November 6, 2017

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RE: Mary River Project – Tote Road Upgrades, Milne Port Increased Fuel Storage, and Milne Port Accommodations Camp
(Modification Request)
Water Licence 2AM-MRY1325 – Amend. No. 1

In accordance with Part G of Baffinland Iron Mines Corporation's (Baffinland) Type A Water Licence 2AM-MRY1325 – Amend. 1 (Type A Water Licence), the purpose of this letter is to request approval from the Nunavut Water Board (NWB) for planned modifications to the Mary River Project's (the Project) Tote Road, Milne Port Fuel Storage Facility, and Milne Port Accommodations Camp.

The organization of this letter is as follows:

- **Section 1 Tote Road Upgrades** – upgrades proposed to the existing Tote Road to address road safety and operational issues.
- **Section 2 Milne Port Fuel Storage Facility Capacity Increase** – addition of a 15 ML diesel fuel tank to the existing Fuel Storage Facility at Milne Port.
- **Section 3 Milne Port Accommodations Camp** – installation of a new 280-person accommodations camp at Milne Port.

The supporting information included in this letter for planned modifications is consistent with the requirements of Part G of the Type A Water Licence. Attachments 1 to 17 provide additional design details and rationale.

Financial Security for this modification request is being determined as part of the 2018/19 Annual Security Review (ASR) process and is described in Baffinland's 2018 Marginal Closure and Reclamation Financial Security Estimate report. Baffinland is committed to post the financial security determined by the NWB to be required for these activities prior to the activities occurring.

1 – TOTE ROAD UPGRADES

The Milne Inlet Tote Road (Figure 1) was originally constructed as a CAT train trail in the 1960s. In 2007, Baffinland upgraded the original road and installed new watercourse crossings in 2007 to support its bulk sample program. Modest improvements have continued to be made since then, but significant upgrades are required to meet productivity and safety objectives associated with the Project's activities.

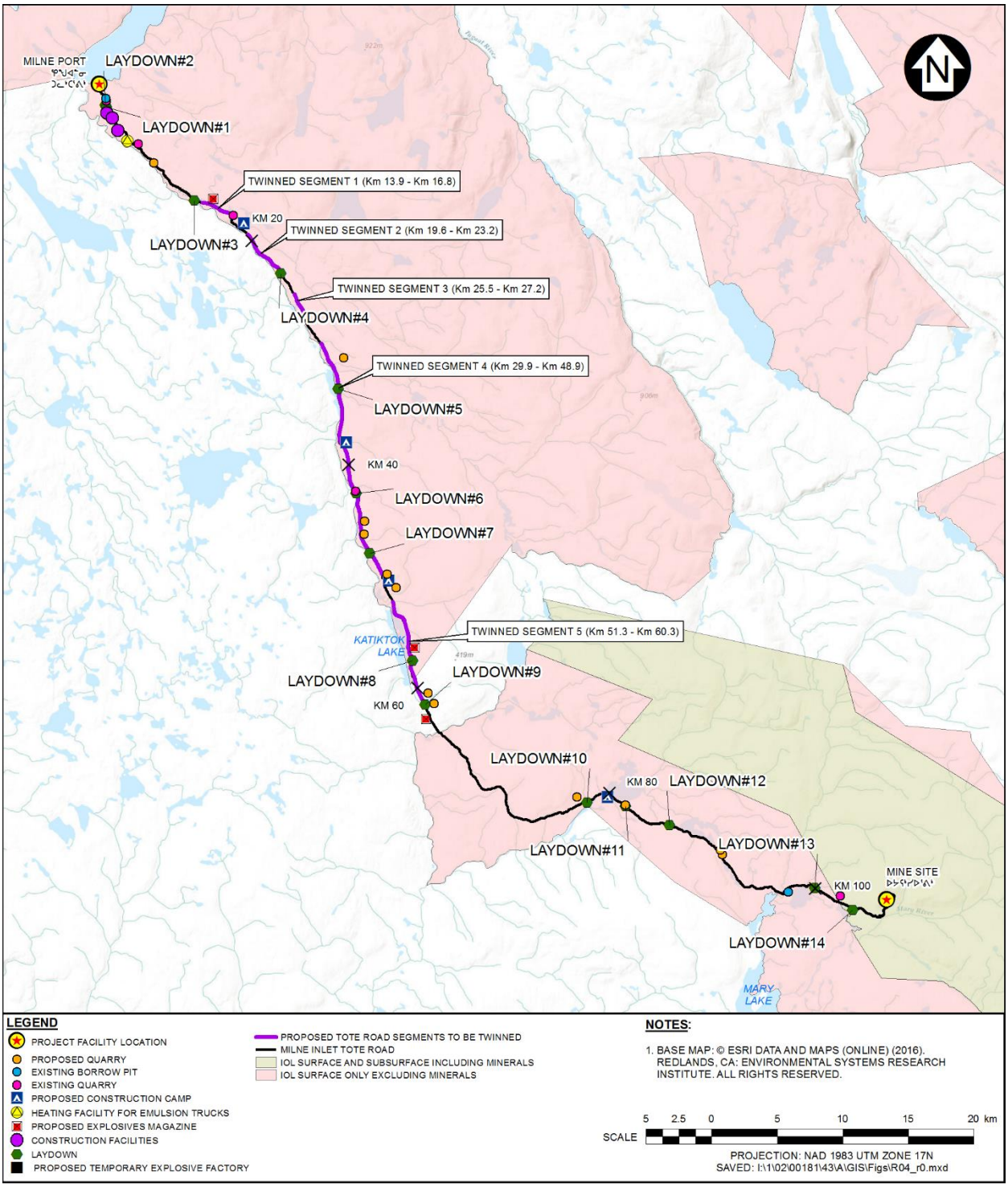

Figure 1 Tote Road Upgrades Overview Map

The Milne Inlet Tote Road was upgraded during the bulk sampling program in 2008 from a winter road to an all-season road adequate for transporting equipment and ore using 45-t trucks. The road was widened to between 8 m to 10 m to accommodate the truck traffic. Pullouts or passing areas were also constructed at intervals to allow traffic to pass. Further upgrades were completed for the Early Revenue Phase (ERP) to support the level of traffic proposed with year round ore haulage from the Mine Site to Milne Port using approximately 150-t trucks. The upgraded road follows the original alignment as constructed in the 1960s.

