimate the peak flow.

Table 2: Rainfall Intensity under Different Return Periods at Rankin Inlet under CMIP6 SSP2-4.5

T (years)	2	5	10	20	25	50	100
5 min	23.38	35.4	45.56	55.43	58.98	70.69	76.41
10 min	19.77	27.18	30.97	33.62	34.43	36.74	38.21
15 min	18.63	23.11	24.72	25.48	25.71	26.29	26.74
30 min	12.52	18.2	21.89	24.92	25.92	28.88	31.66
1 h	8.23	12.44	15.85	19.04	20.17	23.82	27.99
2 h	5.3	8.02	10.27	12.39	13.15	15.63	18.47
6 h	2.98	4.42	5.45	6.33	6.63	7.54	8.49
12 h	2.35	3.27	3.74	4.07	4.17	4.44	4.61
24 h	1.43	2.13	2.55	2.9	3.01	3.33	3.63

The time of concentration (T_C), which represents the time it takes for the most remote portion of the catchment to contribute to the flow at the outlet of the catchment, was calculated using the following Kirpich equation (Akan, A. O., and Houghtalen, R. J. 2003). For catchments where T_C < 10 min, a T_C of 10 minutes was used for design purposes.

$$Tc = (0.948\frac{L^3}{H})^\wedge 0.385$$

Where: Tc is the time of concentration, (hours)

L is the longest waterway from the point under consideration to the basin divide, (km)

H is the difference in elevation between the point under consideration and the basin divide, (m)

The catchment areas and estimated peak flow for Culvert 22 is summarized in Table 3 below.

Table 3: Estimated Peak Flows at Crossings

Crossing Name	Drainage Area (ha)	Estimated Peak Flow (m^3/s)
Culvert 22	11.51	1.1

4.3 Culvert Design

4.3.1 Culvert Sizing, Length, and Inlet Elevation

The flow capacity for each specific culvert size was calculated based on the Gauckler-Manning equation below (P.K. Kundu and I.M. Cohen 2008).

$$Q = A.V = A.\frac{k}{n}.R_h^{\frac{2}{3}}.S^{0.5}$$

Where: A is cross section area (m^2)

V is the cross-sectional average velocity, (m/s)

n is the Gauckler-Manning coefficient (unitless)

R_h is the hydraulic radius which is a function of headwater to diameter (HW/D), (m)

S is the culvert design slope (%)

k is a conversion factor between International System (SI) and English Units. k=1 for SI units

In this study, a Gauckler-Manning coefficient of 0.024 was adopted for corrugated metal pipe (Chow 1959) and the design culvert slope was assumed to be at 1%. The headwater to diameter (HW/D) ratio of 0.80 was used and the impact of the embeddedness on the discharge capacity is assumed to be negligible.

The required diameter and number of culverts at the crossing location were determined based on the calculated flow capacity for each size of culvert to make sure that the total flow capacity of the culverts is greater than the estimated peak flow as presented in Table 3.

The required minimum length of Culvert 22 was determined based on the following approach:

- The length of culverts was calculated based on the geometry of the haul road for a dual lane road for a 72 T haul truck with a crest width of 17.1 m (including the safety berm). The side slope of the haul road was assumed to be 2 Horizontal to 1 Vertical. The minimum cover thickness above the culvert presented in Section 4.3.2 was used to determine the haul road geometry.

The inlet elevation of the culvert was determined based on the original ground elevation at the culvert location.

Table 4 summarizes the proposed size, length, and inlet elevation for Culvert 22.

Table 4: Size, Length, and Inlet Elevation of Culvert 22

Culvert Name	Drainage Area (ha)	Estimated Peak Flow (m^3/s)	Size of Culvert (Number x Diameter)	Design Capacity (m^3/s)	Min. Length of Each Culvert (m)	Inlet Elevation (m)
Culvert 22	11.51	1.1	2 x Φ1000mm	2.4	27.0	60.5

4.3.2 Minimum Backfill Cover Thickness and Culvert Wall Thickness

The required minimum backfill cover thickness above the crown of the culvert was determined based on the assumed maximum design loading condition. For Culvert 22, the maximum design loading condition was assumed to be when the haul truck (KOMATSU HD605-7E0 model or equivalent) with a full load of waste rock passes the culvert location.

