# Prefeasibility Level Design of Water Management Infrastructures for Operation Phase, Meliadine Extension Project, Nunavut






PRESENTED TO

**Agnico Eagle Mines Limited**

JANUARY 13, 2023
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# EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is currently operating the approved Meliadine Gold Mine (Meliadine Mine) which is located approximately 25 km north from Rankin Inlet, Nunavut, Canada. Commercial production at the Meliadine Mine started in 2019 and involves the mining of gold from the Tiriganiaq (TIR) deposit with two open pits and one underground (UG) operation over a mine life extending to 2032. The approved Meliadine Mine is operating under the Nunavut Impact Review Board (NIRB) Project Certificate No. 006 issued in 2015 and the Nunavut Water Board (NWB) amended Type A Water Licence 2AM-MEL1631 issued in 2020.

Agnico Eagle is proposing an extension of the approved project, referred to as the Meliadine Extension Project (Meliadine Extension) to incorporate six additional gold deposits, namely, Wesmeg (WES), Wesmeg-North (WN), Pump (PUM), FZone (FZO), Discovery (DISC), and Tiriganiaq-Wolf (WOLF) to the approved operation. These deposits are proposed to be mined using a combination of open pits and underground mining methods. The Meliadine Extension will extend the mine life from 2032 to 2043.

Agnico Eagle submitted the Final Environmental Impact Statement (FEIS) addendum for the Meliadine Extension to the NIRB in February 2021, and the review process is underway. Agnico Eagle is currently undertaking a prefeasibility study (PFS) to facilitate the application for an amendment of the NWB Water License (2AM-MEL1631) that will incorporate the changes proposed for the Meliadine Extension. The proposed mining facilities for the extension will include an expansion of the existing dry stack tailings storage facility (TSF), and an increase in the number of ore stockpiles, waste rock storage facilities and water management infrastructures.

Tetra Tech Canada Inc. (Tetra Tech) was retained by Agnico Eagle to complete a prefeasibility level design of the water management infrastructure (including dikes, berms, sumps, channels, pumps/pipelines, and culverts) required to support the operation phase of the Meliadine Extension. The open pit and underground mining schedule for the Meliadine Extension and life of mine schedule for all deposits provided by Agnico Eagle were used for the sequencing and scheduling of the water management infrastructure in this study. Yearly site layout plans have been prepared to illustrate the progress of the water management infrastructure development with time. The prefeasibility level design of the required water management infrastructure was undertaken based on knowledge and experience gained from the detailed design of the existing water management infrastructure (e.g., Dike D-CP1and D-CP5) at the Meliadine Mine. Subsurface conditions collected from past geotechnical site investigations performed on site were used in the design.

The required water management infrastructure for the Meliadine Extension include 11 water retention dikes (D-SP6North, D-SP6West, D-B5North, D-B5South, D-CP8North, D-CP8West, D-CP8South, D-CP8East, D-A8North, D-A8South, and D-A6), 8 water collection ponds (CP7, CP8, CP9, CPD1, CPD2), and saline ponds (SP5, SP6, and SPD1), 12 water diversion channels (Channel 11 to Channel 22), 7 sumps (Sumps P1 to P5, and Sumps F1 and F2), 2 water diversion berms (Berm-D1 and Berm-D2), 5 thermal protection berms (Berm-P5, Berm-CP7, Berm-F2, Berm-CPD2, and Berm-SP5), and various pump and pipelines, and culverts as required.

The water management infrastructures have been designed and modelled to estimate construction material quantities. Preliminary construction schedules and design drawings with typical sections and profiles have been prepared. Thermal, seepage, and slope stability analyses for major water collection ponds and dikes will be performed in subsequent studies and designs.

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# ACRONYMS & ABBREVIATIONS

| Acronyms/Abbreviations | Definition |
|---|---|
| AEP | Annual Exceedance Probability |
| Agnico Eagle | Agnico Eagle Mines Limited |
| CDA | Canadian Dam Association |
| CP | Collection Pond |
| DBM | Design Basis Memo |
| EWTP | Effluent Water Treatment Plant |
| FEIS | Final Environmental Impact Statement |
| H | Horizontal |
| IDF | Inflow Design Flood |
| Lorax | Lorax Environmental Service Ltd. |
| masl | Metres Above Sea Level |
| MOWL | Maximum Operating Water Level |
| MTOs | Material Takeoffs |
| NIRB | Nunavut Impact Review Board |
| NWB | Nunavut Water Board |
| PGA | Peak Ground Acceleration |
| PMF | Probable Maximum Flood |
| ppt | Parts Per Thousand |
| SP | Saline Pond |
| SWTP | Saline Water Treatment Plant |
| Tetra Tech | Tetra Tech Canada Inc. |
| TSF | Tailings Storage Facility |
| UG | Underground |
| V | Vertical |
| WLA | Water Licence Amendment |
| WRSF | Waste Rock Storage Facility |

# 1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is currently operating the approved Meliadine Gold Mine (the Meliadine Mine) by mining the Tiriganiaq (TIR) deposit with two open pits and one underground (UG) operation. The Meliadine Mine is located approximately 25 km north of Rankin Inlet, Nunavut (Figure 1), and operated under Project Certificate No. 006 issued by the Nunavut Impact Review Board (NIRB) in 2015 and amended Type A Water Licence 2AM-MEL1631 issued by the Nunavut Water Board (NWB) in 2020.

Agnico Eagle has continued to extend its knowledge and validation of the gold deposits around the Meliadine Mine by way of additional exploration. As a result, an improved project, collectively referred to as the Meliadine Extension Project (Meliadine Extension) is being proposed. The Meliadine Extension will incorporate six additional gold deposits, namely, Wesmeg (WES), Wesmeg-North (WN), Pump (PUM), FZone (FZO), Discovery (DISC), and Tiriganiaq-Wolf (WOLF). These deposits will be mined using a combination of open pits and underground mining methods. The Meliadine Extension will extend the life of the mine from 2032 to 2043 and will add underground mining activities at the already approved WES, PUM, FZO, and DISC deposits. Figure 2 presents the general site layout plan and the required water management infrastructure at the end of mine operation (Year 2043).

The Final Environmental Impact Statement (FEIS) addendum for the Meliadine Extension was submitted to the NIRB by Agnico Eagle in July 2022, and the review process is underway. Agnico Eagle is currently undertaking a prefeasibility study (PFS) to facilitate the application of the Type A Water Licence (2AM-MEL1631) Amendment (WLA) for the Meliadine Extension. Tetra Tech Canada Inc. (Tetra Tech) was retained by Agnico Eagle to conduct the prefeasibility level design of water management infrastructure (including dikes, berms, sumps, channels, pumps/pipelines) required to support the operation phase of the Meliadine Extension. The details of the Scope of Work were presented in Tetra Tech's proposal submitted to Agnico Eagle on February 9. 2022, titled "Proposal for 2022 Water Licence Amendment Permitting Support, Meliadine Extension Project, NU". As directed by Agnico Eagle, the prefeasibility level design of the required water management infrastructure was undertaken based on knowledge and experience gained from the detailed design of the existing water management infrastructure (e.g., Dike D-CP1and D-CP5) at the Meliadine Mine.

As part of the design deliverables requested by Agnico Eagle, Tetra Tech has prepared this technical report to document the prefeasibility level design of the required water management infrastructures during the operation phase of the Meliadine Extension. It is understood that this report will be attached as an appendix or be referenced in the main documents prepared for the WLA application.

# 2.0 GENERAL SITE CONDITIONS

## 2.1 Climate and Meteorology

The Meliadine Mine 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 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. Spring and fall are short. The mean annual temperature for the period of record from 1981 to 2020 was -10.4°C (Agnico Eagle 2022).

The annual average total precipitation at the mine site is 430 mm/year and falls almost equally as snow and rainfall (Agnico Eagle 2022). Average annual evaporation for small waterbodies in the Project area 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 2013b).

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.

The representative concentration pathway scenario 4.5 (RCP4.5) under the Intergovernmental Panel on Climate Change was adopted for the projection of climate at the Meliadine Mine (Agnico Eagle 2022). It is anticipated that the mean temperature in the Project region will increase approximately 0.06 °C/year relative to historical means over the period from 2020 to 2120. Precipitation at the Project region is also predicted to increase by 0.7 mm/year on average.

## 2.2 Environmental Setting

The dominant terrain in the Meliadine 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 property is about 60 metres above sea level (masl) in low-lying topography with numerous lakes. Surface waters are usually frozen by early October and remain frozen until early June.

The surveyed lake surface elevations in the Meliadine 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 Project area. Most of the perched lakes at the Project site are relatively shallow (less than 2 m water depths). Late-winter ice thicknesses on freshwater lakes in the Project 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 Meliadine 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 (Agnico Eagle 2022). 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 0.016°C/m to 0.02°C/m (Agnico Eagle 2022).

The formation of an open-talik, which penetrates through the permafrost, would be expected for lakes that exceed a critical depth and size. Thermal modelling was conducted by Golder to assess the extend of lake taliks. It is anticipated that open-taliks exist below portions of Lake B4, Lake B5, Lake B7, Lake A6, Lake A8, Lake CH6, and

Lake D4 (Agnico Eagle 2022). The salinity of groundwater also influences the temperature at which the groundwater will freeze.

## 2.4 Groundwater

In areas of continuous permafrost, there are generally two groundwater flow regimes: a shallow groundwater flow regime located in the active layer near the ground surface, and a deep groundwater flow regime located beneath permafrost. From late spring to early autumn, when temperatures are above 0°C, the active layer thaws. Within the active layer, the water table is expected to be a subdued replica of topography and is expected to parallel the topographic surface. Groundwater in the active layer flows to local depressions and ponds that drain to larger lakes in the Meliadine Extension area.

The permafrost in the rock in the Meliadine Extension area would be virtually impermeable to groundwater flow. The shallow groundwater flow regime, therefore, has little to no hydraulic connection with the deep groundwater regime. A numerical hydrogeological model for the deep groundwater flow regime was developed in 2012 and updated several times in 2016, 2019, and 2021 (Agnico Eagle 2022). It was reported that the elevations of the larger lakes with taliks extending down to the deep groundwater regime (referred to as open taliks) provide the principal driving force for deep groundwater flow. Through thermal modelling, open-taliks were suggested to exist beneath Lake B4, Lake B5, Lake B7, Lake A6, Lake A8, Lake CH6, and Lake D4 (Agnico Eagle 2022). Hydrogeological testing conducted at the Project site indicated that the bulk bedrock is generally of low hydraulic conductivity, ranged from $1x10^{-10}$ m/s to $6x10^{-9}$ m/s (Agnico Eagle 2022). Groundwater velocities in the deep groundwater regime are very low and on the order of 0.2 m/year to 0.3 m/year.

To a lesser degree, groundwater beneath the permafrost is influenced by density differences due to the upward diffusion of deep-seated brines (density-driven flow). In the Canadian Shield, concentrations of Total Dissolved Solids (TDS) in groundwater increase with depth, primarily in response to upward diffusion of deep-seated brines. A "West Bay"-type well was installed in 2011 at the site near the proposed Tiriganiaq UG infrastructure to establish a baseline for deep groundwater quality. A second "West Bay"-type well was installed in 2020 near the Discovery deposit to support the Meliadine Extension. Mean salinity of groundwater below the permafrost has been estimated at approximately 61,000 mg/L (Agnico Eagle 2022). Salinity can induce a freezing point depression, creating a cryopeg in permafrost where water can be unfrozen even though the temperature is below 0°C. The freezing point depression was calculated to be equivalent to -3.3°C in the Meliadine Extension area (Golder 2012b). The portion of the permafrost, where groundwater may be partially or wholly unfrozen due to the freezing point depression, has been estimated to be at a depth of 280 m to 290 m (Agnico Eagle 2022).

## 2.5 Seismic Zone

The Meliadine Mine site is in an area of low seismic risk. The site classification for seismic response is "Class C" based on the determined ground conditions. The Peak Ground Acceleration (PGA) for a reference "Class C" site under various Annual Exceedance Probability (AEP) was estimated using the 2020 National Building Code of Canada Seismic Hazard Tool. The estimated PGA is 0.0285 g for a 5% in 50-year probability of exceedance (0.001 per annum or 1 in 1,000 year return) and 0.0498 g for a 2% in 50-year probability of exceedance (0.000404 per annum or 1 in 2,475 year return) for the Meliadine Mine site.

# 3.0 MINE DEVELOPMENT AND GENERAL WATER MANAGEMENT STRATEGY

## 3.1 Introduction

The open pit and underground mining schedule for the Meliadine Extension life of mine summary for all deposits were provided by Agnico Eagle and are presented in Table 1. The detailed mine schedule for the individual open pit and underground mine can be found in the Design Basis Memo (DBM) attached in Appendix B. The provided mine development schedule served as the basis for the sequencing and scheduling of the required water management infrastructure for the Meliadine Extension. The operational phase for the Meliadine Extension will commence in 2024 upon reception of permits and approvals. The NIRB approved Meliadine Mine was scheduled to be completed in 2032. With the Meliadine Extension, it is proposed to extend the life of mine (i.e., operation phase) to 2043. Closure will extend for about seven years as pits will be flooded from 2044 to 2050.

### Table 1 : Key Meliadine Extension Mine Development and Sequence

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047-2050 | 2051-2060 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Approved Mining** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tiriganiaq Deposit | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| **Construction** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infrastructure | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | |
| Dewatering and Fish Out | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | |
| **Tiriganiaq Deposit** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Pit | | | | | ■ | ■ | ■ | ■ | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Underground | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | |
| **Wesmeg Deposit** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Pit | | | | | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| **Pump Deposit** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Pit | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | |
| Underground | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | |
| **F Zone Deposit** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Pit | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | |
| Underground | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | |
| **Discovery Deposit** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open Pit | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | |
| Underground | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | |
| **Tiriganiaq-Wolf Mining Area** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Underground | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| **Closure** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infrastructure | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | | |
| Flooding | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | |
| **Post-Closure** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Monitoring | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

## 3.2 General Water Management Strategy

One of the primary water management objectives for the Meliadine Extension is to minimize potential impacts to the quantity and quality of surface water and surrounding waterbodies through the construction and operation of various water management infrastructure. The Meliadine Extension water management plan is based on two guiding principles: 1) where possible, divert clean (non-contact) water away from mine infrastructure, and 2) separate surface contact water and saline water.

The proposed management of surface contact water and saline water is summarized below.

**Surface Contact Water:** Surface contact water originating from developed areas will be intercepted and conveyed to the various collection ponds for temporary storage. The primary sources of contact water include the Waste Rock Storage Facilities (WRSFs), open pits dewatering, Tailings Storage Facility (TSF), laydown areas, and facilities areas.

Collection Pond 1 (CP1) and CP8 will be used as the main water storage ponds and local smaller collection ponds (i.e., CP7, B5North, A6, A8, CP9, CPD1, and CPD2) used for temporary water storage during freshet and after a summer precipitation event. In general, contact water from local smaller collection ponds will be pumped to the larger collection ponds. The surface contact water from Wesmeg, Wesmeg-North, Pump, and F zone areas will be pumped to the water collection pond, CP8. The water stored in CP8 will be transferred to the main attenuation pond, CP1, from where water will be routed through either the Effluent Water Treatment Plant (EWTP) or the Saline Effluent Treatment Plant (SETP) as necessary and discharged to the receiving environment. Discharge to Itivia Harbour via the waterline is prioritized, with the remainder discharged to Meliadine Lake (Agnico Eagle 2021). At the Tiriganiaq-Wolf site, contact water and saline water will be combined and managed in Saline Pond 5 (SP5), and transferred to SP6 for discharge to Itivia Harbour. The surface contact water at the Discovery area will be managed locally and temporarily stored in CPD1 and CPD2, and then pumped to the saline water pond at Discovery (SPD1).

**Saline Contact Water**: Saline contact water will be managed in various saline ponds on the surface and then routed to either TIR02 open pit (prior to 2025) or SP6 (2025 onwards). The primary sources of mine related saline contact water include underground mine dewatering, ore pads, saline WRSFs, and a portion of the TSF.

From 2025 onwards, SP6 will be used as the main saline water collection pond from where the water will be transferred to the SETP and treated for total suspended solids and ammonia prior to discharge to Itivia Harbour. Several local saline ponds such as at Discovery (SPD1), Tiriganiaq-Wolf (SP5), Sumps P3 and P4 at Pump, and Sump F2 at F Zone will be used to temporarily store saline contact water before it is transferred to TIR02 open pit or SP6 depending on the operation year.

## 3.3 Other Input Data

The latest site survey data provided by Agnico Eagle in July 2021 together with the 1-m contour digital map of the ground surface and 0.5 m interval lake bathymetric data for selected lakes provided by Agnico Eagle in 2012 were used as the database for the water management infrastructure design. The proposed footprint of the open pits, WRSFs, TSF, and other general site layouts for other mine site infrastructure were provided by Agnico Eagle. The predicted maximum operating water level (MOWL) in each water storage area and required pumping rate were provided by Lorax Environmental Service Ltd. (Lorax).

# 4.0 REQUIRED WATER MANAGEMENT INFRASTRUCTURE AND PROPOSED CONSTRUCTION SCHEDULE

## 4.1 Required Water Management Infrastructure

The required water management infrastructure (i.e., dikes, berms, sumps, diversion channels, pumps/pipelines etc.) for the Meliadine Extension were assessed and sized based on the overall site water and waste management plans and the results of the water balance and water quality modelling performed by Lorax. The required water management infrastructure for the Meliadine Extension include the following:

- 11 water retention dikes including Dikes D-SP6North, D-SP6West, D-B5North, D-B5South, D-CP8North, D-CP8West, D-CP8South, D-CP8East, D-A8North, D-A8South, and D-A6;
- Eight water collection ponds including contact water ponds CP7, CP8, CP9, CPD1, CPD2, and saline ponds SP5, SP6, and SPD1;
- 12 water diversion channels including Channels 11 to Channel 22;
- Seven sumps including Sump P1, Sump P2, Sump P3, Sump P4, Sump P5, Sump F1, and Sump F2;
- Two water diversion berms including Berm-D1 and Berm-D2;
- Five thermal protection berms including Berm-P5, Berm-CP7, Berm-F2, Berm-CPD2, and Berm-SP5;
- Various pump and pipelines; and
- Culverts as required.

In this study, the following terminology is defined as:

- a **"dike"** is used to refer to a water retention earthwork structure like a dam defined in CDA 2013, which is planned to retain more than 30,000 $m^3$ of water and the maximum height (the vertical distance from the lowest ground to the crest) is greater than 2.5 m.
- **A "berm"** is used to refer to a water diversion or retention earthwork structure with no key trench and liner system, which is planned to retain less than 30,000 $m^3$ of water.
- A **"thermal berm"** is used to refer to an independent earthwork structure with no water against it and acts as a thermal protection structure to protect the permafrost underneath the structure. The construction materials for a thermal berm will be mainly from the excavation of the upstream water storage pond or sump.
- A "**channel**" is used to refer to watercourses created by excavation or berm construction to divert or control a limited volume of runoff where overtopping would adversely affect the performance or stability of critical infrastructure or result in an adverse environmental impact.
- A "**collection pond**" is used to refer to a facility designed to temporarily contain runoff from areas impacts by mining activities and from site infrastructure. The collection pond is generally formed by natural existing lake with dikes or berms.
- A "**sump**" is used to refer to a storage area formed by excavation to temporarily store runoff from adjacent areas impacts by mining activities.

Table 2 summarizes the required water management infrastructure for the Meliadine Extension. The location and extent of the water management infrastructure are presented in the overall site layout plan view (Figure 2).

### Table 2: Required Water Management Infrastructure for Meliadine Extension

| Water Management Infrastructure Type | Nomenclature | Location and Operational Function |
|---|---|---|
| Dike | Dike D-SP6North | Located north of SP6. D-SP6North will be used to contain saline water from the TSF and prevent the saline water from flowing to the downstream receiving environment. |
| | Dike D-SP6West | Located in the narrow between SP6 and Lake B6. D-SP6West will be used to contain saline water from the TSF and prevent the saline water from flowing into downstream dewatered Lake B6. |
| | Dike D-B5North | Located north of WN01 open pit within dewatered Lake B5. D-B5North will be used to divert runoff from flowing into WN01 pit. |
| | Dike D-B5South | Located south of WN01 open pit within dewatered Lake B5. D-B5South will be used to collect runoff from B5 south catchment and portion of runoff from WRSF5. |
| | Dike D-CP8North | Located in the narrow between CP8 and Lake B5. D-CP8North will be used to contain contact water stored within CP8 and prevent the contact from flowing to the dewatered Lake B5. |
| | Dike D-CP8South | Located within the narrow of CP8 and B45. D-CP8South will be used to contain contact water stored within CP8 and prevent the contact from flowing to the downstream receiving environment. |
| | Dike D-CP8West | Located in the narrow between CP8 and B3. D-CP8West will be used to contain contact water stored within CP8 and prevent the contact from flowing to the downstream receiving environment. |
| | Dike D-CP8East | Located west of PUM01 open pit. D-CP8East will be used to contain contact water stored within CP8 and prevent the contact from flowing into PUM01 open pit. |
| | Dike D-A8North | Located south of WES03 open pit. D-A8South will be used to divert runoff from flowing into WES03 open pit. |
| | Dike D-A8South | Located north of PUM02 and PUM04 open pits. D-A8South will be used to divert runoff from flowing into PUM02 and PUM04 open pits. |
| | Dike D-A6 | Located southwest of FZO01 open pit. D-A6 will be used to divert contact water from Lake A6 from flowing into FZO01 open pit. |
| Berm | Berm-D1 | Located west of Saline WRSF3 and industrial pad. Berm-D1 will be used to divert contact water from Saline WRSF3, industrial pad, and saline water from Saline WRSF3 and prevent the contact from flowing to the downstream receiving environment. |
| | Berm-D2 | Located downstream of WRFS8 to divert the runoff water from WRSF8 to CPD1 during operation. |
| Thermal Berm | Berm-P5 | Located in the narrow between Sump P5 and Lake B46. Berm-P5 will be used as thermal protection berm for Sump P5. |
| | Berm-CP7 | Berm-CP7 will be used as a thermal protection berm for CP7 to reduce seepage to F Zone open pits from CP7. |
| | Berm-F2 | Located between Lake A6 and Sump F2. Berm-F2 will be used as thermal protection berm for Sump F2. |
| | Berm-CPD2 | Located north of CPD2. Berm-CPD2 will serve as a thermal protection berm to control the seepage flow from CPD2 to downstream (CH6). |
| | Berm-SP5 | Berm-SP5 will serve as a thermal protection berm to control the seepage flow from SP5 to Lake D4. |

**Table 2: Required Water Management Infrastructure for Meliadine Extension**

| Water Management Infrastructure Type | Nomenclature | Location and Operational Function |
|---|---|---|
| Channel | Channels 11, 12 and 13 | Channels 11 and 12 to divert contact water from WRSF6 towards Sumps P1 and P2.<br>Channel 13 to divert contact water from WRSF6 towards Sump P5. |
| | Channels 14,15, and 16 | Channel 14 and Channel 15 to divert contact water from WRSF7 towards Sump F1. Channel 16 to divert contact water from F Zone Ore Pad and Saline WRSF2 towards Sump F2. |
| | Channels 17,18 | Channels 17 and 18 to divert contact water from Saline WRSF3, ore pad, industrial pad, and fuel pad towards the downstream SPD1. |
| | Channels 19, 20, and 21 | Channels 19 is to divert contact water from WRSF8 towards CPD1.<br>Channels 19 and 20 to divert contact water from WRSF9 towards CPD2. |
| | Channel 22 | Located east side of WRSF5 to divert the runoff water from east slope of WRSF5 to CP9 or PUM01 open pit and prevent the runoff water from flowing to the dewatered Lake A8 area. |
| Sump | Sumps P3 and P4 | Sumps P3 and P4 to collect saline contact water from Saline WRSF2 at Pump. |
| | Sump P1, Sump P2, and Sump P5 | Sumps P1 and P2 to collect contact water from WRSF6 that has been diverted by Channels 11 to 12.<br>Sump P5 will be used to contain contact water from the Pump Ore Pad and WRSF6 and prevent the contact from flowing to the downstream receiving environment. |
| | Sump F1 | Sump F1 to collect contact water from WRSF7 that has been diverted by Channel 14 and Channel 15. |
| | Sump F2 | Sump F2 to collect saline water from F Zone Ore Pad and Saline WRSF2 that has been diverted by Channel 16 and saline water from F Zone Underground mining. |
| Culverts | To be determined | For water conveyance through haul roads and access roads. |

## 4.2 Proposed Construction Schedule

The proposed construction schedule for each required water management infrastructure was defined based on the mine development schedule and planned lake dewatering schedule. It is assumed that the lake dewatering activity will take place two years prior to the associated infrastructure coming online. The construction of the water management infrastructure will take place after the lake dewatering and be complete in about one year.

Table 3 summarizes the planned construction schedule and the water management infrastructure required during the development and expansion of each mining area of the Meliadine Extension.

**Table 3: The Meliadine Extension Planned Water Management Construction Schedule**

| Water Management Infrastructure Required for the Meliadine Extension | Planned Schedule for Start of Construction | Corresponding Mine Development |
|---|---|---|
| Dike D-B5North | 2024 | Wesmeg-North Mine Area Development and form CP8 |
| Dike D-B5South | | |
| Dike D-CP8South | | |
| Dike D-CP8West | | |
| Dike D-CP8North | | |
| Dike D-CP8East | | |
| Dike D-SP6North | 2024 | TSF Expansion and form SP6 |
| Dike D-SP6West | | |
| Saline Pond SPD1 | 2024 | Discovery Mine Area Development |
| Berm-D1 | 2025 | Discovery Mine Area Development |
| Channels 17 and 18 | | |
| Sumps P1, P2, P3, P4, and P5 | 2026 | Wesmeg and Pump Mine Areas Development |
| Channels 11, 12, 13, and 22 | | |
| Berm-P5 | | |
| Dike D-A6 | 2028 | FZone Mine Area Development |
| Collection Pond CP7 and Berm-CP7 | | |
| Channels 14 and 15 | | |
| Sump F1 | | |
| Sump F2 | 2032 | |
| Berm F2 | | |
| Channel 16 | | |
| Collection Pond CPD1 | 2030 | Discovery Mine Area Expansion |
| Collection Pond CPD2 | | |
| Berm-CPD2 | | |
| Berm-D2 | | |
| Channels 19, 20, and 21 | | |
| Dike D-A8South | 2031 | Pump Mine Area Development |
| Saline Pond SP5 | 2032 | Tiriganiaq-Wolf Mine Area Development |
| Berm-SP5 | | |
| Dike D-A8North | 2036 | Wesmeg Mine Area Development |
| Culverts | As required | Overall Site |

# 5.0 SUBSURFACE CONDITIONS

Geotechnical site investigation programs were carried out at various locations of the Meliadine Extension site in 1998, 1999, 2007, 2009, 2011, 2012, 2013, 2014, 2016, and 2021. Figure 3 shows the locations of the geotechnical boreholes drilled around the proposed site facilities for this study. The sub-sections below summarize subsurface conditions obtained from previous geotechnical site investigations performed in some key infrastructure areas. This information includes overburden soils and bedrock depths for the key proposed water management infrastructure for the Meliadine Extension.

## 5.1 Dike D-SP6North

Three boreholes were drilled along the footprint of Dike D-SP6North. All three boreholes encountered a layer of organic material from 0.05 m to 0.2 m thick. The recovered organic material consisted of fibrous, dark brown peat that contained some rootlets. The organic material was frozen with no visible or excess ice observed in them. The underlying overburden encountered in the boreholes consisted of various layers of ice, gravel, silt and sand, and cobbles. Excess ice (Vs, Vx, and Vc) was observed in the boreholes. Excess ice occurred in the form of ice lenses and visible individual ice crystals. A summary of the overburden conditions and bedrock within the proposed Dike D-SP6North footprint is presented in Table 4. (Golder 2011, EBA 2013, Tetra Tech 2021).

**Table 4: Geotechnical Information of Overburden Soils and Bedrock Depths in Dike D-SP6North Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT11-01* | 0.2 | Silty Gravelly Sand; Sand and Gravel | Vs from 2 m to 7 m | 9.15 |
| GT13-05 | 0.05 | Ice and Sand; Sandy Silt; Gravel; Sand | Vx (5-10%) from 0.4 m to 1 m<br>ICE (Vx, Vs, Vc) from 1.4 m to 6.8 m | 9.50 |
| GT21-74* | 0.06 | Inferred Gravel and Cobbles, Silt and Sand; no recovery (57.7 to 57.4 and 56.7 to 56.4) | Vx, Vc (10%)<br>from 0 to 1 | 6.00 |

* GTC installed in this borehole

## 5.2 Dike D-SP6West

A total of seven boreholes were drilled within or close to the proposed footprint of Dike D-SP6West. Six of the boreholes encountered a layer of organic material from 0.05 m to 0.45 m thick. The recovered organic material consisted of fibrous, brown peat that contained gravel, and trace sand. The organic material was frozen with no visible or excess ice observed in them. The underlying overburden encountered in the boreholes consisted of various layers of silt and gravel. Excess ice (Vs, Vx, and Vu) was observed in one borehole. Excess ice occurred in the form of ice lenses and visible individual ice crystals.

A summary of the overburden conditions and bedrock within the proposed Dike D-SP6West footprint is presented in Table 5 (SRK 2007, Golder 2009, Golder 2012c, EBA 2013, Tetra Tech 2021).

**Table 5: Geotechnical Information of Overburden Soils and Bedrock Depths in the D-SP6West Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT07-09* | 0.2 | Sandy Silt; Frozen Silty Sand; Silty Sand with gravel | Vs (30%) from 1.6 m to 2.2 m | 5.40 |
| GT09-18* | 0.45 | Gravel; Sandy Gravel (frozen from 1.35 to 1,66); Cobbles and Boulders | N/A | 5.80 |
| GT12-07 | 0.1 | Gravelly Silty Sand; Gravelly Clayey Sand; Silty Sand, Clayey SILT; Gravelly Sandy Clay; and Gravel | Vx from 0.1 m to 2 m<br>Nbe/Nbn (40%) from 2 m to 11 m<br>Nf (20%) from 11 m to 15 m | 15.60 |
| GT12-08 | 0.06 | Silty Sand; Gravelly Sand; Clayey Sand; Gravelly Silty Sand; Sand and Silt | Vx (30%) from 0.1 m to 2 m<br>Below 2 m no visible ice | 12.78 |
| GT12-09 | 0.0 | Sandy Silty Clay; Silty Sand and Silty Gravel; No recovery from 4.20 to 5.50 m; Ice and Silty Sand from 6 to 7; Gravelly Silty Sand | Vx from 1.5 m to 2.5 m<br>Vr-Vu from 5.5 m to 7.5 m<br>Nbe-Nbn (70%) from 7.5 to 17.5 | 17.58 |
| GT13-04* | 0.05 | Sand; Sand and Silt; Boulders and Gravel | Vs 20%, 1 mm to 5 mm thick ice lenses from 0.2 m to 1.7 m<br>Vx 30% from 1.7 m to 2.5 m | 7.2 |
| GT21-73 | 0.1 | Gravelly and Sandy Silt; Silt; Gravel | Ice crystals and medium lenses observed, Vx, Vu<br>10% from 0.1 m to 3 m | 11.2 |

* GTC installed in this borehole

## 5.3 Dike D-B5North

Five boreholes were drilled within, or close to, the footprint of Dike D-B5North. Boreholes GT21-99, GT21-100, and GT21-101 were drilled from the B5 Lake ice surface. Organic material was not encountered in any of these boreholes. Borehole GT21-102 was drilled from the western shore of B5 Lake and no organic material was encountered in it. The overburden encountered in the boreholes consisted of various layers of gravel and silt, cobbles and boulders, gravel, and sand. Fine material was washed out or lost through the bottom of the drill rod while extracting the rods because of the drilling through lake water. Excess ice (Vs and Vc) was observed in one borehole (GT21-102) and occurred in the form of clear ice lenses up to 12 mm thick and clear ice coatings up to 10 mm thick.

A summary of the overburden conditions and bedrock within the proposed Dike D-B5North footprint is presented in Table 6 (Golder 2012c, Tetra Tech 2021).

**Table 6: Geotechnical Information of Overburden Soils and Bedrock Depths in the D-B5North Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-99 | - | Lake Ice (0 to 3 m)<br>Slush (3 m to 4.5 m)<br>No recovery (4.5 m to 7 m) | - | 6.9 |
| GT21-100 | - | Lake Ice (0 to 3.5 m); Cobbles and Boulders | - | 5.6 |
| GT21-101 | - | Lake Ice (0 to 1.5 m); Slush (1.5 m to 2.5 m); Cobbles; Gravel | - | 5.2 |
| GT21-102* | - | No recovery (0 to 1 m)<br>Gravel and Sand; Sand, Rubbles | Clear ice coatings on gravel to 10 mm thick, Vc 12% from 1 m to 3.5 m | 6.2 |
| GT12-27 | - | 0 to 1.5 was Ice then 1 m of Silty sand, and Gravel | | 5.2 |

* GTC installed in this borehole

## 5.4 Dike D-B5South

No borehole was drilled within or close to the Dike D-B5South footprint, and it was assumed the overburden conditions in this area are similar those encountered in the Dike D-B5North area.

## 5.5 Dike D-CP8North

Two boreholes were drilled along the footprint of D-CP8North. A layer of organic material from 0.27 m to 0.45 m thick was encountered in both boreholes. The recovered organic material consisted of fine fibrous, dark brown to black peat that contained fragmented angular gravel. The organic material was frozen with no visible or excess ice observed in it. The underlying overburden encountered in the boreholes consisted of various layers of gravel and sand, silt, and ice and silt. Excess ice (Vx and Vs) was observed in Borehole GT21-17 and occurred in the form of ice crystals less than 1 mm in size and clear lenticular and wavey ice lenses up to 3 mm thick. The gravimetric moisture content of the overburden varied from 8.4% at a depth of 1.1 m to 13.0% at a depth of 2.0 m (GT21-17).

A summary of the overburden conditions and bedrock within the proposed Dike D-CP8North footprint is presented in Table 7 (Tetra Tech 2021).

**Table 7: Geotechnical Information of Overburden Soils and Bedrock Depths in the D-CP8North Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-16* | 0.27 | Peat; Gravel | Nbn | 2.8 |
| GT21-17 | 0.45 | Peat; Gravel and Sand; Silt; Ice and Silt | Up to 58% Vx, Vs, Nbe; clear ice lenses to 3 mm thick | 3.7 |

* GTC installed in this borehole

## 5.6 Dike D-CP8East

Five boreholes were drilled within or close to the footprint of Dike D-CP8East with a layer of organic material of thickness ranging from 0.06 m to 0.60 m encountered in them. The recovered organic material consisted of fine fibrous, brown to black peat that contained trace shells, silt, and subangular to angular gravel. The organic material was frozen and ice conditions ranged from non-visible, non-excess ice to visible ice crystals and coatings on grains. The underlying overburden encountered in the boreholes consisted of various layers of gravel, sand, ice and sand and silt, silt, and gravel. Excess ice (Vs, Vx, Vr, Vu, and Vc) was observed in all five boreholes. Excess ice occurred in the form of clear lenticular ice lenses up to 10 mm thick and clear ice coatings up to 10 mm thick. Massive ice approximately 1.5 m thick was also observed in Borehole GT21-18 between 2.0 m and 3.5 m depth. The gravimetric moisture content of the overburden varied from 3.4% at a depth of 3.2 m (GH21-26) to 27.2% at a depth of 2.0 m (GH21-18). A summary of the overburden conditions and bedrock within the proposed Dike D-CP8East footprint is presented in Table 8 (Tetra Tech 2021).

**Table 8: Geotechnical Information of Overburden Soils and Bedrock Depths in the D-CP8East Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-18 | 0.26 | Peat; Gravel; Sand; Ice and Silt and Sand | Up to 73% Vs, Vx; ice lenses 1 mm to 10 mm thick; 1.5 m ICE + Silt and Sand | 4.4 |
| GT21-19 | 0.06 | Peat; Silt; Gravel: Ice and Sand and Silt; Cobbles | Up to 55% Vs, Vx, Nbn, Nf; horizontal lenses 1 mm to 5 mm thick | 3.8 |
| GT21-20* | 0.06 | Peat and Gravel; Silt; Ice and Sand; | Up to 57% Vx, Vc, Vs, Vu; clear ice crystals and coatings | 4.0 |
| GT21-21 | 0.21 | Peat; Silt; Gravel | Up to 33% Vx, Vs, Vu, Nbn; clear lenticular ice lenses to 4 mm thick | 4.0 |
| GT21-26 | 0.60 | Peat; Sand and Gravel; Gravel; Ice and Sand; Gravel | Up to 64% Vx, Vr, Vs, Nbe, Nbn; clear ice lenses 1 mm thick | 5.8 |

* GTC installed in this borehole

## 5.7 Dike D-CP8South

Two boreholes (GT21-45 and GT12-32) were drilled within, or close to, the footprint of Dike D-CP8South. A layer of organic material was encountered in GT21-45 from a depth of 0.0 to 2.3 m and a layer of ice and peat from a depth of 2.3 m to 4.3 m. The organic material was frozen and ice conditions ranged from non-visible ice to visible ice coatings and stratified layers of ice. The underlying overburden encountered in the boreholes consisted of various layers of ice and peat, sand, and gravel and sand. The overburden material is mostly non-cohesive and frozen. A summary of the overburden conditions and bedrock within the proposed Dike D-CP8South footprint is presented in Table 9 (Golder 2012c, Tetra Tech 2021).