The road is a public right of way, which Baffinland maintains. Land users are permitted to use the road as prescribed in the Nunavut Agreement. Nonetheless, Project use of the road poses a public safety concern due to the interaction of mine trucks and land users. To mitigate these effects and ensure the safety of all users, Baffinland has implemented its Roads Management Plan (BAF-PH1-830-P16-0023), which includes a Hunter and Visitor Site Access Procedure (BAF-PH1-810-PRO-0002).

Baffinland has gained valuable operational experience over the past three years. A review of current operations has documented 56 safety incidents on the road over the past 1.5 years. This has included equipment coming into contact with other equipment or going off the road. Freshet normally results in a nearly complete halting of ore transport over the road, due to increased surface runoff and reduced stability of the road surface, shoulders, and stream crossings. This review has identified the need to invest in major improvements to the Tote Road to improve operational efficiency and address health and safety concerns.

Several issues are currently affecting safety and operational efficiency on the Tote Road:

- **Sections of road are too narrow** – The road is designed to be 10 m wide, but some areas are as narrow as 8 m, requiring trucks to slow down or stop while passing each other. Soft shoulders can pull vehicles off the road, and thus trucks tend to take the centre of the road.
- **Depth of sub-base** - The road is level with the original ground in many locations, and therefore the road surface does not shed water during freshet or rainfall events. Resulting ponded water induces permafrost degradation and the ground sinks, worsening the problem.
- **Gradient** – The gradient in some locations approaches 10%, compared to preferred maximum grades of 4 to 5%. Fully loaded ore haul trucks struggle, which causes mechanical failures. Occasionally, trucks have needed to be pushed up the hills with other heavy equipment, presenting a safety issue.
- **Sharp turns** – A number of sharp turns cause traffic slow downs, and the road wears significantly at these locations. The sharp turns also cause additional wear on trailer brakes and wheel studs. There are locations where sharp turns combine with steep gradients and these are the locations that trucks often require assistance because it is not safe to accelerate before the hill.
- **Topping availability** - Road crush is typically sourced from the Mine Site primary crushers and placed on the road surface, but loose placement and grading cause washboard effects. Crowning and compacting are required to prevent water from penetrating into the road. Dust along the road needs to be controlled with water and/or calcium chloride.

An area of concern for immediate road improvements is between km 20 and km 60, where the road can be improved greatly from a performance and safety perspective. This section of road closely follows Phillips Creek, and thus creating a twinned loaded route to the east of the existing location is desirable to pull the loaded vehicles away from a potential loss of control into the water. The incident summary also indicates that a significant number of the road widening issues are in this area.

The large hill located between the km 62 bridge and km 76 has been the area of largest performance concern along the road as the loaded uphill climb is hard on trucks and adds significantly to travel time.

The requested modification is described below and is consistent with the requirements of Part G of the Type A Water Licence.

1.1 Description of Facilities and/or Works to be Constructed

1.1.1 Watercourse Crossings

The proposed twinned segments of the Tote Road and watercourse crossing locations are shown on Figures A.2 to A.7 of Attachment 1. Five segments of the Tote Road totalling a cumulative distance of 37.2 km will be upgraded as indicated in Table 1. The new road segments will require the installation of 119 culverts and partial infills of the margins of 4 ponds below the high water mark. Three of the four affected ponds do not contain fish, and only minor habitat encroachment is expected on the fourth pond which is fish bearing. There are 18 confirmed fish crossings on the new twinned road segments, and 17 of these are associated with culvert installations (North/South Consultants Inc., 2017).

Table 1 Proposed Tote Road Segments Designated for Twinning

Twinned Segment No.	Adjacent Tote Road km	Twinned Segment Length (km)	Number of Culverts	Number of Partial Pond Infills	Total Number of Fish Crossings
1	13.9 to 16.8	3.1	13	0	2
2	19.6 to 23.2	3.8	8	1	0
3	25.5 to 27.2	1.9	6	1	0
4	29.9 to 48.9	19.2	65	1	7
5	51.3 to 60.3	9.2	27	1	9
Totals		**37.2**	**119**	**4**	**18**

Road upgrades will consist of constructing a parallel roadbed along these segments. The new roadbed will be constructed to meet the requirements for a surface haulage road specified in the Mine Health and Safety Regulations (Government of Nunavut, 2011). Once the second roadbed has been constructed and is operational, requisite upgrades to the existing roadbed such as grade improvements and realignments at sharp turns can be made. The minimum top width of new road segments will be 6.12 m, using the same design criteria as for the existing Tote Road, while the average subgrade width will average 10 m.

Construction of the twinned road segments will involve rock cuts that intersect three existing streams that will require the stream at the crossing locations to be permanently diverted to nearby streams,

resulting in increased flow in the downstream sections of the receiving watercourse and no flow in the downstream sections of the diverted watercourse. These stream sections are summarized in Table 2 (KP, 2017). The five associated streams do not contain fish (NSC, 2017).

Table 2 Tote Road Stream Diversions

Twinned Segment No.	Diversion from	Diversion To	Crossing Type	Waterbody Type	UTM Coordinates		Mean Annual Flow Range (litres/sec)
1	CV-12-4b	CV-13-1	Cut	LP	511455	7967168	3.4 – 5.1
1	CV-12-5	CV-13-1	Culvert	S	511552	7967152	0.4 – 0.6
5	CV-35-5	CV-35-4	Cut	LP	522298	7948170	20.1 – 30.3

NOTES:

1. WATERBODY TYPE – STREAM (S), LOW POINT (LP)
2. UTM COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.

Plan and section views of typical road profiles and culvert installations are provided as Attachment 2. The list of culverts is provided as Attachment 3.

1.1.2 Quarries and Rock Cuts

Rock quarries will be exploited to support road upgrades and the establishment of laydowns and other development areas. This includes seven existing and permitted rock quarries or borrow areas and 13 new rock quarries (see Attachment 4). The types of rock that will be quarried include granitic gneiss, limestone, and sandstone. Rock volumes from cuts from the road right of way have been included in Attachment 4.

Quarries (and rock cuts) will be developed in accordance with the Borrow Pits and Quarries Management Plan (BAF-PH1-830-P16-0004). This includes preparing quarry-specific management plans in accordance with the requirements of the Type A Water Licence and the Commercial Lease No. Q13C301 (Commercial Lease) agreed upon by the QIA and Baffinland.