Standard galvanized, corrugated steel pipe culvert with a profile of 68 x 13 mm is assumed in the design to determine the minimum wall thickness based on the maximum design loading conditions. The minimum cover thickness and culvert wall thickness were estimated based on the structural design procedure proposed in the Handbook of Steel Drainage and Highway Construction Products (Corrugated Steel Pipe Institute, Canadian Edition, November 2007).

The estimated minimum backfill cover thickness and required culvert wall thickness for Culvert 22 are presented in Table 5. The design drawings for the proposed culverts are attached in Appendix A.

Table 5: Minimum Backfill Thickness and Culvert Wall Thickness

Culvert Name	Estimated Peak Flow (m^3/s)	Design Capacity (m^3/s)	Size of Culvert (Number x Diameter)	Corrugate Profile (mm x mm)	Minimum Specified Wall Thickness (mm)	Minimum Backfill Cover Thickness (m)
Culvert 22	1.1	2.4	2 x Φ1000mm	68x13	1.3 for Φ1000mm pipe	1.0

5.0 CULVERT CONSTRUCTION

5.1 Construction Materials and Specifications

Rockfill (0-600 mm)

The rockfill material will be sourced from Pump 01 open pit excavation or other mining areas. The rockfill will be free from snow, ice, frozen chunks, organic matters, and debris and can have a wide variation of gradation with a maximum particle size of 600 mm. The rockfill will be non-acid generating (non-PAG) and non-metal leaching and free of contaminants. Any oversized boulders should be removed before the rockfill is placed into the earth structures.

Granular Fill (0-50 mm)

The backfill around the culvert will be granular fill (0-50 mm), or an approved equivalent material as per the Design Engineer. Granular Fill (0-50 mm) shall consist of, hard durable particles, be free of roots, topsoil, and other organic material and have a particle size distribution as presented in Table 6. Processing may be required to achieve the specified gradation. The granular fill shall be placed in lifts not greater than 0.3 m thick and compacted to a minimum of 90% of Standard Proctor Maximum Dry Density (ASTM D698) or meet the expectation by the Design Engineer.

Table 6: Granular Fill (0-50 mm) – Particle Size Distribution Limits

Particle Size (mm)	% Passing
50	100
38	87-100
19	60-95
12.5	46-80
5	35-60
2	25-45
0.315	10-25
0.08	4-10

Rip-rap (20-200 mm)

Rip-rap shall be used as the erosion protection material around the culvert inlet and outlet areas. The particle size specifications for the graded rip-rap materials are presented in Table 7. The material shall be free of roots, topsoil, and other organic material. Processing may be required to achieve the specified gradation. The material can be processed from hard, durable, non-PAG rock.

Table 7: Particle Size Specifications for Rip-rap Material

Rip-rap Types for Various Earth Structures	Minimum Particle Size (mm)	Median Particle Size (mm)	Maximum Particle Size (mm)
Rip-rap	50	150	300

5.2 Estimated Quantities of Construction Materials

Table 8 presents the material quantities for the installation of the culvert, excluding any works that might be associated with culvert installing (e.g., road design). Rock fill (0-600 mm) is considered part of the road construction and is not included in the quantities estimation of this study. The given quantities do not include any contingency.

Table 8: Estimated Quantities of Construction Materials

Item	Quantities
Granular fill (0-50 mm) (m^3)	249
Rip-rap (50-300 mm) (m^3)	16.8

5.3 Construction Schedule and Quality Control/Assurance

The construction of the proposed culvert at the Pump area is expected to take place before the spring freshet of 2025. A quality control/assurance program should be conducted during the construction of each of the infrastructures to ensure that construction-sensitive features of the design are achieved.