**Table 9: Geotechnical Information of Overburden Soils and Bedrock Depths in the D-CP8South Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-45 | Peat: 2.3 m<br>ICE and Peat: 2 m | Peat; Ice and Peat; Sand; Gravel and Sand | Up to 75% Vc, Vr, Vs, Nbe; clear ice lenses to 2 mm thick, up to 20 mm clear ice coatings | 7.3 |
| GT12-32 | - | 1 m of Ice; Silt and Sand; trace to some subrounded gravel; non-cohesive and frozen | Vx, Nbe; | 2.24 |

## 5.8 Dike D-CP8West

Two boreholes (GT21-63 and GT12-31) were drilled within the proposed Dike D-CP8West footprint. A layer of organic material ranging from 0.13 m to 0.30 m thick was encountered in both boreholes. The recovered organic material consisted of fibrous, brown peat that contained gravel, and trace sand. The organic material was frozen and ice conditions were non-visible non-excess ice. The underlying overburden encountered in the boreholes consisted of various layers of silt and sand, gravel, and gravel and sand. Excess ice (Vx) was observed in GT21-63. Excess ice occurred in the form of visible individual ice crystals up 4 mm thick. A summary of the overburden conditions and bedrock within the proposed Dike D-CP8West footprint is presented in Table 10 (Golder 2012c, Tetra Tech 2021).

**Table 10: Geotechnical Information of Overburden Soils and Bedrock Depth in the D-CP8West Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-63* | 0.13 | Peat; Silt and Sand; Gravel; Gravel and Sand | Up to 10% Vx, ice crystals to 4 mm | 4.4 |
| GT12-31 | 0.30 | Peat; Sandy Silty Gravel; Frozen Sand; Frozen Sandy Silt; Sand and Gravel | Up to 30% Nbn | 4.90 |

* GTC installed in this borehole

## 5.9 Dike D-A8North

Two boreholes (GT21-35 and GT13-10) were drilled within the proposed Dike D-CP8North footprint. The overburden encountered at Borehole GT13-10 consists of a veneer of organic material 0.65 m thick and underlain by a layer of predominantly sand and silt. The overburden is predominately frozen to a depth of 3.86 m with a 1.3 m layer of unfrozen overburden to a depth of 5.16 m where bedrock is encountered. The estimated percentage of visible ice ranged from 1-2% to 30%. Some of the excess ice occurred in the form of ice lenses ranging in thickness from 1 mm to 5 mm. The gravimetric moisture content varied from 5% at a depth of 3.2 m to 158% at a depth of 2.1 m. The porewater salinity at a depth of 1.82 m was 4.0 ppt. A summary of the overburden conditions and bedrock within the proposed Dike D-CP8North footprint is presented in Table 11 (EBA 2013, Tetra Tech 2021)

**Table 11: Geotechnical Information of Overburden Soils and Bedrock Depth in the D-A8North Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT21-35 | - | - | - | 2.34 |
| GT13-10* | 0.65 | Sand and Silt with some gravel; | Frozen by depth of 3.8 m, Up to 30% of visible ice, ice lenses ranging in thickness from 1 mm to 5 mm | 5.2 |

## 5.10 Dike D-A8South

No borehole was drilled within or close to the footprint of Dike D-A8South, and it was assumed the overburden conditions are similar to those at Dike D-A8North.

## 5.11 Dike D-A6

Six boreholes (GT09-01, GT09-02, GT09-03, GT21-60, GT21-61 and GT21-62) were drilled within or close to the footprint of Dike D-A6 with a veneer of organic material encountered in five of them. The recovered organic material was mostly frozen and consisted of fine fibrous, grey to brown to black peat that contained leafy plants. The underlying overburden encountered in the boreholes consisted of various layers of sand and silt, and gravel and an approximately 0.1 m thick layer of clay in GT21-62 at a depth of 0.7 m to 0.8 m. Excess ice (Vs, Vx, Vr, and Vc) was observed in some of the boreholes. The depth of bedrock varied from 3 m to 8.5 m. A summary of the overburden conditions and bedrock within the proposed Dike D-A6 footprint is presented in Table 12 (Golder 2009, Tetra Tech 2021).

**Table 12: Geotechnical Information of Overburden Soils and Bedrock Depth in the D-A6 Area**

| Borehole No. | Organic Layer Thickness (m) | Major Overburden Soil Types | Ice Conditions | Depth to Bedrock (m) |
|---|---|---|---|---|
| GT09-01* | 0.62 | Gravel; Sand; Cobbles and Gravel; Clayey Silt; Sand | - | 6 |
| GT09-02* | 0.37 | Gravel and Boulders; Clayey Silt; Clayey Silty Gravel; Sand and Clayey Silt; | - | 8.57<br>(Lake Bed at 0 m) |
| GT09-03 | 0 | Sand and Gravel; Boulders and Gravel; | - | 3.5 |
| GT21-60 | 0.7<br>(ice and peat) | Cobbles; Sand; Silt | Ice, clear, hard, 5-8 mm discs<br>Vs 2%, peat is Nbn<br>Vx 9% | 5.5 |
| GT21-61* | 0.06 | Boulders; Sand and Silt; Gravel | Vs, Vc, Vx 30-35% from 1 to 3 m | 7.5 |
| GT21-62 | 0.25 | Peat and Silt; Clay; Gravel; Silt | Up to 40% Vr, Vx, Vs; clear to cloudy ice lenses up to 5 mm thick spaced 2 mm to 3 mm apart | 3.0 |

* GTC installed in this borehole

## 5.12 Channels and Sumps

Destructive boreholes (very limited recovery of disturbed overburden material) were drilled along the proposed channels and sumps to determine the depth of bedrock and the moisture contents of the overburden material. The drilling information and moisture content testing results were provided by Agnico Eagle. The encountered bedrock depths and destructive boreholes for each channel and sump are presented in Table 13.

### Table 13: Bedrock Depth in Channels and Sumps Area

| Water Management Infrastructure Type | Nomenclature | Destructive Boreholes | Bedrock Depth (m) |
|---|---|---|---|
| Channel | Channel 11 | GT21-27 | 10.2 |
| | Channel 12 | GT21-25 | 10.4 |
| | | GT21-28 | 9.4 |
| | | GT21-29 | 8.4 |
| | Channel 13 | GT21-30 | 7.8 |
| | | GT21-31 | 8.9 |
| | Channel 14 | GT21-40 | 7.3 |
| | | GT21-41 | 7.2 |
| | Channel 15 | GT21-42 | 8.7 |
| | | GT21-43 | 11.4 |
| | Channel 16 | - | n/a |
| | Channel 17 | GT21-89 | n/a |
| | Channel 18 | GT21-87 | 4.2 |
| | | GT21-88 | 3.5 |
| | Channel 19 | GT21-81 | 8.7 |
| | | GT21-84 | - |
| | | GT21-90 | 2.2 |
| | | GT21-91 | 3 |
| | Channel 20 | - | n/a |
| | Channel 21 | - | n/a |
| | Channel 22 | - | n/a |
| Sump | Sump P1 | GT21-22 | 8.7 |
| | | GT21-23 | 9.8 |
| | Sump P2 | GT21-24 | 8.4 |
| | Sump P3 | GT21-32 | n/a |
| | | GT21-33 | 12.4 |
| | Sump P4 | - | n/a |
| | Sump P5 | GT21-34 | 7 |
| | Sump F1 | GT21-36 | 7.3 |
| | | GT21-37 | 7.6 |
| | | GT21-38 | 8.4 |
| | | GT21-39 | 8.5 |
| | Sump F2 | - | n/a |

# 6.0 PREFEASIBILITY LEVEL DESIGN OF WATER MANAGEMENT INFRASTRUCTURE

## 6.1 Design of Water Retention Dikes

### 6.1.1 Key Design Objectives

- In accordance with Canadian Dam Safety Guidelines (CDA 2007/2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014/2019);
- In accordance with Agnico Eagle's Corporate Standard – Risk Management and Monitoring System – Water Management (2021);
- Meet the requirements in the Type 'A' Water License for Meliadine (2AM-MEL1631);
- Minimize seepage through the dike and its foundation while optimizing the construction efficiency;
- Maximize the use of available construction materials produced at the site;
- Minimize overall environmental footprints and effects; and
- Consider site specific geotechnical and climatic conditions, and water storage pond operation requirements.

### 6.1.2 Dam Classification

The water retention dikes were designed to comply with the Canadian Dam Safety Guidelines (CDA 2013). CDA (2013) provides recommendations and directions for dam/dike classification based on the consequences of failure. The consequences of dam/dike failure are evaluated in terms of loss of life, environmental and cultural values, and infrastructure and economics. Table 14 presents the assigned CDA classification for each dike required for the Meliadine Extension. More details on the CDA classification can be found in the DBM, as attached in Appendix B.

**Table 14: Dike CDA Classification**

| Dike | CDA Classification | Notes |
|---|---|---|
| Dike D-SP6North | High | Saline Pond |
| Dike D-SP6West | High | |
| Dike D-B5North | High | WN01 open pit downstream |
| Dike D-B5South | High | |
| Dike D-CP8South | Significant | Located in the narrow between CP8 and Lake B45 |
| Dike D-CP8West | Significant | Located in the narrow between CP8 and Lake B3 |
| Dike D-CP8North | High | WN01 open pit downstream |
| Dike D-CP8East | High | PUM01 open pit downstream |
| Dike D-A6 | High | FZO01 open pit downstream |
| Dike D-A8South | High | PUM02 and PUM04 open pit downstream |
| Dike D-A8North | High | WES03 open pit downstream |

### 6.1.3 Inflow Flood Design

The Inflow Flood Design (IDF) for each water retention dike is presented in the DBM in Appendix B. Brief descriptions of the IDF are presented in this section. Extreme wet year spring freshet from snowmelt or high-intensity short-term rainfall events are normally critical to the design of a dike. The resulting water level rise in the pond from a short-term flood event tends to be greater than that under a longer precipitation event. The longer event allows additional time for design event water to be pumped to another facility or to a water treatment plant for discharge. A runoff coefficient of 1.0 was adopted to estimate the runoff volume during an inflow flood design event. The maximum operating water level (MOWL) for each infrastructure was determined based on the water balance results provided by Lorax, the operation constraints, local ground condition, and the benefits of having a higher water containment element to increase local storage capacity.

#### 6.1.3.1 Inflow Flood Design for the “Significant” Consequence Classification Structures

The IDF for a given classification is suggested in CDA (2013). Based on a classification of “Significant”, an annual exceedance probability (AEP) of between 1/100 and 1/1,000 is recommended in CDA (2013). For the CPs which store water year-round (e.g., CP8) and the CPs which temporarily store freshet water (e.g., CP7 and CPD2), the associated dikes/berms are classified as “Significant”, the following four cases were evaluated and the case resulting in the highest water level in the storage was adopted for IDF:

- Spring freshet for a 1 in 100 return wet year without pumping;
- Spring freshet for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme Spring rainfall event without pumping;
- Maximum monthly total rainfall for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme Summer-Autumn rainfall event without pumping; and
- Maximum monthly total rainfall for a 1 in 100 return wet year without pumping.

#### 6.1.3.2 Inflow Design Flood for the “High” Consequence Classification Structures

The IDF is suggested as 1/3 between 1 in 1,000 return and Probable Maximum Flood (PMF) for the dike classified as “High” as per CDA (2013). For the collection ponds which store water year-round such as SP6, with the associated dike classified as “High”, the following four cases were considered and the case resulting in the highest water level in the storage was adopted for IDF in this study:

- Spring freshet for a 1 in 1,000 return wet year without pumping;
- Spring freshet for a mean (1 in 2 return) year plus a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Spring rainfall event without pumping;
- Maximum monthly total rainfall for a mean (1 in 2 return) year plus a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Summer-Autumn rainfall event without pumping; and
- Maximum monthly total rainfall for a 1 in 1,000 return wet year without pumping.

For the CPs which will be operated generally in “dry” condition (for temporarily storage of the freshet water) and may store water in the summer (e.g., A8, A6, B5North, and B5South) with the associated dikes/berms classified as “High”, the following three cases were considered and the case resulting in the highest water level in the storage was adopted for IDF.

- For dry condition before freshet, spring freshet for a 1 in 1,000 return wet year without pumping;

- For dry condition before freshet, spring freshet for a 1 in 2 return wet year plus a 1/3 between 1 in 1,000 and PMF 24-hour extreme Spring rainfall event without pumping; and
- For wet condition (with ponding water in the summer), 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping.

The selected IDF values for the dikes are presented in Table 5 below. More details on the selection of the IDF values can be found in the DBM as attached in Appendix B.

### 6.1.4 Design Top Elevation of Water Retention Element and Dike Crest

In this study, the top elevation of the water containment element (e.g., geomembrane liner or low permeability till core) has been selected to have a minimum freeboard that exceeds that required by CDA (2013). Accordingly, the top elevation of the dike water containment element will be designed to be higher than the MOWL during the IDF plus wind set-up plus settlement due to consolidation of foundation and embankment materials after construction to provide some contingencies. The top elevation of the dike crest will be designed to be higher than the MOWL during the IDF plus wind set-up plus wave run-up plus settlement due to consolidation of foundation and embankment materials after dike construction.

Table 15 summarizes the design top elevations of water retention elements and crest elevations for the dikes required for the Meliadine Extension. More details on the design elevations can be found in the DBM as attached in Appendix B.

**Table 15: Design Top Elevations of Water Retention Elements and Dike Crest Elevations**

| Dike | Area | CDA Dam Class | IDF value (mm) | Design MOWL (m) | Estimated MOWL under IDF (m) | Design Top Elevation of Water Retention Element (m) | Design Dike Crest Elevation (m) |
|---|---|---|---|---|---|---|---|
| D-SP6North | SP6 | High | 241 | 63.10 | 63.80 | 64.2 | 65.5 |
| D-SP6West | | | | 63.10 | 63.80 | 64.2 | 65.5 |
| D-B5North | B5 | High | 137 | 57.96 | 58.39 | 59.2 | 60.2 |
| D-B5South | | | 241 | 57.30 | 58.72 | 59.3 | 60.3 |
| D-CP8South | CP8 | Significant | 241[a] | 58.17 | 58.60 | 59.4 | 60.4 |
| D-CP8West | | Significant | 241[a] | 58.17 | 58.60 | 59.4 | 60.4 |
| D-CP8North | | High | 241 | 58.17 | 58.60 | 59.4 | 60.4 |
| D-CP8East | | High | 241 | 58.17 | 58.60 | 59.4 | 60.4 |
| D-A6 | A6 | High | 137 | 59.5 | 60.19 | 61.0 | 62.0 |
| D-A8South | A8 West | High | 137 | 60.45 | 60.84 | 61.5 | 62.5 |
| D-A8North | | | | 60.45 | 60.75 | 61.5 | 62.5 |

[a]: The selected IDF is governed by D-CP8North and D-CP8East classification (High)

### 6.1.5 Design Concepts and Typical Cross-Sections

A total of 11 new dikes are required for the water management of the Meliadine Extension during mine operation phase. The location and operation function of each dike are described in Table 2. A minimum setback of 100 m from the dike to the open pit limits is maintained in the design. Two types of seepage control features (i.e., liner and low permeability till material) have been adopted for these dikes based on the site conditions, construction material availability, construction schedule, overall construction efficiency, function, and the criteria adopted. As mentioned in Section 1, engineering analyses were not conducted at this stage study. The design concepts and sections were developed based on the engineering judgement and experience gained from the detailed design of other infrastructure at the Meliadine site. Detailed engineering analyses should be conducted to evaluate the design concept and section during the next phase study.

#### 6.1.5.1 Dikes D-SP6North and D-SP6West

Collection pond SP6 will serve as the main global saline water collection pond to store the saline water from the underground mining and the saline contact water transferred from other local saline ponds. Dikes D-SP6North and D-SP6West are associated perimeter dikes to form the SP6 and to prevent the saline water stored in SP6 from flowing to the downstream receiving environment.

Permafrost is anticipated beneath the footprints of these two dikes based on the measured ground temperatures and the findings from the past drilling programs. Seepage control measures adopted for these dikes include a bituminous geomembrane liner (Coletanche or equivalent) keyed into competent frozen ground (ice-poor permafrost) or bedrock. The design intent is to protect the original permafrost foundation beneath the key trench from thawing, thus limiting seepage through these earth structures and their foundations. The design concepts for these two dikes are like the Dike D-CP1 and D-CP5 which were constructed and are in operation at the Meliadine site. The key design features for Dikes D-SP6North and D-SP6West includes:

- A key trench ranging from 2 m to 2.5 m deep and 16 m wide depending on ground conditions.
- Liner keyed into competent frozen ground or bedrock
- Bentonite-augmented material to seal the liner and foundation
- An upstream fill zone with esker sand material to serve as a thermal buffer between the reservoir and the key trench and provides additional benefit to reduce seepage if there are defects in the liner.
- A minimum 3.5 m thick thermal cover over the key trench along the dike abutments to maintain the design temperature.
- The dike side slopes are 2.5H:1V (Horizontal to Vertical) on the upstream side and 2H:1V on the downstream side.

The profile and typical design section for Dike D-SP6North and D-SP6West are presented in Figures 4 and 5, respectively. The key design parameters for the dikes are presented in Table 16

**Table 16: Key Design Parameters for Dike D-SP6North and D-SP6West**

| Dike | Total Length at Centre Line (m) | Maximum Height at Centre Line (m) | Width of Dike Crest (m) | Maximum Width at Base (m) | Side Slope (H:V) |
|---|---|---|---|---|---|
| D-SP6North | 135 | 4.5 | 18.0 | 30.0 | 2.5:1 Upstream<br>2.0:1 Downstream |
| D-SP6West | 375 | 5.0 | 18.0 | 33.0 | |

#### 6.1.5.2 Dikes D-CP8North, D-CP8South, D-CP8West, and D-CP8East

Collection pond CP8 will serve as the main contact water attenuation pond to store the water transferred from other local contact water ponds. Four perimeter dikes (Dikes D-CP8Noth, D-CP8South, D-CP8West, and D-CP8East) are required to form the CP8 and to prevent the water stored in CP8 from flowing into the receiving environment. Permafrost is anticipated beneath the footprints of these dikes based on the findings from the past drilling programs.

However, talik zones (layer of year-round unfrozen ground that lies in permafrost areas) may exist within the footprint of Dike D-CP8South. In this study, the design of Dikes D-CP8North, D-CP8South, D-CP8West, and D-CP8East has similar features as Dike D-SP6North and D-SP6West, which include a bituminous geomembrane liner or equivalent keyed into competent frozen ground or bedrock as the seepage control measure and a wide upstream fill zone to serve as a thermal buffer. More subsurface foundation information needs to be collected during the next phase study to evaluate the current proposed design concept.

The profile and typical design section for Dikes D-CP8North, D-CP8South, D-CP8West, and D-CP8East are presented in Figures 6 to 9, respectively. The key design parameters for Dikes D-CP8North, D-CP8South, D-CP8West, and D-CP8East are presented in Table 17.

**Table 17: Key Design Parameters for Dike D-CP8North, D-CP8South, D-CP8West, and D-CP8East**

| Dike | Total Length at Centre Line (m) | Maximum Height at Centre Line (m) | Width of Dike Crest (m) | Maximum Width at Base (m) | Side Slope (H:V) |
|---|---|---|---|---|---|
| D-CP8North | 290 | 4.5 | 19.5 | 30.0 | 2.5:1 Upstream<br>2.0:1 Downstream |
| D-CP8South | 198 | 4.0 | 19.5 | 38.0 | |
| D-CP8West | 335 | 5.4 | 19.5 | 42.0 | |
| D-CP8East | 460 | 3.5 | 19.5 | 30.0 | |

### 6.1.5.3 Dikes D-B5North, D-B5South, D-A8North, D-A8South, and D-A6

Dikes D-B5North and D-B5South are internal water retention dikes within Lake B5 to form the temporary water storage areas. The purpose of Dikes D-B5North and D-B5South is to prevent the upstream runoff flowing into the WN01 open pit. Dikes D-A8North and D-A8South are internal water retention dikes within the dewatered Lake A8 to prevent the runoff water from flowing into the PUM02/04 and WES03 open pits. Dike D-A6 is an internal water retention dike within Lake A6 to prevent runoff water from flowing into the FZO01 open pit.

Based on the predicted water levels and local topography, the dikes will have relatively low water head (less than 2.0 m) against the structure. A wide low permeability till core with sufficient fines particle has been selected as the main seepage control measure for these dykes. The dikes will be maintained minimum 100 m away from the adjacent open pit and be constructed in dry conditions (the lakes (B5, A8, and A6) will be fully dewatered prior to the dike construction). The lakebed sediments within the footprint of the dikes will be removed.

It is understood that talik zones may exist below the Lake B5, A8, and A6. The impacts of the talik on the performance of the dikes need to be further evaluated during the next phase study. Based on the current water management plan, the CPs associated with these dikes will be operated in the summer period only. At the end of each fall, the CPs will be in “dry” condition before freezing up. As a result, the dike and its foundation will be exposed to air during the winter period, which may help to develop permafrost in the dikes and foundation. Depending on the operation requirements, the dike can serve as part of access road and/or haul road.

The profile and typical design section for Dikes D-B5North, D-B5South, D-A8North, D-A8South, and D-A6 are presented in Figures 10 and 14, respectively. The key design parameters for Dikes D-B5North, D-B5South, D-A8North, D-A8South, and D-A6 are presented in Table 18.

**Table 18: Key Design Parameters for Dike Dikes D-B5North, D-B5South, D-A8North, D-A8South, and D-A6**

| Dike | Total Length at Centre Line (m) | Maximum Height at Centre Line (m) | Width of Dike Crest (m) | Maximum Width at Base (m) | Side Slope (H:V) |
|---|---|---|---|---|---|
| D-B5North | 495 | 4.0 | 32.6 | 52 | 2.5:1 Upstream<br>2.0:1 Downstream |
| D-B5South | 600 | 4.8 | 15.0 | 40 | |
| D-A8North | 840 | 3.0 | 25.0 | 41 | |
| D-A8South | 870 | 3.0 | 25.0 | 41 | |
| D-A6 | 560 | 5.5 | 22.5 | 50 | |

## 6.2 Design of Water Collection Ponds

A total of nine contact water CPs (CP7, CP8, CP9, B5North, B5South, A6, A8West, CPD1, and CPD2) and three saline water CPs (SP5, SP6, and SPD1) will be established for the Meliadine Extension. CP8, B5North, B5South, A6, and A8West will be formed by the water retention dikes described in above Section 6.1. CP7, CPD1, and CPD2 will be established through sub-excavation of the original ground to meet the required water storage and limit the dike construction. A thermal protection berm will be constructed downstream of CP7, CPD2 to preserver the permafrost foundation and limit the seepage. CP9 will be established within the drained basin of lake B36. No bathymetric survey data for Lake B36 at this stage. Sub-excavation may be required to meet the CP9 design storage capacity requirement. Based on the current mine plan and water management plan, CP9 will have about one-year service life and then eliminated by the mining activity at PUM01 open pit. The saline water SP5 and SPD1 will be established through sub-excavation of the original ground to meet the required water storage. A thermal protection berm will be constructed downstream of SP5 to preserver the permafrost foundation and limit the seepage. Meliadine Type A Water Licence 2AM-MEL1631 Part D, item 15 specifies that any earthworks should be at a distance of at least thirty-one metres from the ordinary High Water Mark in order to prevent the deposition of debris or sediment into or onto any adjacent water bodies. Given the local topography and limited space for SPD1, no thermal protection berm will be adopted for SPD1. SP6 will be established within the drained Lake B7 together with the two perimeter dikes (Dike D-SP6North and D-SP6West).

For the CPs (CP8, CP9, B5North, B5south, A6, A8West, and SP6) which will be established within the dewatered lakes, the CPs were sized based on the design MOWL presented in Table 15) and the selected IDF values. For other CPs (CPD1, CPD2, SP5, SPD1, and CP7), the CPs were designed to handle three days of a 1 in 100 wet year spring freshet with pumping. The duration of the spring freshet is assumed to occur in 7 days. The maximum water level under mean precipitation year condition will be maintained at 2 m below the outlet of the pond (the lowest ground elevation along the perimeter of the pond). The maximum design storage capacity for each CP is presented in the DBM, as attached in Appendix B.

Figure 15 present the typical design section for the CPs (CP7, CPD2, and SP5) with thermal protection berm downstream. Figure 16 presents the typical design section for the CPs (CPD1 and SPD1) without thermal protection berm downstream.

The excavation of overburden for the CPs will have a flat side slope of 3(H):1(V) to maintain long-term stability. However, in the case where the excavation is through bedrock to the design depth, rock surface slopes may vary between 1H:1V to 1H:10V depending on actual rock quality encountered during excavation. A layer of rip-rap (1 m thick) will be placed over the side slopes along the overburden and at least 5 m inside of the excavated pond at the elevation of bedrock to prevent slope erosion. Table 19 summarizes the key information and design parameters for CP8, SP6, A6, B5North, B5South, and A8West. Table 20 summarizes the key information and design parameters for SP5, CP7, SPD1, CPD1, and CPD2.

### Table 19: Key Information and Design Parameters for CP8, SP6, A6, B5North, B5South, and A8West

| Pond | CP8 | SP6 | A6 | B5North | B5South | A8West |
|---|---|---|---|---|---|---|
| Original Lake Elevation (m) | 56.55 | 62.72 | 59.59 | 58.25 | 58.25 | 62.16 |
| Pond Volume for Water Elevation at Original Lake Elevation ($m^3$) | 743,716 | 843,558 | 780,951 | 380,537 | 82,053 | 1,188,000 |
| Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years (m) | 58.17 | 62.7 | 59.5 | 57.96 | 57.30 | 60.45 |
| Pond Volume for Water Elevation at Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years ($m^3$) | 2,366,729 | 837,662 | 737,359 | 307,350 | 30,000 | 226,679 |
| Estimated Maximum Water Elevation during IDF (m) | 58.60 | 63.48 | 60.19 | 58.39 | 58.72 | 60.84 |
| Pond Volume for Water Elevation at Estimated Maximum Water Elevation during IDF ($m^3$) | 2,843,673 | 1,366,764 | 1,120,458 | 417,732 | 134,598 | 382,235 |
| Dike for Pond | D-CP8 North<br>D-CP8 South<br>D-CP8 West<br>D-CP8 East | D-SP6 North<br>D-SP6 West | D-A6 | D-B5 North | D-B5 South | D-A8 South |
| Design Crest Elevation of Dike Containment Element (m) | 60.4 | 65.5 | 62.0 | 60.2 | 60.3 | 62.5 |
| Pond Volume for Water Elevation at Design Crest Elevation of Dike Containment Element ($m^3$) | 4,429,238 | 3,292,325 | 2,597,193 | 952,162 | 262,569 | 1,188,000 |

### Table 20: Key Information and Design Parameters for SP5, CP7, SPD1, CPD1, and CPD2

| Pond | SPD1 | CP7 | CPD1 | CPD2 | SP5 |
|---|---|---|---|---|---|
| Excavated Pond Bottom Elevation (m) | 50.0 | 40.0 | 61.0 | 59.0 | 42.0 |
| Excavated Pond Outlet Elevation (m) | 62.9 | 58.0 | 71.0 | 66.7 | 57.7 |
| Pond Volume for Water Elevation at Pond Outlet Elevation ($m^3$) | 102,700 | 217,000 | 52,600 | 35,400 | 265,800 |
| Pond Volume for Water Elevation at Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years ($m^3$) | 59,800 | 130,000 | 30,800 | 18,400 | 170,300 |
| Pond Volume for Water Elevation at Estimated Maximum Water Elevation during IDF ($m^3$) | 72,000 | 156,000 | 36,300 | 22,900 | 204,600 |
| Thermal Protection Berm for Pond | N/A | Berm-CP7 | N/A | Berm-CPD2 | Berm-SP5 |
| Average Excavation Depth (m) | 12.5 | 13.0 | 11.0 | 9.5 | 17.5 |

## 6.3 Design of Channels

Agnico Eagle's Corporate Standard – RMMS Corporate Standard Water Management (Agnico Eagle 2021) specifies the design criteria for channels: At a minimum, operational channels should be designed for a combination of the 1,000-year return period, 24-hour event, and, where applicable, snowmelt in 30 days with no concentration time and no infiltration. The design may assume that repairs and occasional maintenance can be provided.

The channels in this study were designed to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 5 mm with a minimum freeboard of 0.2 m. This design criterion is the same as adopted for the detailed design for the channels (e.g., Channels 3, 4, 9, and 10) currently in operation at the Meliadine Mine site which also comply with the design criteria specified in the RMMS Corporate Standard Water Management (Agnico Eagle 2021).

Preliminary hydraulic analyses were carried out to determine the required geometry for each of the channels. The channels will be constructed by excavating the existing ground to develop channel bottoms with designed widths and gradients. Depending on the actual ground condition and drilling/blasting practice, the channels may be constructed by over excavating the existing ground beyond the design limits. Run-of-mine material will be used to backfill the over excavated zones to develop channel bottoms with designed widths and gradients. A layer of nonwoven geotextile and rip-rap (0.3 m thick) will be placed at the bottom of the excavations to serve as an erosion control measure.

Figure 17 presents the typical design section and material quantities for the channels. Table 21 presents the key information and design parameters for the channels.

**Table 21: Key Information and Design Parameters for Channel11 to Channel22**

| Channels | Approximate Total Length (m) | Channel Bottom Width (m) | Side Slopes | Rip-rap Thickness (m) | Minimum Bottom Slope Gradient (%) | Maximum Depth of Channel Excavation (m) |
|---|---|---|---|---|---|---|
| Channel 11 | 298 | 1.0 | 3.0(H):1(V) | 0.3 | 1.3 | 1.5 |
| Channel 12 | 296 | 1.0 | | | 1.2 | 1 |
| Channel 13 | 507 | 1.0 | | | 0.3 | 1.7 |
| Channel 14 | 360 | 1.0 | | | 0.6 | 2 |
| Channel 15 | 553 | 1.0 | | | 0.1 | 1.3 |
| Channel 16 | 258 | 1.0 | | | 0.5 | 1 |
| Channel 17 | 290 | 1.5 | | | 0.6 | 1.5 |
| Channel 18 | 130 | 1.0 | | | 1.2 | 1.3 |
| Channel 19 | 750 | 2.0 | | | 1.0 | 1.5 |
| Channel 20 | 520 | 1.0 | | | 1.5 | 1.5 |
| Channel 21 | 290 | 1.0 | | | 1.0 | 1.3 |
| Channel 22 | 735 | 1.0 | | | 0.4 | 2.0 |

## 6.4 Design of Berms/Thermal Berms

Two water diversion berms (Berm-D1 and BermD-2) and five thermal protection berms (Berm-SP5, Berm-CP7, Berm-P5, Berm-F2, and Berm-CPD2) are required for the Meliadine Extension based on the proposed water management plan. Berm-D1 and Berm-D2 were designed to be a low permeability till berm with a crest of 2.5 m wide and approximately 1.5 m high above the original ground surface. A layer of geotextile will be applied at downstream berm towards the center line of the berm and along the interface between the rockfill material and the till fill as the erosion protection. The thermal berms (Berm-SP5, Berm-CP7, Berm-P5, Berm-F2, and Berm-CPD2) were designed to protect the permafrost foundation from thawing downstream of each associated CP with a crest of 12 m wide with side slopes of 2.5H:1V and approximately 4.0 m high above the original ground surface. The thermal protection berms will be constructing using the overburden material from the CP excavation. A layer of geotextile will be applied at downstream berm towards the center line of the berm and along the interface between the rockfill material and the till fill as the erosion protection.

Figure 18 presents the typical design section and material quantities for the berms. Table 22 presents the key information and design parameters for the berms.

**Table 22: Design Parameters for Berms**

| Berm | Berm-D1 | Berm-D2 | Berm-SP5 | Berm-CP7 | Berm-P5 | Berm-F2 | Berm-CPD2 |
|---|---|---|---|---|---|---|---|
| Berm Maximum Height (m) | 1.5 | 1.5 | 4 | 4 | 4 | 4 | 4 |
| Side Slopes | 2.5(H):1(V) | | | | | | |
| Length (m) | 320 | 75 | 290 | 490 | 150 | 240 | 220 |

## 6.5 Design of Sumps

Seven sumps (Sumps P1 to P5, Sump F1 and Sump F2) are proposed for the Meliadine Extension to facilitate the contact water and saline water management. The sumps were sized to store 3/7 of the 1 in 100 wet year spring freshet volume with pumping or based on the storage requirement from the water balance modelling performed by Lorax. The design basis used to size the sump and maximum design storage capacity for the sumps can be found in the DBM, as attached in Appendix B.

Limited subsurface ground conditions are available within the footprint of the proposed sumps. The bedrock depth ranges from 7.0 m to 12.4 m based on the borehole information provided by Agnico Eagle as presented in Table 13. The sumps will be formed through sub-excavation of the original ground with a side slope of 3H:1V in overburden zone and 1H:1V in the bedrock zone if there is bedrock within the excavation depth. The actual rock surface slope may vary between 1H:1V to 1H:10V depending on actual rock quality encountered during excavation. A layer of 1 m thick rip-rap will be placed over the side slopes and at the excavated sump bottom to prevent slope erosion. A layer of geotextile will be placed along the interface between the rip-rap material and the excavated surface to prevent any loss of the native soils into the rip-rap material.

Figure 19 presents the typical design sections for the sumps. Table 23 summarizes the key design parameters for the sumps.

**Table 23: Key Information and Design Parameters for Sumps**

| Sump | Sump P1 | Sump P2 | Sump P3 | Sump P4 | Sump P5 | Sump F1 | Sump F2 |
|---|---|---|---|---|---|---|---|
| Side Slopes (H:V) | 3:1 | | | | | | |
| Rip-rap Thickness (m) | 1.0 | | | | | | |
| Maximum Depth of Excavation (m) | 6.0 | 5.0 | 5.0 | 11.0 | 9.0 | 6.0 | 8.0 |

## 6.6 Construction Material Quantities

Tables 24 to 28 present the material quantities for the construction of the water management infrastructures for the Meliadine Extension.

## Table 24: Estimated Construction Material Quantities for Dikes

| Material | D-SP6 North | D-SP6 West | D-CP8 North | D-CP8 South | D-CP8 West | D-CP8 East | D-B5 North | D-B5 South | D-A8 North | D-A8 South | D-A6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Run of Mine Rockfill, 600 mm Minus ($m^3$) used for Upstream | 3,285 | 8,544 | 12,419 | 7,234 | 8,938 | 16,234 | 26,406 | 13,072 | 26,114 | 24,164 | 16,949 |
| Run of Mine Rockfill, 600 mm Minus ($m^3$) used for Downstream | 1,175 | 6,230 | 3,739 | 3,047 | 12,352 | 3,150 | 7,470 | - | - | - | - |
| Transition Rockfill, 150 mm Minus ($m^3$) | 1,244 | 3,224 | 3,275 | 2,415 | 4,061 | 5,418 | 1,621 | 7,205 | 4,995 | 2,917 | 4,363 |
| Granular Fill or Esker Sand, 20 mm Minus ($m^3$) | 1,073 | 3,111 | 2,912 | 2,342 | 4,114 | 5,046 | 2,765 | 4,227 | 3,572 | 2,090 | 3,653 |
| Esker Sand and gravel, 75mm Minus ($m^3$) | 795 | 3,541 | 2,229 | 2,480 | 4,961 | 4,531 | - | - | - | - | - |
| Granular Till Fill, 75 mm Minus ($m^3$) | - | - | - | - | - | - | 17,436 | 25,705 | 30,953 | 16,484 | 29,668 |
| Bentonite-Augmented Material ($m^3$) | 321 | 865 | 886 | 603 | 948 | 1,459 | - | - | - | - | - |
| Bituminous Geomembrane Liner (Coletanche or equivalent) ($m^2$) | 1,463 | 3,947 | 3,699 | 2,890 | 5,039 | 6,353 | - | - | - | - | - |
| Key Trench Excavation ($m^3$) | 1,869 | 4,899 | 4,988 | 3,428 | 5,402 | 8,117 | - | - | - | - | - |
| **Total Fill Material Volume ($m^3$)** | 7,893 | 25,515 | 25,460 | 18,121 | 35,374 | 35,838 | 55,698 | 50,209 | 65,634 | 45,655 | 54,633 |

### Table 25: Material Quantities for the Construction of Water Collection Ponds and Associated Thermal Berms

| Water Collection Pond/Saline Pond | Clean Rockfill from Excavation and Other Sources (600 mm Minus) ($m^3$) | Overburden Till Fill from Pond Excavation (300 mm Minus) ($m^3$) | Nonwoven Geotextile ($m^2$) | Total Excavation Volume ($m^3$) |
|---|---|---|---|---|
| CP7 | 50,099 | 41,265 | 8,106 | 364,723 |
| CPD1 | 3,875 | - | 3,650 | 79,971 |
| CPD2 | 12,224 | 19,804 | 3,999 | 52,916 |
| SPD1[a] | 8,097 | - | 7,322 | 123,891 |
| SP5[a] | 91,240 | 123,000 | 5,500 | 293,386 |

(a)Saline Pond

### Table 26: Material Quantities for the Construction of Channels

| Channel | Total Length of Channel (m) | Maximum Depth of Channel Excavation (m) | Total Channel Excavation Volume ($m^3$) | Total Rip-rap Fill Volume ($m^3$) | Geotextile ($m^2$) |
|---|---|---|---|---|---|
| Channel 11 | 298 | 1.5 | 1,321 | 627 | 2,090 |
| Channel 12 | 296 | 1 | 1,083 | 580 | 1,925 |
| Channel 13 | 507 | 1.7 | 2,912 | 1,200 | 4,019 |
| Channel 14 | 360 | 2 | 2,700 | 990 | 3,300 |
| Channel 15 | 553 | 1.3 | 3,056 | 1,331 | 4,436 |
| Channel 16 | 258 | 1 | 1,219 | 498 | 1,661 |
| Channel 17 | 290 | 1.5 | 2,570 | 780 | 2,850 |
| Channel 18 | 130 | 1.3 | 750 | 320 | 1,060 |
| Channel 19 | 750 | 1.5 | 11,997 | 3,083 | 10,276 |
| Channel 20 | 520 | 1.5 | 3,129 | 1,213 | 4,043 |
| Channel 21 | 290 | 1.3 | 3,271 | 987 | 3,293 |
| Channel 22 | 735 | 2.0 | 5,993 | 1,881 | 6,273 |

### Table 27: Material Quantities for the Construction of Sumps

| Sump | Clean Rockfill from Excavation and Other Sources (600 mm Minus) ($m^3$) | Overburden Till Fill from Pond Excavation (300 mm Minus) ($m^3$) | Nonwoven Geotextile ($m^2$) | Total Excavation Volume ($m^3$) | Estimated Overburden Excavation Volume (no bulking factor) ($m^3$) |
|---|---|---|---|---|---|
| Sump P1 | 8,871 | - | 8,871 | 36,971 | 36,971 |
| Sump P2 | 8,200 | - | 8,200 | 31,490 | 31,490 |
| Sump P3 | 3,950 | - | 3,950 | 9,614 | 9,614 |
| Sump P4 | 20,950 | - | 20,950 | 136,600 | 136,600 |
| Sump P5 | 22,040 | 7,348 | 21,340 | 97,800 | 97,800 |
| Sump F1 | 11,904 | - | 12,000 | 47,379 | 47,379 |
| Sump F2 | 26,685 | 9,100 | 19,730 | 92,550 | 92,550 |

### Table 28: Material Quantities for the Construction of Berms

| Berm | Berm-D1 | Berm-D2 |
|---|---|---|
| Rip-rap ($m^3$) | 560 | 100 |
| Excavated Overburden Till Fill, 300 mm Minus ($m^3$) | 1480 | 328 |

# 7.0 PREFEASIBILITY DESIGN LEVEL OF PUMPS AND PIPELINES

## 7.1 Design Criteria and Pipeline Routes

The design of the pump and pipeline systems required for the Meliadine Extension is based on information from the following documents provided by Agnico Eagle:

- General Guidelines Design Site Information and Design Coefficients, 6515-GGD-003, Agnico Eagle 2016a.
- Mechanical and Piping System Design Criteria, 6515-GGD-010, Agnico Eagle 2016b.
- Piping, Valves, Fittings, General Specifications, 6515-GGD-012, Agnico Eagle 2016c.
- Piping Supports General Specifications, 6515-GGD-013, Agnico Eagle 2016d.
- General Guideline for Design Insulation of Piping, Tanks, and Equipment, 6515-GGD-025, Agnico Eagle 2016e.