A number of geochemical evaluations have been conducted to establish the metal leaching (ML) or acid rock drainage (ARD) potential of these materials (KP, 2007a,b; AMEC, 2010; Hatch, 2017a). The sedimentary rocks (limestone and sandstone) identified along the railway alignment are carbonate rich and pose no ML/ARD risk. While the granitic rocks (granite, gneiss, and schist) and the diabase contain low sulphide content, due to the relatively low neutralizing potential of these rocks, there is a low risk of ML/ARD (AMEC, 2010; Hatch, 2017a).

As a mitigation strategy, Baffinland's Borrow Pit and Quarry Management Plan (BAF-PH1-830-P16-0004) prescribes site-specific geochemical testing of rocks prior to quarrying. As a precautionary measure, quarries and rock cuts within granitic and diabase rock materials will be subject to geochemical testing to confirm that the material is geochemically suitable.

Several mitigation options are available if a potential rock cut area is found to be acid generating. The first option would be to avoid the area, and re-route the road if possible. If not possible, rock cuts may

be managed by placing non-acid generating materials (non-PAG) over the acid generating material, or placing limestone within the seepage path to increase pH and decrease metal loading of the runoff.

1.1.3 Laydown Areas

Development of 14 laydown areas will be established along the Tote Road alignment for crushed rock stockpiling and material storage, reducing Tote Road construction traffic. The laydowns will be constructed utilizing blasted rock with granular topping to a total minimum thickness of 1 m, free draining to appropriate ditches and watercourses. The approximate proposed locations of the laydown areas are shown on Figure 1 and Figures A.1 to A.7 of Attachment 1. The total area of the 14 laydowns is 250,000 m^2.

1.1.4 Explosives Storage Magazines

Explosives storage magazines will be established at three locations adjacent to the Tote Road upgrades (km 12.8, 48, and 59). A temporary heated garage for bulk emulsion truck parking will be established at about km 6.9 as well. Location details for the heated garage are provided in Attachment 5. The approximate proposed locations of the explosives storage magazines are shown on Figure 1 and Figures A.2 to A.7 of Attachment 1. These features will be temporary, but nonetheless, minor leveling and grading will be required before the magazines and heated garage can be established. Details associated with the proposed explosives magazines and heated garage are summarized in Table 3.

1.1.5 Portable Fuel Storage

Portable double-walled fuel storage tanks will be positioned at laydown areas to supply fuel to the mobile earthworks fleet executing the road upgrades. This is expected to consist of 14 tanks (6 - 50,000 L, 2 - 22,500 L and 6 - 10,000 L). Positioning the portable double walled fuel tanks will reduce fuel vehicle traffic and spill risk by minimizing fuel handling. Baffinland and its contractors will implement the same safe fuel transfer protocols as used elsewhere on the Project. Contractors will position spill response equipment and implement spill contingency measures. Baffinland will update its Spill Contingency Plan (BAF-PH1-830-P16-0036) to identify the additional fuel storage and spill response equipment, response training and responsibilities for implementing the additional spill response measures.

Table 3 Proposed Heated Garage and Explosives Storage Magazines

Location Along Tote Road	Footprint Area (m^2)	Details
Km 6.9	6,400	• Pad measuring 131 m x 49 m consisting of compacted gravel over existing ground • Access road 220 m long x 131 m wide • Temporary heated garage for bulk emulsion truck parking
km 12.8	12,500	• Pad measuring 205 m x 43 m consisting of compacted gravel over existing ground • Access road 352 m long x 6 m wide • Approximately four magazines • Temporary heated garage for explosives truck
Km 48	10,000	• Pad measuring 100 m x 100 m consisting of compacted gravel over existing ground • Access road 265 m long x 6 m wide • Approximately one magazine
km 59	19,658	• Pad measuring 135 m x 150 m consisting of compacted gravel over existing ground • Access road 425 m long x 6 m wide • Approximately two magazines

1.1.6 Mobile Construction Camps

Two 80-bed mobile temporary camps will be positioned along the Tote Road using four different locations (km 18, km 38, km 50, and km 80) near to road upgrade activities, as shown on Figure 1.

The temporary mobile camps will consist of a hardwall kitchen and wash cars and soft wall accommodations units, all constructed on wood block foundations. The camps will be installed on 75 m x 120 m pads, located approximately 500 m from the Tote Road and accessed by constructing 8 m wide access roads. The installation of mobile camps will increase productivity, reduce worker vehicle traffic on the Tote Road and improve working conditions.

Water from the mobile temporary camps will be delivered from either the Mine Site or Milne Port by truck. Total water use at both the Milne Port and Mine Site water sources will remain within the daily volumes approved under the Type A Water Licence. Sewage and waste will be trucked to the Mine Site for treatment in existing facilities.

1.2 Proposed Location of the Structure

An overview map of the Milne Inlet Tote Road is shown on Figure 1. The proposed twinned sections of the Tote Road and locations of watercourse crossings, quarries, laydown areas, temporary explosives magazines, and mobile construction camps are shown on Figures A.1 to A.7 of Attachment 1. The coordinates of all 123 watercourse crossing locations are included in Attachment 3.

1.3 Identification of any Potential Impacts to the Receiving Environment

Activities associated with the Tote Road Upgrades include:

- Construction of approximately 37.2 km of new road parallel to the existing Tote Road
- Installation of culverts at 119 watercourses and partial infills at 4 ponds
- Extraction of 1,746,000 m^3 of rock from seven existing permitted quarries and 13 new quarries along the Tote Road
- Extraction of 650,000 m^3 of rock and granular material from new road excavations
- Operation of two 80-bed mobile temporary construction camps, located on gravel pads at four locations along the Tote Road
- New explosives storage magazines at Tote Road km 12.8, 48, and 59
- Temporary heated parking garage for parking the bulk emulsion truck at Tote Road km 6.9
- Use of temporary fuel tanks at various locations (14 tanks, 10,000 L to 50,000 L)
- Establishment of 14 laydown pads with a combined surface area of 250,000 m^2.