5.4 Performance Monitoring

Performance monitoring is an integral part of the operation of any water management structure, particularly in an arctic environment. The performance of the culverts will be monitored throughout their construction and operating life. The monitoring activities will be regular visual inspections during the operation by Agnico Eagle site staff. It is understood that Agnico Eagle will perform snow removal activities before each freshet to reduce the potential for the culvert to be blocked by snow or ice during the freshet season.

An annual inspection should be conducted by a qualified geotechnical engineer to document the performance of the culverts. Regular maintenance activities may be required to ensure adequate operation of the culverts.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Agnico Eagle 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, 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 document is subject to the Limitations on Use of this Document attached in Appendix B or Contractual Terms and Conditions executed by both parties.

7.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

Signature ____________________

Date 2025-03-20

PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

/jf

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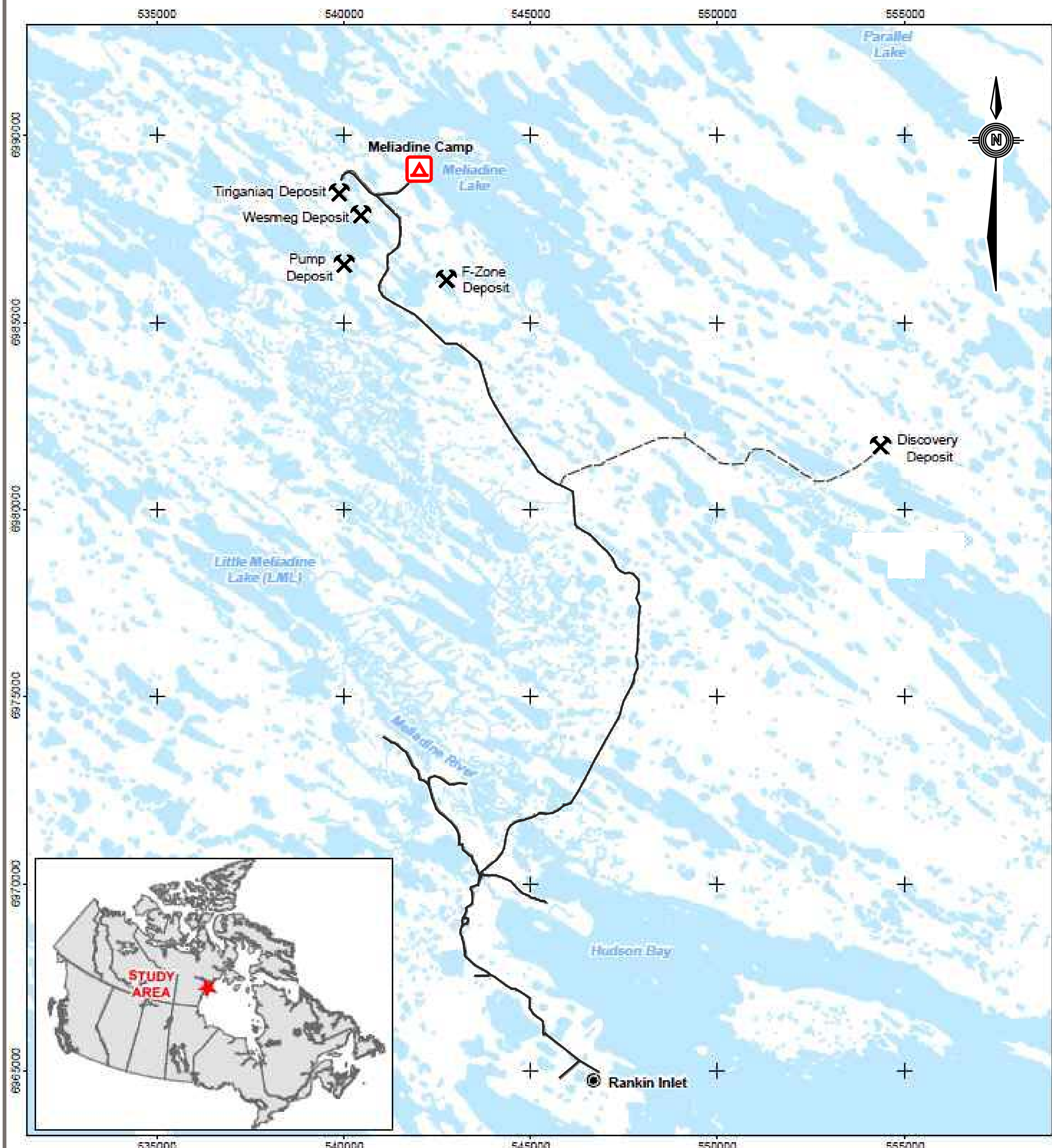
WSP File: CA0020476.6818-MEL2024_004-R-REV0.