The following specific design criteria will also be considered for the design of pumps and pipelines for the Meliadine Extension:

- All pumps will be diesel pumps at this stage. Diesel pumps will be replaced with electrical motors if possible.
- All pipelines will be HDPE pipe with diameters either 6 inches, 8 inches, 10 inches, or 14 inches. Alternative pipeline diameters can be considered based on the confirmation of Agnico Eagle.
- When possible, existing pumps and pipelines available at the Meliadine site will be re-used.
- The pump intake will be selected based on the operation condition of each collection pond.

It should be noted that only the design of pumps and pipeline required for the water conveyance between the water management infrastructure during the operation phase is within Tetra Tech's current mandate. The design of the pumps and pipelines required for pit water management, water management for the underground mine, and saline water transfer from SETP to the waterline is outside Tetra Tech's current scope of work. The general pipeline route layout plan for the Meliadine Extension is presented in Figure 20.

Agnico Eagle provided the pumping design considerations based on historical operational experience at the Meliadine site. The considerations are summarized as follows:

- Pumping season will be late May/early June until September, and winterize in October;
- Pumping generally continues in June and intermittently throughout July/August/September with about 25% to 50% of the time after freshet;
- Dual pump system setup: high-capacity pump for freshet, and smaller capacity pump during standard season operations; and
- As directed by Agnico Eagle, if the required pumping rate is higher than 5,000 $m^3$/day for a 1 in 100 wet year freshet, a dual pump system setup will be designed. If the required pumping rate is smaller than 5,000 $m^3$/day for a 1 in 100 wet year freshet, a single pump will be designed.

Tetra Tech estimated the required minimum pumping rate based on the directions from Agnico Eagle and the following design criteria adopted for freshet and water management:

- 1 in 100 wet year spring freshet will occur over seven days;
- Freshet pumping will occur from the fourth day of the freshet and continue until the water level was drawdown to the designated water level after freshet (to provide sufficient storage capacity for extreme rainfall event or IDF);
- Periodic pumping will occur through July to September to maintain or drawdown the water level; and
- The CPs and sumps will be empty by the end of fall (September) to provide storage capacity for the following year spring freshet.

## 7.2 Design Pumping Rates

Table 29 summarizes the proposed design pumping rates for the Meliadine Extension Project. As noted in Table 29, the pumping rates for SP6 to TIR02 Pit, CP8 to CP1, CPD1 to SPD1, CPD2 to SPD1, SPD1 to TIR02 or SP6, and SP5 to SP6 provided by Lorax were adopted for this study.

### Table 29: Assumed Design Pumping Rate for the Meliadine Extension

| Pipeline ID | Description of Water | Pumping From | Pumping To | Required Minimum Design Pumping Rate ($m^3/d$) | Pumping Rate Notes |
|---|---|---|---|---|---|
| 1 | Saline Water in SP6 | SP6 | TIR02 Pit, then SP1, then SETP to Itivia Harbour via waterline | 20,000 | Lorax (2022) |
| 2 | Runoff Water in Lake B6 | Lake B6 | CP8 | 3,500 | Estimated by Tetra Tech |
| 3 | Contact Water in North B5 | North B5 | CP8 | 5,000 | |
| 4 | Contact Water in South B5 | South B5 | CP8 | 5,000 | |
| 5 | Contact Water in West A8 | West A8 | CP8 | 15,000[a] and 4,000[b] | |
| 6 | Runoff Water in Lake A8 East | Lake A8 East | CP8 | 8,000[a] and 3,000[b] | |
| 7 | Contact Water in CP8 | CP8 | CP1 | 30,000 | Lorax (2022) |
| 8 | Contact Water in CP9 | CP9 | CP8 | 4,000 | Estimated by Tetra Tech |
| 9 | Contact Water in Sump P1 | Sump P1 | CP8 | 2,300 | |
| 10 | Contact Water in Sump P2 | Sump P2 | CP8 | 2,200 | |
| 11 | Contact Water in Sump P3 | Sump P3 | Sump P4 | 1,000 | |
| 12 | Contact Water in Sump P4 | Sump P4 | SP6 | 4,000 | |
| 13 | Contact Water in Sump P5 | Sump P5 | CP8 | 5,000 | |
| 14 | Contact Water in A6 | Lake A6 | CP8 | 23,000[a] and 6,000[b] for dual pump setup | |
| | | | | 13,800 for single pump | |
| 15 | Contact Water in CP7 | CP7 | CP8 | 10,000[a] and 3,500[b] | |
| 16 | Contact Water in Sump F1 | Sump F1 | CP7 then CP8 | 4,800 | |
| 17 | Contact Water in Sump F2 | Sump F2 | SP6 | 3,000 | Estimated by Tetra Tech |
| 18 | Runoff Water in Lake A22 | Lake A22 | A3 | 9,000[a] and 2,000[b] | Lorax (2022) |

**Table 29: Assumed Design Pumping Rate for the Meliadine Extension**

| Pipeline ID | Description of Water | Pumping From | Pumping To | Required Minimum Design Pumping Rate ($m^3$/d) | Pumping Rate Notes |
|---|---|---|---|---|---|
| 19 | Contact Water in CPD1 | CPD1 | SPD1 | 4,500 | |
| 20 | Contact Water in CPD2 | CPD2 | SPD1 | 500 | |
| 21 | Saline Water in SPD1 | SPD1 | TIR02 or SP6 | 2,000 | |
| 22 | Saline Water in SP5 | SP5 | SP6 | 2,400 | |

[(a)] Main pump for 1 in 100 wet year freshet management. [(b)] Secondary pump for summer operation.

## 7.3 Material Take offs

Material takeoffs (MTOs) for each pipeline showing quantities required per pipeline and a summary of quantities per diameter size of mechanical and piping materials were done in a related study in 2021 and have been adopted for this study. The MTOs summary table is attached in Appendix C. An update for the MTO of pipeline SP6 to TIR02 has been recently performed and the result was added to the summary table.

# 8.0 LIMITATIONS OF REPORT

This technical report and its contents are intended for the sole use of Agnico Eagle Mines Limited (Agnico Eagle) and their agents. Tetra Tech Canada Inc. (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 A or Contractual Terms and Conditions executed by both parties.

# 9.0 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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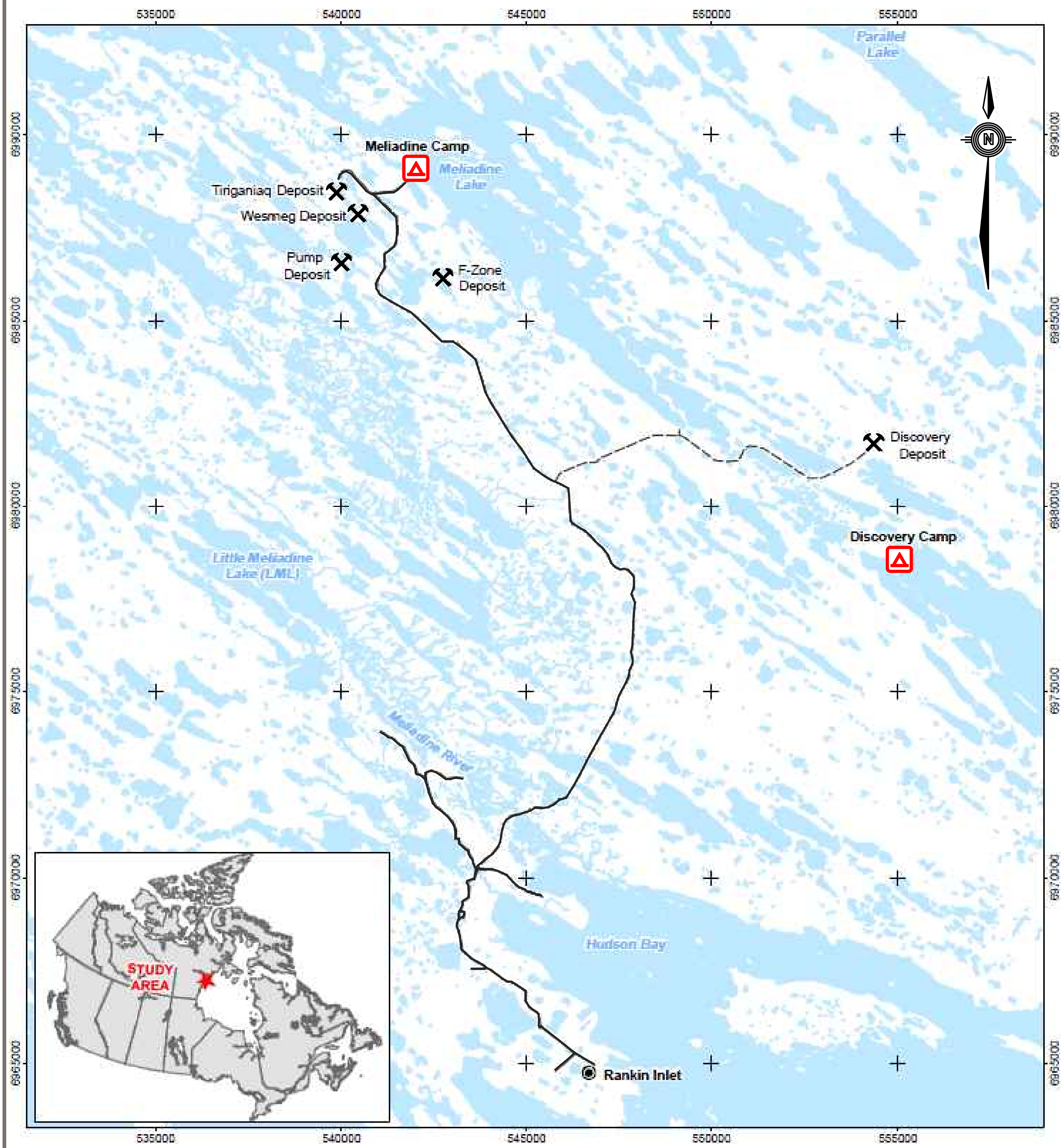
# FIGURES




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

STATUS
ISSUED FOR USE

**LEGEND**

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

CLIENT
AGNICO EAGLE

TETRA TECH

**MELIADINE EXTENSION PROJECT**
**NUNAVUT, CANADA**

**SITE LOCATION PLAN**

| PROJECT NO. | DWN | CKD | REV |
|---|---|---|---|
| EARC03158-01 | HX | NG | 0 |
| OFFICE | DATE | | |
| EDM | Nov. 25, 2022 | | |

**Figure 1**


**LEGEND**

- EXISTING GROUND
- ROAD
- CATCHMENT BOUNDARY LINE
- MINING AREA
- DIVERSION CHANNEL
- CONTACT WATER POND
- SALINE POND
- WATER
- DEWATERED
- OPEN PITS
- TAILINGS STORAGE FACILITY
- WASTE ROCK STORAGE FACILITY
- OPEN PIT START OF MINING

**NOTE**

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.

**REFERENCE**

1. REFERENCE BASE DRAWING FROM AGNICO EAGLE "14-2043 YEAR OVER SITE LAYOUT.DXF".

NOT FOR CONSTRUCTION

0 500 1,000
1:15,000 METRES

CLIENT
AGNICO EAGLE MINES LIMITED

CONSULTANT
TETRA TECH

| | |
|---|---|
| YYYY-MM-DD | 2022-05-24 |
| DESIGNED | HX |
| PREPARED | HX |
| REVIEWED | HX |
| APPROVED | |

PROJECT
MELIADINE MINE EXTENSION

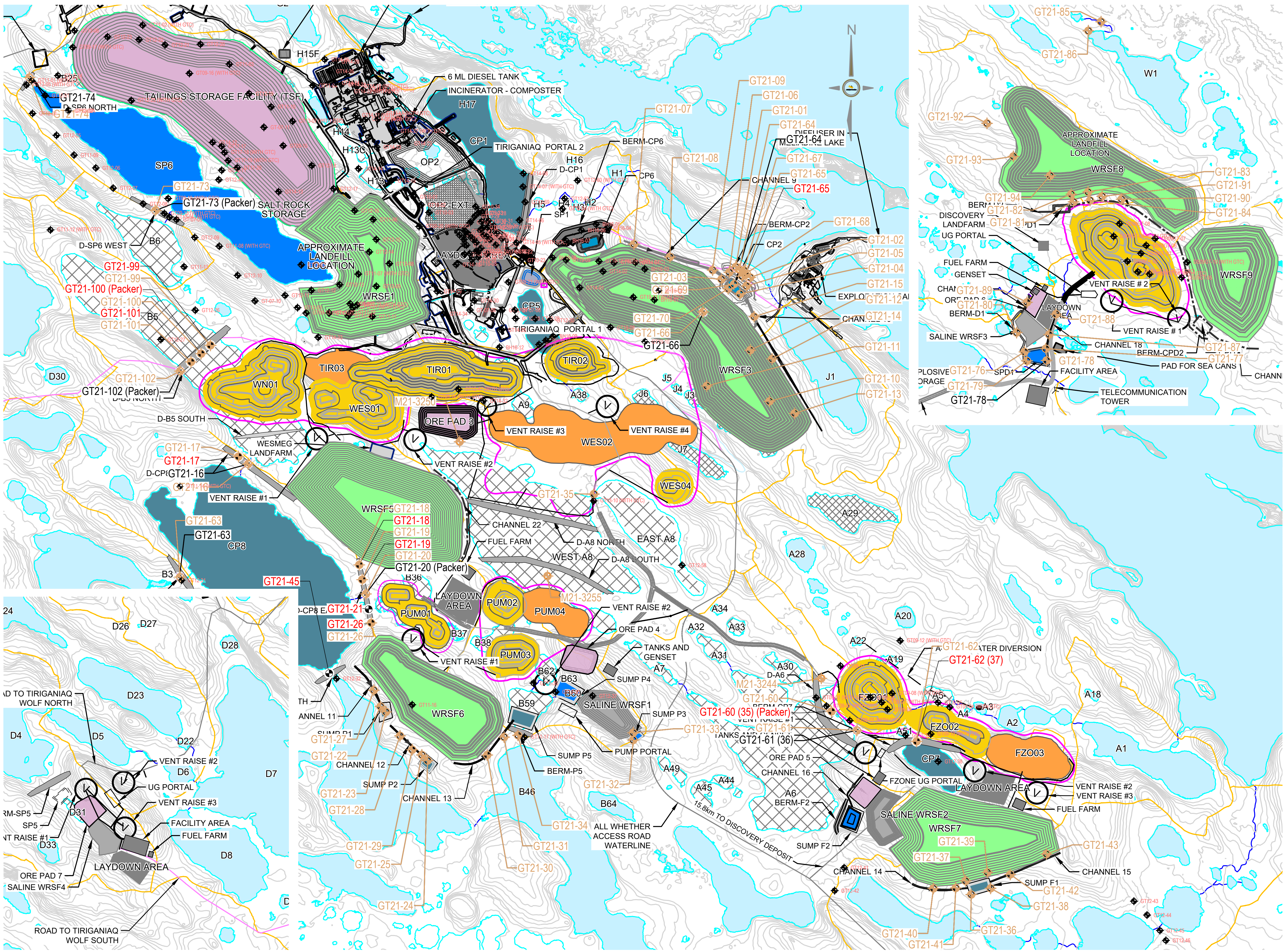
TITLE
**FIGURE 2 - GENERAL SITE LAYOUT (YEAR 2043)**

| PROJECT NO. | PHASE/TASK/DOC. | REV. | FIGURE |
|---|---|---|---|
| EARC03193 | 04 | A | 2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm

NO. DESSIN
DRAWING NO.

FORMAT ANSI B-11x17




## LEGEND

- CATCHMENT BOUNDARY
- ROADS IN WATER LICENSE AMENDEMENT
- SERVICE ROAD AS BUILD
- HAUL ROAD AS BUILD
- WASTE ROCK STORAGE FACILITY
- PLOM 2020 PIT DESIGN LIMIT
- MINING AREA BOUNDARY
- HAUL ROAD TO BUILD
- SERVICE ROAD TO BUILD
- DIVERSION CHANNEL
- PROPOSED BOREHOLE LOCATION (NON-DESTRUCTIVE)
- PROPOSE BOREHOLE LOCATION WITH MULTI-BEAD GROUND TEMPERATURE CABLE
- 2021 DDH PROBEHOLES
- 2021 BOREHOLES (AGNICO EAGLE)
- EXISTING BOREHOLE FROM PREVIOUS DRILLING PROGRAMS

AGNICO EAGLE

TETRA TECH



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| APPROUVÉ PAR / APPROVED BY | |
| No. PROJET / PROJECT NO. | |
| DATE | |

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION

MELIADINE EXTENSION PROJECT
BOREHOLE LOCATIONS

| ÉCHELLE/ SCALE | 1:15000 | FICHIER FILE | .DWG |
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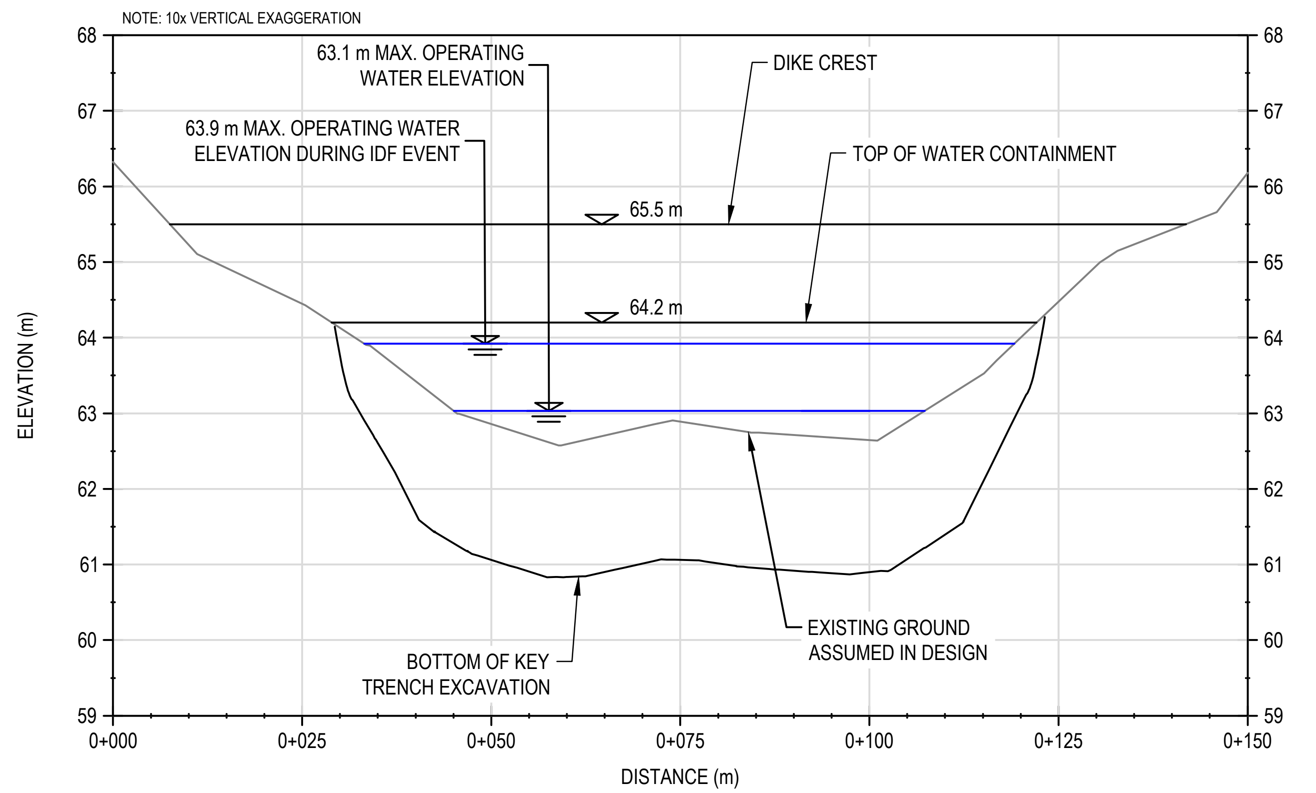
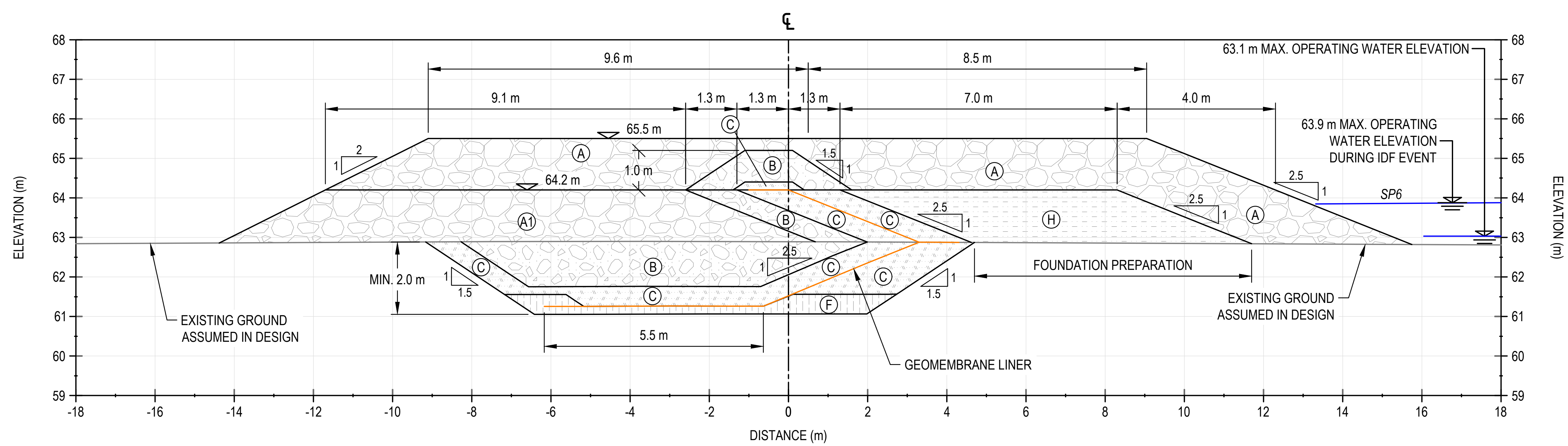



*DIKE D-SP6NORTH – PROFILE*
SCALE: H-1:1000 V-1:100

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-SP6NORTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | $m^3$ | 3,285 |
| (A1) | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | $m^3$ | 1,175 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | $m^3$ | 1,244 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | $m^3$ | 1,073 |
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | $m^3$ | 321 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | $m^3$ | 795 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | $m^2$ | 1,463 |
| | KEY TRENCH EXCAVATION | $m^3$ | 1,869 |




*DIKE D-SP6NORTH – TYPICAL SECTION*
SCALE: H-1:125

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE

TETRA TECH



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| APPROUVÉ PAR APPROVED BY | NG | | 2022-07-16 |
| No. PROJET PROJECT NO. | | | |
| DATE | 2022-07-16 | | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION
PROFILE AND TYPICAL DESIGN SECTION OF DIKE D-SP6NORTH

ÉCHELLE/SCALE: AS SHOWN
FICHIER FILE: .DWG
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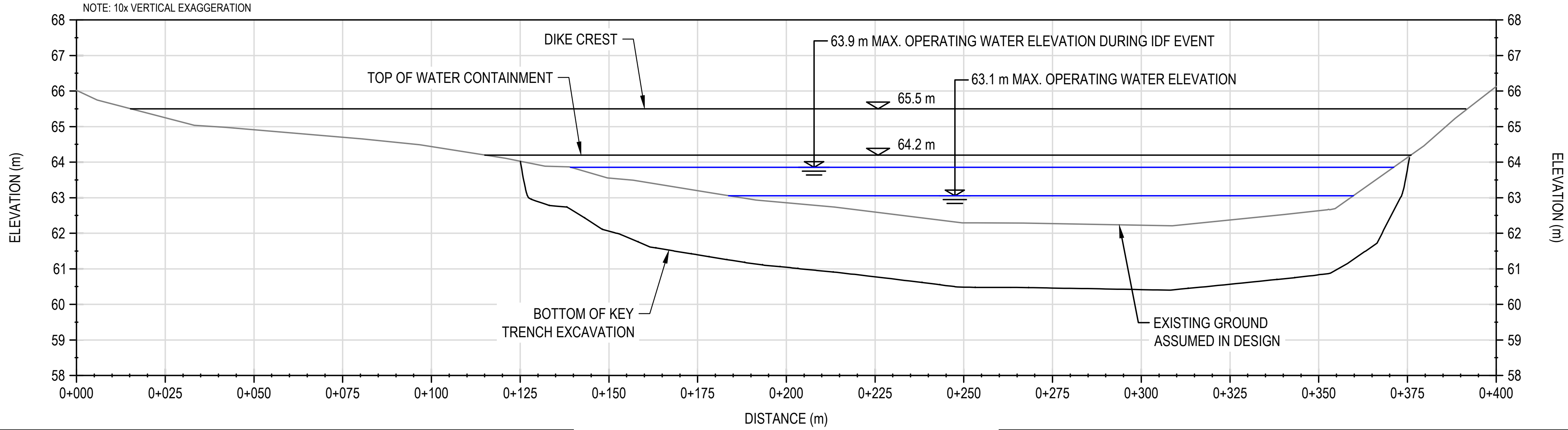
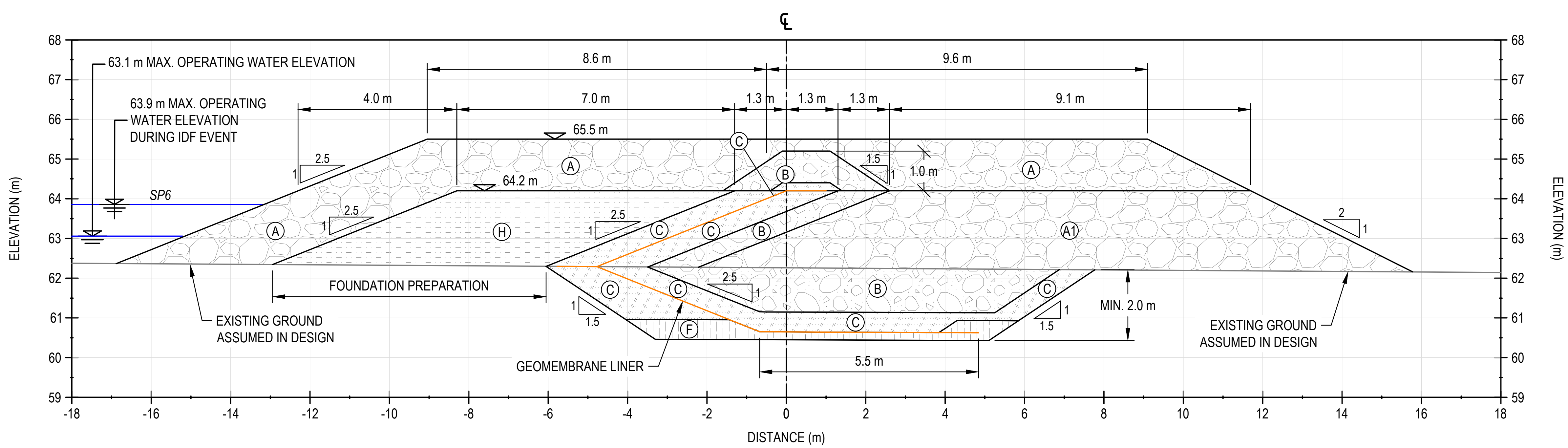



*DIKE D-SP6WEST – PROFILE*

SCALE: H-1:1500 V-1:150

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-SP6WEST | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 8,544 |
| (A1) | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | m³ | 6,230 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 3,224 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 3,117 |

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-SP6WEST | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | m³ | 865 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | m³ | 3,541 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | m² | 3,947 |
| | KEY TRENCH EXCAVATION | m³ | 4,899 |




*DIKE D-SP6WEST – TYPICAL SECTION*

SCALE: H-1:125

NOTES:

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE

TETRA TECH



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| A | ISSUED FOR REVIEW | 2022–11–25 | |

REVISIONS

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| DATE | 2022–07–16 | | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D-SP6WEST

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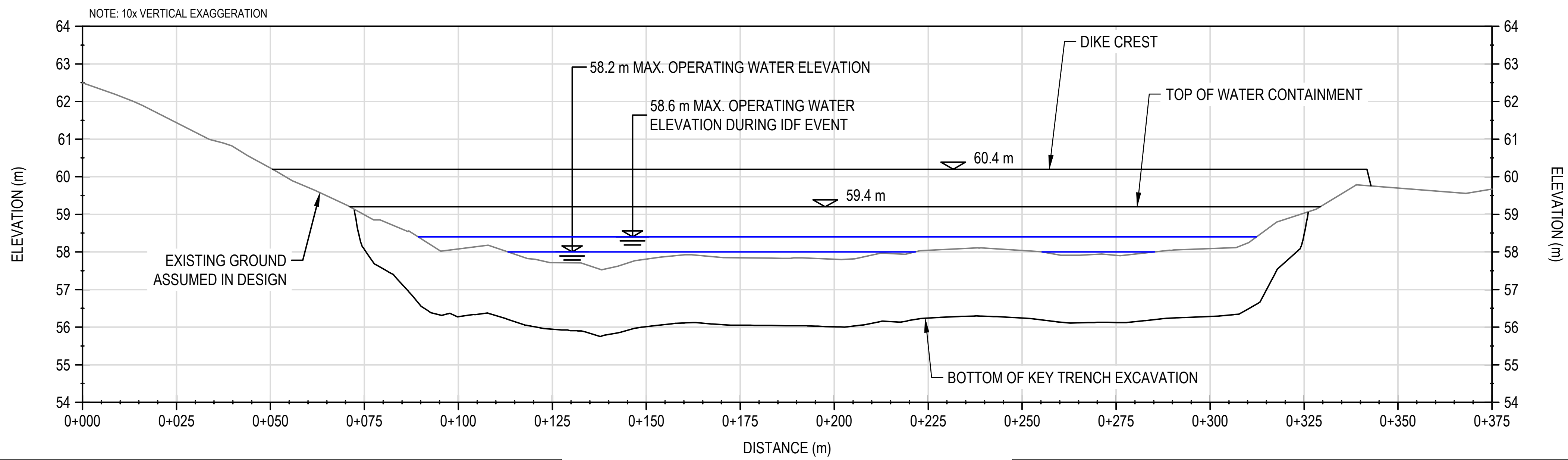
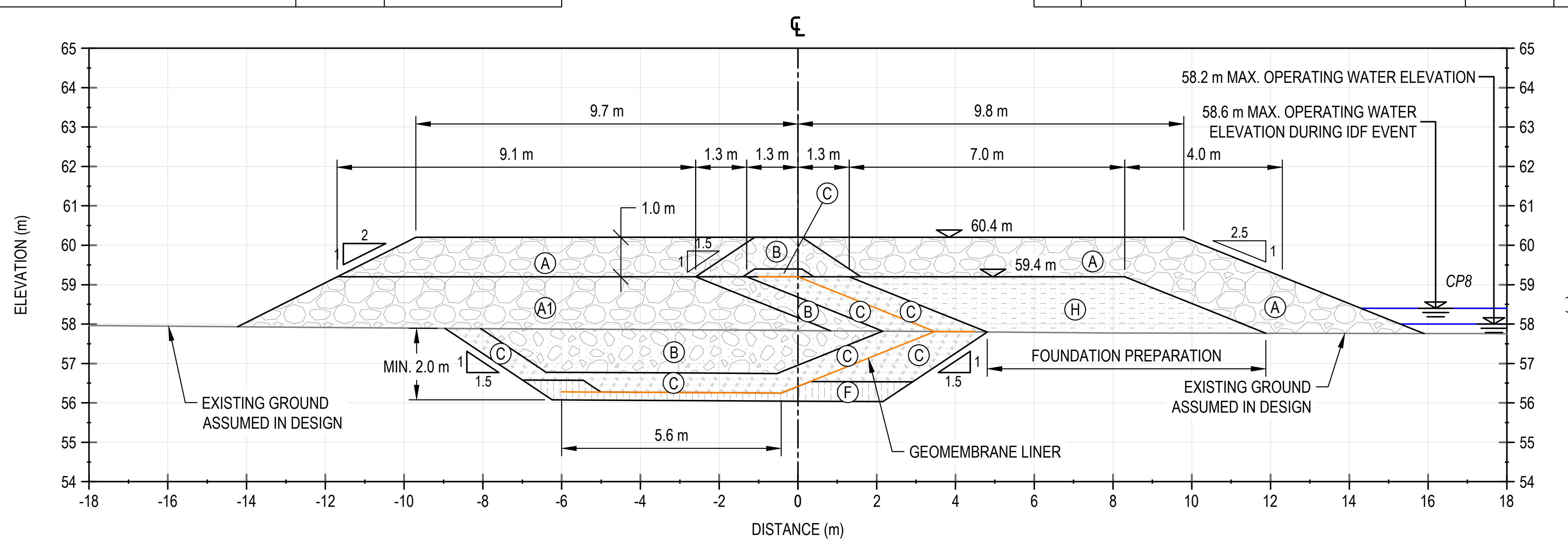



*DIKE D-CP8NORTH – PROFILE*
SCALE: H-1:1500 V-1:150

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8NORTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 12,419 |
| Ⓐ1 | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | m³ | 3,739 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 3,275 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 2,912 |

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8NORTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | m³ | 886 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | m³ | 2,229 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | m² | 3,699 |
| | KEY TRENCH EXCAVATION | m³ | 4,988 |




*DIKE D-CP8NORTH – TYPICAL SECTION*
SCALE: H-1:150

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE
TETRA TECH



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REVISIONS

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| VÉRIFIÉ PAR / CHECKED BY | HX | | 2022-07-16 |
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| No. PROJET / PROJECT NO. | | | |
| DATE | 2022-07-16 | | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D-CP8NORTH

ÉCHELLE/SCALE: AS SHOWN
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No. DESSIN/DRAWING NO.: FIGURE 6
REVISION: A
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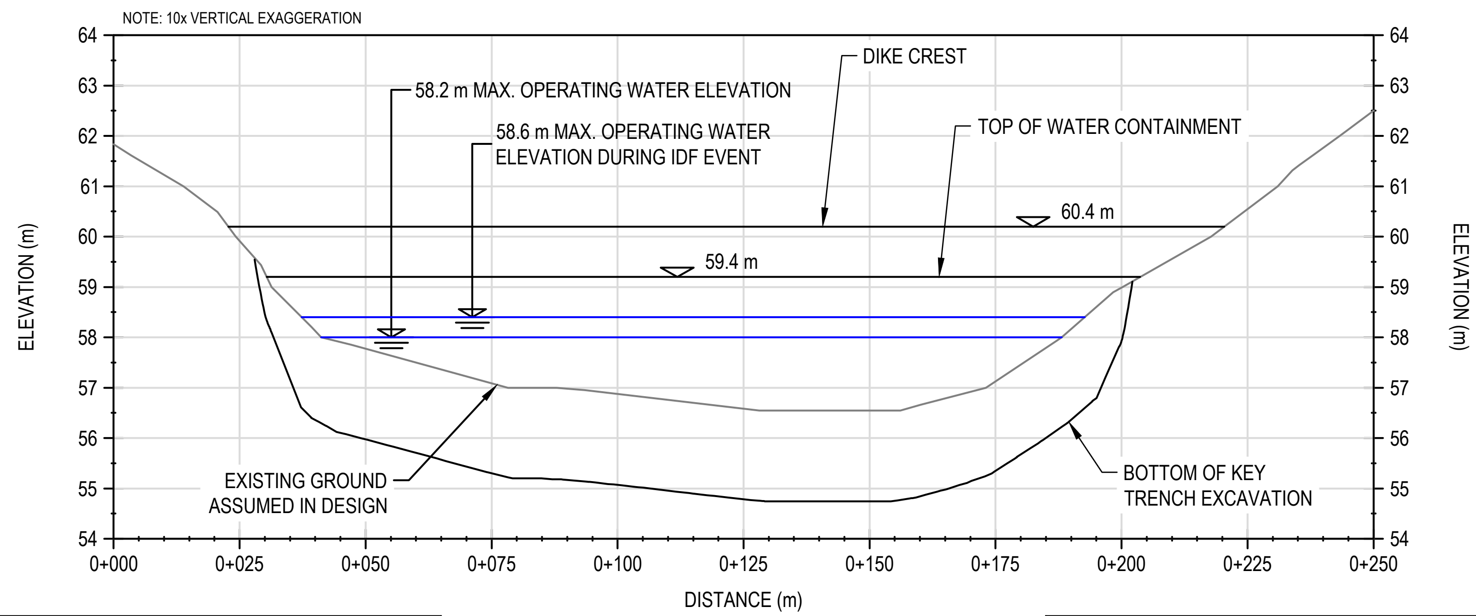
DRAWING NO.