The potential effects of these activities are similar to those previously assessed in the FEIS and FEIS Addendum (Baffinland 2012, 2013) and include:

- Atmospheric Environment: emission of criteria air contaminants and an increase in noise and vibration levels.
- Terrestrial Environment:
    - ML/ARD associated with quarry operations
    - Change in thermal regime of permafrost
    - Loss of vegetation, including culturally valued vegetation
    - Direct habitat loss within the project footprint
    - Indirect habitat loss as a result of noise (sensory disturbance)
    - Disruption of migration corridors for caribou
    - Indirect morality from contamination of the environment (air and water emissions)
    - Direct morality from increased access to the area for hunters and collisions with vehicles.
- Aquatic Environment:
    - Loss of habitat (direct habitat loss related to the project footprint, indirect habitat loss associated with changes in water quality and quantity and sediment quality)
    - Potential fish mortality and indirect effects on fish health.

The Tote Road Potential Development Area (PDA) presented in the FEIS is 865 ha (Baffinland, 2012). The proposed Tote Road upgrades will increase the Tote Road PDA by 188 ha to 1,053 ha, equivalent to a 22% increase. Tote Road upgrades are expected to have minor interactions with the atmospheric and

terrestrial environment, and increased interactions with the aquatic environment. Mitigation measures and monitoring previously developed for work in and around water are presented in the sections below.

1.4 Monitoring

Baffinland has developed and implemented comprehensive programs for the existing Tote Road in accordance with the following regulatory approvals:

- Type A Water Licence 2AM-MRY1325
- Fisheries Authorization NU-06-0084 (Tote Road watercourse crossings)
- Commercial Lease No. Q13C301 (activities on Inuit Owned Land)
- Class A Land Use Permit #N2014Q0016 (quarrying on the Tote Road).

The current monitoring programs are largely adequate to address the additional infrastructure and activities associated with the Tote Road upgrades. Biophysical environment components will require minor updates to the current monitoring programs such as additional monitoring parameters and/or modifications to the locations of monitoring stations to account for an expanded project footprint.

Environmental monitoring of construction activities will consist of water quality monitoring and periodic environmental inspections. Specific monitoring measures related to fish protection include:

- An environmental monitor will be on on-site to assess the crossings prior to the onset of construction to confirm the absence or presence of spawning sites at least 20 m upstream or downstream of the crossing location, and whether spawning Arctic char are present in the vicinity (only applies where fish may be present).
- For all crossings where fish may be present an environmental monitor will be present to monitor construction activities and document turbidity levels upstream and downstream of the crossing under construction.
- Environmental monitoring and data collection will be conducted by a qualified environmental professional who will be present during all in-water construction, compensation, and restoration works to ensure implementation of the designs as intended in the engineering plans and compliance with permit conditions.

1.5 Schedule for Construction

The construction of the proposed Tote Road upgrades is planned to start as soon as the Request for Modification approval has been received from the NWB with the intent of completing construction by September 2018 prior to the ground freezing.

1.6 Drawings of Engineered Structures

Plan and section views of typical road profiles and culvert installations are provided as Attachment 2.

1.7 Proposed Sediment and Erosion Control Measures

Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.), as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-830-P16-0008) and Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026), to address and manage sedimentation concerns during construction. Further details concerning specific fish protection measures pare discussed below.

1.7.1 Timing Windows for In-Water Work

The Nunavut Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO, 2013) outlines timing constraints to protect fish and fish habitat during instream construction projects. The Project area is within Nunavut Fish Timing Zone 1, and the general range of spawning times for Arctic char, the species of concern, is noted as Fall (DFO, 2013). The in-water work timing restrictions (i.e., when work should be avoided) for fall spawning species in Zone 1 is September 1 to June 30. None of the waterbodies within the new road alignments with the North Rail right of way support permanent populations of anadromous char, due to the lack of connectivity between Milne Inlet and all freshwater spawning habitat (i.e., lakes with sufficient depths) in the study area (NSC, 2017).

If instream work is scheduled to occur within the restricted timing window, applicable "measures to avoid causing harm to fish and fish habitat including aquatic species at risk" (DFO, 2016) will be implemented. The primary "measure to avoid causing harm" will be to conduct all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse (DFO, 2016). Temporary diversion channels may be required to isolate the work sites if the streams are flowing: the diversion channels will be designed by a professional engineer to accommodate peak flows.

A fish salvage program will be conducted prior to re-routing fish-bearing streams into the diversion channel. A fish collection permit will be obtained for salvage operations and the salvage will be completed by qualified professionals. Fish will be relocated in areas upstream or downstream of the work site in suitable habitat. If pumping is required in the isolated stream channel between the cofferdams prior to fish salvage, water intakes will be screened to prevent fish entrainment, and pumps and intake screens will be sized to prevent impingement of fish.

1.7.2 Contaminant and Spill Management

Adverse effects to Arctic char and other freshwater biota from deleterious substances will be prevented by applying the following mitigation measures:

- Emergency spill kits will be kept near any instream works
- No waste material resulting from work activities will be left within 30 m of the top of any bank without containment measures
- Machinery will be washed, refueled, and serviced, and fuel and other materials will be stored in such a way as to prevent any deleterious substances from entering the water; such activities typically occur at least 50 m away from the high water mark of a stream or lake

- Spill response plan measures will be implemented immediately in the event of a sediment release or spill of a deleterious substance
- Machinery will arrive at site in a clean condition and be maintained free of fluid leaks, invasive species, and noxious weeds
- Fording of the watercourse by machinery will be limited to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be constructed.

1.7.3 Erosion and Sediment Control

Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.), as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-840-P16-0002) and Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026), to address and manage sedimentation concerns during construction.

Erosion and sediment control measures will be implemented prior to the start of construction and maintained until all disturbed ground has been permanently stabilized. The following measures will be included in engineering and construction along fish-bearing watercourses to minimize and mitigate erosion and sedimentation issues:

- Culverts will be installed in accordance with approved environmental protection and management plans
- Sediment and erosion control measures will be implemented prior to work and left in place and maintained until all disturbed areas have been stabilized
- Measures for managing contact and non-contact water flowing onto the site such that sediment is filtered out prior to entering a waterbody. These could include pumping/diversion of water to a vegetated area, or construction of a settling basin or other filtration system.
- Slopes will be stabilized with rocks, geotextiles and/or hydraulic seed and mulch
- Any stockpiled materials shall be stored and stabilized 30 m away from the High-Water Mark of any water body, unless for immediate use
- Fill material placed below the high water mark within the floodplain will be either erosion resistant or protected from erosion and only clean fill will be used
- Whenever possible, machinery will be operated on land above the high water mark or on ice, in a manner that minimizes disturbance to the banks and bed of the waterbody.