FIGURES

C:\Users\hongwei.xia\OneDrive - Tetra Tech, Inc_Meliadine\Meliadine MAA Study\Technical Memo\Figures for MAA\Figure 1-1 Site Location.dwg [FIGURE 1] June 27, 2024 - 9:42:13 am (BY: XIA, HONGWEI)



NOTES
BASED ON DRAWING PROVIDED BY AGNICO EAGLE MINES LTD.
DATUM: NAD83 PROJECTION: UTM ZONE 15

0 — 5 000 m
Scale 1: 150 000

STATUS
ISSUED FOR USE

LEGEND
- EXISTING CAMP
- MELIADINE GOLD DEPOSIT
- EXISTING ROAD
- PROPOSED ROAD
- WATERBODY

CLIENT
AGNICO EAGLE

TETRA TECH

MELIADINE GOLD MINE
NUNAVUT, CANADA

SITE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
EARC03284-01	HX	NG	0

OFFICE	DATE
EDM	JUNE 27. 2024

Figure 1

NO. DESSIN
DRAWING NO.

LEGEND

- CATCHMENT BOUNDARY
- HAUL ROAD
- WATER FLOW
- DRAINED LAKE AREA
- WASTE ROCK STORAGE FACILITY

AGNICO EAGLE

TETRA TECH

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–
–	–

DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY

REVISIONS

DESSINÉ PAR DRAWN BY	HX	DATE	2025-01-15
VÉRIFIÉ PAR CHECKED BY	HX		2015-01-15
APPROUVÉ PAR APPROVED BY			
No. PROJET PROJECT NO.	ENG.EARC03140-39		
DATE			

TITRE / TITLE
AGNICO EAGLE – MELIADINE GOLD MINE
WRSF6 PHASE 1 RUNOFF WATER MANAGEMENT PLAN AND FLOW PATHS

ÉCHELLE/ SCALE
FICHIER FILE .DWG
No. DESSIN/ DRAWING NO. FIGURE 2
REVISION
FEUILLE/SHT 1 / 1

FORMAT ANSI B-11x17
AE-CART-ANSI B

C:\Users\hongwei.xia\OneDrive – Tetra Tech, Inc_Meliadine\General Site Layout Plan-Existing 2024 for WRSF6 WM Culvert.dwg–2013–02–19 12:48:40