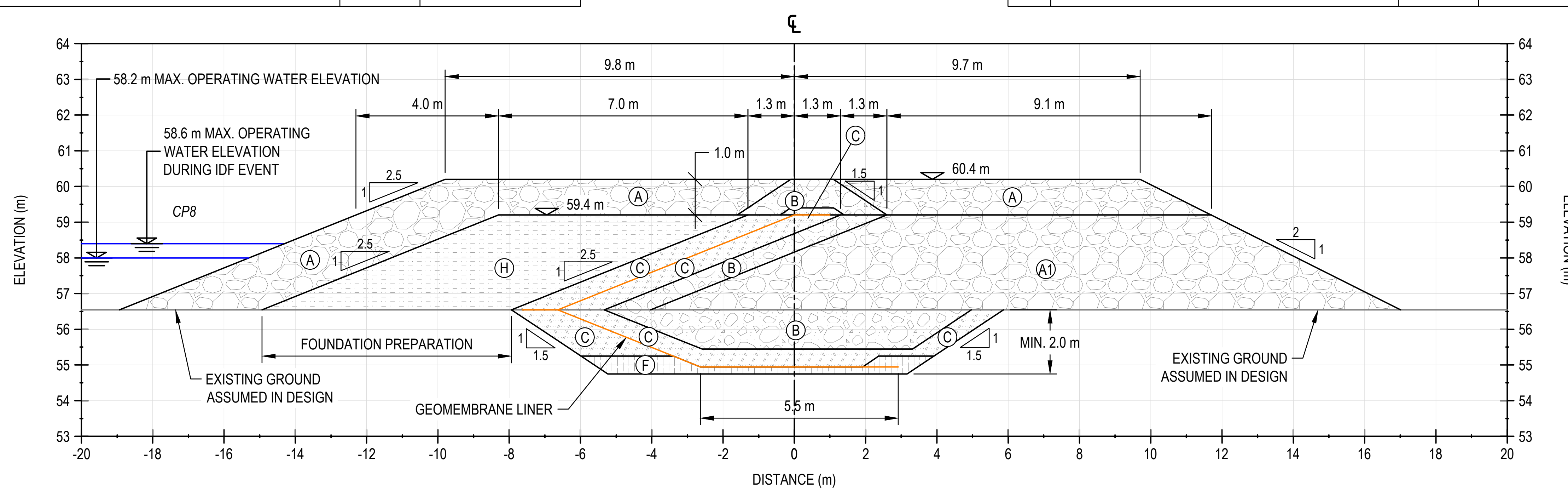
FORMAT ANSI B–11x17




*DIKE D–CP8SOUTH – PROFILE*
SCALE: H–1:1500 V–1:150

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8SOUTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 7,234 |
| Ⓐ1 | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | m³ | 3,047 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 2,415 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 2,342 |

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D- CP8SOUTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | m³ | 603 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | m³ | 2,480 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | m² | 2,890 |
| | KEY TRENCH EXCAVATION | m³ | 3,428 |




*DIKE D–CP8SOUTH – TYPICAL SECTION*
SCALE: H–1:150

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE
TETRA TECH

DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

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No. PROJET PROJECT NO.
DATE 2022–07–16

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION
PROFILE AND TYPICAL DESIGN SECTION OF DIKE D–CP8SOUTH

ÉCHELLE/SCALE AS SHOWN
FICHIER FILE .DWG
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REVISION A
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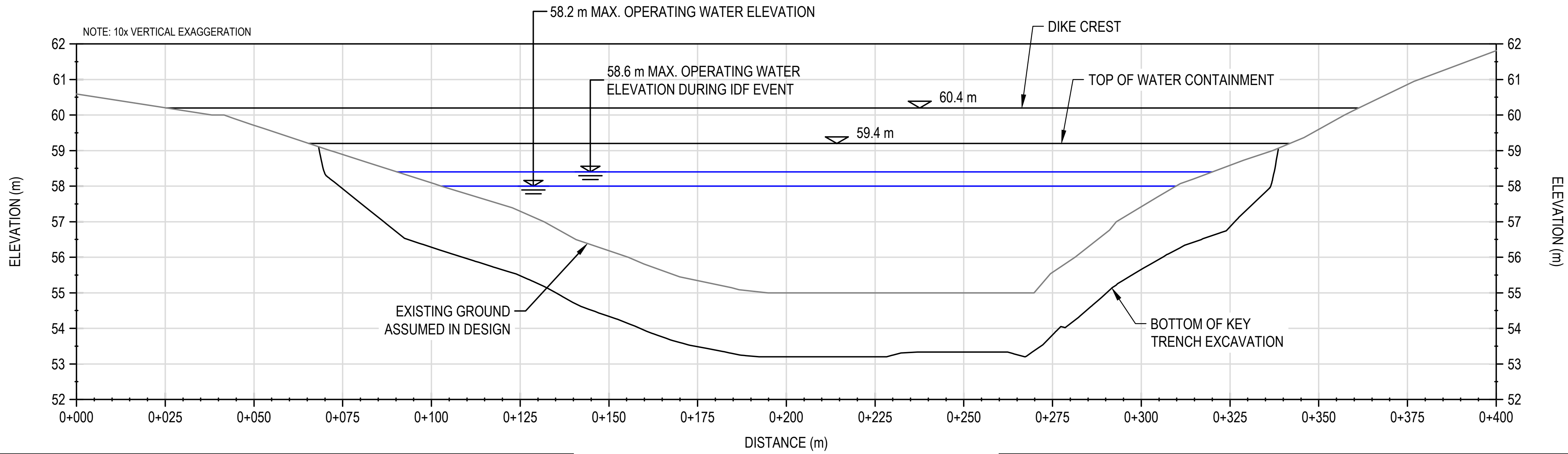
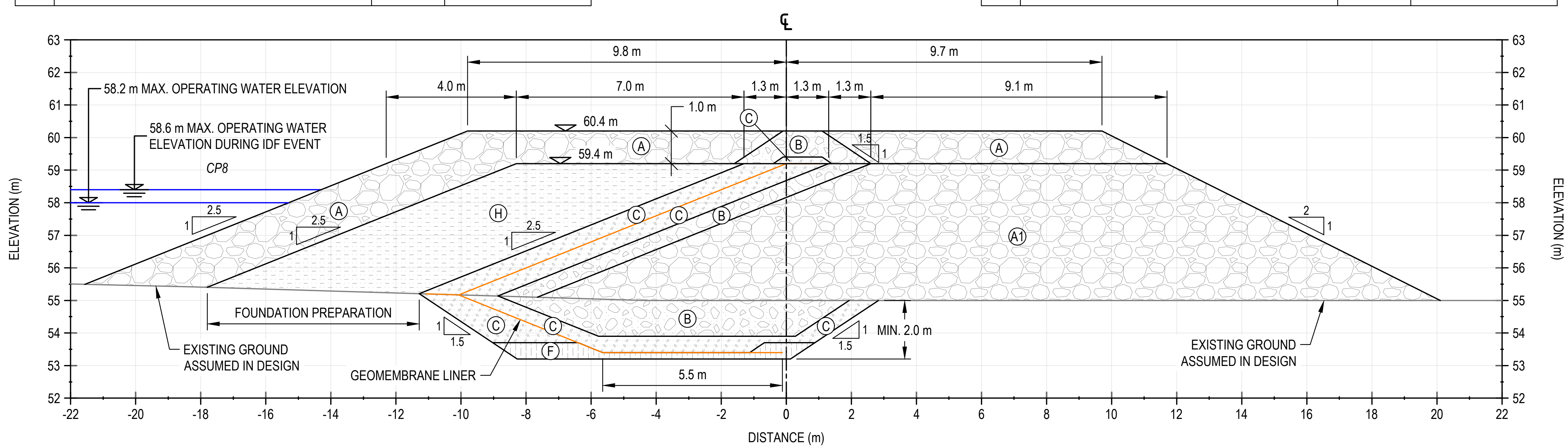



*DIKE D–CP8WEST – PROFILE*

SCALE: H–1:1500 V–1:150

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8WEST | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 8,938 |
| Ⓐ1 | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | m³ | 12,352 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 4,061 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 4,114 |

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8WEST | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | m³ | 948 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | m³ | 4,961 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | m² | 5,039 |
| | KEY TRENCH EXCAVATION | m³ | 5,402 |




*DIKE D–CP8WEST – TYPICAL SECTION*

SCALE: H–1:150

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE

TETRA TECH



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DATE 2022–07–16

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D–CP8WEST

ÉCHELLE/SCALE AS SHOWN | FICHIER FILE .DWG

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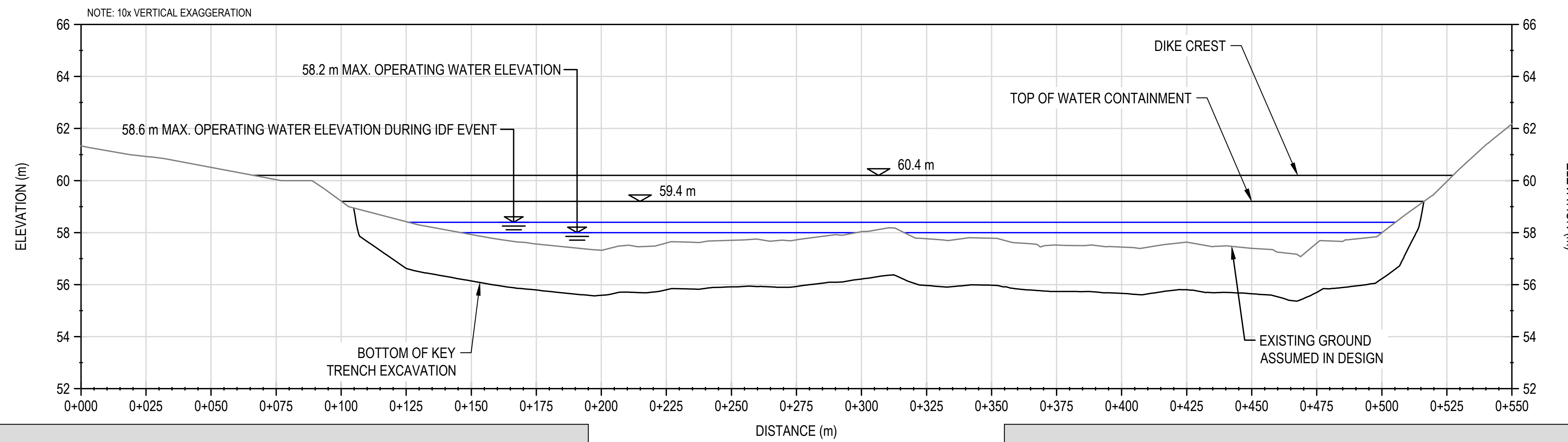


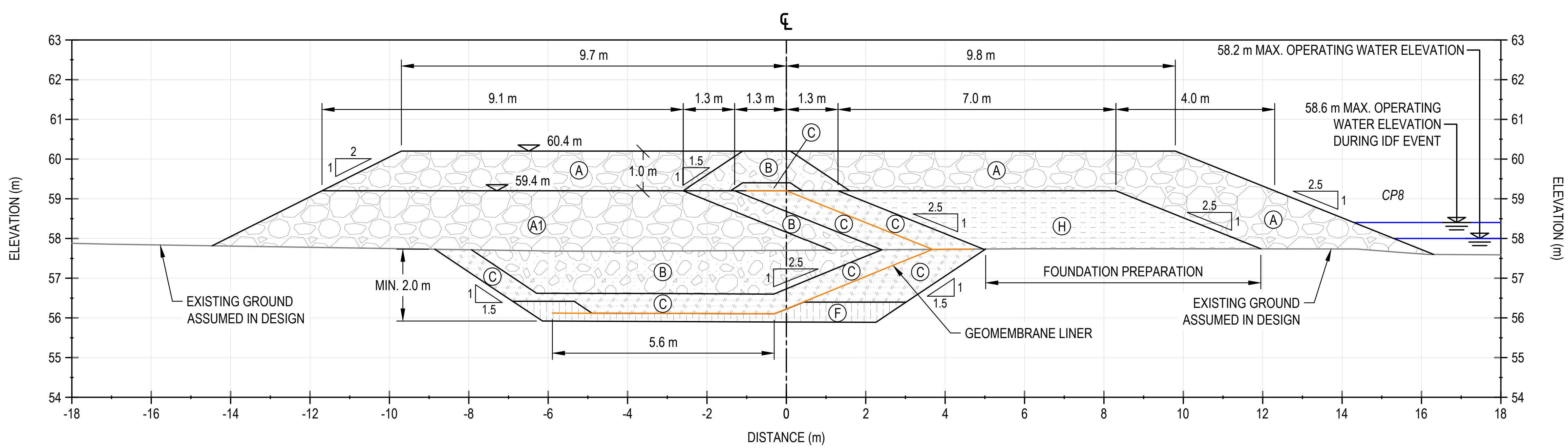

*DIKE D-CP8EAST – PROFILE*
SCALE: H-1:2000 V-1:200

**ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8EAST**

| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
|---|---|---|---|
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 16,234 |
| Ⓐ1 | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | m³ | 3,150 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 5,418 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 5,046 |

**ESTIMATED MATERIAL QUANTITIES FOR DIKE D-CP8EAST**

| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
|---|---|---|---|
| Ⓕ | BENTONITE-AUGMENTED MATERIAL | m³ | 1,459 |
| Ⓗ | ESKER SAND AND GRAVEL (75 mm MINUS) | m³ | 4,531 |
| | GEOMEMBRANE LINER (COLETANCHE ES3) | m² | 6,353 |
| | KEY TRENCH EXCAVATION | m³ | 8,117 |




*DIKE D-CP8EAST – TYPICAL SECTION*
SCALE: H-1:125

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE | TETRA TECH

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DATE 2022-07-16
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AGNICO EAGLE MELIADINE EXTENSION
PROFILE AND TYPICAL SECTION OF DIKE D-CP8EAST

ÉCHELLE/ SCALE AS SHOWN | FICHIER FILE .DWG
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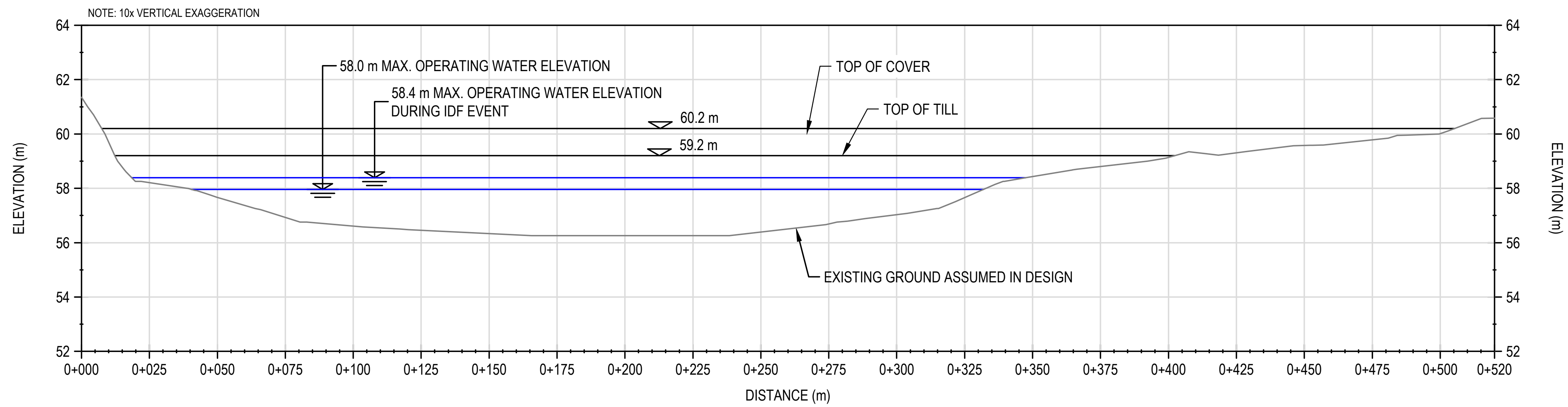
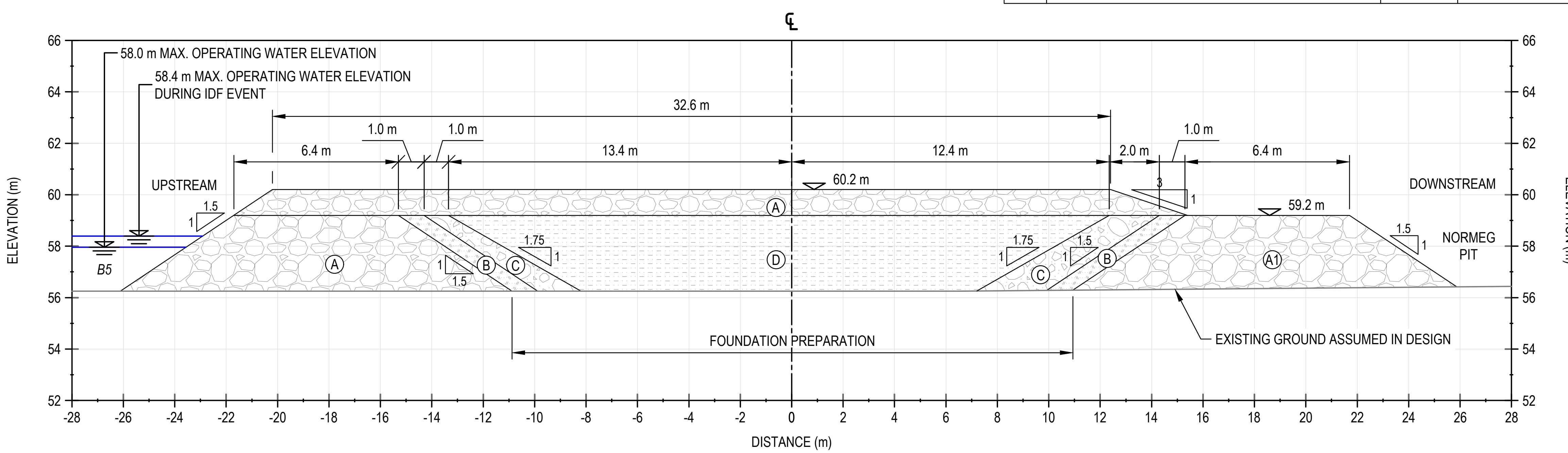
FORMAT ANSI B-11x17




*DIKE D-B5NORTH – PROFILE*
SCALE: H-1:2000 V-1:200

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-B5NORTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | $m^3$ | 26,406 |
| Ⓐ1 | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE DOWNSTREAM | $m^3$ | 7,470 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | $m^3$ | 1,621 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | $m^3$ | 2,765 |
| Ⓓ | GRANULAR TILL (75 mm MINUS) | $m^3$ | 17,436 |




*DIKE D-B5NORTH – TYPICAL SECTION*
SCALE: H-1:200

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE | TETRA TECH

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TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D-B5NORTH

ÉCHELLE/SCALE AS SHOWN
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REVISION A
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AE-CART-ANSI B

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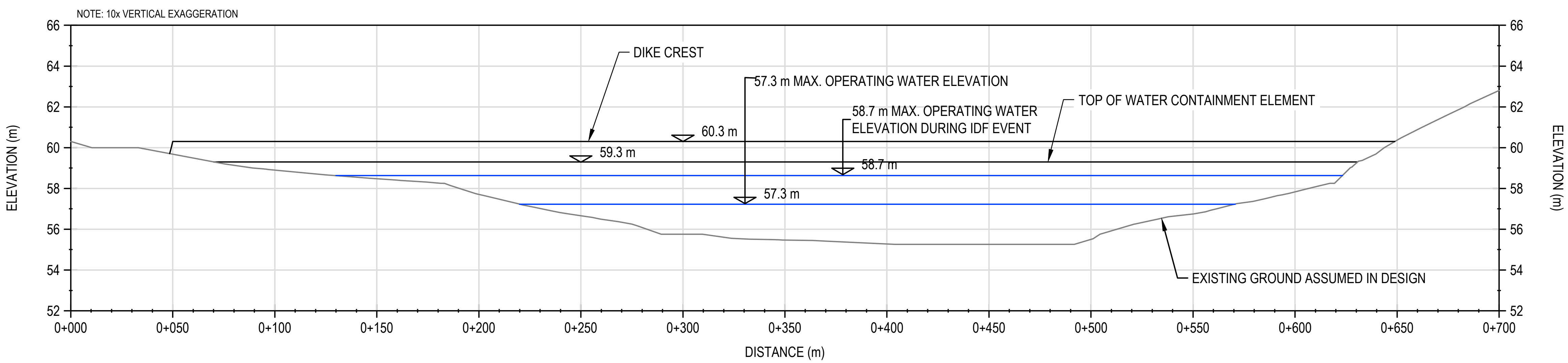
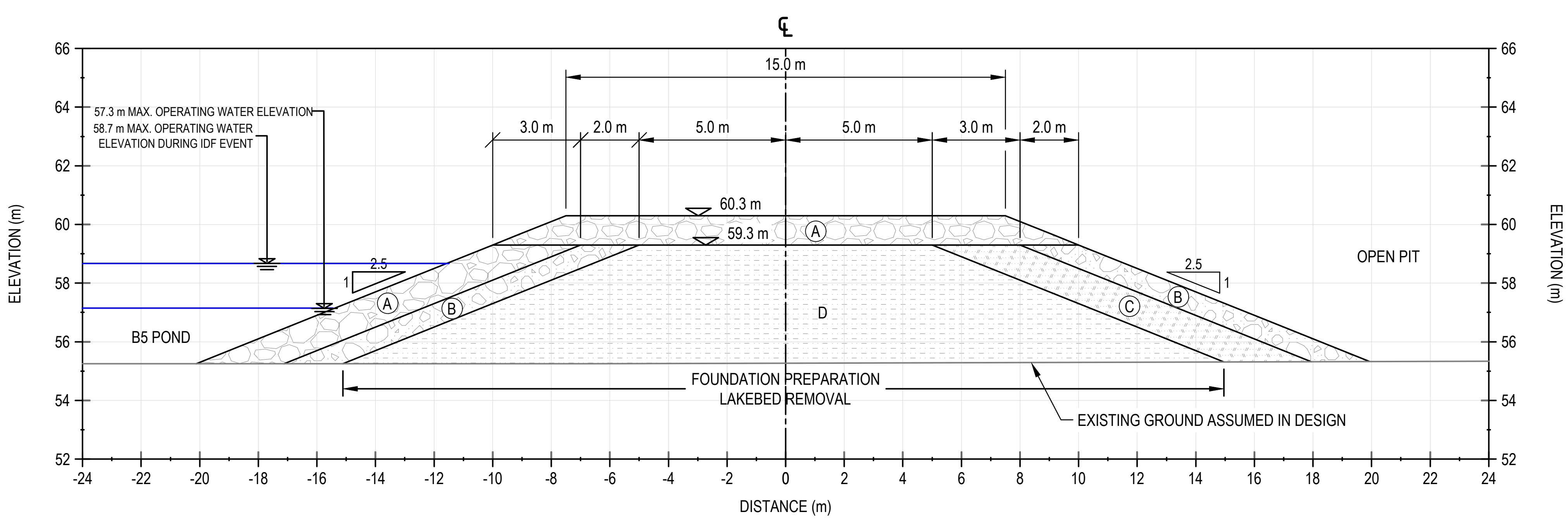



*D–B5SOUTH – PROFILE*

SCALE: H–1:2500 V–1:250

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-B5SOUTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| (A) | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 13,072 |
| (B) | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 7,205 |
| (C) | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 4,227 |
| (D) | GRAVEL TILL FILL (75 mm MINUS) | m³ | 25,705 |




*D–B5SOUTH – TYPICAL SECTION*

SCALE: H–1:200

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE

TETRA TECH

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TITRE / TITLE

AGNICO EAGLE MELIADINE DIVISION

PROFILE AND TYPICAL DESIGN SECTION OF D–B5SOUTH

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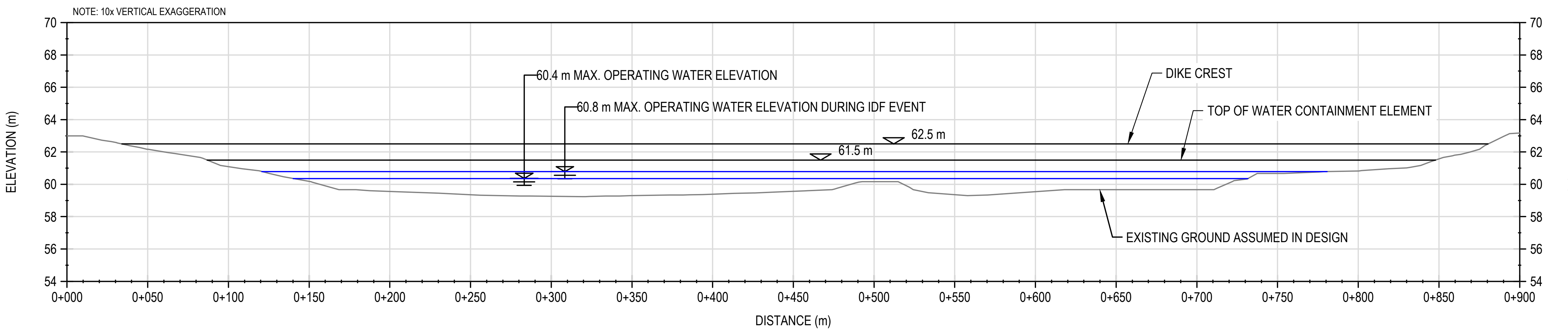
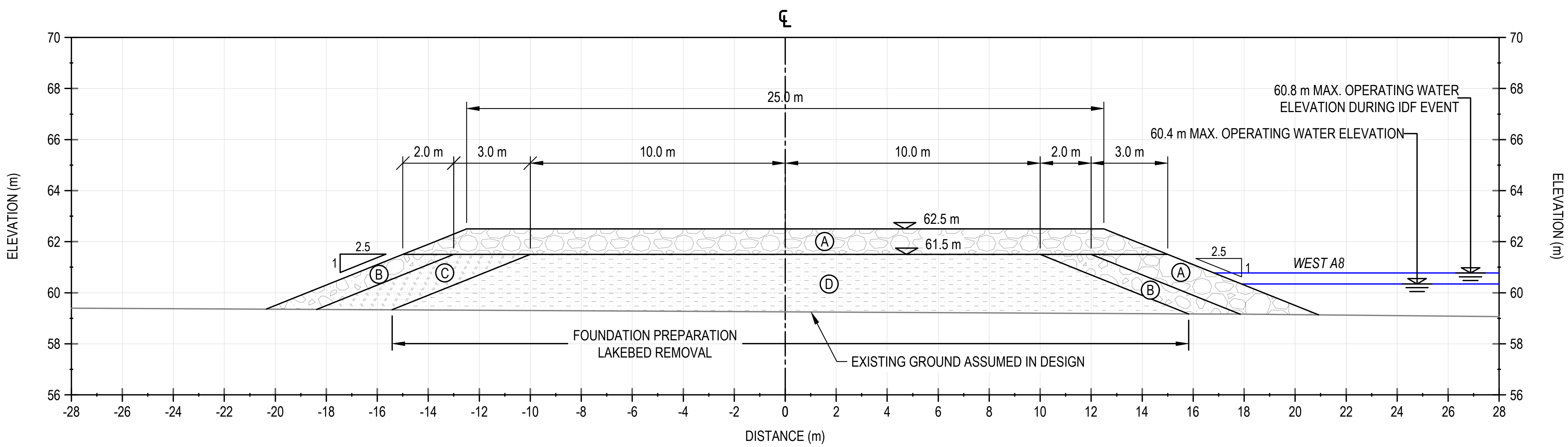



*DIKE D–A8NORTH – PROFILE*

SCALE: H–1:3000 V–1:300

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-A8NORTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | $m^3$ | 26,114 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | $m^3$ | 4,995 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | $m^3$ | 3,572 |
| Ⓓ | GRAVELTILL FILL (75 mm MINUS) | $m^3$ | 30,953 |




*DIKE D–A8NORTH – TYPICAL SECTION*

SCALE: H–1:200

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE | TETRA TECH

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TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D–A8NORTH

ÉCHELLE/ SCALE: AS SHOWN — FICHIER FILE: .DWG

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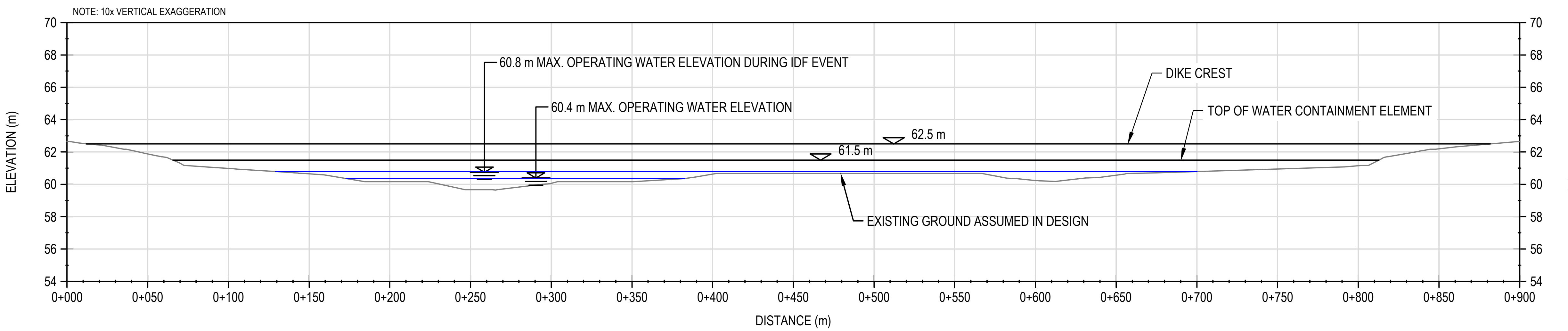
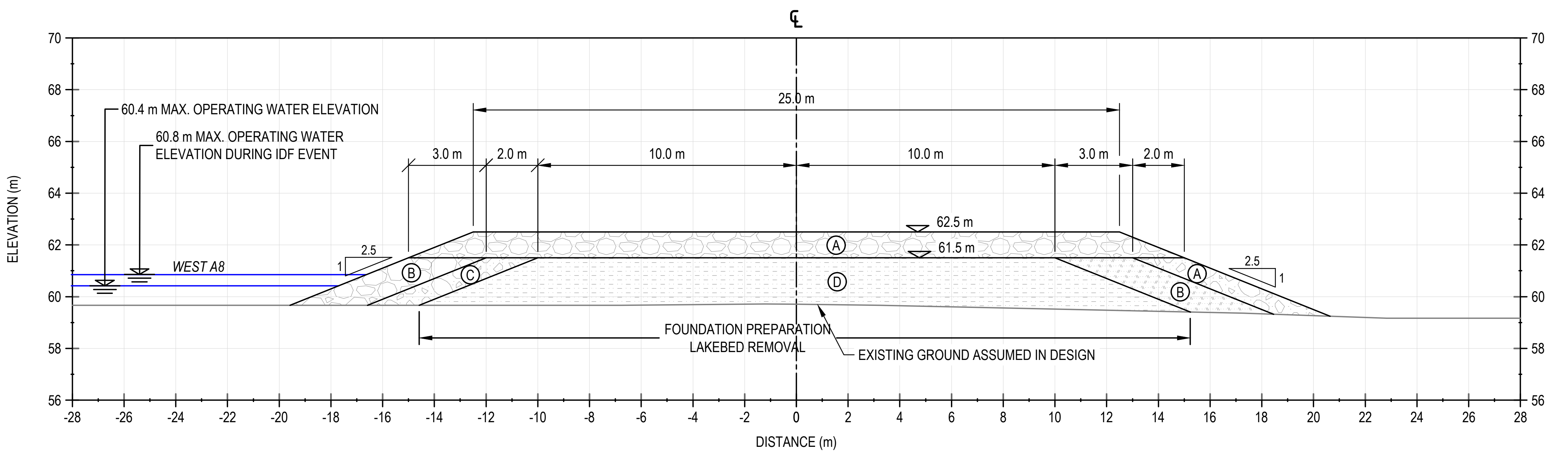



*DIKE D-A8SOUTH – PROFILE*

SCALE: H-1:3000 V-1:300

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-A8SOUTH | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | m³ | 24,164 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | m³ | 2,917 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | m³ | 2,090 |
| Ⓓ | GRAVEL TILL FILL (75 mm MINUS) | m³ | 16,484 |




*DIKE D-A8SOUTH – TYPICAL SECTION*

SCALE: H-1:200

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE

TETRA TECH



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AGNICO EAGLE MELIADINE EXTENSION

PROFILE AND TYPICAL DESIGN SECTION OF DIKE D-A8SOUTH

ÉCHELLE/SCALE: AS SHOWN
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No. DESSIN/DRAWING NO.: FIGURE 13
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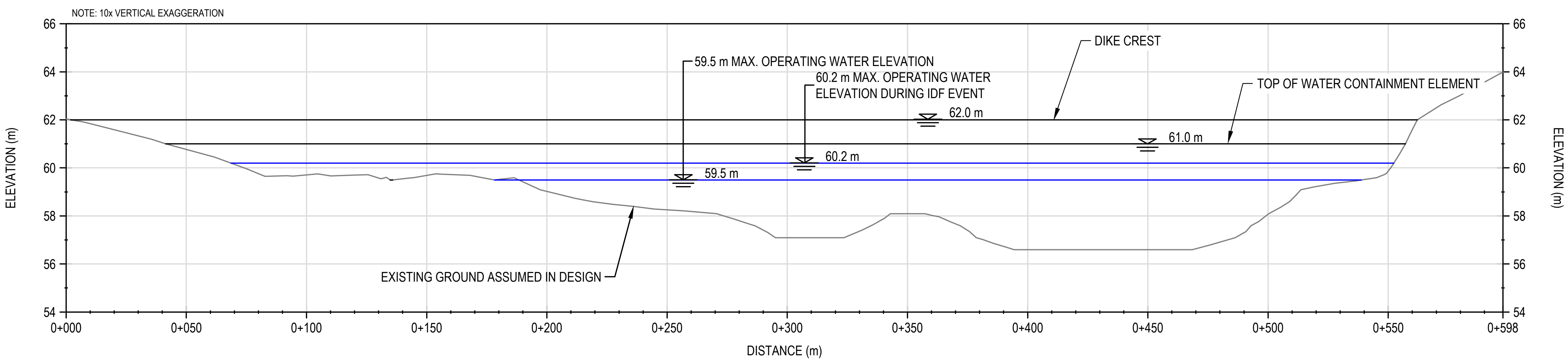
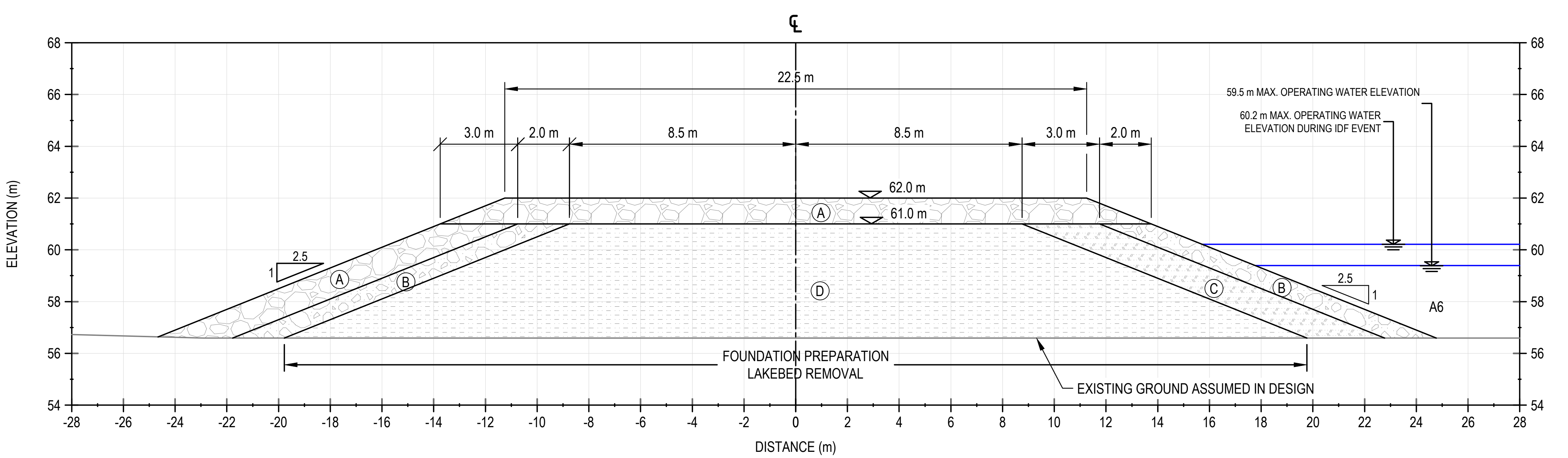



*DIKE D–A6 – PROFILE*
SCALE: H–1:2000 V–1:200

| ESTIMATED MATERIAL QUANTITIES FOR DIKE D-A6 | | | |
|---|---|---|---|
| | ITEM | UNIT | ESTIMATED MATERIAL QUANTITIES |
| Ⓐ | RUN-OF-MINE ROCKFILL (600 mm MINUS) IN DIKE UPSTREAM AND FOR THERMAL COVER | $m^3$ | 16,949 |
| Ⓑ | TRANSITION ROCKFILL (150 mm MINUS) | $m^3$ | 4,363 |
| Ⓒ | GRANULAR FILL OR ESKER SAND (20 mm MINUS) | $m^3$ | 3,653 |
| Ⓓ | GRAVEL TILL FILL (75 mm MINUS) | $m^3$ | 29,668 |




*DIKE D–A6 – TYPICAL SECTION*
SCALE: H–1:200

**NOTES:**

IDF - INFLOW DESIGN FLOOD

AGNICO EAGLE
TETRA TECH



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No. PROJET / PROJECT NO.
DATE 2022–11–04

TITRE / TITLE
AGNICO EAGLE MELIADINE DIVISION
PROFILE AND TYPICAL DESIGN SECTION OF DIKE D–A6

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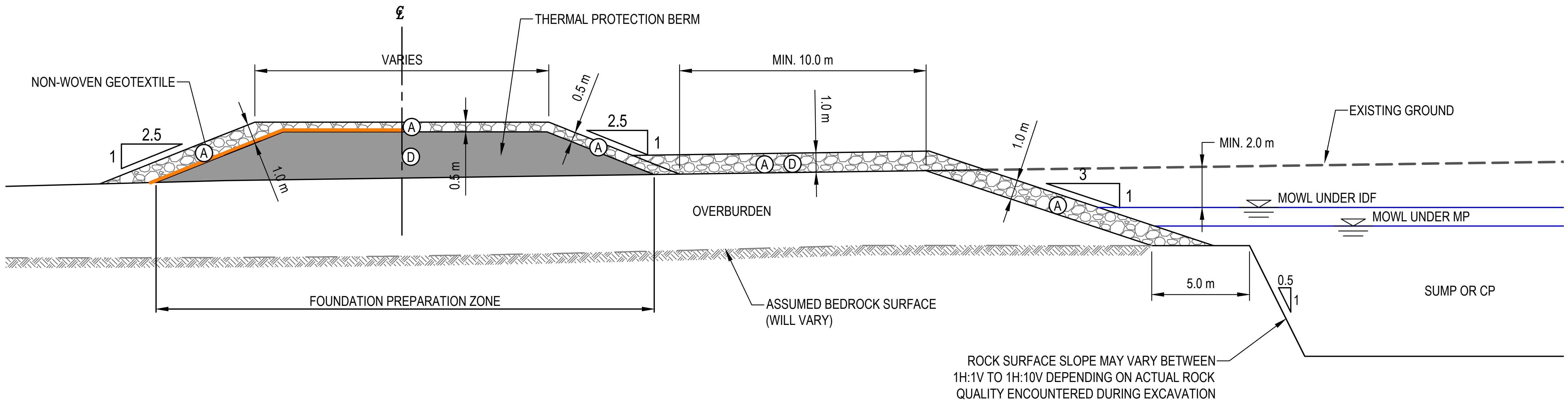


## TYPICAL DESIGN SECTION FOR SUMP P5, SUMP F2, CP7, CPD2, SP5, AND ASSOCIATED THERMAL BERMS

| MATERIAL | QUANTITY | | | | |
|---|---|---|---|---|---|
| | SUMP P5 | SUMP F2 | CP7 | CPD2 | SP5 |
| CLEAN ROCKFILL FROM EXCAVATION AND OTHER SOURCES (600 mm MINUS) ($m^3$) | 22,040 | 26,685 | 50,099 | 12,224 | 91,240 |
| OVERBURDEN TILL FILL FROM POND EXCAVATION (300 mm MINUS) ($m^3$) | 7,348 | 9,100 | 41,265 | 19,804 | 123,000 |
| NONWOVEN GEOTEXTILE ($m^2$) | 21,340 | 19,703 | 8,106 | 3,999 | 5,500 |
| TOTAL EXCAVATION VOLUME ($m^3$) | 97,800 | 92,550 | 364,723 | 48,916 | 293,386 |
| ESTIMATED OVERBURDEN EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | 97,800 | 92,550 | 204,723 | 22,935 | 123,085 |
| ESTIMATED ROCK EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | - | - | 160,000 | 29,981 | 170,301 |

NOTE: THE ACTUAL MATERIAL QUANTITIES FOR CONSTRUCTION AND EXCAVATION MAY VARY DEPENDING ON ACTUAL OVERBURDEN THICKNESS IN THE AREA, AND ACTUAL EXCAVATION SLOPE AND DEPTH et. al.