1.7.4 Culvert Design and Installation

During the detailed design phase fish-bearing streams and lakes will be assessed to identify fish passage requirements (depth and velocity) and mitigation measures to ensure maintenance of access and reduction of fish mortality. These mitigation measures include:

- Installation culverts at the same slope as the existing stream, where feasible
- Minimizing culvert lengths: culverts with lengths that exceed 50 m may be considered barriers to fish passage
- Placement of rocks and boulders or baffles, baffle inserts, or weirs inside the culverts to provide greater friction and velocity refugia
- Diversion channels and cofferdams will be used in fish-bearing streams in the open-water season to isolate the watercourse from flow prior to construction, and a fish salvage will be conducted in the isolated section prior to dewatering
- For installation of culverts in lake infill sections silt booms or silt curtains will be installed to contain suspended sediment.

To the extent possible the natural channel width will be maintained within crossing structures.

1.7.5 Stream Diversion Design and Installation

Site specific assessments will be undertaken during the detailed design phase at watercourse crossings that will require diversions for construction of the new road segments. The assessments will consider fish use and length of impacted channel, and potential mitigation options can be identified and incorporated into the final design. Mitigation measures and design will depend on:

- Channel capacity: If flow increases are modest, flooding may be infrequent. Where flow increases are larger, the channel banks may be overtopped each year during freshet (nival runoff) or during rainfall driven runoff events. Given the lack of vegetation and shallow frozen soils, rainfall runoff is rapid, causing sudden pronounced and relatively large increases in flow. If the channel is within a well defined valley, the flooded extent may be modest, but in flat terrain flooding may be extensive or follow low terrain (e.g. ice wedges) into other drainages.
- Changes in permafrost and frozen soil. Flooding and higher water levels may affect permafrost and frozen soil conditions proximal to the channel, causing subsidence or slope instability
- Fluvial geomorphic change. Increased flows may cause channel bed scour or bank erosion. Additionally, overbank flows may erode surficial soils. These eroded materials would be deposited downstream where the watercourse meets the diverted channel, larger river or lake.

1.7.6 Blasting

Use of explosives in or near water produces shock waves and vibrations that can damage a fish swim bladder, rupture internal organs, or kill or damage fish eggs or larvae (DFO, 2016). DFO “Measures to avoid causing harm to fish and fish habitat” will be considered during planning for construction of the stream crossings.

2 – MILNE PORT FUEL STORAGE FACILITY

The Mary River Project uses two types of fuel:

1. Arctic diesel for mobile equipment, trucking, mining equipment, and power generation
2. Jet-A aviation fuel for helicopters and aircraft

Fuel is delivered to Milne Port by tanker each open water season, and is transferred to the main tank farm at Milne Port using the floating hose method that is used at nearly all Nunavut communities. The Milne Port tank farm needs to be sized to store more than one year of fuel.

In 2016, 31.5 ML of arctic diesel and 2.0 ML of Jet A aviation fuel was delivered to Milne Port. Arctic diesel stored at Milne Port is used to supply the power plant and other port users, as well as trucks operating over the Milne Inlet Tote Road. The main tank farm at Milne Port stores arctic diesel, with a current capacity of 46 ML (an available volume of 41.4 ML allowing for 10% thermal expansion). The current Jet A fuel storage capacity at Milne Port is 2.25 ML.

To meet the fuel demands associated with current operations, Baffinland included an additional 3 ML tank of arctic diesel and 0.75 ML of Jet-A aviation fuel in an amended (and approved) 2017 Work Plan. The 0.75 ML tank has been constructed and the 3 ML tank will be constructed in 2018.

To support the earthworks and other construction activities associated with the Tote Road upgrades and other capital improvements, an additional 15 ML of arctic diesel fuel is required. A 15 ML tank is proposed within the existing Fuel Storage Facility to address this need for additional diesel fuel (Figure 2.13). There is sufficient room in the existing lined containment facility to accommodate the 3 ML and 15 ML tanks.

The proposed modification to the Milne Inlet Fuel Storage Facility will occur within the Project's Development Area and is consistent with approved activities outlined in the Project Certificate (Project Certificate 005 – Amend. 1) issued for the Mary River Project by the Nunavut Impact Review Board (NIRB).

The requested modification is described below and is consistent with the requirements of Part G of the Type A Water Licence.

2.1 Description of Facilities and/or Works to be Constructed

The design and construction of the proposed additional fuel tank and associated piping will be similar to the Fuel Storage Facility's existing tanks and in accordance with the applicable guidelines and standards.

Attachments 7 and 8 show the process flow diagram and general layout for the Fuel Storage Facility, respectively, including the proposed additional fuel tanks and associated piping. Attachment 9 shows the earthworks setting out points for the additional fuel tank and the Facility's overall piping layout, respectively. A review of the Fuel Storage Facility's secondary containment, presented in Attachment 10, confirms that there is sufficient secondary containment to accommodate the proposed additional fuel tanks, as per Canadian Council of Ministers of the Environment (CCME) guidelines. Attachment 11 discusses the construction methodology for the proposed additional fuel tanks and associated piping.

Tank construction and leak testing will be undertaken using the construction methodology provided in Baffinland's previous application for tank farm upgrade submitted to the Nunavut Water Board (Hatch Ltd., 2017b).

Another required upgrade will be to install a fuel pipeline from the tank farm to a new fuel manifold that will be constructed at the shore next to the proposed freight dock. The freight dock is part of the Approved Project will be installed during the 2018 open water season at or immediately adjacent to the current barge landing. This will allow ship-to-shore fuel transfers to occur at the freight dock. The current fuel manifold used for floating hose fuel transfers from tankers will be decommissioned. This upgrade will improve the safety and efficiency of marine fuel delivery for the Project.

Baffinland's existing marine fuel transfer and fuel storage practices at Milne Port are covered by a Transport Canada approved Oil Pollution Emergency Plan (OPEP, BAF-PH1-830-P16-0013). The OPEP was updated in 2017 to account for the proposed additional tank farm capacity. Before the freight dock and new fuel manifold are used, Baffinland will obtain approval of a revised OPEP that addresses the relocation of the marine fuel manifold and ship-to-shore transfers occurring at the proposed freight dock.