APPENDIX A

ISSUED FOR CONSTRUCTION DRAWINGS

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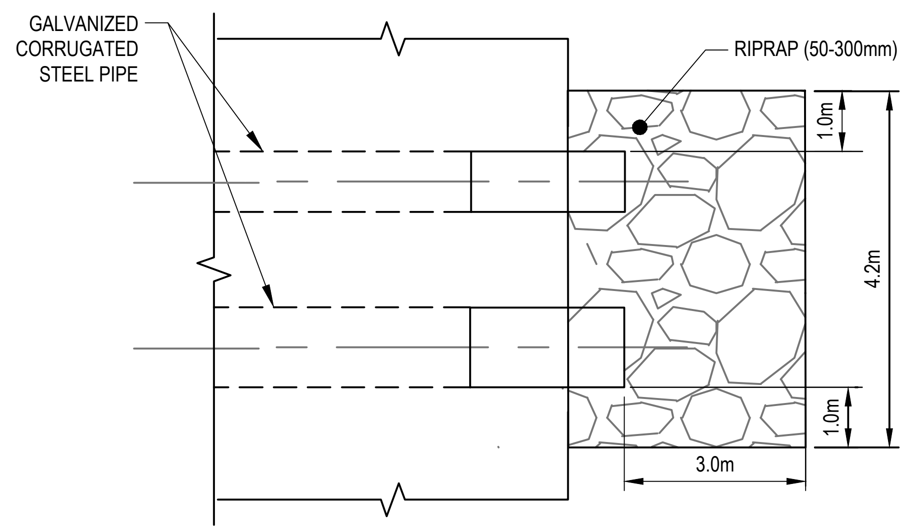
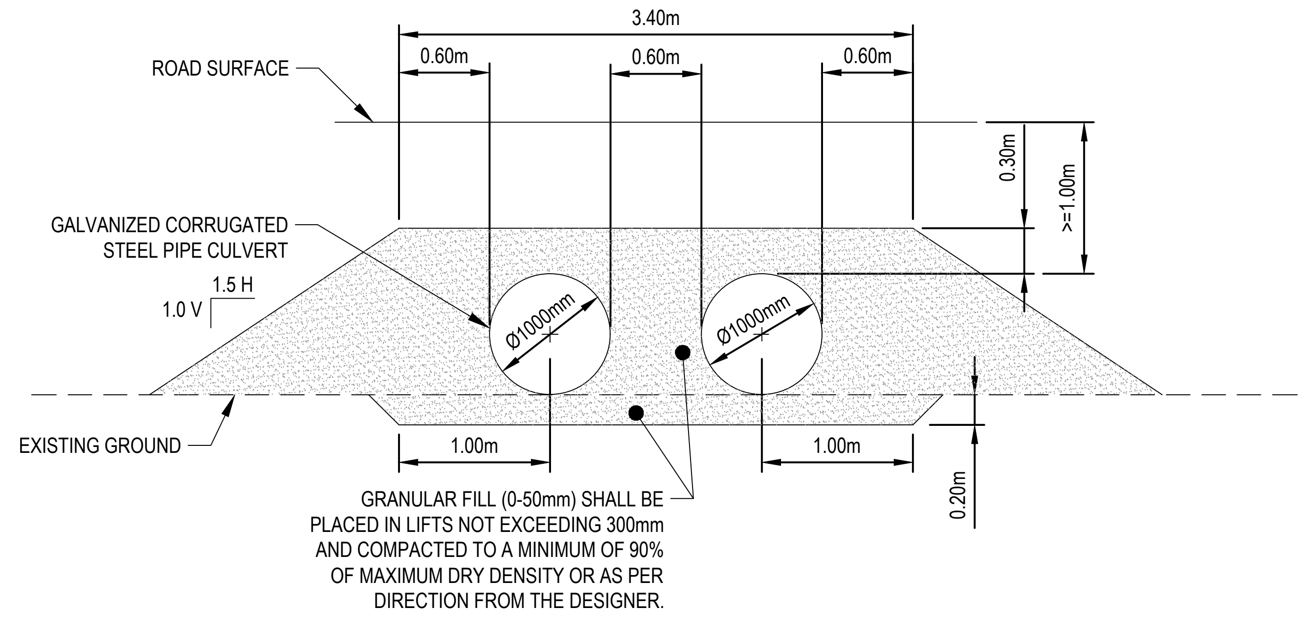
DRAWING NO.