**NOT TO SCALE**

NOTES:

MWE: MAXIMUM WATER ELEVATION
IDF: INFLOW DESIGN FLOOD
MP: MEAN PRECIPITATION

MAXIMUM WATER LEVEL UNDER INFLOW DESIGN FLOOD EVENT IN THE SUMP OR CPS WILL BE MAINTAINED AT LEAST 2 M BELOW THE LOWEST GROUND LEVEL AROUND THE PERIMETER OF THE STRUCTURE

AGNICO EAGLE
TETRA TECH



| TITRE / TITLE | # DWG |
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DATE 2022–07–12

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

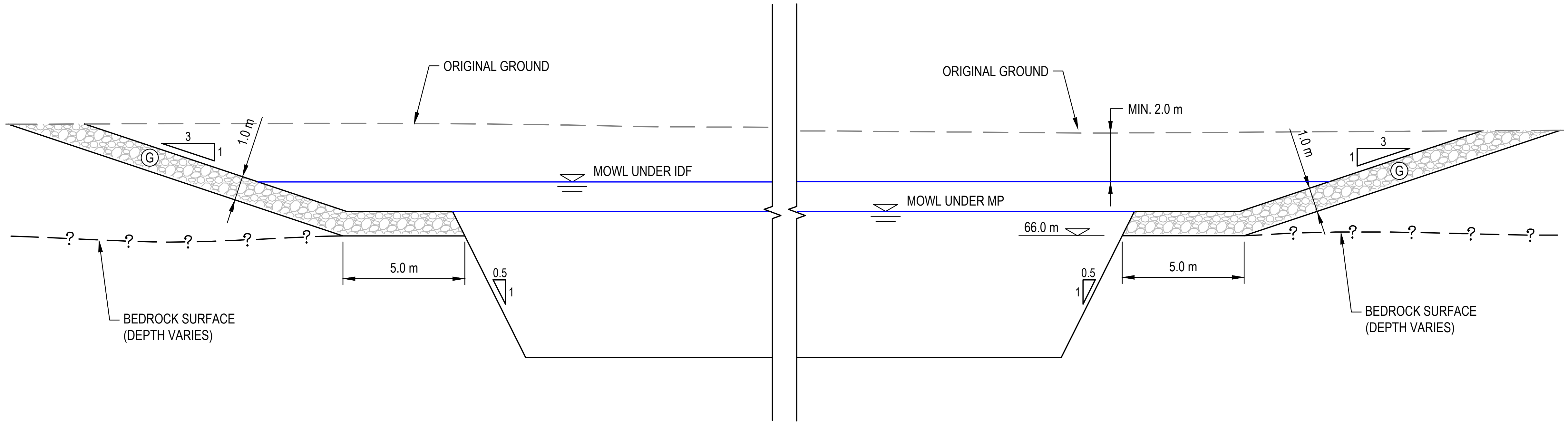
TYPICAL DESIGN SECTION OF SUMPS AND CPs WITH THERMAL BERMS

ÉCHELLE/SCALE AS SHOWN
FICHIER FILE

No. DESSIN/DRAWING NO. FIGURE 15
REVISION A
FEUILLE/SHT 1 / 1

NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17




## TYPICAL DESIGN SECTION FOR CPD1 AND SPD

| MATERIAL | QUANTITY | |
|---|---|---|
| | CPD1 | SPD1 |
| CLEAN ROCKFILL FROM EXCAVATION AND OTHER SOURCES (600 mm MINUS) ($m^3$) | 4,735 | 8,097 |
| OVERBURDEN TILL FILL FROM POND EXCAVATION (300 mm MINUS) ($m^3$) | - | - |
| TOTAL EXCAVATION VOLUME ($m^3$) | 61,131 | 123,891 |
| ESTIMATED OVERBURDEN EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | 25,923 | 54,790 |
| ESTIMATED ROCK EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | 35,208 | 69,101 |

NOTE: THE ACTUAL MATERIAL QUANTITIES FOR CONSTRUCTION AND EXCAVATION MAY VARY DEPENDING ON ACTUAL OVERBURDEN THICKNESS IN THE AREA, AND ACTUAL EXCAVATION SLOPE AND DEPTH et. al.

**NOT TO SCALE**

NOTES:

MWE: MAXIMUM WATER ELEVATION
IDF: INFLOW DESIGN FLOOD
MP: MEAN PRECIPITATION

MAXIMUM WATER LEVEL UNDER INFLOW DESIGN FLOOD EVENT IN THE SUMP OR CPS WILL BE MAINTAINED AT LEAST 2 M BELOW THE LOWEST GROUND LEVEL AROUND THE PERIMETER OF THE STRUCTURE

AGNICO EAGLE

TETRA TECH



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| APPROUVÉ PAR / APPROVED BY | NG | 2022–07–12 |
| No. PROJET / PROJECT NO. | | |
| DATE | 2022–07–12 | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

TYPICAL DESIGN SECTION OF CP11 AND SPD1

ÉCHELLE/ SCALE: AS SHOWN
FICHIER FILE:

No. DESSIN/ DRAWING NO.: FIGURE 16
REVISION: A
FEUILLE/SHT: 1 / 1

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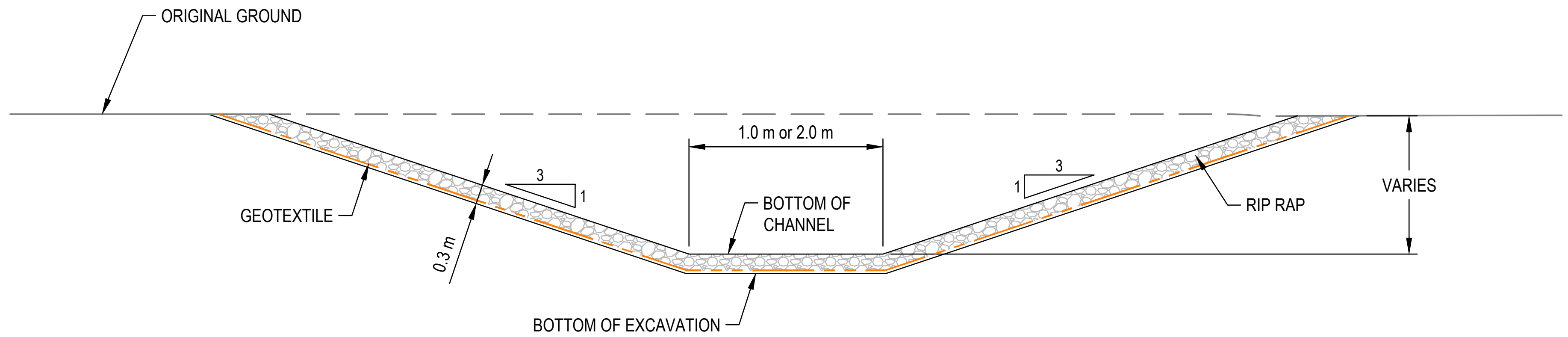


## TYPICAL DESIGN SECTION FOR CHANNELS

(CHANNELS 9 TO 22)

| MATERIAL | ESTIMATED MATERIAL QUANTITY FOR CHANNEL CONSTRUCTION | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CHANNEL 9 | CHANNEL 10 | CHANNEL 11 | CHANNEL 12 | CHANNEL 13 | CHANNEL 14 | CHANNEL 15 | CHANNEL 16 | CHANNEL 17 | CHANNEL 18 | CHANNEL 19 | CHANNEL 20 | CHANNEL 21 | CHANNEL22 |
| TOTAL EXCAVATION VOLUME ($m^3$) | 7,500 | 7,890 | 1,321 | 1,083 | 2,912 | 2,700 | 3,056 | 1,219 | 2,570 | 750 | 11,997 | 3,129 | 3,271 | 5,993 |
| RIP RAP ($m^3$) | 1,540 | 2,650 | 627 | 580 | 1,200 | 990 | 1,331 | 498 | 780 | 320 | 3,083 | 1,213 | 987 | 1,881 |
| NON-WOVEN GEOTEXTILE ($m^2$) | 5,320 | 8,833 | 2,090 | 1,925 | 4,019 | 3,300 | 4,436 | 1,661 | 2,850 | 1,060 | 10,276 | 4,043 | 3,293 | 6,273 |

**NOT TO SCALE**

NOTES:

CHANNEL WAS SIZED TO PASS THE PEAK FLOW OF 5 MINUTE 1 IN 100 RAINFALL OF 5 MM WITH APPROXIMATELY 0.3 TO 0.4 M FREEBOARD

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| DATE | 2022-07-12 | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

TYPICAL DESIGN SECTION OF CHANNELS

ÉCHELLE/ SCALE: AS SHOWN
FICHIER FILE:

No. DESSIN/ DRAWING NO.: FIGURE 17
REVISION: A
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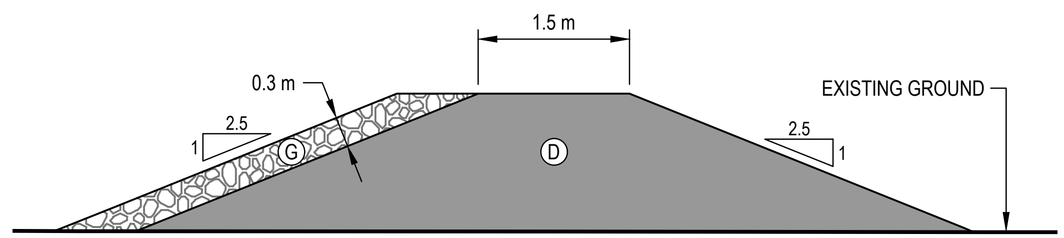


*TYPICAL SECTION – BERM–D1 and BERM–D2*
SCALE: 1:75

| | ITEM | UNITS | ESTIMATED IN-PLACE QUANTITY FOR BERM-D1 | ESTIMATED IN-PLACE QUANTITY FOR BERM-D2 |
|---|---|---|---|---|
| G | RIP RAP | m³ | 560 | 100 |
| D | EXCAVATED OVERBURDEN TILL FILL (300 mm MINUS) | m³ | 1,480 | 328 |

NOTES:

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| TITRE / TITLE | # DWG |
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| No. PROJET PROJECT NO. | | | |
| DATE | 2020–10–09 | | |

TITRE / TITLE
AGNICO EAGLE MELIADINE GOLD PROJECT

BERM–D1 AND BERM–D2
TYPICAL CROSS–SECTION

ÉCHELLE/ SCALE: AS SHOWN
FICHIER FILE: .DWG

No. DESSIN/ DRAWING NO.: FIGURE 18
REVISION: A
FEUILLE/SHT: 5 / 6

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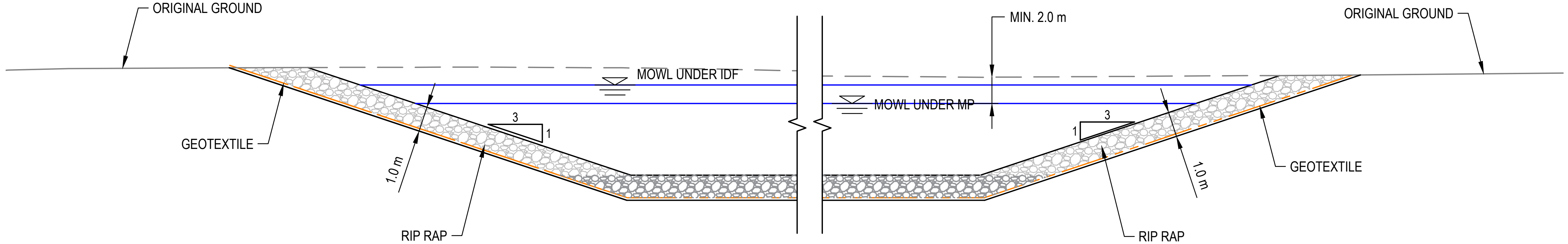
NOTES:

MOWL: MAXIMUM OPERATING WATER LEVEL
IDF: INFLOW DESIGN FLOOD
MP: MEAN PRECIPITATION

MAXIMUM OPERATING WATER LEVEL UNDER MEAN PRECIPITATION BE MAINTAINED AT MINIMUM 2.0 M BELOW THE LOWEST GROUND LEVEL AROUND THE PERIMETER OF THE SUMP




## TYPICAL DESIGN SECTION FOR SUMP

(SUMPS P1, P2, P3, P4, AND F1)

| MATERIAL | QUANTITY | | | | |
|---|---|---|---|---|---|
| | SUMP P1 | SUMP P2 | SUMP P3 | SUMP P4 | SUMP F1 |
| CLEAN ROCKFILL FROM EXCAVATION AND OTHER SOURCES (600 mm MINUS) ($m^3$) | 8,871 | 8,200 | 3,950 | 20,950 | 11,904 |
| OVERBURDEN TILL FILL FROM POND EXCAVATION (300 mm MINUS) ($m^3$) | - | - | - | - | - |
| NONWOVEN GEOTEXTILE ($m^2$) | 8,871 | 8,200 | 3,950 | 20,950 | 12,000 |
| TOTAL EXCAVATION VOLUME ($m^3$) | 36,971 | 31,490 | 9,614 | 136,600 | 47,379 |
| ESTIMATED OVERBURDEN EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | 36,971 | 31,490 | 9,614 | 136,600 | 47,379 |
| ESTIMATED ROCK EXCAVATION VOLUME (NO BULKING FACTOR) ($m^3$) | - | - | - | - | - |

NOTE: THE ACTUAL MATERIAL QUANTITIES FOR CONSTRUCTION AND EXCAVATION MAY VARY DEPENDING ON ACTUAL OVERBURDEN THICKNESS IN THE AREA, AND ACTUAL EXCAVATION SLOPE AND DEPTH et. al.

**NOT TO SCALE**

AGNICO EAGLE

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| No. PROJET / PROJECT NO. | | | |
| DATE | 2022-07-12 | | |

TITRE / TITLE
AGNICO EAGLE MELIADINE EXTENSION

TYPICAL DESIGN SECTION OF SUMP

ÉCHELLE/ SCALE: AS SHOWN
FICHIER FILE:

No. DESSIN/ DRAWING NO.: FIGURE 19
REVISION: A
FEUILLE/SHT: 1 / 1

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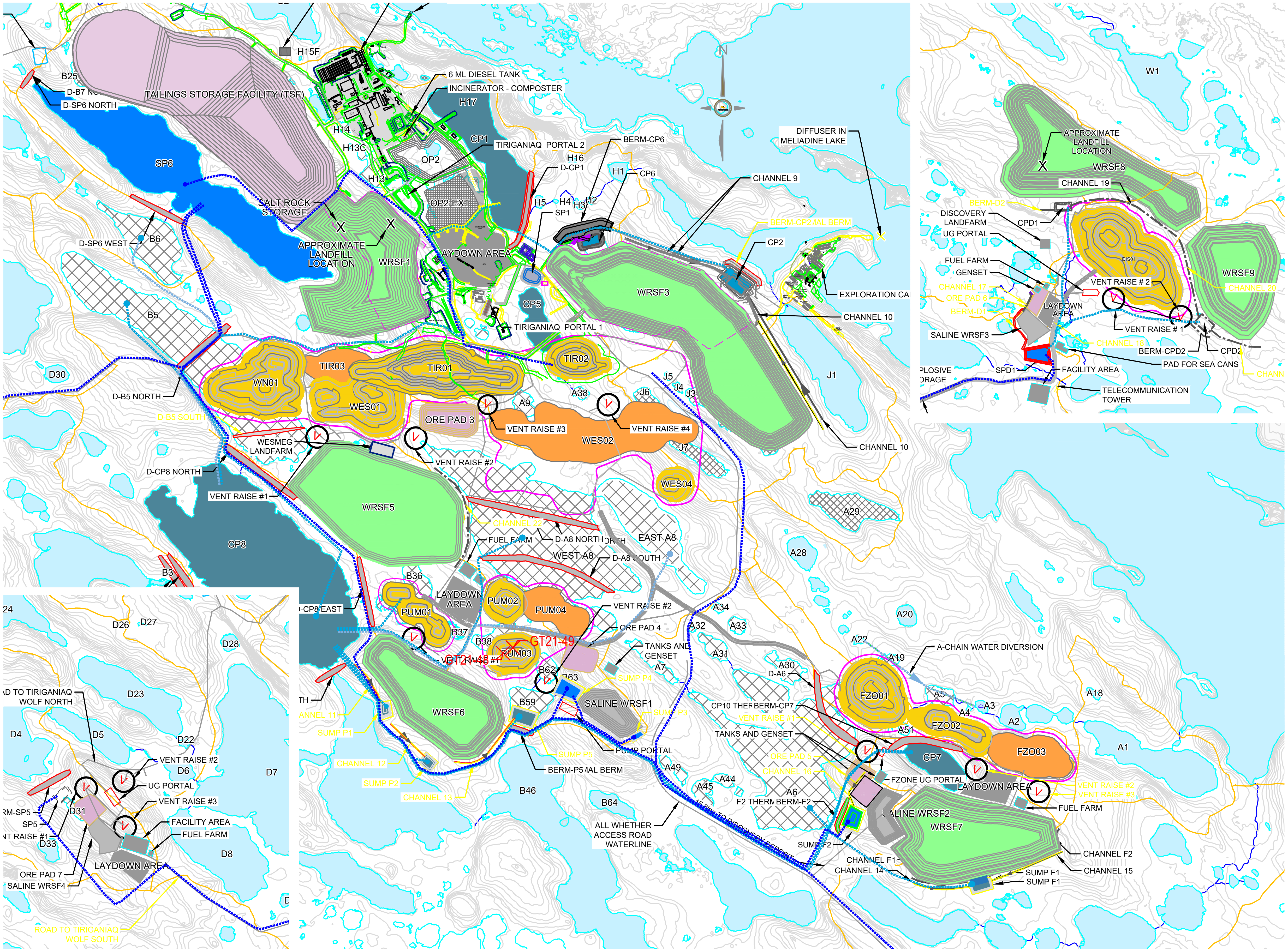


## LEGEND

- CATCHMENT BOUNDARY
- ROADS IN WATER LICENSE AMENDEMENT
- SERVICE ROAD AS BUILD
- HAUL ROAD AS BUILD
- WASTE ROCK STORAGE FACILITY
- PLOM 2020 PIT DESIGN LIMIT
- DIVERSION CHANNEL
- PIPELINE FOR CONTACT WATER
- PIPELINE FOR SALINE WATER
- PIPELINE FOR NATURAL RUNOFF WATER
- CONTACT WATER
- SALINE WATER
- NATURAL RUNOFF WATER

AGNICO EAGLE



| TITRE / TITLE | # DWG |
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REVISIONS

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| APPROUVÉ PAR / APPROVED BY | NG | 25–11–2022 |
| No. PROJET / PROJECT NO. | ENG.EARC03193–04 | |
| DATE | | |

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION

MELIADINE EXTENSION PROJECT
OVERALL PIPELINE ROUTE MAP
(YEAR 2036)

ÉCHELLE/SCALE: 1:15000 | FICHIER/FILE: .DWG

No. DESSIN/DRAWING NO.: FIGURE 20 | REVISION: A | FEUILLE/SHT: 1 / 2

AE–CART–ANSI B

Q:\Edmonton\Engineering\E141\Projects_MELIADINE\ENG.EARC03193-04 MEL WLA\MEL Extension WLA Site Layout\Yearly Layout Update R1 – 2022\Figure 20 Pipeline Plan View.dwg

# APPENDIX A

## TETRA TECH'S LIMITATIONS ON USE OF THIS DOCUMENT

# LIMITATIONS ON USE OF THIS DOCUMENT

## DESIGN REPORT

### 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.

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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.

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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 third parties 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 exploration, 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 so stipulated in the Design Report, TETRA TECH was not retained to explore, address or consider, and has not explored, addressed or considered any environmental or regulatory issues associated with the project specific design.

### 1.8 CALCULATIONS AND DESIGNS

TETRA TECH may have undertaken design calculations and prepared project specific designs in accordance with terms of reference that were previously set out in consultation with, and agreement of, TETRA TECH's client. These designs have been prepared to a standard that is consistent with current industry practice. Notwithstanding, if any error or omission is detected by TETRA TECH's Client or any party that is authorized to use the Design Report, the error or omission should be immediately drawn to the attention of TETRA TECH.

### 1.9 GEOTECHNICAL CONDITIONS

A Geotechnical Report is commonly the basis upon which the specific project design has been completed. It is incumbent upon TETRA TECH's Client, and any other authorized party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the geotechnical information that was reasonably acquired to facilitate completion of the design.

If a Geotechnical Report was prepared for the project by TETRA TECH, it may be included in the Design Report as appropriate. The Geotechnical Report contains Limitations that should be read in conjunction with these Limitations for the Design Report.

### 1.10 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This report has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

# APPENDIX B

## DESIGN BASIS MEMO FOR MELIADINE EXTENSION

# TECHNICAL MEMO

ISSUED FOR USE REV1

| | | | |
|---|---|---|---|
| **To:** | Angie Arbaiza, Agnico Eagle<br>Colleen Prather, Agnico Eagle | **Date:** | January 13, 2023 |
| **c:** | Jenyfer Mosquera, Agnico Eagle | **Memo No.:** | 01 |
| **From:** | Nigel Goldup, Tetra Tech<br>Fai Ndofor, Tetra Tech<br>Hongwei Xia, Tetra Tech | **File:** | ENG.EARC03193-04 |
| **Subject:** | Design Basis for Water Management Infrastructure, TSF and WRSF PFS Engineering Design for Operation Phase, Meliadine Extension, Nunavut | | |

## 1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is currently operating the Meliadine Gold Mine by mining the Tiriganiaq (TIR) deposit with two open pits and one underground (UG) operation. The mine is located approximately 25 km north of Rankin Inlet, Nunavut. Agnico Eagle has continued to extend its knowledge and validation of the gold deposits around the Meliadine Gold Mine by way of additional exploration. As a result, an improved project, collectively referred to as Meliadine Extension, is being proposed. The Meliadine Extension will incorporate six additional gold deposits, namely, Wesmeg, Wesmeg-North, Pump, F Zone, Discovery, and Tiriganiaq-Wolf. These deposits will be mined using a combination of open pits and underground mining methods. The Meliadine Extension will extend the life of the mine from 2032 to 2043 and will add underground mining activities at the already approved Wesmeg, Pump, F Zone, Tiriganiaq-Wolf, and Discovery deposits.

Agnico Eagle is currently undertaking a prefeasibility study (PFS) for the Meliadine Extension. Tetra Tech Canada Inc. (Tetra Tech) was retained by Agnico Eagle to conduct the prefeasibility level design of water management infrastructure (including dikes, berms, sumps, channels, pumps/pipelines), Dry stack Tailing Storage Facility (TSF), and Waste Rock Storage Facilities (WRSFs) required to support the operations phase of extension. Water balance and water quality modelling for the Meliadine Extension have been undertaken by others.

As part of the design deliverables requested by Agnico Eagle, Tetra Tech has developed this Design Basis Memorandum (DBM) for the Meliadine Extension water management infrastructure. Version 4 of the DBM was updated to (Version 5) incorporate comments from Agnico Eagle, to reflect some project changes, and to include the design basis for the TSF and WRSFs and issued to Agnico Eagle on October 11, 2022 for review. The DBM presented herein is Issued for Use.

The purpose of this DBM is to inform Agnico Eagle's project team and Agnico Eagle's internal Engineer of Record (EoR) of the design parameters that will be used for the water management infrastructure, TSF, and WRSFs associated with the Meliadine Extension. Figure 1 presents the general site layout of the Meliadine Extension and shows the proposed water management infrastructure, TSF, and WRSFs in operation Year 2036.

## 2.0 MELIADINE EXTENSION MINE SCHEDULE

Sequencing of the water management infrastructure will be dependent on the requirements of the mine operations. The open pit and underground mining schedule for the Meliadine Extension is presented in Table 1 below and is reflective of Version 11 of the Mine Plan provided by Agnico Eagle. Each mining area of the Meliadine Extension

Tetra Tech Canada Inc.
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
Tel 780.451.2121 Fax 780.454.5688

(i.e., Tir, Wesmeg, Wesmeg-North, Pump, F Zone, Discovery, and Tiriganiaq-Wolf) will require water management structures to be operational prior to mining operations.

**Table 1: Planned Mine Schedule for Meliadine Extension – Version 11**

| Open Pit (OP) / Underground (UG) Mine | Start of Mining (Year) | End of Mining (Year) | Duration of Mine Operation |
|---|---|---|---|
| Tiriganiaq - UG | 2020 | 2038 | 19 years |
| TIR02 - OP | 2020 | 2027 | 8 years |
| TIR01 - OP | 2021 | 2028 | 8 years |
| WES04 - OP | 2024 | 2025 | 2 years |
| WES01 - OP | 2025 | 2029 | 5 years |
| Discovery - UG | 2025 | 2032 | 8 years |
| WN01 - OP | 2026 | 2031 | 6 years |
| PUM03 - OP | 2027 | 2031 | 5 years |
| Pump - UG | 2029 | 2036 | 8 years |
| FZO01 - OP | 2029 | 2035 | 7 years |
| PUM01 - OP | 2030 | 2032 | 3 years |
| DIS01 - OP | 2031 | 2037 | 7 years |
| PUM02 - OP | 2032 | 2037 | 6 years |
| F Zone - UG | 2033 | 2040 | 8 years |
| FZO02 - OP | 2033 | 2036 | 4 years |
| TIR03 - OP | 2036 | 2041 | 6 years |
| WES02 - OP | 2036 | 2041 | 6 years |
| PUM04 - OP | 2036 | 2037 | 2 years |
| FZO03 - OP | 2036 | 2037 | 2 years |
| WES03 - OP | 2037 | 2041 | 5 years |
| TIR04 - OP | 2040 | 2044 | 5 years |
| WES05 - OP | 2040 | 2043 | 4 years |
| Tiriganiaq-Wolf - UG | 2034 | 2043 | 10 years |

# 3.0 DESIGN BASIS FOR WATER MANAGEMENT INFRASTRUCTURE

## 3.1 Meliadine Extension Water Management Plan

### 3.1.1 General Water Management and Flow Chart

One of the primary water management objectives for the Meliadine Extension is to minimize potential impacts to the quantity and quality of surface water at the Meliadine Gold Mine and surrounding waterbodies. The Meliadine Extension water management plan is based upon two guiding principles: 1) where possible, divert clean (non-contact) water away from mine infrastructure, and 2) separate surface contact water and saline water.

The proposed management of surface contact water and saline water is presented in the following sections.

#### 3.1.1.1 Surface Contact Water

Surface contact water originating from developed areas will be intercepted and conveyed to the various collection ponds for temporary storage. The primary sources of contact water include the WRSFs, open pits dewatering, TSF, laydown areas, and facilities areas.

Collection Pond 1 (CP1) and CP8 will be used as the main water storage ponds with smaller local collection ponds (i.e., CP7, B5North, A6, A8, CP9, CPD1, and CPD2) to be used for temporary water storage during freshet and after a summer precipitation event. In general, the contact water from the local smaller collection ponds will be pumped to the larger collection ponds. The surface contact water from Wesmeg, Wesmeg-North, Pump, and F zone areas will be pumped to CP8. The water stored in CP8 will be transferred to, the main attenuation pond, CP1, from where water will be routed through either the Effluent Water Treatment Plant (EWTP) or the Saline Effluent Treatment Plant (SETP) as necessary and discharged to the receiving environment. Discharge to Itivia Harbour via the waterline is prioritized, with the remainder discharged to Meliadine Lake (Agnico Eagle 2021). At the Tiriganiaq-Wolf site, contact water and saline water will be combine managed in the saline pond (SP5) and transferred to SP6 for discharge to Itivia Harbour. The surface contact water at the Discovery area will be managed locally and temporarily stored in CPD1 and CPD2, and then pumped to the saline water pond at Discovery (SPD1).

#### 3.1.1.2 Saline Contact Water

Saline contact water will be managed in various saline ponds (SPs) on the surface and then routed to either TIR02 open pit (prior to 2025) or SP6 (2025 onwards). The primary sources of mine related saline contact water include underground mine dewatering, ore pads, saline WRSFs, and a portion of the TSF.

From 2025 onwards, SP6 will be used as the main saline water collection pond from where the water will be transferred to the SETP, where it will be treated for total suspended solids and ammonia prior to discharge to Itivia Harbour. Several local SPs such as Saline Pond at Discovery (SPD1), Saline Pond at Tiriganiaq-Wolf (SP5), Sumps P3 and P4 at Pump, and Sump F2 at F Zone will be used to temporarily store the saline contact water before it is transferred to TIR02 open pit or SP6 depending on the operational year.

The overall water flow diagram at the end of mine operation (Year 2043) for Meliadine Extension provided by Lorax Environmental Services Ltd. (Lorax) is presented in Figure 2.

### 3.1.2 Meliadine Extension Water Management Infrastructure

In the Dam Safety Guidelines (CDA 2013), a dam is defined as "*a barrier constructed for the retention of water, water containing any other substance, fluid waste, or tailings, provided the barrier is capable of impounding at least 30,000 m$^3$ of liquid and is at least 2.5 m high".* Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (CDA 2019) *states that "the definition of a dam should include dams less than 2.5 m high if the consequence of failure is likely to be unacceptable to the public, such as retaining contaminated substance".*

In this DBM, the term:

- **"dike"** is used to refer to a water retention earthwork structure like a dam defined in CDA 2013, which is planned to retain more than 30,000 m$^3$ of water and the maximum height (the vertical distance from the lowest ground to the crest) is greater than 2.5 m.
- **"berm"** is used to refer to a water diversion or retention earthwork structure with no key trench and liner system, which is planned to retain less than 30,000 m$^3$ of water.

- **"thermal berm"** is used to refer to an independent earthwork structure with no water against it and acts as a thermal protection structure to protect the permafrost underneath the structure. The construction materials for a thermal berm will be mainly from the excavation of the upstream water storage pond or sump.

Water management infrastructure required for the Meliadine Extension is shown in the general site layout plan (Figure 1). These components and a brief description of their location and purpose are presented in Table 2 below.