2.2 Proposed Location of the Structure

The 15 ML fuel tanks will be installed in the Milne Inlet Fuel Storage Facility's existing secondary containment at Milne Port, adjacent to existing fuel tanks, as shown on Figure A.1 of Attachment 1. Associated piping, with the exception of the diesel piping system feeding the Milne Port generators, will be installed inside the Fuel Storage Facility's secondary containment to allow for fuel transfer with minimal additional piping and no additional dispensing modules.

2.3 Identification of any Potential Impacts to the Receiving Environment

Baffinland foresees minimal impacts to the receiving environment during the construction and installation of the 15 ML fuel tank and associated piping at the Milne Inlet Storage Facility. As discussed in Attachment 11, the majority of the work will occur within the existing secondary containment of the Fuel Storage Facility and therefore sediment releases to nearby water bodies from earthworks are not expected. The Fuel Storage Facility is not located near fish-bearing streams, but is located in proximity to Milne Inlet.

Appropriate crane pads and access ramps will be constructed at the Fuel Storage Facility to prevent mobile equipment from coming into contact and transferring hydrocarbon impacted soils outside the Facility's containment. In addition, construction activities at the Milne Inlet Fuel Storage Facility will be conducted in accordance with Baffinland's suite of environmental management plans including but not limited to:

- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Waste Management Plan (BAF-PH1-830-P16-0011)
- Spill Contingency Plan (BAF-PH1-830-P16-0036)

- Environmental Protection Plan (BAF-PH1-830-P16-0008).

2.4 Monitoring

Environmental monitoring of construction activities will include periodic environmental inspections conducted by Baffinland's Environmental personnel in concert with the Contractor's Health, Safety and Environment Lead. Inspections will ensure Contractors are properly managing waste and hazardous materials and operating in accordance with Project's onsite procedures and management plans. Inspections will be documented by taking photos of any deficiencies and using Baffinland's existing environmental inspection forms. Deficiencies identified will be compiled and forwarded to the responsible Contractor to be corrected and addressed. In addition, before, during and after photographs of the tank construction and installation will be taken.

2.5 Schedule for Construction

Construction and installation of the 15 ML tank and associated piping at the Milne Fuel Storage Facility are planned to start as soon as approval has been received from NWB with the intent of completing construction prior to the arrival of the fuel sealift vessels in August 2017.

2.6 Drawings of Engineered Structures

Hatch were retained to develop the design and construction plan for the proposed fuel tanks and associated piping at the Milne Inlet Fuel Storage Facility. Construction drawings are provided in Attachments 7, 8, and 9 of this letter. Confirmation that the Fuel Storage Facility's secondary containment can accommodate the proposed additional fuel tanks is provided in Attachment 10.

2.7 Proposed Sediment and Erosion Control Measures

Baffinland does not foresee sedimentation and erosion as a likely environmental concerns during the construction and installation of the additional fuel tank and associated piping at the Milne Inlet Fuel Storage Facility. In the unlikely event that sedimentation and erosion become a concern during construction, Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.), as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-830-P16-0008) and Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026), to address and manage sedimentation and erosion concerns.

3 – MILNE PORT ACCOMMODATIONS CAMP

In operating the Mary River Project since 2013, Baffinland has determined that more equipment is required to reach full production (4.2 Mt per annum). The additional equipment will require additional operators and in turn more maintenance and support personnel than originally expected during the previous approval process. Moreover, Baffinland has observed that the work at Milne Port, and therefore the required number of beds, is very seasonal, peaking during the spring and open water season (June to October). Key port activities during the spring and open water season include refurbishment and maintenance on the ship loader, loading of the ore carriers, off-loading of freight and fuel vessels and all of the associated work for port operations, facility operations and maintenance, procurement and warehousing, Health and Safety, and environmental monitoring.

In addition, Baffinland is experiencing high turnover rates with the site workforce. Several returning contractors are refusing to send their employees to site due to the current accommodations conditions. During 2016, approximately 50% of personnel who resigned cited poor accommodations as a primary reason for their resignation.

To address the accommodations issues described above, a new combination hardwall and softwall accommodations camp facility is proposed to upgrade the existing Milne Port Weatherhaven softwall camp (i.e., Matrix). The new camp location is shown on Figure A.1 of Attachment 1.

As outlined in Table 3 of the Water Licence, the domestic water use limit at Milne Port is 300 m^3/day. Baffinland anticipates that domestic water use at Milne Port will continue to remain significantly below the permitted 300 m^3/day limit following the construction and operation of the new camp and that no increase to the Water Licence Terms and Conditions is required.

During the last two years of operation, daily domestic water consumption at both Milne Port and the Mary River Mine Site have been on average 200 L per person per day. With an expected active bed capacity of 554 beds at peak summer capacity, the daily water use at Milne Port is expected to be 111 m^3/day which is well below the Water License permitted volume of 300 m^3/day for domestic use.

The requested modification will occur just outside the Milne Port PDA. The proposed accommodations camp is consistent with approved activities outlined in the Project Certificate (Project Certificate 005 – Amend. 1) issued for the Mary River Project by the Nunavut Impact Review Board (NIRB).

The requested modification is described below and is consistent with the requirements of Part G of the Type A Water Licence.

3.1 Description of Facilities and/or Works to be Constructed

The new camp features softwall single rooms connected to a hardwall core configuration consisting of the camp dining area, kitchen, and food preparation areas. The camp was purchased as a 380 room camp based on an evaluation of available of used camps on the open market that met the Project criteria however only 280 of the rooms are proposed to be installed and occupied in 2018.

The camp layout and associated facilities, including a dedicated potable water treatment plant and sewage treatment plant, are shown in Attachment 15. Upon completion of the new camp, the Matrix camp will be scheduled for decommissioning and reclamation. Attachment 16 shows the Milne Port

process flow diagram for camp water use, sewage treatment, and effluent discharge to Milne Inlet. The Waste Water Treatment Plant (WWTP) guarantee from the supplier is included as Attachment 17.