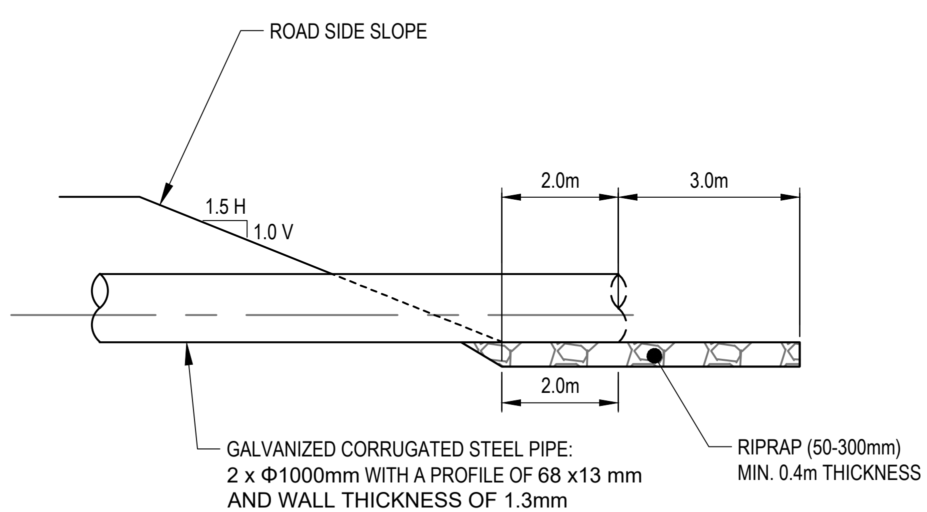
PLAN VIEW

SCALE: N.T.S



TYPICAL CULVERT DETAL - CONFIGURATION WITH 2 CULVERTS SECTION VIEW

SCALE: 1:50



TYPICAL DETAL - CULVERT RIPRAP FOR BOTH INLET AND OUTLET SECTION VIEW

SCALE: N.T.S

FORMAT ANSI B-11x17

NOTES:

1. CULVERTS WILL BE GALVANIZED CORRUGATED PIPES, WITH A PROFILE OF 68 x 13mm.
2. AT ANY TIME, A MINIMUM OF 1,000 mm BACKFILL COVER SHALL BE PLACED ON TOP OF THE HIGHEST PIPE.
3. THE INSTALLATION OF THE CULVERTS SHALL BE CONFORM TO THE MANUFACTURER INSTRUCTIONS.
4. THE DESIGN SLOPE OF CULVERT 22 IS 1.0%. INSTALL RIPRAP TO FILL THE GAP BETWEEN THE PIPE BOTTOM AND THE EXISTING GROUND IF REQUIRED.

REGISTERED PROFESSIONAL ENGINEER
H. XIA
LICENSEE
NTNU
2025-03-20

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
Signature
Date 2025-03-20
PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

AGNICO EAGLE

TETRA TECH

TITRE / TITLE	# DWG
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DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
0	ISSUED FOR CONSTRUCTION	2025-03-19	HX

REVISIONS

DESSINÉ PAR DRAWN BY	RC	DATE 2025-01-27
VÉRIFIÉ PAR CHECKED BY	LW	2025-01-27
APPROUVÉ PAR APPROVED BY		
No. PROJET PROJECT NO.	ENG.EARC03140-40	
DATE		

TITRE / TITLE
AGNICO EAGLE – MELIADINE GOLD MINE
TYPICAL SECTIONS AND SPECIFICATION FOR CULVERT 22 AT PUMP ZONE

ÉCHELLE/ SCALE
FICHIER FILE .DWG

No. DESSIN/ DRAWING NO. 65-695-230-025
REVISION
FEUILLE/SHT 1 / 1

AE-CART-ANSI B

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APPENDIX B

LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the “Professional Document”).

The Professional Document is intended for the sole use of TETRA TECH’s Client (the “Client”) as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the “Contract” herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an “Authorized Party”), consideration for such authorization is the Authorized Party’s acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the “Limitations on Liability”). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party’s express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH’s professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH’s “Instruments of Professional Service”), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH’s Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH’s Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.