### Table 2: Summary of the Meliadine Extension Water Management Infrastructure by Ore Deposit

| Ore Deposit | Related Infrastructure | Water Management Infrastructure Required for Meliadine Extension | Details |
|---|---|---|---|
| Tiriganiaq and Wesmeg-North | SP6 - Saline Pond | Dike D-SP6North | Located north of SP6. D-SP6North will be used to contain saline water from the TSF and prevent the saline water from flowing to the downstream receiving environment. |
| | SP6 - Saline Pond | Dike D-SP6West | Located in the narrow between SP6 and Lake B6. D-SP6West will be used to contain saline water from the TSF and prevent the saline water from flowing into downstream dewatered Lake B6. |
| | WN01 - Open Pit | Dike D-B5North | Located north of WN01 open pit within dewatered Lake B5. D-B5North will be used to divert runoff from flowing into WN01 pit. |
| | WN01 - Open Pit | Dike D-B5South | Located south of WN01 open pit within dewatered Lake B5. D-B5South will be used to collect runoff from B5 south catchment and portion of runoff from WRSF5. |
| | WRSF5 | Channel22 | Located east side of WRSF5 to divert the runoff water from east slope of WRSF5 to CP9 or PUM01 open pit and prevent the runoff water from flowing to the dewatered Lake A8 area. |
| Pump and Wesmeg | CP8 | Dike D-CP8South | Located within the narrow of CP8 and B45. D-CP8South will be used to contain contact water stored within CP8 and prevent the contact from flowing to the downstream receiving environment. |
| | CP8 | Dike D-CP8West | Located in the narrow between CP8 and B3. D-CP8West will be used to contain contact water stored within CP8 and prevent the contact from flowing to the downstream receiving environment. |
| | CP8 | Dike D-CP8North | Located in the narrow between CP8 and Lake B5. D-CP8North will be used to contain contact water stored within CP8 and prevent the contact from flowing to the dewatered Lake B5. |
| | CP8 and CP9 | Dike D-CP8East | Located west of PUM01 open pit. D-CP8East will be used to contain contact water stored within CP8 and prevent the contact from flowing into PUM01 open pit. |
| | PUM02/04 - Open Pit | Dike D-A8South | Located north of PUM02 and PUM04 open pits. D-A8South will be used to divert runoff from flowing into PUM02 and PUM04 open pits. |
| | WES03 - Open Pit | Dike D-A8North | Located south of WES03 open pit. D-A8South will be used to divert runoff from flowing into WES03 open pit. |

### Table 2: Summary of the Meliadine Extension Water Management Infrastructure by Ore Deposit

| Ore Deposit | Related Infrastructure | Water Management Infrastructure Required for Meliadine Extension | Details |
|---|---|---|---|
| Pump | WRSF6 | Channels 11, 12, and 13 | Channels 11 and 12 to divert contact water from WRSF6 towards Sumps P1 and P2. Channel 13 to divert contact water from WRSF6 towards Sump P5. |
| | WRSF6 | Sumps P1 and P2 | Sumps P1 and P2 to collect contact water from WRSF6 that has been diverted by Channels 11 to 12. |
| | Saline WRSF1 at Pump | Sumps P3 and P4 | Sumps P3 and P4 to collect saline contact water from Saline WRSF2 at Pump. |
| | Pump Ore Pad and WRSF6 | Sump P5 | Sump P5 will be used to contain contact water from the Pump Ore Pad and WRSF6 and prevent the contact from flowing to the downstream receiving environment. |
| | Sump P5 | Berm-P5 | Located in the narrow between Sump P5 and Lake B46. Berm-P5 will be used as thermal protection berm for Sump P5. |
| F Zone | A6 | Dike D-A6 | Located southwest of FZO01 open pit. D-A6 will be used to divert contact water from Lake A6 from flowing into FZO01 open pit. |
| | WRSF7 | CP7 | Located upstream of FZO02 open pit. CP7 will be used to collect water from WRSF7 and prevent contact water from flowing into F Zone open pits. |
| | CP7 | Berm-CP7 | Berm-CP7 will be used as a thermal protection berm for CP7 to reduce seepage to F Zone open pits from CP7. |
| | WRSF7 | Channel 14 and 15 | Channel 14 and Channel 15 to divert contact water from WRSF7 towards Sump F1. |
| | Saline WRSF2 at F Zone and Ore Pad | Channel 16 | Channel 16 to divert contact water from F Zone Ore Pad and Saline WRSF2 towards Sump F2. |
| | WRSF7 | Sump F1 | Sump F1 to collect contact water from WRSF7 that has been diverted by Channel 14 and Channel 15. |
| | Saline WRSF2 at F Zone and Ore Pad | Sump F2 | Sump F2 to collect saline water from F Zone Ore Pad and Saline WRSF2 that has been diverted by Channel 16 and saline water from F Zone Underground mining. |
| | Sump F2 | Berm-F2 | Located between Lake A6 and Sump F2. Berm-F2 will be used as thermal protection berm for Sump F2. |

### Table 2: Summary of the Meliadine Extension Water Management Infrastructure by Ore Deposit

| Ore Deposit | Related Infrastructure | Water Management Infrastructure Required for Meliadine Extension | Details |
|---|---|---|---|
| Discovery | WRSF8 | CPD1 | Located downstream of WRSF8. CPD1 will be used to collect contact water from WRSF8 and DIS01 open pit. |
| | WRSF8 | Berm-D2 | Located downstream of WRFS8 to divert the runoff water from WRSF8 to CPD1 during operation. |
| | WRSF8 | Channel19 | Channels 19 is to divert contact water from WRSF8 towards CPD1. |
| | WRSF9 | CPD2 | Located downstream of WRSF10. CPD2 will be used to collect contact water from WRSF9. |
| | CPD2 | Berm-CPD2 | Located north of CPD2. Berm-CPD2 will serve as a thermal protection berm to control the seepage flow from CPD2 to downstream (CH6). |
| | WRSF9 | Channels 20 and 21 | Channels 19 and 20 to divert contact water from WRSF9 towards CPD2. |
| | Discovery Saline Pond | SPD1 | Located downstream of Saline WRSF3. SPD1 will be used to collect contact water from Saline WRSF3, ore pad, industrial pad, and fuel pad. It will also serve as a temporarily saline water storage area from underground mining. |
| | Discovery Industrial Pad | Channels 17 and 18 | Channels 17 and 18 to divert contact water from Saline WRSF3, ore pad, industrial pad, and fuel pad towards the downstream SPD1. |
| | Saline WRSF3 | Berm-D1 | Located west of Saline WRSF3 and industrial pad. Berm-D1 will be used to divert contact water from Saline WRSF3, industrial pad, and saline water from Saline WRSF3 and prevent the contact from flowing to the downstream receiving environment. |
| Tiriganiaq-Wolf | Saline Pond at Tiriganiaq-Wolf | SP5 | Located upstream of Lake D4. SP5 will be used to collect contact water from ore pad, industrial pad, Saline WRSF4 at Tiriganiaq-Wolf, and store the ground water from Tiriganiaq-Wolf underground mining. |
| | SP5 | Berm-SP5 | Berm-SP5 will serve as a thermal protection berm to control the seepage flow from SP5 to Lake D4. |
| Overall Site | Overall Site | Culverts | For water conveyance through haul roads and access roads. |

### 3.1.3 Water Management Infrastructure Construction Schedule

Table 3 summarizes the planned construction schedule and the water management infrastructure required during development and expansion of each mining area for Meliadine Extension.

**Table 3: The Meliadine Extension Planned Water Management Construction Schedule**

| Water Management Infrastructure Required for the Meliadine Extension | Planned Schedule for Start of Construction | Corresponding Mine Development |
|---|---|---|
| Dike D-B5North | 2024 | Wesmeg-North Mine Area Development and form CP8 |
| Dike D-B5South | | |
| Dike D-CP8South | | |
| Dike D-CP8West | | |
| Dike D-CP8North | | |
| Dike D-CP8East | | |
| Dike D-SP6North | 2024 | TSF Expansion and form SP6 |
| Dike D-SP6West | | |
| SPD1 | 2024 | Discovery Mine Area Development |
| Berm D1 | 2025 | Discovery Mine Area Development |
| Channels 17 and 18 | | |
| Sumps P1, P2, P3, P4, and P5 | 2026 | Pump Mine Area Development |
| Channels 11, 12, 13, and 22 | | |
| Berm P5 | | |
| Dike D-A6 | 2028 | F Zone Mine Area Development |
| CP7 and Berm CP7 | | |
| Channels 14 and 15 | | |
| Sump F1 | | |
| Sump F2 | 2032 | |
| Berm F2 | | |
| Channel 16 | | |
| CPD1 | 2030 | Discovery Mine Area Expansion |
| CPD2 and Berm CPD2 | | |
| Channels 19, 20, and 21 | | |
| Berm D2 | | |
| Dike D-A8South | 2031 | Pump Mine Area Development |
| SP5 and Berm SP5 | 2032 | Tiriganiaq-Wolf Mine Area Development |
| Dike D-A8North | 2036 | Wesmeg Mine Area Development |
| Culverts | As Required | Overall Site |

## 3.2 Collection Ponds and Sumps Operation Function and Condition

Water storage areas, CPs, and sumps are required to manage the surface contact water and saline contact water based on the proposed water management plans for the Meliadine Extension. The water collected and stored in the reservoirs will be pumped to the designated areas as required. Table 4 summarizes the operation function and assumed operation condition for each water storage area. Generally, the global water storage reservoirs, such as SP6 and CP8, will store the water year-round, and the water level will be drawn down to the minimum operating water level before freeze up (i.e., winter). The local saline water collection ponds such as SPD1, SP5, Sump P4, and Sump F2, will store the water year-round, and the water level in each pond will be lowered to the minimum operating water level at the end of each fall to provide sufficient storage capacity for the saline water from the underground mining during the winter. Other local water CP's such as B6, B5North, A8East, A6, CP7, CP9, CPD1, CPD2, and sumps at F Zone and Pump will be used to temporarily store the spring freshet water in June. These will require active monitoring and pumping to manage the collected summer runoff water after the freshet. The local ponds will be brought to "dry" condition by the end of each fall to provide the storage capacity for the next freshet.

### Table 4: Collection Ponds and Sumps Operation Function and Based Operation Condition

| Water Storage Area | Water Type | Water Pumping To | Operation Function | Assumed Operation Condition |
|---|---|---|---|---|
| SP6 | Saline Water | TIR02 Pit (before 2025), then SP1, then SETP to Itivia Harbour | To store saline water from underground mines, and part of runoff/seepage water from WRSF1and TSF. | Year-round operation, brought to minimum operating water level at the end of each fall. |
| B6 | Natural Runoff Water | CP8 | To collect natural runoff water from Lake B6 catchment. | Temporarily store spring freshet water in June. Periodical pumping in summer, brought to "dry" condition before winter. |
| B5North | Contact Water | CP8 | To temporarily store runoff water from Lake B5 North catchment and runoff water from WRSF1. | |
| B5South | Contact Water | CP8 | To temporarily store runoff water from Lake B5 South catchment and runoff water from WRSF5. | |
| CP8 | Contact Water | CP1 | Serves as attenuation pond, store runoff water from Pump, F Zone, Wesmeg-North area including natural runoff, contact water from WRSFs, ore pad, open pit etc. | Year-round operation, brought to minimum operating water level at the end of each fall. |
| A8East | Natural Runoff Water | CP8 | To collect natural runoff water from Lake A8 East catchment. | Temporarily store spring freshet water in June. Periodical pumping in summer, brought to "dry" condition before winter. |
| A8West | Contact Water | CP8 | To collect natural runoff water from Lake A8 west catchment and portion of runoff from WRSF5. | |
| A6 | Runoff Water | CP8 | To collect natural runoff water from Lake A6 catchment. | |
| CP9 | Contact Water | CP8 | To collect natural runoff water, runoff from WRSF5 and WRSF6. | |
| CP7 | Contact Water | CP8 | To collect natural runoff water, runoff from WRSF7 and F Zone pit water. | |
| CPD1 | Contact Water | SPD1 | To collect natural runoff water, runoff from WRSF9. | |
| CPD2 | Contact Water | SPD1 | To collect natural runoff water, runoff from WRSF10. | |
| Sumps P1, P2, P5, and F1 | Contact Water | CP8 | To collect runoff from WRSF6 and WRSF7. | |
| Sumps P3 | Saline Water | SP6 | To collect runoff from Saline WRSF1 at Pump. | Temporarily store spring freshet water in June. Periodical pumping in summer, brought to "dry" condition before winter. |

**Table 4: Collection Ponds and Sumps Operation Function and Based Operation Condition**

| Water Storage Area | Water Type | Water Pumping To | Operation Function | Assumed Operation Condition |
|---|---|---|---|---|
| Sumps P4 and F2 | Saline Water | SP6 | To collect runoff from Saline WRSF1 at Pump and Saline WRSF2 at F Zone, and saline water from underground mine. | Year-round operation, brought to minimum operating water level at the end of each fall. |
| SPD1 | Saline Water | TIR02 Pit before 2025, then SP6 from 2025 | To collect saline water from underground mine and runoff water from industrial pad at Discovery. | |
| SP5 | Saline Water | To SP6 then to main SETP | To collect saline water from underground mine and runoff water from industrial pad at Tiriganiaq-Wolf. | |

## 3.3 Catchment Areas

Table 5 summarizes the maximum catchment areas that were used to estimate the volume of runoff water for each CP and sumps during freshet and under Inflow Design Flood (IDF) in this study. The catchment area associated with key water management infrastructure was delineated by Lorax and presented in the Meliadine Extension Water Balance and Water Quality Model-Technical Report (Lorax 2022). Tetra Tech understood that the catchment area was delineated based on the site layout at the end of mine life and did not consider the mining and construction sequence. For example, the catchment area associated with A8 west provided by Lorax did not reflect the maximum catchment area during operation as the timing of dike construction and open pit mining schedule were not considered. Tetra Tech revised some catchment areas provided by Lorax based on the mine plan and construction sequence for the design of the water management infrastructure. **The maximum catchment area for each water management infrastructure should be refined in the next phase of the study.**

**Table 5: The Meliadine Extension Maximum Catchment Area Adopted for Sizing the Water Management Infrastructure**

| Storage Area/CP/Sump | Associated Dike/Berm | Catchment Area (ha) | Note |
|---|---|---|---|
| SP6 | Dike D-SP6North | 219.3 | Including SP6 and portion of TSF and WRSF1 (Lorax 2022). |
| | Dike D-SP6West | | |
| B6 | N/A | 33.2 | Including Lake B6 (Provided by Lorax via an email on July 7, 2021). |
| B5 | Dike D-B5North | 80.6 | North portion of Lake B5 delineated by Dike D-B5North (Lorax 2022). |
| | Dike D-B5South | 55.85 | South portion of Lake B5 delineated by Dike B5South (Lorax 2022). |
| CP8 | Dike D-CP8South | 207.1 | CP8 catchment delineated by dikes around CP8 (Lorax 2022). |
| | Dike D-CP8West | | |
| | Dike D-CP8North | | |
| | Dike D-CP8East | | |
| A8 East | N/A | 63.5 | East portion of A8 including WES04 open pit (Estimated by Tetra Tech). |

### Table 5: The Meliadine Extension Maximum Catchment Area Adopted for Sizing the Water Management Infrastructure

| Storage Area/CP/Sump | Associated Dike/Berm | Catchment Area (ha) | Note |
|---|---|---|---|
| A8 West | Dike D-A8South | 113.6/50.5 | 113.6 ha for the catchment before the construction of D-A8South (Estimated by Tetra Tech).<br>50.5 ha for the catchment area after the construction of D-A8South (Estimated by Tetra Tech). |
| | Dike D-A8North | 50.5 | 50.5 ha for the catchment area after the construction of D-A8South (Estimated by Tetra Tech). |
| A6 | Dike D-A6 | 290.74 | Lake A6 catchment delineated by D-A6 (Lorax 2022). |
| CP9 | Dike D-CP8East | 59.5 | Lake B36 (Provided by Lorax via an email on June 24, 2021). |
| CP7 | Berm-CP7 | 48.3 | Including Lake A52 and portion of WRSF7 (Estimated by Tetra Tech). |
| CPD1 | N/A | 68.8 | Portion of WRSF9 runoff reporting to CPD1 (Estimated by Tetra Tech. |
| CPD2 | Berm-CPD2 | 50.0 | Portion of WRSF10 runoff reporting to CPD1 (Estimated by Tetra Tech). |
| Sump P1 | N/A | 8.12 | Portion of WRSF6 runoff reporting to sump (Lorax 2022). |
| Sump P2 | N/A | 7.57 | |
| Sump P3 | N/A | 3.57 | Portion of Saline WRSF1 reporting to sump (Lorax 2022). |
| Sump P4 | N/A | 10.43 | |
| Sump P5 | Berm-P5 | 32.3 | Portion of WRSF6 reporting to sump (Lorax 2022). |
| Sump F1 | N/A | 17.1 | Portion of WRSF7 runoff reporting to sump (Lorax 2022). |
| Sump F2 | Berm-F2 | 17.8 | Portion of WRSF7, ore pad runoff, Saline WRSF2 reporting to sump (Estimated by Tetra Tech). |
| SPD1 | N/A | 8.94 | Discovery area pad and Saline WRSF3 (Lorax 2022). |
| SP5 | Berm-SP5 | 36.04 | Tiriganiaq area pad and Saline WRSF4 (Lorax 2022). |

## 3.4 Precipitation and Extreme Events

As part of the design, Tetra Tech undertook the frequency analysis to update the climate characterization for the Meliadine site by incorporating the latest measured climate data at Rankin Inlet Weather Station. The details on the climate characterization update can be found in the technical memo issued by Tetra Tech on August 18, 2021, entitled "Rankin Inlet Design Storm and Precipitation Frequency Quantiles Update Meliadine Gold Mine, Nunavut" (Tetra Tech 2021a). The key results from the study were summarized as follows:

- **Table 6** summarizes the results obtained from this study for spring and summer-autumn rainfall depths in 24 hours for different return periods and Probable Maximum Precipitation (PMP).
- **Table 7** summarizes the annual rainfall, annual snowfall, and annual total precipitation for different return periods. These values will be adopted in the present study.

### Table 6: Estimated Meliadine Gold Mine Site 24-Hour Rainfall Event (Based on Adjusted Homogenized Precipitation Data)

| Type of Year | Return Period (Years) | 24-Hour Spring Rainfall (mm) | 24-Hour Summer-Autumn Rainfall (mm) |
|---|---|---|---|
| Wet | 1,000 | 72.4 | 73.4 |
| | 500 | 64.2 | 69.8 |
| | 200 | 54.0 | 64.9 |
| | 100 | 46.7 | 60.9 |
| | 50 | 39.7 | 56.6 |
| | 20 | 30.9 | 50.5 |
| | 10 | 24.5 | 45.2 |
| | 5 | 18.3 | 39.1 |
| Median | 2 | 9.6 | 28.1 |
| Dry | 5 | 5.9 | 21.6 |
| | 10 | 4.0 | 17.9 |
| | 20 | 2.0 | 12.9 |
| | PMP | 207 | 275 |

**Note: PMP is not associated with any return period**

### Table 7: Estimated Meliadine Gold Mine Site Extreme Annual Precipitation (Based on Adjusted Homogenized Precipitation Data)

| Type of Year | Return Period (Years) | Annual Rainfall (mm) | Annual Snowfall (mm) | Annual Total Precipitation (mm) |
|---|---|---|---|---|
| Wet | 1,000 | 398 | 531 | 738 |
| | 500 | 381 | 494 | 708 |
| | 200 | 358 | 447 | 668 |
| | 100 | 339 | 411 | 636 |
| | 50 | 320 | 376 | 602 |
| | 20 | 292 | 328 | 555 |
| | 10 | 268 | 291 | 515 |
| | 5 | 241 | 252 | 471 |
| Median | 2 | 194 | 192 | 394 |
| Dry | 5 | 153 | 148 | 327 |
| | 10 | 133 | 129 | 296 |
| | 20 | 117 | 115 | 272 |
| | 50 | 101 | 102 | 247 |
| | 100 | 90 | 94.3 | 231 |

Frequency analysis of short duration rainfall data was conducted based on the daily historical data at Rankin Inlet Station using the computerized tool developed by The University of Western Ontario (Computerized IDF CC Tool for the Development of Intensity-Duration-Frequency Curves under a Changing Climate: (idf-cc-uwo.ca)). The calculated short-term duration rainfall event ranging from five minutes to 24 hours for the Meliadine site are presented in Table 8.

### Table 8: Short Duration Rainfall Intensity at Rankin Inlet

| Duration | Return Period (Years) and Corresponding Rainfall Rate (mm/h) | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 5 | 10 | 25 | 50 | 100 |
| 5 min | 20.56 | 30.25 | 37.86 | 49.1 | 58.67 | 60.81 |
| 10 min | 17.44 | 22.9 | 25.5 | 27.96 | 29.34 | 30.4 |
| 15 min | 16.44 | 19.41 | 20.29 | 20.84 | 21.04 | 21.15 |
| 30 min | 11.07 | 15.42 | 18.07 | 21.16 | 23.3 | 25.29 |
| 1 h | 7.25 | 10.62 | 13.14 | 16.71 | 19.66 | 22.88 |
| 2 h | 4.67 | 6.85 | 8.52 | 10.92 | 12.94 | 15.17 |
| 6 h | 2.64 | 3.76 | 4.5 | 5.44 | 6.13 | 6.81 |
| 12 h | 2.06 | 2.76 | 3.08 | 3.37 | 3.52 | 3.64 |
| 24 h | 1.26 | 1.8 | 2.11 | 2.45 | 2.68 | 2.88 |

## 3.5 Wind Frequency Analysis

A wind frequency analysis was conducted based on the historical data measured at Rankin Inlet to determine the wave height and required crest elevation of the water management infrastructure. The results from the wind analysis summarized in Table 9.

### Table 9: Extreme Return-Period Peak Hourly Wind Speed from North, Northwest, and West for the Meliadine Gold Mine Site

| Return Period (Years) | Extreme Event Peak Hourly Wind Speed (m/s) | Extreme Event Peak Hourly Wind Speed (km/hr) |
|---|---|---|
| 1 | 21.6 | 77.8 |
| 2 | 23.4 | 84.2 |
| 5 | 25.6 | 92.2 |
| 10 | 27.1 | 97.6 |
| 20 | 28.6 | 103.0 |
| 50 | 30.6 | 110.2 |
| 100 | 31.9 | 114.8 |
| 200 | 33.3 | 120.0 |
| 1,000 | 36.4 | 131.0 |

# 4.0 DESIGN CRITERIA

## 4.1 Dike and Berms

### 4.1.1 Key Design Objective

- In accordance with Canadian Dam Safety Guidelines (CDA 2007/2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014/2019);
- In accordance with Agnico Eagle's Corporate Standard – Risk Management and Monitoring System – Water Management (2021);
- Meet requirements of the Water Licence "A" for Meliadine Project (2AM-MEL1631);
- Minimize seepage through the dike and its foundation while optimizing the construction efficiency;
- Maximize the use of available construction materials produced at the site;
- Minimize overall environmental footprints and effects;
- Consider site specific geotechnical and climatic conditions, and
- Water storage pond operation requirements.

### 4.1.2 Dam Classification

A consequence classification system has been developed by the Canadian Dam Safety Association to categorize the consequence of a dam failure in terms of loss of life, environmental and culture, and infrastructure and economic losses. Five consequence categories were used by CDA, including Low, Significant, High, Very High, and Extreme.

The dike/berm will be designed in accordance with the recommendations provided in the CDA Dam Safety Guidelines (CDA 2013 and 2014). Table 10 provides consequence classification criteria as well as suggested design flood and earthquake levels as a function of dam consequence classification based on 2013 CDA Dam Safety Review Guidelines.

### Table 10: CDA 2013 Consequence Classification Criteria and Earthquake Design Ground Motion and Inflow Design Flood

| Dam Classification | Population at Risk (Note 1) | Incremental Losses | | | Annual Exceedance Probability (AEP) Level | |
|---|---|---|---|---|---|---|
| | | Loss of Life (Note2) | Environmental and Cultural Losses | Infrastructure and Economics Losses | Inflow Design Flood (IDF) | Earthquake Design Ground Motion (EDGM) |
| Low | None | 0 | Minimal short-term loss No long-term loss | Low economic losses; area contains limited infrastructure or services | 1/100 | 1/100 |
| Significant | Temporary only | Unspecified | No significant loss or deterioration of fish or wildlife habitat<br>Loss of marginal habitat only<br>Restoration or compensation in kind highly possible | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes | Between 1/100 and 1/1,000 | Between 1/100 and 1/1,000 |
| High | Permanent | 10 or fewer | Significant loss or deterioration of important fish or wildlife habitat<br>Restoration or compensation in kind highly possible | High economic losses affecting infrastructure, public transportation, and commercial facilities | 1/3 between 1/1,000 and PMF | 1/2,475 |
| Very high | Permanent | 100 or fewer | Significant loss or deterioration of critical fish or wildlife habitat<br>Restoration or compensation in kind possible but impractical | Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances) | 2/3 between 1/1,000 and PMF | ½ between 1/2,475 and 1/10,000 or MCE |
| Extreme | Permanent | More than 100 | Major loss of critical fish or wildlife habitat<br>Restoration or compensation in kind impossible | Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances) | PMF | 1/10,000 or MCE |

Acronyms: PMF, probable maximum flood; AEP, annual exceedance probability; MCE, maximum credible earthquake; IDF, inflow design flood; EDGM, earthquake design ground motion.

**Note 1** Definitions for population at risk:

None-There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary-People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent-The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

**Note 2** Implications for loss of life:

Unspecified-The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

### 4.1.3 Selected Classification, Inflow Design Flood, and Design Earthquake

#### 4.1.3.1 Dam Classification

The consequence of a failure of the proposed water retention dikes for the Meliadine Extension was assessed and classified in accordance with the Dam Safety Guidelines (CDA 2013). Accordingly, the assigned classification for each dam/dike is summarized in Table 11 below. The details on the classification are presented in Appendix A.

**Table 11: Dike CDA Classification**

| Dike | CDA Classification | Notes |
|---|---|---|
| D-SP6North | High | Saline Pond |
| D-SP6West | High | |
| D-B5North | High | WN01 open pit downstream |
| D-B5South | High | |
| D-CP8South | Significant | Located in the narrow between CP8 and Lake B45 |
| D-CP8West | Significant | Located in the narrow between CP8 and Lake B3 |
| D-CP8North | High | WN01 open pit downstream |
| D-CP8East | High | PUM01 open pit downstream |
| D-A6 | High | FZO01 open pit downstream |
| D-A8South | High | PUM02 and PUM04 open pit downstream |
| D-A8North | High | WES03 open pit downstream |

#### 4.1.3.2 Inflow Flood Design

Extreme wet year spring freshet from snowmelt or high-intensity short-term rainfall events are normally critical to the design of a dike/berm. The resulting water level rise in the pond from a short-term flood event tends to be greater than that under a longer precipitation event. The longer event allows additional time for design event water to be pumped to another facility or to a water treatment plant for discharge. Runoff coefficient of 1.0 was adopted to estimate the runoff volume during an inflow flood design event.

**Inflow Flood Design for the "Significant" Consequence Classification Structures**

The IDF for a given classification is suggested in CDA (2013). Based on a classification of "Significant", the annual exceedance probability (AEP) of between 1/100 and 1/1,000 is recommended in CDA (2013). For the CPs which store water year-round (e.g., CP8) and the CPs which temporarily store the freshet water (e.g., CP7 and CPD2), with the associated dikes/berms are classified as "Significant", the following four cases were evaluated and the case resulting in the highest water level in the storage was adopted for IDF.

- Spring freshet for a 1 in 100 return wet year without pumping;
- Spring freshet for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme Spring rainfall event without pumping;
- Maximum monthly total rainfall for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme Summer-Autumn rainfall event without pumping; and
- Maximum monthly total rainfall for a 1 in 100 return wet year without pumping.

Table 12 summarizes the IDF values for the dike/berms classified as “Significant” with the CPs storing water year-round and temporarily storing freshet.

### Table 12: Inflow Design Flood Cases Considered for Water Retention Structures with a “Significant” Consequence Classification with Ponded Water Year-Round and Temporarily Freshet Storage

| Dike/Berm | Cases of IDF Considered | Value for IDF (mm) |
|---|---|---|
| D-CP8South<br>D-CP8West | Equivalent unit area runoff during spring freshet (in June) for a 1 in100 return wet year without pumping | 198 |
| | Equivalent unit area runoff during spring freshet (in June) for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme rainfall without pumping | 174 |
| | Maximum monthly total rainfall (in August) for a mean (1 in 2 return) year plus a 1 in 1,000 return 24-hour extreme rainfall without pumping | 133 |
| | Maximum monthly total rainfall (in August) for a 1 in 100 return wet year without pumping | 105 |

**Inflow Design Flood for the “High” Consequence Classification Structures**

For the dike classified as “High” as per CDA (2013), the recommended IDF design value is 1/3 between 1 in 1,000 return and PMF. In this study, for the collection ponds which store water year-round such as SP6, with the dike that is classified as “High”, the following four cases were considered and the case resulting in the highest water level in the collection pond was adopted for IDF:

- Spring freshet for a 1 in 1,000 return wet year without pumping;
- Spring freshet for a mean (1 in 2 return) year plus a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Spring rainfall event without pumping;
- Maximum monthly total rainfall for a mean (1 in 2 return) year plus a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Summer-Autumn rainfall event without pumping; and
- Maximum monthly total rainfall for a 1 in 1,000 return wet year without pumping.

Table 13 summarizes the IDF values for the dike classified as “High” for the collection ponds storing water year-round.

### Table 13: Inflow Design Flood Cases Considered for Water Retention Structures with a "High" Consequence Classification with Ponded Water Year-Round

| Dike | Cases of IDF Considered | Value for IDF (mm) |
|---|---|---|
| D-SP6North<br>D-SP6West<br>D-CP8North<br>D-CP8East | Equivalent unit area runoff during spring freshet (in June) for a 1 in 1,000 return wet year without pumping | 241 |
| | Equivalent unit area runoff during spring freshet (in June) for a 1 in 2 return year a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Spring rainfall event without pumping | 218 |
| | Maximum monthly total rainfall (in August) for a mean (1 in 2 return) year plus a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Summer-Autumn rainfall event without pumping | 197 |
| | Maximum monthly total rainfall (in August) for a 1 in 1,000 return wet year without pumping | 123 |

For the CPs which will be operated generally in "dry" condition (temporarily store the freshet water) and may store water in the summer (e.g., A8, A6, B5North, and B5South) with the associated dikes/berms are classified as "High", the following three cases were considered and the case resulting in the highest water level in the storage was adopted for IDF.

- For dry condition before freshet, spring freshet for a 1 in 1,000 return wet year without pumping;
- For dry condition before freshet, spring freshet for a 1 in 2 return wet year plus a 1/3 between 1 in 1,000 and PMF 24-hour extreme Spring rainfall event without pumping; and
- For wet condition (with ponding water in the summer), 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping.

Table 14 summarizes the IDF values for the dike/berm classified as "High" with the CPs in "dry" condition before freshet and ponding water in the summer with a strictly managed water elevation strategy.

### Table 14: Inflow Design Flood Cases Considered for Water Retention Structures with a "High" Consequence Classification with the Pond in "Dry" Condition before Freshet and Ponding Water in Summer

| Dike | Cases of IDF Considered | Value for IDF (mm) |
|---|---|---|
| D-B5North<br>D-B5South<br>D-A6<br>D-A8South<br>D-A8North | For dry condition before freshet, equivalent unit area runoff during spring freshet (in June) for a 1 in1,000 return wet year without pumping | 241 |
| | For dry condition before freshet, equivalent unit area runoff during spring freshet (in June) for a 1 in 2 return year a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Spring rainfall event with assumed pumping rate | 218 |
| | For wet condition (ponding water in the summer with a strictly managed water elevation strategy), equivalent unit area runoff during a 1/3 between 1 in 1,000 return and PMF 24-hour extreme Summer-Autumn rainfall event without pumping | 137 |

#### 4.1.3.3 Design Earthquake

As per CDA (2013), the AEP for the design earthquake is 1 in 2,475 year return was suggested for a structure with a “High” classification. The Meliadine Gold Mine site is located in a low seismic zone and the seismic loading is not a controlling factor, an AEP value of 1/2,475 will be adopted for seismic loading in stability evaluations for all the water management infrastructure, which will be on the conservative side for the structure classified as “Significant”. The estimated Peak Ground Acceleration (PGA) is 0.0498 g for a 1 in 2,475 year return for the site area (Class C) based on the 2020 National Building Code of Canada.

#### 4.1.3.4 Summary of Water Retention Structure Classification, Selected Inflow Design Flood, and Design Earthquake Event

On the basis of the above classifications Table 15 summarizes the selected water retention structure classification, IDF, and design earthquake for each water management infrastructure. The IDF value was selected based on the cases evaluated with the highest water level in the storage under different conditions.

**Table 15: Water Retention Structure Classification, Design Inflow Design Flood, and Design Earthquake**

| Dike/Berm | CDA Classification | Recommended IDF Criteria | Selected IDF Criteria and Value | Selected Design Earthquake |
|---|---|---|---|---|
| D-SP6North | High | 1/3 Between 1/1,000 and PMF | Equivalent unit area runoff during spring freshet (in June) for a 1 in 1,000 return wet year without pumping **(241 mm)** | 1/2,475 (0.0498 g) |
| D-SP6West | High | | | |
| D-B5North | High | 1/3 Between 1/1,000 and PMF | 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping **(137 mm)** | |
| D-B5South | High | 1/3 Between 1/1,000 and PMF | Equivalent unit area runoff during spring freshet (in June) for a 1 in 1,000 return wet year without pumping **(241 mm)** | |
| D-CP8South | Significant | Between 1/100 and 1/1,000 | Equivalent unit area runoff during spring freshet (in June) for a 1 in1,000 return wet year without pumping **(241 mm)** [(a)] | |
| D-CP8West | Significant | | | |
| D-CP8North | High | 1/3 Between 1/1,000 and PMF | Equivalent unit area runoff during spring freshet (in June) for a 1 in1,000 return wet year without pumping **(241 mm)** | |
| D-CP8East | High | | | |
| D-A6 | High | 1/3 Between 1/1,000 and PMF | 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping **(137 mm)** | |
| D-A8South | High | 1/3 Between 1/1,000 and PMF | 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping **(137 mm)** | |
| D-A8North | High | 1/3 Between 1/1,000 and PMF | 1/3 between 1 in 1,000 and PMF 24-hour extreme Summer-Autumn rainfall event without pumping **(137 mm)** | |

**[(a)] The selected IDF is governed by D-CP8North and D-CP8East classification.**

### 4.1.4 Maximum Operating Water Level, Design Freeboard, and Crest Elevation

#### 4.1.4.1 Design Maximum Operating Water Level and Water Level under Inflow Design Flood

The design maximum operating water level (MOWL) is based on the following;

- Operation constraints:
  - Storage capacity;
  - Water elevation and its potential to flood the toe of adjacent WRSFs and TSF; and
  - Pumping capacity.
- Catchment areas and water balance model inputs/outputs from Lorax;
- Water elevations for each storage facility developed by Lorax;
- Local ground conditions;
- The benefits of having a higher infrastructure to increase local storage;
- The impacts of the water management strategy both upstream and downstream of the water storage facility; and
- Operational period.

Table 16 summarizes the proposed design MOWL's and predicted water levels under the selected IDF against the dikes and berms for each water storage area. As a comparison, the original lake water level and the corresponding volume of water in the lake are also presented in Table 16.

**Table 16: Proposed Design Maximum Operating Water Level and Water Level Under Inflow Design Flood**

| Dike/Berm | CDA Dam Class | Corresponding Area | Original Lake Water Level (m) | Water Volume at Original Lake Level ($m^3$) | Design MOWL[(a)] (m) | Volume of Water at Design MOWL ($m^3$) | Water Level under the Selected IDF (m) | Volume of Water under IDF ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| D-SP6North | High | SP6 | 62.72 | 843,558 | 63.10 | 1,092,784 | 63.80 | 1,621,261 |
| D-SP6West | High | | 62.72 | 843,558 | 63.10 | 1,092,784 | 63.80 | 1,621,261 |
| D-B5North | High | B5 | 58.25 | 380,537 | 57.96 | 307,350 | 58.39 | 417,732 |
| D-B5South | High | | 58.25 | 82,053 | 57.30 | 30,000 | 58.72 | 134,598 |
| D-CP8South | Significant | CP8 | 56.55 | 743,716 | 58.17 | 2,366,729 | 58.60 | 2,843,673 |
| D-CP8West | Significant | | 56.55 | 743,716 | 58.17 | 2,366,729 | 58.60 | 2,843,673 |
| D-CP8North | High | | 56.55 | 743,716 | 58.17 | 2,366,729 | 58.60 | 2,843,673 |
| D-CP8East | High | | 56.55 | 743,716 | 58.17 | 2,366,729 | 58.60 | 2,843,673 |

### Table 16: Proposed Design Maximum Operating Water Level and Water Level Under Inflow Design Flood

| Dike/Berm | CDA Dam Class | Corresponding Area | Original Lake Water Level (m) | Water Volume at Original Lake Level ($m^3$) | Design MOWL[(a)] (m) | Volume of Water at Design MOWL ($m^3$) | Water Level under the Selected IDF (m) | Volume of Water under IDF ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| D-A6 | High | A6 | 59.59 | 780,951 | 59.5 | 737,359 | 60.19 | 1,120,458 |
| D-A8South | High | A8 West | 62.16 | 1,188,000 | 60.45 | 226,679 | 60.84 | 382,235 |
| D-A8North | High | | 62.16 | 1,188,000 | 60.45 | 157,769 | 60.75 | 226,920 |

**[(a)] The MOWLs highlighted in light blue are estimated by Tetra Tech for maximum water storage contingency. The MOWLs highlighted in light green are provided by Lorax based on Meliadine Extension EOM water balance modelling.**

#### 4.1.4.2 Minimum Freeboard and Crest Elevation

As per CDA (2013), ***minimum freeboard*** is defined as *"the difference in elevation between the lowest elevation of the top of the dam and the maximum still pool reservoir level that would result should the IDF occur".* No specified minimum freeboard requirements are described in the Meliadine Type A (2AM-MEL1631) Water Licence.

CDA (2013) states that "*the minimum freeboard should be such that no overtopping by 95% of the waves caused by the most critical wind when the reservoir is at its maximum extreme level during the passage of the IDF".*

The most critical wind depends on the consequence class of the dam. CDA (2013) suggests the following AEP values of wind frequency used for the calculation of the minimum freeboard are as follows:

| | |
|---|---|
| *Low consequence dam* | *AEP=1/100* |
| *Significant consequence dam* | *AEP=1/10* |
| *High, very high, or extreme consequence dam* | *AEP=1/2* |

In this study, the top elevation of the water containment element (e.g., geomembrane liner or low permeability till core) has been selected to have a minimum freeboard that meets or exceeds that required by CDA (2013). Accordingly, the top elevation of the dike water containment element will be designed to be higher than the MOWL during the IDF plus wind set-up plus settlement due to consolidation of foundation and embankment materials after construction. The top elevation of the dike crest will be designed to be higher than the MOWL during the IDF plus wind set-up plus wave run-up plus settlement due to consolidation of foundation and embankment materials after dike construction. These design criteria meet the requirements suggested in CDA (2013).

Dikes required for the Meliadine Extension are classified as "Significant" or "High" based on CDA (2013). An AEP of 1/10 return period was considered for the calculation of wind set-up and wave run-up to determine the crest elevation of the dikes. The assessment of the wind set-up and wave run-up was conducted based on the methodology and equations provided in U.S. Bureau of Reclamation, Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams (USBR 1992), and US Army Corps of Engineers – Costal Engineering Manual (USACE 2008).

Table 17 presents the minimum freeboards and the proposed elevations for water retention structures based on the design MOWL. Table 18 summarizes the proposed design crest elevation required to prevent overtopping from wave run-up and wind setup during the IDF.