The sub-grade of the accommodations camp pad will be constructed using coarse material and capped with crushed granular surface material. The same capping material will be utilized as a final pavement for walkways and parking areas. The foundations will consist of wooden cribbing assembled on top of interlocking 6" thick wooden matting. Both the hard-wall common core structures as well as the soft-wall dormitories will be erected upon these wooden foundations. The foundations for the potable water treatment plant and the sewage treatment plant will incorporate a high-density expanded polystyrene insulating layer to offset any potential thermal migration into the underlying pad.

The new camp will need to be temporarily energized following the assembly of the camp and associated infrastructure using an electrical feed (3-5 kV cable) tied into Milne Port's existing power generators. A route for the utility berm extension has been determined and is aligned in a northeast direction from the new camp pad.

Construction of the new camp and associated infrastructure will commence on the north end of the new camp pad with the erection of a garage. The garage will be used by the Camp Installation Contractor as a warming shed and fabrication area during the assembly of the new camp and associated infrastructure (sewage treatment plant, potable water treatment plant, etc.). Following the construction of the new camp and associated infrastructure, the garage will continue to be used to support the operation of the new camp.

Following the construction of the garage, construction of the new camp will commence with placement of the hard-wall common core facilities on the wooden foundations. While these common core units of the new camp are being integrated and assembled, the installation of the potable water treatment plant, located adjacent to the garage, will begin. The installation of the transformer and dedicated e-house will also occur during this same period in the schedule.

In parallel to the installation of the potable water treatment plant, the installation of the sewage treatment plant will occur on the far southern portion of the new camp pad. This location has been selected to take advantage of the prevailing winds from the north. Commissioning of the sewage treatment plant and potable water treatment plant will include connecting the plants to the new camp using insulated HDPE piping.

The new camp, sewage treatment plant and potable water treatment plant include a fire suppression system (sprinkler system) that will be connected to the fire pumps and tanks by insulated HOPE piping. Assembly and commissioning of the fire suppression systems and associated pumps and tanks will occur during the construction of the new camp.

Following the assembly and integration of the hardwall common core units of the new camp, the Camp Installation Contractor will start the installation and integration of the soft walled accommodations modules, starting from the north and progressing to the south. During this time, and following the sewage treatment plant and potable water treatment plant becoming operational, Baffinland Operations will coordinate the opportunity to populate the beds as they become available.

3.2 Proposed Location of the Structure

The proposed location of the Milne Port camp is shown on Figure A.1 of Attachment 1.

3.3 Identification of any Potential Impacts to the Receiving Environment

The expected Milne Port camp occupancy was under-estimated in the FEIS Addendum (Baffinland, 2013), and additional camp space is required to support planned road upgrades. The proposed 280-person accommodations camp will involve marginal impacts as follows:

- The camp footprint is small (4.1 ha), which represents a modest (1.8%) increase to the current Milne Port PDA of 224 ha
- No drainage diversion system is required at the proposed location (unlike the previous modification request)
- The revised camp location avoids the water diversion issues of the previously proposed camp
- The proposed new accommodations camp is not located near fish-bearing streams
- The proposed camp location is not in an environmentally sensitive area or where there are sensitive landforms
- No increases in the water use approved under the Type A Water Licence will be required
- Additional sewage will be generated by a second WWTP. Final discharge will be the same as the final discharge location of the current Milne Port WWTP. The additional volume of treated sewage being discharged to Milne Inlet is minor in the context of Milne Inlet as the receiving environment.

The proposed WWTP is the same as the existing camp facility; mitigation measures and monitoring will be conducted in accordance with the Fresh Water Supply, Sewage, and Wastewater Management Plan (BAF-PH1-830-P16-0010), and the requirements of the Type A Water Licence. Sewage from the new camp will be piped to the new WWTP, and the treated effluent will be discharged by pipeline or truck to the existing final discharge location for the current WWTP. Sewage sludge will be incinerated.

The type of camp, approximate location, water supply locations/quantities, and sewage treatment facility technology/discharge location remains consistent with what was previously proposed in the FEIS Addendum. The increase in environmental impacts is likely not detectable.

To prevent the release of sediment into the receiving environment during construction, Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.) to address sedimentation concerns, as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-830-P16-0008) and Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026).

The operation of the new camp will increase the number of people that can be housed at Milne Port and will increase the amount of associated wastewater and waste generation from operations. The volume of wastewater generated is less than the expected volume of water already approved under the current Water Licence and the vendor has provided a performance guarantee to ensure that the wastewater meets the discharge criteria specified in the Water Licence. Regular sampling of wastewater discharge

will continue as required under the Water Licence and other permits. Waste generated by the upgraded facility will be managed under the existing Waste Management Plan for the site and will use the existing waste management facilities including the waste management building at Milne Port and the landfill located at the Mary River Mine site.

3.4 Monitoring

The environmental management plans applicable to the proposed activities (road upgrades, camp and tank farm expansion) that require update include:

- Fresh Water Supply, Sewage and Wastewater Management Plan (BAF PH1 830 P16 0010) – the plan will be updated to include the additional camp and WWTP; no changes to the mitigation measures or monitoring requirements are needed.
- Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026) – The sediment and erosion control measures described in this plan will remain unchanged. Monitoring of effluent from the new WWTP will be added in accordance with anticipated addition of a monitoring station in the Type A Water Licence.

Environmental monitoring of construction activities will consist of water quality monitoring and periodic environmental inspections. Water quality monitoring will focus on runoff originating from the construction area and monitoring the potential impacts of the runoff on downstream water bodies. In the event that turbid runoff is observed originating from the construction area, sedimentation mitigation measures will be installed and water quality monitoring locations will be established downstream of construction activities to assess the potential impacts on nearby water bodies. Water quality at monitoring locations will be compared to the water quality discharge criteria established under Baffinland's Type A Water Licence.

In addition, periodic environmental inspections of the construction activities will be conducted by Baffinland's Environmental personnel in concert with the Contractor's Health, Safety and Environment Lead. Inspections will ensure Contractors are properly managing waste and hazardous materials and operating in accordance with Project's onsite procedures and management plans. Inspections will be documented by taking photos of any deficiencies and using Baffinland's existing environmental inspection forms. Deficiencies identified will be compiled and forwarded to the responsible Contractor to be corrected and addressed. Photos will also be taken to document the construction of the new camp and associated infrastructure.