## Table 17: Minimum Freeboards and Proposed Design Top Elevations of Water Retention Elements

| Berm/Dike | CDA Dam Class | Design MOWL (m) | Estimated MOWL under IDF (m) | Minimum Freeboard for Water Retention Element as per CDA (2013) [(a)] (m) | Design Minimum Freeboard for Water Retention Element (m) | Minimum Required Top Elevation of Water Retention Element as per CDA (2013) (m) | Design Top Elevation of Water Retention Element (m) |
|---|---|---|---|---|---|---|---|
| D-SP6North | High | 63.1 | 63.80 | 0.24 | 0.40 | 64.04 | 64.2 |
| D-SP6West | High | 63.1 | 63.80 | 0.11 | 0.40 | 63.92 | 64.2 |
| D-B5North | High | 57.96 | 58.39 | 0.26 | 0.81 | 58.65 | 59.2 |
| D-B5South | High | 57.30 | 58.72 | 0.12 | 0.58 | 58.84 | 59.3 |
| D-CP8South | Significant | 58.17 | 58.60 | 0.22 | 0.80 | 58.82 | 59.4 |
| D-CP8West | Significant | 58.17 | 58.60 | 0.15 | 0.80 | 58.75 | 59.4 |
| D-CP8North | High | 58.17 | 58.60 | 0.15 | 0.80 | 58.75 | 59.4 |
| D-CP8East | High | 58.17 | 58.60 | 0.18 | 0.80 | 58.78 | 59.4 |
| D-A6 | High | 59.5 | 60.19 | 0.16 | 0.81 | 60.35 | 61.0 |
| D-A8South | High | 60.45 | 60.84 | 0.16 | 0.66 | 61.0 | 61.5 |
| D-A8North | High | 60.45 | 60.75 | 0.17 | 0.75 | 60.92 | 61.5 |

**[(a)] Minimum freeboard for water retention elevation = wind set-up plus potential settlement after construction.**

## Table 18: Minimum Freeboards and Proposed Design Dike Crest Elevations

| Berm/Dike | CDA Dam Class | Design MOWL (m) | Estimated MOWL under IDF (m) | Minimum Freeboard for Dike Crest as per CDA (2013) [(b)] (m) | Design Minimum Freeboard for Dike Crest (m) | Minimum Required Dike Crest Elevation as per CDA (2013) (m) | Design Dike Crest Elevation (m) |
|---|---|---|---|---|---|---|---|
| D-SP6North | High | 63.10 | 63.80 | 1.59 | 1.70 | 65.39 | 65.5 |
| D-SP6West | High | 63.10 | 63.80 | 0.49 | 1.70 | 64.30 | 65.5 |
| D-B5North | High | 57.96 | 58.39 | 1.17 | 1.81 | 59.56 | 60.2 |
| D-B5South | High | 57.30 | 58.72 | 0.53 | 1.58 | 59.25 | 60.3 |
| D-CP8South | Significant | 58.17 | 58.60 | 1.33 | 1.80 | 59.93 | 60.4 |
| D-CP8West | Significant | 58.17 | 58.60 | 0.92 | 1.80 | 59.52 | 60.4 |
| D-CP8North | High | 58.17 | 58.60 | 0.92 | 1.80 | 59.52 | 60.4 |
| D-CP8EAST | High | 58.17 | 58.60 | 1.14 | 1.80 | 59.74 | 60.4 |
| D-A6 | High | 59.5 | 60.19 | 0.86 | 1.81 | 61.05 | 62.0 |
| D-A8South | High | 60.45 | 60.84 | 0.87 | 1.66 | 61.71 | 62.5 |
| D-A8North | High | 60.45 | 60.75 | 0.87 | 1.75 | 61.62 | 62.5 |

**[(b)] Minimum freeboard for dike crest = wind set-up plus wave run-up plus potential settlement after construction.**

### 4.1.5 Stability, Seepage, Filtration, and Thermal Analyses

The prefeasibility level design will be undertaken based on knowledge and past experiences from the detailed designs for other water management infrastructure at Meliadine site. More detailed engineering analysis including stability, seepage, and thermal assessments will be undertaken during the subsequent design phases of the project.

### 4.1.6 Foundation Conditions

Agnico Eagle undertook a geotechnical drilling program that was logged by Tetra Tech during the period April 12, 2021 to April 26, 2021. A total of 20 vertical holes were drilled at the proposed locations for the dikes/berms that will be required for the Meliadine Extension water management. Nine multi-bead ground temperature cables were installed during the site investigation. Sixty-one representative soil and bedrock samples were collected during the site investigation. Twenty-two samples were tested for excess ice content on site and the remaining 39 samples were shipped to Tetra Tech's Edmonton laboratory for testing including moisture content, particle size distribution, direct shear, and constant head hydraulic permeability tests. The Spring 2021 Geotechnical Site Investigation Data Report was submitted to Agnico Eagle for use on September 22, 2021, entitled "Spring 2021 Geotechnical Site Investigation, Meliadine Gold Project, NU" (Tetra Tech 2021b).

A total of 59 destructive holes were drilled by Kivalliq Contractors Group Ltd. (KCG) in January and March 2021 on site to obtain the bedrock depth within the footprints of the proposed CPs, sumps, and channels. Moisture contents of the collected samples from the destructive drilling were tested at various depths by Agnico Eagle and provided to Tetra Tech.

Tetra Tech will refer to the findings from the Spring 2021 drilling program and past drilling programs to understand the foundation stratigraphy within the footprint of the water management infrastructure for the Meliadine Extension. The collected ground temperature data from the new installed GTCs during the 2021 Spring drilling program and other GTCs installed during the past investigations will be referred to evaluate the thermal condition around the dikes/berms. Figure 3 presents the plan view of the borehole locations drilled during the 2021 Spring drilling program and previous drilling programs.

## 4.2 Channels

Channels will be constructed to divert the natural run-off and contact water originating from the embankments of WRSFs, saline WRSFs, ore stockpiles, and laydown areas where the natural topography would otherwise drain towards the existing water bodies. The channels will divert the contact water towards collection ponds and sumps that will be subsequently pumped to the main collection areas.

### 4.2.1 Channel and Diversion Berm

The channels and diversion berms will be designed to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 5 mm. This design criterion is the same as adopted for the detailed design for the channels and diversion berms (e.g., Berm1 and Berm2, Channel2 to Channel4) currently in operation at the Meliadine Gold Mine site. Depending on the actual ground topography, a berm may be required along the edge of the channels to provide sufficient freeboard and to prevent the water overflowing the channels under the design IDF.

The side slope of the channel will be generally between 2.5 Horizontal (H):1Vertical (V) and 3H:1V depending on the actual ground condition. A layer of geotextile and 0.3 m thick layer of riprap will be placed as erosion protection. Riprap will be designed to achieve D50 size specifications and gradation to protect the channel based on the calculated design flow rate. Table 19 summaries the channels proposed for Meliadine Extension.

### Table 19: Channel Function and Design Intent for the Meliadine Extension

| Channel | Function | Receiving CPs | Design Basis |
|---|---|---|---|
| Channels 11, 12, and 13 | Divert contact water from the WRSF6 away from Lake B46 and Lake B45. | Sump P1, Sump P2, Sump P5 | 5 minute 1 in 100 return rainfall of 5 mm (as per Table 8) |
| Channels 14 and 15 | Divert contact water from the WRSF7. | Sump F1 | |
| Channel 16 | Divert contact water from the WRSF7, Ore Pad, and Saline WRSF2 at F Zone into Sump F2. | Sump F2 | |
| Channels 17 and 18 | Divert contact water from the Ore Pad 6, Saline WRSF3, and Laydown away from the downstream receiving environment. | SPD1 | |
| Channel 19 | Divert contact water from the WRSF9 away from the downstream receiving environment. | CPD1 | |
| Channels 20 and 21 | Divert contact water from the WRSF10 away from the downstream receiving environment. | CPD2 | |
| Channel 22 | Divert contact water from the WRSF5 away from the dewatered Lake A8. | CP9 or PUM01 open pit | |

## 4.3 Collection Ponds and Sumps

CPs and sumps will be used to collect and store contact water and natural run-off originating from WRSFs, saline WRSFs, ore stockpiles, laydown areas, and discharge from associated channels. Water collected in the CPs or sumps will be either pumped to CP8, CP1, or SP6 depending on the water type.

### 4.3.1 Collection Ponds and Sumps Design Basis

For the CPs or sumps to be formed by excavation with or without a thermal protection berm downstream (e.g., CP7, CPD1, CPD2, sumps at Pump and F Zone), a failure of the structure will have low economic loss, no or low risk of loss of life, and minimal environmental and cultural impacts. The 1 in 100 wet year spring snow water equivalent (198 mm) will be adopted for the IDF for the CPs and associated thermal berm design. These CPs and sumps will be designed to store 3/7 of the 1 in 100 wet year freshet volume as presented below:

- Spring freshet will occur over seven days;
- The first three days of freshet water will be stored in the CPs or sumps;
- Pumping will commence on the fourth day at a pumping rate that is equal or greater than the inflow rate;
- The water level in each CP or sump will be drawdown to the specified level after freshet to keep sufficient storage capacity in case of an extreme rainfall event occurring during the summer; and
- It is assumed that CPs and sumps will be empty by the end of fall (September) or have enough capacity to temporarily store at least 3/7 of water from the spring freshet the following year.

The minimum required storage capacity at the MOWL along with the assumptions for the sizing for the CPs and sumps required for the Meliadine Extension are summarized in Table 20.

**Table 20: Collection Ponds and Sumps Maximum Design Capacity**

| CP/Sump | Function | Maximum Storage Capacity at MOWL ($m^3$) | Notes |
|---|---|---|---|
| CP9 | Collect contact water from WRSF5 and WRSF6. | 100,000 | To store three days 1 in 100 wet year freshet runoff with assumed pumping rate during freshet. |
| CP7 | Collect contact water from WRSF7 and pit water. | 140,000 | |
| CPD1 | Collect natural runoff water and contact water from WRSF9 at Discovery and pit water. | 33,000 | |
| CPD2 | Collect natural runoff water and contact water from WRSF10 at Discovery. | 22,000 | |
| Sump P1 | Collect contact water from WRSF6. | 7,000 | To store three days 1 in 100 wet year freshet runoff with assumed pumping rate during freshet. |
| Sump P2 | Collect contact water from WRSF6. | 7,000 | |
| Sump P3 | Collect contact water from Saline WRSF1 at Pump. | 3,000 | |
| Sump P4 | Collect contact water from Saline WRSF1 at Pump and groundwater from Pump underground mining. | 50,000 | Provided by Lorax based on preliminary water balance results. |
| Sump P5 | Collect contact water from WRSF6 diverted by Channel 13. | 44,000 | To store three days 1 in 100 wet year freshet runoff with assumed pumping rate during freshet. |
| Sump F1 | Collect contact water from WRSF7. | 15,000 | |
| Sump F2 | Collect contact water from Saline WRSF2 and Ore Pile at F Zone and groundwater from F Zone underground mining. | 40,000 | Provided by Lorax based on preliminary water balance results. |

## 4.4 Saline Ponds

### 4.4.1 Saline Pond at Discovery

It is understood that saline water from Discovery underground mining will be stored in SPD1 during winter and then pumped to TIR02 open pit or SP6 saline pond depending on the operational year. The SPD1 will also receive contact water from the Saline WRSF3 at Discovery, ore stockpile, and the industrial pad, and the surface contact water pumped from CPD1 and CPD2. The maximum underground water inflow rate was estimated to be 200 $m^3$/day for Discovery underground mine. The SPD1 will be designed based on the maximum water storage volume required (60,000 $m^3$) provided by Lorax (Lorax 2022) plus the runoff water from the Saline WRSF3, ore stockpile, and industrial pad during freshet under 1 in 100 wet precipitation year.

### 4.4.2 Saline Pond at Tiriganiaq-Wolf

Similar to the SPD1, the SP5 will be used to store the groundwater inflow from Tiriganiaq-Wolf underground mining and collect additional contact water from the Saline WRSF4 at Tiriganiaq-Wolf, ore stockpile, and the industrial pad. The saline water collected at SP5 will be pumped to SP6 through June to September each year. The maximum underground water inflow rate was estimated to be 150 $m^3$/day for Tiriganiaq-Wolf underground mine. The SP5 will be designed based on the maximum water storage volume required (90,000 $m^3$) provided by Lorax (Lorax 2022) plus the runoff water from the Saline WRSF4, ore stockpile, and industrial pad during freshet under 1 in 100 wet precipitation year.

## 4.5 Culverts

Culvert locations will be identified on the expansion layout to allow adequate water conveyance through haul roads and access roads throughout the site. The design for culverts is beyond the current scope of work undertaken by Tetra Tech.

# 5.0 TAILINGS STORAGE FACILITY

Tailings for the Meliadine Extension project will be in the form of pressure filtered stack tailings with a solids content of approximately 85% by weight. The pressure filtered tailings will have the consistency of damp, sandy silt and will be transported by haul truck to the proposed TSF for placement and storage or to the paste plant for use underground as backfill.

Under the current mine plan for the Meliadine Extension project, about 65 Mt of tailings will be produced during the 24 years of the mine life. Approximately 51.6 Mt or 79% of the tailings will be deposited within the TSF and the remaining 13.4 Mt or 21% will be used as underground cemented paste backfill.

Approximately 8.3 Mt of waste rock and 0.2 Mt of overburden will be placed at the TSF as progressive cover material.

## 5.1 TSF Key Design Parameters

Table 21 summarizes some of the key physical parameters used for the design of the TSF. The TSF will be constructed using a cell by cell approach to limit the active deposition area such that dust generation, and surface erosion can be effectively managed and progressive reclamation and closure of the TSF can be conducted during the operation phase. The current cover system for the TSF includes a layer of waste rock on the slopes and a layered combination of waste rock and overburden on the crest.

**Table 21: Design Parameters for the Tailings Storage Facility**

| Parameters | Value |
|---|---|
| Meliadine Extension Maximum TSF crest elevation | 129 masl |
| Reference ground elevation | 65 masl |
| Average height of TSF over original ground surface | 62 m |
| Side slope for lower placed tailings (or below elevation 100 m) | 4H:1V |
| Side slope for upper placed tailings (or above elevation 100 m) | 3H:1V |
| Slope of the final tailings surface at crest | 4% |
| Waste rock (NAG) cover system thickness on slopes | 3.7 m to 4.2 m |
| Waste rock (NAG) cover system thickness on plateau | 2.5 m |
| Overburden cover system thickness on plateau | 0.5 m |
| Assumed moisture content of tailings to TSF | 17.6% (by mass) |
| Assumed tailings solid content to TSF | 85% w/w (by weight) |
| Minimum target dry density of compacted tailings | 1.65 t/$m^3$ |
| Assumed waste rock in place bulk density | 1.88 t/$m^3$ |
| Assumed overburden in place bulk density | 1.62 t/$m^3$ |
| Total footprint of the TSF | 1,071,842 ($m^2$) |

## 5.2 Engineering Analysis and Design Criteria

### 5.2.1 Slope Stability Analysis and Design Criteria

Limit equilibrium analyses will be conducted using SLOPE/W from GeoStudio International Ltd to determine the factor of safety against slope failure in short term during construction and long term after the closure of the TSF. A design factor of safety (FoS) will be used to account for the uncertainty and variability in the strength and pore water pressure parameters, and to limit deformations. In addition, earthquake loading will be modeled using pseudo-static peak horizontal ground acceleration.

The British Columbia Mine Waste Rock Pile Research Committee publication - Mined Rock and Overburden Piles, Investigation and Design Manual, Interim Guidelines, May 1991 provides accepted minimum stability factors of safety for various conditions based on the importance of the structure, potential failure consequences, uncertainties involved in design loads, and soil parameters, especially shear strength parameters (PAE 1991). The additional cost associated with a higher factor of safety, and the risk that the owner of the structure is willing to take are presented in Table 22.

**Table 22: Suggested Minimum Design Values for Factor of Safety (PAE 1991)**

| Stability Condition | Suggested Minimum Design Values for Factor of Safety[(1)] | |
|---|---|---|
| | **Case A** | **Case B** |
| Stability of Dump Surface (Shallow Seated Stability) | | |
| ▪ Short Term (During Construction) | 1.0 | 1.0 |
| ▪ Long Term (Reclamation – Abandonment) | 1.2 | 1.1 |
| Overall Stability (Deep Seated Stability) | | |
| ▪ Short Term (Static) | 1.3 - 1.5 | 1.1 - 1.3 |
| ▪ Long Term (Static) | 1.5 | 1.3 |
| ▪ Pseudo-Static (Earthquake)[2] | 1.1 - 1.3 | 1.0 |
| Case A:<br>▪ Low level of confidence in critical analysis parameters<br>▪ Possibly unconservative interpretation of conditions, assumptions<br>▪ Severe consequences of failure<br>▪ Simplified stability analysis method (charts, simplified method of slices)<br>▪ Stability analysis method poorly simulates physical conditions<br>▪ Poor understanding of potential failure mechanism(s) | | |
| Case B:<br>▪ High level of confidence in critical analysis parameters<br>▪ Conservative interpretation of conditions, assumptions<br>▪ Minimal consequences of failure<br>▪ Rigorous stability analysis method<br>▪ Stability analysis method simulates physical conditions well<br>▪ High level of confidence in critical failure mechanism(s) | | |

1. A range of suggested minimum design values are given to reflect different levels of confidence in understanding site conditions, material properties, consequences of instability, and other factors.
2. Where pseudo-static analyses, based on peak ground accelerations which have a 10% probability of exceedance in 50 years, yield a FoS < 1.0, dynamic analyses of stress-strain response, and comparison of results with stress-strain characteristics of dump material is recommended.

Generally, the selection of a design factor of safety for an earth structure depends on the importance of the structure, potential failure consequences, and uncertainties involved in design loads and soil parameters. Considering these subjects, the minimum design factors of safety for the TSF stability analyses to be adopted which are representative of Case A (more conservative factor of safety) are presented in Table 23.

### Table 23: Design Factors of Safety for TSF Stability

| Slip Surface | Loading Condition | Design Factor of Safety |
|---|---|---|
| Surface or Potential Shallow | Short-term, during construction | 1.0 |
| | Long-term static loading | 1.2 |
| Potential Deep Seated | Short-term, during construction | 1.3 |
| | Long-term static loading | 1.5 |
| | Long–term seismic (pseudo-static) loading | 1.1 |

The Meliadine Gold Mine site is situated in an area of low seismic risk. The estimated PGA is 0.0498 g for a 1 in 2,475 year return for the site area (Class C) based on the 2020 National Building Code of Canada (http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/calc-en.php). and will be adopted in the TSF stability analyses.

### 5.2.2 Material Properties

The material properties to be adopted for the stacked tailings and foundation materials in the stability analyses are presented in Table 24. Laboratory direct shear tests on the tailings (Tetra Tech EBA 2014) indicated that the tailings had an inferred peak internal angle of friction of 33.5° for the tailings sample with a dry density of 1,708 kg/m$^3$. In consideration of the large-strain shear stress softening behaviour observed in the direct shear tests and possible lower dry density in the field conditions, a relative conservative internal angle of friction of 30° was adopted for the dry stack tailings. A laboratory consolidated-undrained triaxial test on a silty sand overburden sample was conducted (EBA 2014). The test indicated the soil had an inferred peak internal angle of friction of 36°. In the stability analyses for the TSF, most of the input parameters for the overburden soils and closure cover fills were assumed based on experience and engineering judgement. These parameters are relatively conservative and reasonable for this study. The long-term cohesion of the frozen ice rich silt depends on its temperatures – the colder the soil, the higher its long-term cohesion. The material properties for the frozen ice-rich silt was estimated based on the estimated ground temperatures from the long-term thermal performance modelling and correlations suggested by Weaver and Morgenstern (1981).

### Table 24: Material Parameters Used in TSF Stability Analyses

| Material | Thickness (m) | Angle of Internal Friction (º) | Cohesion, c (kPa) | Bulk Unit Weight, (kN/m3) |
|---|---|---|---|---|
| Waste Rock Closure Cover | 2.5 (top); 3.7 to 4.2 (side slopes) | 42 | 0 | 19 |
| Overburden Till Fill for Closure Cover | 0.5 (top only) | 30 | 0 | 18 |
| Dry Stacked Tailings | Up to 65 | 30 | 0 | 19.4 |
| Sand and Silt | 1.5 | 31 | 0 | 20 |
| Unfrozen Ice rich Silt | 1 | 28 | 0 | 17 |
| Long-term Frozen Ice rich Silt (c=70 kPa) | | 0 | 70 | 17 |
| Long-term Frozen Ice rich Silt (c=160 kPa) | | 0 | 160 | 17 |
| Ice-poor Sand/Silt | 2.5 | 32 | 0 | 20 |

$\bar{B}$= 0.1 for sand and silt during construction period.
$\bar{B}$= 0.2 for unfrozen ice rich silt during construction period.
$\bar{B}$= 0 for long term after construction.

An assumed piezometric line, together with a pore pressure coefficient ( $\bar{B}$) will be used in the analyses to simulate potential pore water conditions. A $\bar{B}$ will be applied in modeling the excess pore-pressure that can be potentially generated during construction under loading. The $\bar{B}$ is defined as a ratio of the excess pore-pressure generated in a given soil to the change in vertical stress in the soil due to fill placement above the original ground surface. For long-term static and seismic loading conditions, $\bar{B}$ will be set to zero.

# 6.0 WASTE ROCK STORAGE FACILITY

Approximately 191.6 Mt of waste rock and 34.6 Mt of overburden will be produced from the mine operations under the current mine plan for the Meliadine Extension project. Of the total 191.6 Mt of waste rock, about 167.9 Mt will be placed and stored within the designated WRSFs (WRF1, WRSF3, WRSF5, WRSF6, WRSF7, WRSF8, and WRSF9). The remaining waste rock will be used for other purposes, including about 11.9 Mt backfilled to the underground mine, about 2.4 Mt for construction activities (including thermal protection and aggregate production to support the open pits, and 8.3 Mt of waste rock TSF closure cover material. About 1.1 Mt of saline waste rock produced from underground mining will be temporary stored on surface during operation. The saline waste rock will be backfilled to the underground mine working during closure phase. About 0.2 Mt of overburden will be used for the TSF closure cover. The remaining overburden will be co-disposed with waste rock in the designated WRSF. The WRSF will be constructed with the material placed in controlled lifts. The overburden material from the mine operation will be placed in the center of the WRSF.

## 6.1 WRSF Key Design Parameters

Tables 25 and 26 summarize some of the key physical parameters that will be used for the design of the preliminary WRSFs for the Meliadine Extension project. Table 27 summarizes the estimated maximum height of each WRSF.

### Table 25: WRSF Key Design Parameters for WRSF1, WRSF3, and WRSF5

| Design Parameters | WRSF1 | WRSF3 | WRSF5 |
|---|---|---|---|
| Maximum height of each overburden and waste rock bench (m) | 5 | | |
| Side slope of each lift of waste rock | Angle of repose (approximately 1.3H:1V) | | |
| Typical width of the horizontal offset between adjacent waste rock lifts (m) | 16.5 | | |
| Average overall side slopes of the WRSF (from bottom toe of first lift to top crest of final lift) | 3H:1V | 3H:1V | 2.5H:1V [(a)] |
| Side slope for each lift of overburden | Angle of repose (approximately 1.8H:1V) | | |
| Typical width of horizontal offset between adjacent overburden lifts (m) | 21.0 | | |
| Internal overburden setback from toe of the WRSF for the first lift (m) | Minimum 40.0 | | |
| Maximum waste rock crest elevation above the sea level (masl) | 136 | 132 | 150 |
| Maximum overburden top elevation above the sea level (masl) | 100 | 82 | 95 |
| Storage Capacity Required ($Mm^3$) | 16.9 | 30.9 | 27.7 |
| Design Storage Capacity ($Mm^3$) | 16.9 | 31 | 27.9 |
| Assumed waste rock in place bulk density ($t/m^3$) | 1.88 | | |
| Assumed overburden in place bulk density ($t/m^3$) | 1.62 | | |

[(a)]: Assume that ice-rich overburden and till within the proposed footprint of WRSF5 will be fully excavated out for dike construction and improve the stability of the WRSF5.

### Table 26: WRSF Key Design Parameters for WRSF6, WRSF7, WRSF8, and WRSF9

| Design Parameters | WRSF6 | WRSF7 | WRSF8 | WRSF9 |
|---|---|---|---|---|
| Maximum height of each overburden and waste rock bench (m) | 5 | | | |
| Side slope of each lift of waste rock | Angle of repose (approximately 1.3H:1V) | | | |
| Typical width of the horizontal offset between adjacent waste rock lifts (m) | 16.5 | | | |
| Average overall side slopes of the WRSF (from bottom toe of first lift to top crest of final lift) | 3H:1V | | | |
| Side slope for each lift of overburden | Angle of repose (approximately 1.8H:1V) | | | |
| Typical width of horizontal offset between adjacent overburden lifts (m) | 21.0 | | | |
| Internal overburden setback from toe of the WRSF for the first lift (m) | Minimum 40.0 | | | |
| Maximum waste rock crest elevation above the sea level (masl) | 92 | 108 | 126 | 126 |
| Maximum overburden top elevation above the sea level (masl) | 87 | 105 | 90 | n/a |
| Storage Capacity Required ($Mm^3$) | 6.4 | 13 | 12.3 | 8.7 |
| Design Storage Capacity ($Mm^3$) | 6.7 | 13.6 | 12.5 | 9.2 |
| Assumed waste rock in place bulk density ($t/m^3$) | | 1.88 | | |
| Assumed overburden in place bulk density ($t/m^3$) | | 1.62 | | |

### Table 27 Estimated Maximum Height of the Waste Rock Storage Facility

| WRSF | Estimated Maximum Height [(a)], m |
|---|---|
| WRSF1 | 65 |
| WRSF3 | 65 |
| WRSF5 | 92 |
| WRSF6 | 40 |
| WRSF7 | 50 |
| WRSF8 | 61 |
| WRSF9 | 60 |

(a): maximum height is estimated to be the vertical distance between the lowest ground surface elevation within the footprint of the WRSF and the top crest elevation of the WRSF.

## 6.2 Slope Stability Analysis and Design Criteria

### 6.2.1 Methodology

Limit equilibrium analyses will be conducted to determine the factor of safety against slope failure during construction and in the long term after the construction of each WRSF. All analyses will be conducted using the two-dimensional, limit equilibrium software, Slope/W of GeoStudio 2021 (Geo-Slope International Ltd.). The Morgenstern-Price method with a half-sine interslice force assumption will be adopted in the analyses. The analyses will be conducted to evaluate the slope stability of each WRSF under long-term static and pseudo-static loading conditions post-construction. Potential post-construction seismic loading was modelled as pseudo-static with a design horizontal peak acceleration. A design factor of safety is used to account for the uncertainty and variability in the strength and pore water pressure parameters, and to limit deformations.

The same estimated PGA adopted for TSF design (0.0498 g for a 1 in 2,475 year return) will be used for the analysis under pseudo-static loading condition.

### 6.2.2 Stability Acceptance Criteria for Factors of Safety

The *Guidelines for Mine Waste Dump and Stockpile Design* (Hawley and Cunning 2017) provides guidelines for assigning stability criteria and factors of safety for various waste rock pile configurations and site conditions. The suggested stability acceptance criteria from Hawley and Cunning (2017) are based on the failure consequence and confidence level in foundation conditions, waste material properties, piezometric pressures, overall fill slope angles, height of repose angle slopes, and precipitation. The guidelines in Hawley and Cunning (2017) are considered an update to the previous (PAE 1991) interim design acceptability criteria, which did not specifically distinguish between factors such as the size of facility, consequence of failure, or confidence in foundation conditions. Therefore, the design acceptance criteria for the analyses in this study are based on the guidelines in Hawley and Cunning (2017).

The stability acceptance criteria suggested by Hawley and Cunning (2017) is presented in Table 28.

### Table 28: Suggested Stability Acceptance Criteria

| Consequence [1] | Confidence [2] | Minimum FoS for Static Analysis | Minimum FoS for Pseudo-Static Analysis |
|---|---|---|---|
| Low | Low | 1.3-1.4 | 1.05-1.1 |
| | Moderate | 1.2-1.3 | 1.0-1.05 |
| | High | 1.1-1.2 | 1.0 |
| Moderate | Low | 1.4-1.5 | 1.1-1.15 |
| | Moderate | 1.3-1.4 | 1.05-1.1 |
| | High | 1.2-1.3 | 1.0-1.05 |
| High | Low | >1.5 | 1.15 |
| | Moderate | 1.4-1.5 | 1.1-1.15 |
| | High | 1.3-1.4 | 1.05-1.1 |

1. Consequence of Failure:

   Low – waste dumps and stockpiles with overall fill slopes less than 25° and less than 100 m high and repose angle slopes less than 50 m high. No critical infrastructure or unrestricted access within potential runout shadow. Limited potential for environmental impact. Long-term (more than 5 years) exposure for sites subject to very low to low (less than 350 mm) annual precipitation; medium-term (1 to 5 years) exposure for sites subject to moderate (350 mm to 1,000 mm) annual precipitation; short-term (less than 1 year) exposure for sites subject to high (1,000 mm to 2,000 mm) annual precipitation; dry season construction/operation only for sites subject to very high (more than 2,000 mm) annual precipitation or intensive rainy season(s).

   Moderate – waste dumps with overall fill slopes less than 30° and less than 250 m high or repose angle slopes less than 100 m high. No critical infrastructure or unrestricted access, or robust containment/mitigative measures to protect critical infrastructure and access within potential runout shadow. Potential for moderate environmental impact, but manageable. Long-term (more than 5 years) exposure for sites subject to moderate (350 mm to 1,000 mm) annual precipitation; medium-term (1 to 5 years) exposure for sites subject to high (1,000 mm to 2,000 mm) annual precipitation; short-term (less than 1 year) exposure for sites subject to very high (more than 2,000 mm) annual precipitation or intensive rainy season(s).

   High – waste dumps with overall fill slopes more than 30° and more than 250 m high, or with repose angle slopes more than 200 m high. Critical infrastructure or unrestricted access within potential runout shadow with limited runout mitigation/containment measures. Potential for high environmental impact that would be difficult to manage. Long-term exposure (more than 5 years) for sites subject to high (1,000 mm to 2,000 mm) annual precipitation; medium-term (1 to 5 years) exposure for sites subject to very high (more than 2,000 mm) annual precipitation or intensive rainy season(s).

2. Confidence Level:

   Low – limited confidence in foundation conditions, waste material properties, piezometric pressures, analysis technique, or potential instability mechanism(s). Poorly defined or optimistic input parameters; high data variability. For proposed structures, investigations at the conceptual level with limited supporting data. For existing structures, poorly documented or unknown construction and operational history; lack of monitoring records; unknown or poor historical performance.

   Moderate – moderate confidence in foundation conditions, waste material properties, piezometric pressures, analysis technique, or potential failure mechanism(s). Input parameters adequately defined; moderate data variability. For proposed structures, investigations at the pre-feasibility study level with adequate supporting data. For existing structures, reasonably complete construction documentation and monitoring records; fair historical performance.

   High – high confidence in foundation conditions, waste material properties, piezometric pressures, analysis technique, and instability mechanism(s). Well-defined, conservative input parameters; low data variability. For proposed structures, investigations at the feasibility study level with comprehensive supporting data. For existing structures, well-documented construction and monitoring records and good historical performance."

The stability acceptance criteria for each WRSF design will be adopted to capture different slope slip mechanisms, failure consequence, and confidence levels in stability analysis input parameters, key assumptions, proximity to mining open pit, and site conditions. Table 29 summarizes the stability criteria adopted for the design of each WRSF. The key considerations to choose the stability design criteria for each WRSF are presented in Table 30.

### Table 29: Adopted Stability Criteria for WRSF Design

| WRSF | Consequence of Failure | Confidence Level | Minimum Factor of Safety for Static Loading | Minimum Factor of Safety for Pseudo-static Loading |
|---|---|---|---|---|
| WRSF1 | Moderate | Moderate | 1.3-1.4 | 1.05-1.1 |
| WRSF3 | High | Moderate | 1.4-1.5 | 1.1-1.15 |
| WRSF5 | High | Low | >1.5 | 1.15 |
| WRSF6 | High | Low | >1.5 | 1.15 |
| WRSF7 | High | Low | >1.5 | 1.15 |
| WRSF8 | High | Low | >1.5 | 1.15 |
| WRSF9 | High | Low | >1.5 | 1.15 |

### Table 30: Key Considerations for WRSF Design

| WRSF | Key Considerations |
|---|---|
| WRSF1 | Deep seated failure may slide into SP6. Overall design of 20.5°, less than 25°. 20 geotechnical boreholes drilled within the footprint of the WRSF. Localized ice-rich layer. Slightly conservative assumption on shear strength of the ice-rich layer. |
| WRSF3 | Deep seated failure may slide into CP2 and Meliadine Lake. Overall design of 20.5°, less than 25°. 20 geotechnical boreholes drilled within the footprint of the WRSF. Localized ice-rich layer. Slightly conservative assumption on shear strength of the ice-rich layer. |
| WRSF5<br>WRSF6<br>WRSF7<br>WRSF8<br>WRSF9 | Deep seated failure may slide into adjacent mining open pit. Overall design of 20.5°, less than 25°. No geotechnical boreholes drilled within the footprint of the WRSF. Potential ice-rich layer in the foundation. |

## 6.2.3 Foundation Soil Profile and Material Properties

The foundation soil profiles to be used for the stability for each WRSF will be generated based on the available drilling borehole information. For WRSF1 it is assumed that the original ground within the footprint of the WRSF1 consists of 1.5 m sand and silt, 1.0 m ice-rich silt (weak layer under long-term condition), 2.0 m to 10 m silty sand over bedrock. For WRSF3 it was assumed that the original ground consists of 1.5 m sand, 1.0 m ice-rich sand/silt, 1.5 m sandy silt over bedrock. Limited geotechnical conditions underlying WRSF5, WRSF6, WRSF7, WRSF8, and WRSF9 are available at this stage of study. Accordingly, the foundation of these WRSFs is assumed to be similar to WRSF1 at this stage.

Soil strength tests on samples from the Meliadine Gold Mine are limited. A laboratory consolidated-undrained triaxial test on a silty sand overburden sample was conducted in EBA (2013). The sample was taken from a borehole drilled in an area more than 300 m west of WRSF1. The test indicated the soil had an inferred peak internal angle of friction of 36°. This value is on the high side for a silty sand. In this study, the effective angle of internal friction for the silty sand in the foundation was assumed to be 34°, which is the same as what were used in WRSF1 detailed design (Tetra Tech 2019b). However, since there are weaker layers above the silty sand layer in the foundation, the strength parameter for the silty sand does not govern the stability analysis results.

Of importance to the slope stability assessment is the strength of the ice-rich silt in the foundation. The long-term cohesion of the ice-rich silt depends on its temperatures – the colder the soil, the higher its long-term cohesion. The long-term cohesion of the frozen ice-rich silt was adopted based on Weaver and Morgenstern (1981). No thermal analysis will be conducted for this study due to the limited data available. Detailed thermal analyses were performed by Tetra Tech for the detailed design of WRSF1 and WRSF3 (Tetra Tech 2019a, 2019b, 2020). Tetra Tech reviewed the past thermal analyses for WRSF1 and WRSF3 and assumed that the thermal condition of the WRSF5, WRSF6, WRSF7, WRSF8, and WRSF9 and the foundation underneath under the long-term condition will be similar as predicted in the detailed design of WRSF1. The representative temperatures in various zones along the ice-rich silt layer under long-term conditions after construction from the thermal analysis for the detailed design of WRSF1 will be adopted for this study. Table 31 summarizes the typical material properties for the stability analysis of the WRSF. Depending on the actual foundation conditions for each WRSF, the foundation material properties to be used for each WRSF may be slightly different with the typical values presented in Table 31.

**Table 31: Typical Material Properties for WRSF Stability Analyses**

| Material | | Effective Angle of Internal Friction, (º) | Cohesion, (kPa) | Bulk Unit Weight, (kN/m³) |
|---|---|---|---|---|
| Waste Rock | | 42 | 0 | 19 |
| Overburden Waste | | 28 | 0 | 16 |
| Sand/gravel and Silt | | 29 | 0 | 20 |
| Unfrozen Silt | | 28 | 0 | 17 |
| Ice-rich Silt | Ice-rich Silt C40 (for zones with predicted temperatures of -0.7°C to -1.0°C) | 0 | 40 | 16 |
| | Ice-rich Silt C60 (for zones with predicted temperatures of -1.0°C to -1.5°C) | 0 | 60 | 16 |
| | Ice-rich Silt C100 (for zones with predicted temperatures of -1.5°C to -2.0°C) | 0 | 100 | 16 |
| | Ice-rich Silt C130 (for zones with predicted temperatures of -2.0°C to -2.5°C) | 0 | 130 | 16 |
| Thawing Ice-rich Silt | | 28 | 0 | 16 |
| Ice-Poor Silty Sand | | 34 | 0 | 21 |

# 7.0 PUMP AND PIPELINES

## 7.1 General

The design of the pump systems and pipeline required for the Meliadine Extension refer to the documents provided by Agnico Eagle for the pump/pipeline design for the approved project which mainly include:

- General Guidelines Design Site Information and Design Coefficients, 6515-GGD-003, Agnico Eagle 2016a.
- Mechanical and Piping System Design Criteria, 6515-GGD-010, Agnico Eagle 2016b.
- Piping, Valves, Fittings, General Specifications, 6515-GGD-012, Agnico Eagle 2016c.
- Piping Supports General Specifications, 6515-GGD-013, Agnico Eagle 2016d.
- General Guideline for Design Insulation of Piping, Tanks, and Equipment, 6515-GGD-025, Agnico Eagle 2016e.

The following specific design criteria will also be considered for the design of pumps and pipelines for the Meliadine Extension:

- All pumps will be diesel pump at this stage. Diesel pumps will be replaced with electrical motors if possible.
- All pipelines will be HDPE pipe with diameter either 6 inch, 8 inch, 10 inch, or 14 inch. Alternative pipeline diameter can be considered based on the confirmation of Agnico Eagle.
- When possible, existing pumps and pipelines available at the Meliadine site will be re-used.
- The pump intake will be selected based on the operation condition of each collection pond.

It should be noted that only the design of pumps and pipeline required for the water conveyance between the water management infrastructure during the operation phase is within Tetra Tech's current mandate. The design of the pumps and pipelines required for pit water management, water management for underground mine, and saline water transfer from SETP to the waterline is outside Tetra Tech's current scope of work. The general pipeline route layout plan view for the Meliadine Extension is presented in Figure 4.

## 7.2 Design Pumping Rate

Agnico Eagle provided the pumping design considerations based on the past three years operational experience at the Meliadine site. The considerations are summarized as follows:

- Pumping season will be late May/early June until September, and winterize in October;
- Pumping generally continues in June and intermittently throughout July/August/September with about 25% to 50% of the time following freshet;
- Dual pump system setup – high capacity pump for freshet, and smaller capacity pump during standard season operation; and
- As directed by Agnico Eagle, if the required pumping rate is higher than 5,000 $m^3$/day for a 1 in 100 wet year freshet, a dual pump system setup will be designed. If the required pumping rate is smaller than 5,000 $m^3$/day for a 1 in 100 wet year freshet, a single pump will be designed.

Tetra Tech estimated the required minimum pumping rate based on the directions from Agnico Eagle and following assumptions adopted for freshet and water management:

- 1 in 100 wet year spring freshet will occur over seven days;
- Freshet pumping will occur from the fourth day of the freshet and continue until the water level is drawn down to the designated water level after freshet (to provide sufficient storage capacity for extreme rainfall event or IDF);
- Periodic pumping will occur through July to September to maintain or drawdown the water level; and
- The CPs and sumps will be empty by the end of fall (September) to provide storage capacity for the following year spring freshet.

Table 32 summarizes the proposed design pumping rate for the Meliadine Extension. As noted in Table 21, the pumping rates for SP6 to TIR02 Pit, CP8 to CP1, CPD1 to SPD1, CPD2 to SPD1, SPD1 to TIR02 or SP6, and SP5 to SP6 provided by Lorax were adopted for this study.

### Table 32: Assumed Design Pumping Rate for the Meliadine Extension

| Pipeline ID | Description of Water | Pumping From | Pumping To | Required Minimum Design Pumping Rate ($m^3/d$) | Pumping Rate Notes |
|---|---|---|---|---|---|
| 2 | Saline Water in SP6 | SP6 | TIR02 Pit, then SP1, then SETP to Itivia Harbour via waterline | 20,000 | Lorax (2022) |
| 3 | Runoff Water in Lake B6 | Lake B6 | CP8 | 3,500 | Estimated by Tetra Tech |
| 4 | Contact Water in North B5 | North B5 | CP8 | 5,000 | |
| 5 | Contact Water in South B5 | South B5 | CP8 | 5,000 | |
| 6 | Contact Water in West A8 | West A8 | CP8 | 15,000[a] and 4,000[b] | |
| 7 | Runoff Water in Lake A8 East | Lake A8 East | CP8 | 8,000[a] and 3,000[b] | |
| 8 | Contact Water in CP8 | CP8 | CP1 | 30,000 | Lorax (2022) |
| 9 | Contact Water in CP9 | CP9 | CP8 | 4,000 | Estimated by Tetra Tech |
| 10 | Contact Water in Sump P1 | Sump P1 | CP8 | 2,300 | |
| 11 | Contact Water in Sump P2 | Sump P2 | CP8 | 2,200 | |
| 12 | Contact Water in Sump P3 | Sump P3 | Sump P4 | 1,000 | |
| 13 | Contact Water in Sump P4 | Sump P4 | SP6 | 4,000 | |
| 14 | Contact Water in Sump P5 | Sump P5 | CP8 | 5,000 | |
| 15 | Contact Water in A6 | Lake A6 | CP8 | 23,000[a] and 6,000[b] for dual pump setup | |
| | | | | 13,800 for single pump | |
| 16 | Contact Water in CP7 | CP7 | CP8 | 10,000[a] and 3,500[b] | |
| 17 | Contact Water in Sump F1 | Sump F1 | CP7 then CP8 | 4,800 | |
| 18 | Contact Water in Sump F2 | Sump F2 | SP6 | 3,000 | Estimated by Tetra Tech |
| 19 | Runoff Water in Lake A22 | Lake A22 | A3 | 9,000[a] and 2,000[b] | Lorax (2022) |
| 20 | Contact Water in CPD1 | CPD1 | SPD1 | 4,500 | |
| 21 | Contact Water in CPD2 | CPD2 | SPD1 | 500 | |
| 22 | Saline Water in SPD1 | SPD1 | TIR02 or SP6 | 2,000 | |
| 23 | Saline Water in SP5 | SP5 | SP6 | 2,400 | |

[a] Main pump for 1 in 100 wet year freshet management. [b] Secondary pump for summer operation.

# 8.0 LIMITATIONS OF REPORT

This technical memo and its contents are intended for the sole use of Agnico Eagle Mines Limited (Agnico Eagle) and their agents. Tetra Tech Canada Inc. (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 C or Contractual Terms and Conditions executed by both parties.

# 9.0 CLOSURE

We trust this design basis memo 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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/jf

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# FIGURES


**LEGEND**

| | | | |
|---|---|---|---|
| | EXISTING GROUND | | WATER |
| | ROAD | | DEWATERED |
| | CATCHMENT BOUNDARY LINE | | OPEN PITS |
| | MINING AREA | | TAILINGS STORAGE FACILITY |
| | DIVERSION CHANNEL | | WASTE ROCK STORAGE FACILITY |
| | CONTACT WATER POND | | OPEN PIT START OF MINING |
| | SALINE POND | | |

**NOTE**

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.

**REFERENCE**

1. REFERENCE BASE DRAWING FROM AGNICO EAGLE "14-2043 YEAR OVER SITE LAYOUT.DXF".

NOT FOR CONSTRUCTION

0 500 1,000
1:15,000 METRES

CLIENT
AGNICO EAGLE MINES LIMITED

CONSULTANT
TETRA TECH

| | |
|---|---|
| YYYY-MM-DD | 2022-05-24 |
| DESIGNED | HX |
| PREPARED | HX |
| REVIEWED | HX |
| APPROVED | |

PROJECT
MELIADINE MINE EXTENSION

TITLE
**FIGURE 1 - GENERAL SITE LAYOUT (YEAR 2043)**

| PROJECT NO. | PHASE/TASK/DOC. | REV. | FIGURE |
|---|---|---|---|
| EARC03193 | 04 | A | 1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm

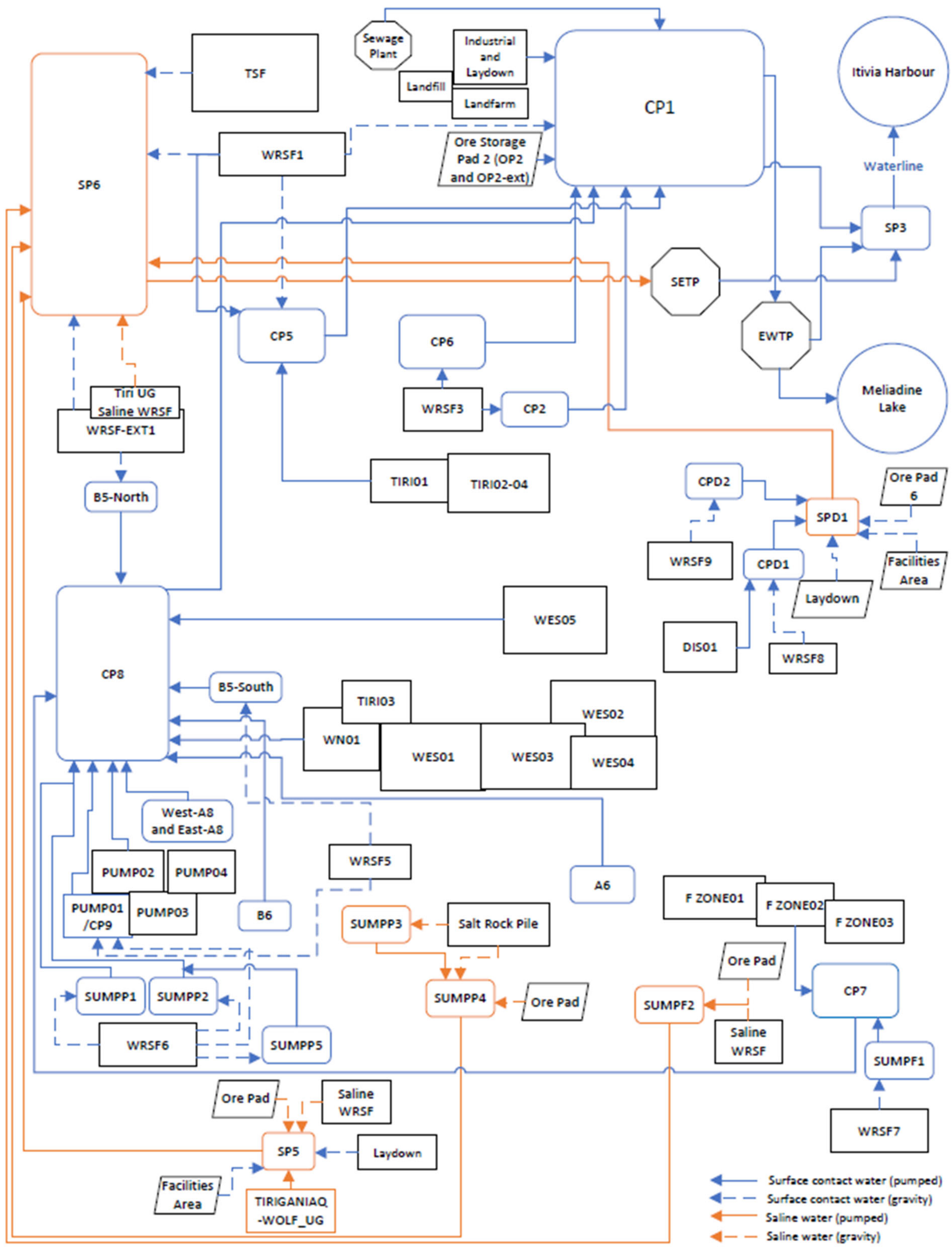


**Figure 2: Meliadine Extension Water Management Flow Diagram – 2043 (November 9, 2022 provided by Lorax)**



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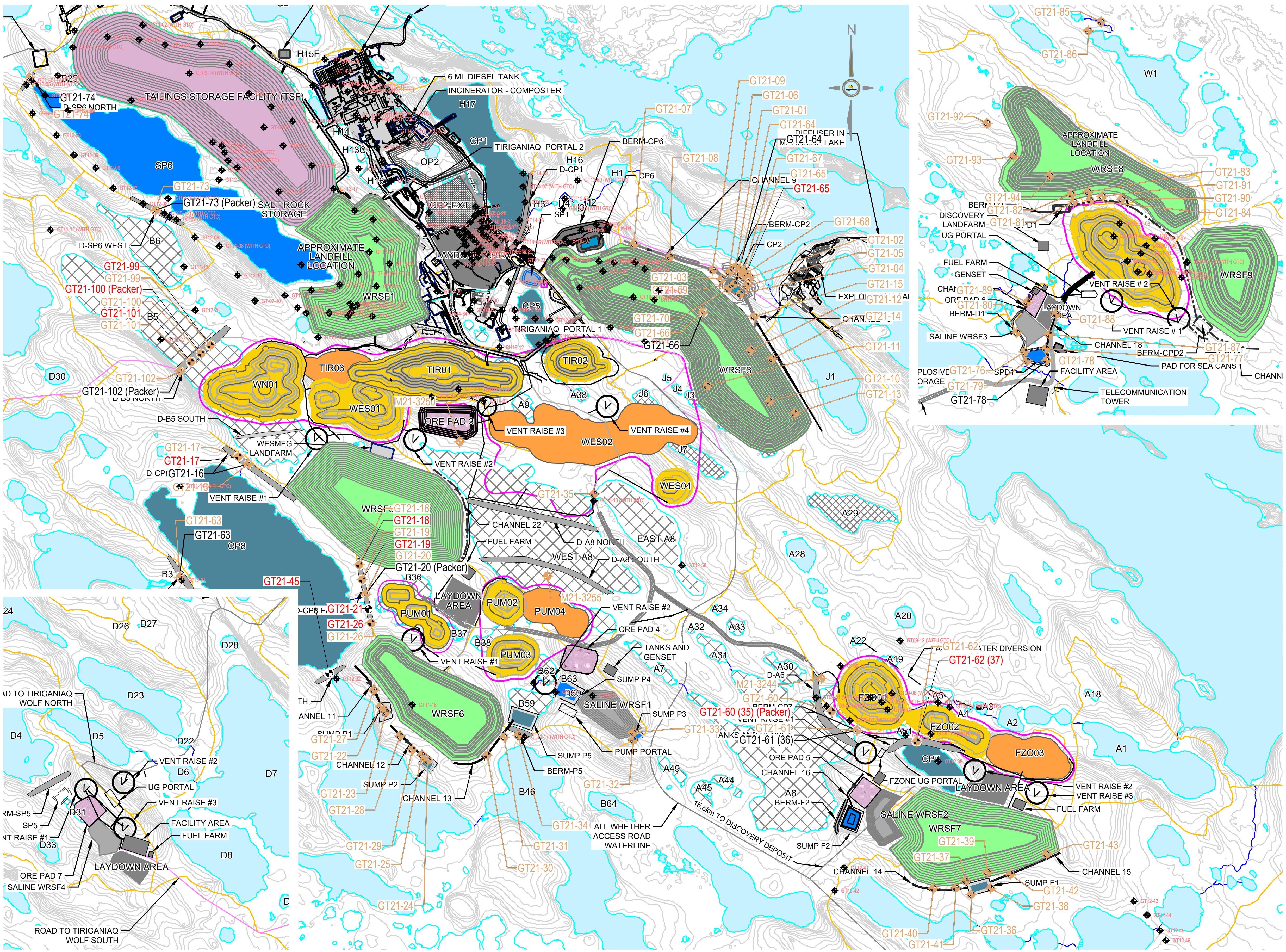
FORMAT ANSI B-11x17

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| TITRE / TITLE | # DWG |
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DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

| REV | DESCRIPTION | DATE | PAR BY |
|---|---|---|---|
| | | | |

REVISIONS

DESSINÉ PAR / DRAWN BY — DATE
VÉRIFIÉ PAR / CHECKED BY
APPROUVÉ PAR / APPROVED BY
No. PROJET / PROJECT NO.
DATE

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
MELIADINE EXTENSION PROJECT
BOREHOLE LOCATIONS

ÉCHELLE/SCALE 1:15000 FICHIER/FILE .DWG

No. DESSIN/DRAWING NO. FIGURE 3 REVISION A FEUILLE/SHT 1 / 2

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O:\Edmonton\Engineering\E141\Projects_MELIADINE\ENG.EARC03193-04 MEL WLA\MEL Extension WLA Site Layout\Yearly Layout Update R1 - 2022\Figure 3-DBM.dwg

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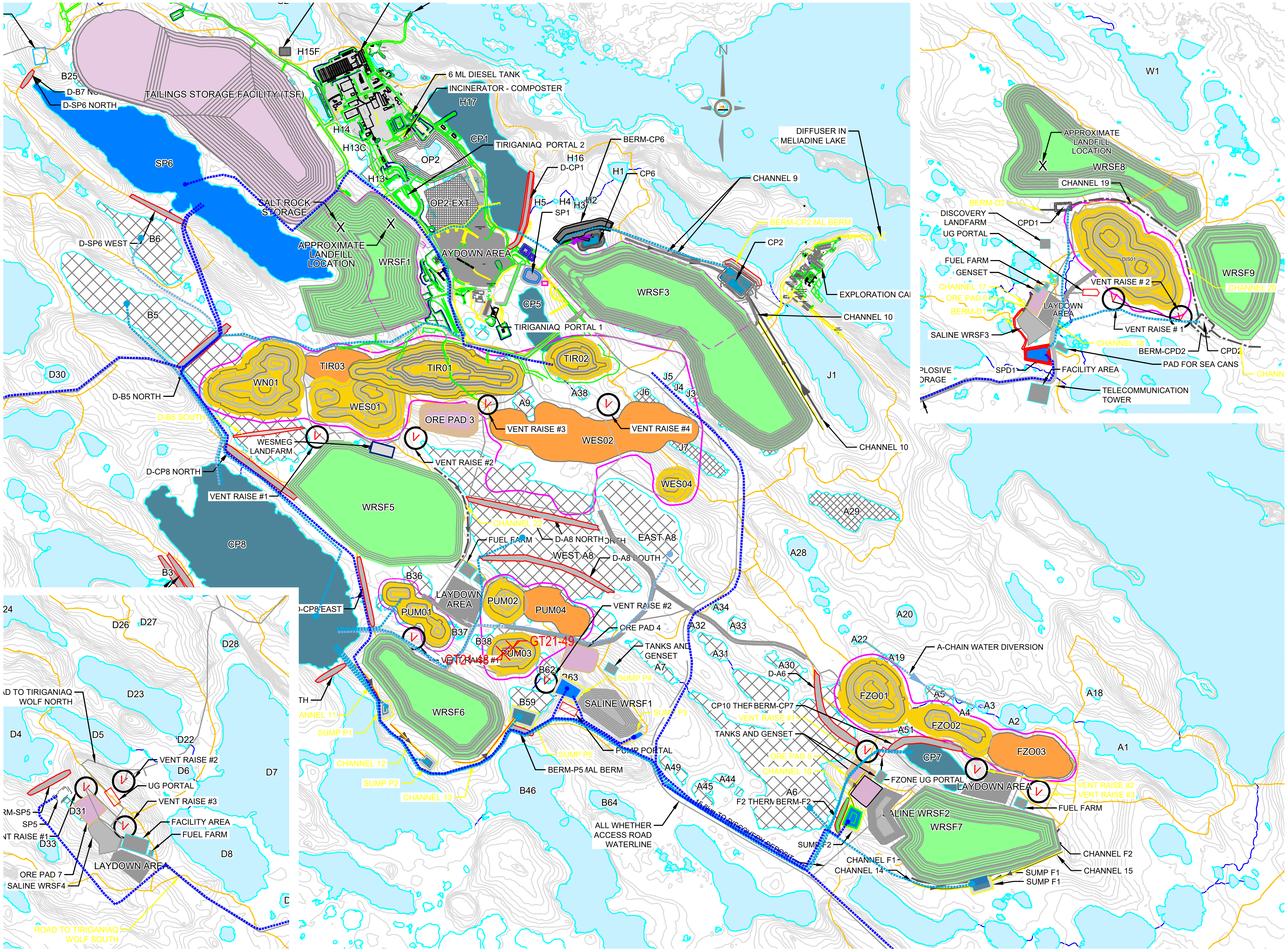


LEGEND

- CATCHMENT BOUNDARY
- ROADS IN WATER LICENSE AMENDEMENT
- SERVICE ROAD AS BUILD
- HAUL ROAD AS BUILD
- WASTE ROCK STORAGE FACILITY
- PLOM 2020 PIT DESIGN LIMIT
- DIVERSION CHANNEL
- PIPELINE FOR CONTACT WATER
- PIPELINE FOR SALINE WATER
- PIPELINE FOR NATURAL RUNOFF WATER
- CONTACT WATER
- SALINE WATER
- NATURAL RUNOFF WATER

AGNICO EAGLE

| TITRE / TITLE | # DWG |
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| REV | DESCRIPTION | DATE | PAR BY |
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| A | ISSUED FOR REVIEW | 2022–11–25 | |

REVISIONS

| | | DATE |
|---|---|---|
| DESSINÉ PAR / DRAWN BY | HX | 25–11–2022 |
| VÉRIFIÉ PAR / CHECKED BY | FN | 25–11–2022 |
| APPROUVÉ PAR / APPROVED BY | NG | 25–11–2022 |

No. PROJET / PROJECT NO. ENG.EARC03193–04

DATE

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
MELIADINE EXTENSION PROJECT
OVERALL PIPELINE ROUTE MAP
(YEAR 2036)

ÉCHELLE/SCALE 1:15000 | FICHIER/FILE .DWG

No. DESSIN/DRAWING NO. FIGURE 4 | REVISION A | FEUILLE/SHT 1 / 2

AE–CART–ANSI B

Q:\Edmonton\Engineering\E141\Projects_MELIADINE\ENG.EARC03193-04 MEL WLA\MEL Extension WLA Site Layout\Yearly Layout Update R1 – 2022\Figure 20 Pipeline Plan View.dwg

# APPENDIX A

## CDA DAM CLASSIFICATION ASSESSMENT SUMMARY TABLE

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

**Name of structure:** D-SP6North
**Date completed:**
**CDA rating:** High

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | |
|---|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | low water head against dike, away from main working areas |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Inundation outside main working areas |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | minimal affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | B7 will be saline water collection pond. Significant deterioration of fish habitat in Lake E3 (North of Lake B7) due to release of saline water from Lake B7 pond |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association
Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-SP6West<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| Dam Class | | Low | Significant | High | Very High | Extreme | Comments / justifications: |
| **Population at Risk**<br>see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | away from main working areas |
| **Incremental Losses** | **Loss of Life**<br>see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Normeg open pit downstream |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | minimal affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | Lakes B6 and B5 will be fully dewatered and fish-out. Minimal environmtal and cultural lossess if a failure occurs |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-B5North<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | Downstram Nor01 Open pit |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Less warning time |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | potential delay mine operation and schedule, and potential damage company's reputation and cause company finance loss |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | Inundation within mine site, flooding open pit |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association
Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-B5South<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| Dam Class | | Low | Significant | High | Very High | Extreme | Comments / justifications: |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | Downstram Nor01 Open pit |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | unlikely delay mine operation and schedule, and potential damage company's reputation and cause company finance loss |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | Inundation within mine site, flooding open pit |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-CP8North<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| **Dam Class** | | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk**<br>see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | low water head against dike, away from main working areas |
| **Incremental Losses** | **Loss of Life**<br>see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Normeg open pit downstream |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | minimal affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | B5 lake dewatered and will be operated in "dry" condition, minimal environmental impact. |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | **Name of structure:** D-CP8South<br>**Date completed:**<br>**CDA rating:** Significant |
|---|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk**<br>see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | low water head against dike, away from main working areas |
| **Incremental Losses** | **Loss of Life**<br>see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Inundation outside main working areas |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | minimal affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | Potential of temporary deterioration of fish habitat in Lake B45 (South of Lake B4) due to release of contact water from Lake B4 pond |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanen**t - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-CP8West<br>Date completed:<br>CDA rating: Significant |
|---|---|---|---|---|---|---|---|
| **Dam Class** | | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk**<br>see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | low water head against dike, away from main working areas |
| **Incremental Losses** | **Loss of Life**<br>see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Inundation outside main working areas |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | minimal affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | Potential of temporary deterioration of fish habitat in Lake B3 and B2 (West of Lake B4) due to release of contact water from Lake B4 pond |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-CP8East<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | Pump 01 open pit downstream |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | Less warming time |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | may affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | minimal environmental impact. |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanen**t - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

CDA ACB Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | Name of structure: D-A8South<br>Date completed:<br>CDA rating: High |
|---|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | Pump 02/04 open pit downstream |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | less warning time |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | may affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | flooding into open pit |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Canadian Dam Association / Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

**Name of structure:** D-A8North
**Date completed:**
**CDA rating:** High

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | | |
|---|---|---|---|---|---|---|---|
| **Dam Class** | | **Low** | **Significant** | **High** | **Very High** | **Extreme** | **Comments / justifications:** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent | Wes05 open pit downstream |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 | less warning time |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) | may affecting infrastructure, mine operation and schedule, and company finance |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. | flooding into open pit |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Canadian Dam Association
Association canadienne des barrages

**Canadian Dam Association (CDA) "Dam Safety Guidelines" (2013) and Application of Dam Safety Guidelines to Mining Dams (CDA 2014)**

| | | CDA Dam Safety Guidelines (CDA, 2013) Dam Classification | | | | |
|---|---|---|---|---|---|---|
| | **Dam Class** | **Low** | **Significant** | **High** | **Very High** | **Extreme** |
| **Population at Risk** see NOTE 1 | | None | Temporary | Permanent | Permanent | Permanent |
| **Incremental Losses** | **Loss of Life** see NOTE 2 | 0 | Unspecified | 10 or fewer | 10 to 100 | More than 100 |
| | **Infrastructure and Economics** | Low economic losses; area contains limited infrastructure or services | Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. | High economic losses affecting infrastructure, public transportation, and commercial facilities. | Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances) | Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances) |
| | **Environmental & Cultural Losses** | Minimal short-term loss, no long-term loss | No significant loss or deterioration of fish or wildlife habitat. Loss of marginal habitat only. Restoration or compensation in kind highly possible. | Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible. | Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical. | Major loss of critical fish or wildlife habitat. Restoration or compensation in king impossible. |

**Name of structure:** D-A6
**Date completed:**
**CDA rating:** High

| **Comments / justifications:** |
|---|
| Fzone 01 open pit downstream |
| less warning time |
| may affecting infrastructure, mine operation and schedule, and company finance |
| flooding into open pit |

**Note 1** **Definitions for population at risk**

**None** - there is no difference at risk, so there is no possibility of loss of life other than through unforeseeable misadventure

**Temporary** - people are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities)

**Permanent** - the population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent residents); three consequences classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life

**Note 2** **Implications for loss of life**

Unspecified - the appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

# APPENDIX B

## INFLOW DESIGN FLOOD CALCULATION SHEET

## Meliadine Extension Design Inflow Design Flood Calculation

| Water Management Infrastructure | CAD Classification | Selected Inflow Flood Design (IDF) Criteria | Selected IDF Value, (mm) | Corresponding Area | Original Lake Water Level, (m) | Water Volume at Original Lake Level. (m3) | Design Max. Operating WL, (m) | Volume of Water in CPs at Design Max. Operating WL, (m3) | Volume of Water in CPs under IDF, (m3) | Projected Max. Operating WL under IDF (m) | Required Minimum Dam Containment Element Elevation (IDF, wind setup (1 in 10), and potential settlement) (m) | Design Top Elevation for Water Containment Element (m) | Required Minimum Dam Crest Elevation against Overtopping (IDF, wave runup, wind setup, and potential settlement) (m) | Design Dam Crest Elevation (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-SP6North** | High | Spring freshet for a 1 in 1,000 return wet year without pumping | 241 | Lake B7 | 62.71 | 843,558.44 | 63.1 | 1,092,748 | 1,621,261 | 63.8 | 64.02 | 64.20 | 65.39 | 65.50 |
| **D-SP6West** | High | | 241 | Lake B7 | 62.71 | 843,558.44 | 63.10 | 1,092,748 | 1,621,261 | 63.8 | 63.92 | 64.20 | 64.30 | 65.50 |
| **D-B5North** | High | 1/3 between 1 in 1000 and PMF 24-hour extreme rainfall event without pumping | 137 | Lake B5 | 58.25 | 380,537.20 | 57.96 | 307,350.15 | 417,732.11 | 58.39 | 58.65 | 59.20 | 59.56 | 60.20 |
| **D-B5South** | High | Spring freshet for a 1 in 1,000 return wet year without pumping | 241 | Lake B5 | 58.25 | 82,053.00 | 57.30 | 30,000.00 | 134,589.00 | 58.72 | 58.84 | 59.30 | 59.25 | 60.30 |
| **D-CP8South** | Significant | Spring freshet for a 1 in 1,000 return wet year without pumping | 241 | Lake B4 | 56.55 | 743,716.26 | 58.17 | 2,355,851.71 | 2,854,842.21 | 58.60 | 58.81 | 59.40 | 59.93 | 60.40 |
| **D-CP8West** | Significant | | 241 | Lake B4 | 56.55 | 743,716.26 | 58.17 | 2,355,851.71 | 2,854,842.21 | 58.60 | 58.75 | 59.40 | 59.51 | 60.40 |
| **D-CP8North** | High | | 241 | Lake B4 | 56.55 | 743,716.26 | 58.17 | 2,355,851.71 | 2,854,842.21 | 58.60 | 58.75 | 59.40 | 59.51 | 60.40 |
| **D-CP8East** | High | | 241 | Lake B4 | 56.55 | 743,716.26 | 58.17 | 2,355,851.71 | 2,854,842.21 | 58.60 | 58.78 | 59.40 | 59.74 | 60.40 |
| **D-A6** | High | 1/3 between 1 in 1000 and PMF 24-hour extreme rainfall event without pumping | 137 | Lake A6 | 59.59 | 780,950.75 | 59.50 | 737,359.93 | 1,120,644.83 | 60.19 | 60.35 | 61.00 | 61.05 | 62.00 |
| **D-A8South** | High | 1/3 between 1 in 1000 and PMF 24-hour extreme rainfall event without pumping | 137 | Lake A8 West | 62.16 | 1,188,000.00 | 60.45 | 226,679.00 | 382,235.27 | 60.84 | 61.01 | 61.50 | 61.71 | 62.50 |
| **D-A8North** | High | 1/3 between 1 in 1000 and PMF 24-hour extreme rainfall event without pumping | 137 | Lake A8 West | 62.16 | 1,188,000.00 | 60.45 | 157,769.06 | 226,920.39 | 60.75 | 60.92 | 61.50 | 61.62 | 62.50 |

# APPENDIX C

## TETRA TECH'S 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.

# APPENDIX C

## MELIADINE EXTENSION PUMP AND PIPELINE MATERIAL TAKEOFFS

| MELIADINE EXTENSION PIPELINE AND PUMP MTOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| **PIPELINE** | Design Pressure Rating (PSIG/Class) | | 125 | Pipe Spec/Class: HDPE, PE4710, DR17, I.P.S. | | | | | | | | | | |
| **Pipeline Material List** | | | | | | | | | | | | | | |
| **Pipeline Identification** | **Flow Rates (m³/d)** | **Pipeline Diam. (in) Nominal** | **Number of pumps** | **Pipeline length (m)** | **Insulated (m)** | **Long Radius 90° Elbows** | **Long Radius 45° Elbows** | **Number of Sections (Stub-end & Fused connections)** | **T-Connections with main line** | **Dual Vacuum/Air release valves** | **Check Valves (Non Return Valves)** | **Isolation valves** | **Number of manual drain valves for low points** | **Pipeline Supports** |
| CP8 to CPI | 30000 | 26 | 1 | 5192.1 | No | 5 | 9 | 341 | 0 | 3 | 0 | 2 | 0 | 12 |
| **SUMMARY** | | 26 | 1 | 5192.1 | No | 5 | 9 | 341 | 0 | 3 | 0 | 2 | 0 | 12 |
| | | | | | | | | | | | | | | |
| CP2 to CP1 Main Pump | 18000 | 20 | 1 | 1492.5 | No | 1 | 3 | 98 | 1 | 3 | 2 | 5 | 0 | 6 |
| SP6 to TIR02* | 20000 | 20 | 1 | 3325.3 | No | 7 | 2 | 219 | 0 | 3 | 0 | 2 | 0 | 16 |
| A6 to CP8 Main Pump | 23000 | 20 | 1 | 4336.8 | No | 19 | 0 | 295 | 1 | 3 | 2 | 2 | 0 | 16 |
| **SUMMARY** | | 20 | 3 | 9154.6 | No | 27 | 5 | 612 | 2 | 9 | 4 | 9 | 0 | 38 |
| | | | | | | | | | | | | | | |
| West A8 to CP8 Main Pump | 15000 | 16 | 1 | 1826.9 | No | 8 | 0 | 130 | 1 | 3 | 2 | 5 | 0 | 14 |
| CP7 to CP8 Main Pump | 10000 | 16 | 1 | 4977.1 | No | 21 | 0 | 332 | 1 | 3 | 2 | 5 | 0 | 16 |
| **SUMMARY** | | 16 | 2 | 6804 | No | 29 | 0 | 462 | 2 | 6 | 4 | 10 | 0 | 30 |
| | | | | | | | | | | | | | | |
| East A8 to CP8 Main Pump | 8000 | 12 | 1 | 2641.5 | No | 3 | 5 | 174 | 1 | 4 | 2 | 5 | 0 | 10 |
| A6 to CP8 Secondary Pump | 6000 | 12 | 1 | 50 | No | 2 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 2 |
| **SUMMARY** | | 12 | 2 | 2691.5 | No | 5 | 5 | 180 | 1 | 4 | 2 | 7 | 0 | 12 |
| | | | | | | | | | | | | | | |
| F1 to CP7 | 4800 | 10 | 1 | 1842.9 | No | 3 | 0 | 121 | 0 | 2 | 0 | 2 | 0 | 12 |
| F2 to SP6 | 3000 | 10 | 1 | 7812.9 | No | 20 | 0 | 513 | 0 | 2 | 0 | 2 | 0 | 12 |
| North B5 to CP8 | 5000 | 10 | 1 | 1373.2 | No | 0 | 3 | 90 | 0 | 1 | 0 | 2 | 0 | 6 |
| B6 to CP8 | 3500 | 10 | 1 | 2060.4 | No | 3 | 2 | 136 | 0 | 1 | 0 | 2 | 0 | 8 |
| South B5 to CP8 | 5000 | 10 | 1 | 500 | No | 3 | 2 | 33 | 0 | 1 | 0 | 2 | 0 | 4 |
| P4 to SP6 | 4000 | 10 | 1 | 5642.1 | No | 17 | 0 | 380 | 0 | 4 | 0 | 2 | 0 | 24 |
| B59 to CP8 | 5000 | 10 | 1 | 1766.2 | No | 3 | 0 | 120 | 0 | 2 | 0 | 2 | 0 | 6 |
| CPD1 to CPD2 | 4500 | 10 | 1 | 1492.1 | No | 0 | 6 | 98 | 0 | 1 | 0 | 2 | 0 | 4 |
| CP7 to CP8 Secondary Pump | 3500 | 10 | 1 | 50 | No | 2 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 2 |
| **SUMMARY** | | 10 | 9 | 22539.8 | No | 51 | 13 | 1497 | 0 | 14 | 0 | 18 | 0 | 78 |
| | | | | | | | | | | | | | | |
| CP9 to CP8 | 4000 | 8 | 1 | 499.4 | No | 1 | 0 | 35 | 0 | 1 | 0 | 2 | 0 | 6 |
| Wolf UG to SP6 | 2400 | 8 | 1 | 4978 | No | 5 | 4 | 327 | 0 | 4 | 0 | 2 | 0 | 18 |
| West A8 to CP8 Secondary Pump | 4000 | 8 | 1 | 50 | No | 2 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East A8 to CP8 Secondary Pump | 3000 | 8 | 1 | 50 | No | 2 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 2 |
| CP2 to CP1 Secondary Pump | 2500 | 8 | 1 | 50 | No | 2 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 2 |
| **SUMMARY** | | 8 | 5 | 5627.4 | No | 12 | 4 | 380 | 0 | 5 | 0 | 10 | 0 | 30 |
| | | | | | | | | | | | | | | |
| P1 to CP8 | 2300 | 6 | 1 | 489.9 | No | 1 | 0 | 34 | 0 | 1 | 0 | 2 | 0 | 4 |
| P2 to CP8 | 2200 | 6 | 1 | 974.9 | No | 3 | 0 | 66 | 0 | 2 | 0 | 2 | 0 | 8 |
| **SUMMARY** | | 6 | 2 | 1464.8 | No | 4 | 0 | 100 | 0 | 3 | 0 | 4 | 0 | 12 |
| | | | | | | | | | | | | | | |
| P3 to P4 | 1000 | 4 | 1 | 533.8 | No | 3 | 0 | 40 | 0 | 1 | 0 | 2 | 0 | 4 |
| CPD2 to SEPT | 800 | 4 | 1 | 2435 | No | 0 | 11 | 160 | 0 | 1 | 0 | 2 | 0 | 12 |
| SPD1 to SEPT | 800 | 4 | 1 | 100 | No | 3 | 0 | 120 | 0 | 2 | 0 | 2 | 0 | 6 |
| **SUMMARY** | | 4 | 3 | 3068.8 | No | 6 | 11 | 320 | 0 | 4 | 0 | 6 | 0 | 22 |
| | | | | | | | | | | | | | | |
| A19 to A3 | 62 | 2 | 1 | 810 | No | 1 | 0 | 54 | 0 | 0 | 0 | 2 | 0 | 3 |
| **SUMMARY** | | 2 | 1 | 810 | No | 1 | 0 | 54 | 0 | 0 | 0 | 2 | 0 | 3 |
| | | | | | | | | | | | | | | |
| **Descripton of Materials** | | **Description:** HDPE, PE 4710, DR 17 pipe, I.P.S. | Description: Electrical centrifugal water pump. (see details on next page.) | **Description:** HDPE PE 4710 DR 17 pipe, I.P.S. ASTM D3350 C/W Stub Ends or Butt Ends, Section Length: 50Ft (15.24 m). | | | | **Description:** Stub Ends c/w Slip-On metal flanges, drilled 150 lb, ASTM A36 | | | | **Description:** Gate Valves (Suction and Discharge lines isolation) | | **Description:** Concrete blocks with carbon steel saddles |
| | | | | | | | | **Gaskets:** 150 class, 3 mm thick,FF, Garlock Style 3760. | | | | | | |
| | | | | | | | | **Bolts:** Hex Head machine bolts with heavy Hex nuts, ASTM A193 Gr. B7, with A194 Gr.2H nuts. | | | | | | |
| | | | | | | | | **Fused Connections:** Conventional heat butt fusion joints. Conform to ASTM F2620 | | | | | | |

| | | | |
|---|---|---|---|
| **NOTES:** | | | **HDPE pipe is manufactured in sections of 50 Ft, (15.24 m) length.** |
| | | | **Connections: Piping connected to piping equipment utilize flanged connections. Branched and straight pipeline section connections are fused joints.** |
| | | | **Long Radius Elbows, T-Connections are manufactured from the same HDPE and conform to DR17 pressure ratings and sizes.** |
| **EXCLUSIONS** | | | **MTO does not include materials for civil works preparation prior to pipeline installation.** |
| | | | **MTO does not include materials for the electric pump installation accessories.** |
| | | | |

* Design Pressure Rate (PSIG/Class): 200