3.5 Schedule for Construction

The construction of the proposed accommodations camp infrastructure and facilities is planned to start as soon as the Request for Modification approval has been received from the NWB with the intent of completing the camp construction as soon as possible.

3.6 Drawings of Engineered Structures

Horizon North Logistics (Horizon North) is the selected contractor for the construction and commissioning of the new camp and associated facilities. A site plan and vendor drawings for the new camp are provided by Horizon North in Attachment 15. Any additional Issued for construction (IFC) drawings required under Baffinland's Type A Water Licence will be provided to the NWB 90-days prior to construction.

3.7 Proposed Sediment and Erosion Control Measures

Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.), as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-830-P16-0008)and Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026), to address and manage sedimentation concerns during construction.

4 – CLOSURE

We trust that this information meets the requirements under Part G under Baffinland's Type A Water Licence and look forward to the NWB's response. Please do not hesitate to contact the undersigned should you have any questions or comments.

Regards,

Christopher Murray,
Compliance Manager, Baffinland Iron Mines.

Cc:
David Hohnstein, (Nunavut Water Board)
Stephen Williamson Bathory (Qikiqtani Inuit Association)
Jonathan Mesher, Sarah Forté, Karen Costello (Indigenous and Northern Affairs Canada)
Solomon Amuno (Nunavut Impact Review Board)
Todd Burlingame, Megan-Lord Hoyle, Timothy Ray Sewell, Andrew Vermeer (Baffinland)

Attachments:

1. Figures A.1 to A.7 Detailed Site Layouts
2. Culvert Details
3. Watercourse Crossings
4. Quarry Details
5. Explosives Magazines and Truck Parking Details
6. Mobile Construction Camp Details
7. Port Site TM001 Fuel System Process Flow Diagram (H353004-48000-210-282-0001-0001, Rev. 1)
8. Port Site TM001 Fuel System Overall Layout (H353004-48400-240-272-0001, Rev. 2)
9. Milne Port Fuel Tanks 003, 010 & 011 Setting Out Earthworks (H353004-40000-220-260-0003-0001, Rev. 0)
10. Memo: Calculations of Tank Farm Containment Capacity (H353004-00000-240-202-0001, Rev. A)
11. Construction Methodology Milne Inlet Fuel Storage Facility System (H353004-40000-400-050-0002, Rev. 0)
12. Banner Environmental Engineering Consultants Ltd. – Baffin WWTP Review
13. Horizon North – FilterBoxx WWTP General Arrangement Drawings
14. FilterBoxx WWTP – Process Description (Section 3 of O&M Manual)
15. Milne Port Accommodations Camp Site Plan
16. Milne Port Water and Sewage Process Flow Diagram
17. Newterra Vendor Guarantee for Camp Water Treatment System (Potable)

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Baffinland

Attachment 1

Figures A.1 to A.7 Detailed Site Layouts

SAVED: I:\1\02\00181\43\A\Acad\FIGS\B06_r0, 11/6/2017 3:42:53 PM , SRICHARD PRINTED: 11/6/2017 3:46:06 PM, Layout1, SRICHARD
XREF FILE(S): X-C-TOPO-MILN-DETAIL-MAP; X-C-TOPO-MILN-LAYT-ANUL-REP; X-C-TOPO-MINE-MILN-FROM-OTHRS-OCT17 - ORIG LAYDWN IMAGE FILE(S): GIS Baffinland Logo

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ORE STOCKPILES

W6

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PHILLIPS CREEK

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LAND FARM MP-04

SNOW DUMP

W15

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MAINTENANCE BUILDING

LP3

W10A

W10B

LP5

W11

LP6

LP7

PROPOSED 280 PERSON ACCOMMODATION CAMP

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NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN/SECTION BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 31, 2014, AND OCTOBER 2017).
4. CONTOUR INTERVAL IS 2.5 METRES.

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1. ᓄᓇᕗᒻᒥᐅ ᑎᑎᕋᒪᓂᖅ ᒪᓕᓕᒃ UTM NAD83 ZONE 17N.
2. ᓄᓇᕗᒻᒥᐊᓕᓴᐃᓕᑦ EAGLE MAPPING (2005).
3. ᐊᑦᓇᔪᑎᑦᔨᐃᓕᓴᐅᑦ ᑐᓴᒪᓂᒋᔪᓕᑦ ᑐᓂᔨᐅᑦᒪᓕᓴᐅᑎᓂᖅ ᑐᓄᔨᐅᔨᒪᓕᓴᐅᑦ ᐃᑦᕋᓗᒍ, ᐅᓪᓗᖓᑦᑐᑎᒃ 9ᖏᓄᐊᓕ 31, 2014).
4. ᑎᑎᕋᒪᓕᓴᐅᑦ ᒥᑦ ᐊᖏᓂᑦᑐᓂᒃ ᐅᖓᔪᓂᑎᑎᓕᑦ 2.5 ᒥᑦ

LEGEND:

- ᐃᒥᖅ WATER
- ᐊᑐᖅᑕᐅᓵᒻᒪᓗᓂᖅᓴᓂᐊᖅᑐᑐᓄᑦ BORROW AREAS
- ᐅᔨᕐᑕᑦᓴᓵᒥᑦ ᐃᓂᓪᓕ QUARRY AREA
- PERMITTED LAYDOWN AREA
- PROPOSED LAYDOWN AREA 2018 WORK PLAN
- ᐊᖏᔪᒥ ROAD
- ᐅᒃᑐᖅ/ᐊᒃᓚᓵᑐᖅ/ᐊᓂᐃᐅᔨᓴᖅ RIVER/STREAM/DRAINAGE
- ᖃᑭᖅᑕᓂᒃ ᐃᓄᐃᑦ ᑲᑐᔨᖅᖃᕐᕕᒋᑦ ᖃᓄᖓᓄᑦ ᓄᓇᔨᑦ ᑭᓇᐅᔨᓕᐅᔨᓴᓯᐊᖅᑎᑎᔨᑦ ᐊᑐᖅᑐᐊᖅᑕᐅᓵᑦ ᑭᓚᓪᓚ QIA SURFACE COMMERCIAL LEASE IMPACT BOUNDARY
- POTENTIAL DEVELOPMENT AREA
- PROPOSED 2018 WORK PLAN

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SCALE A

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	MMD	CM

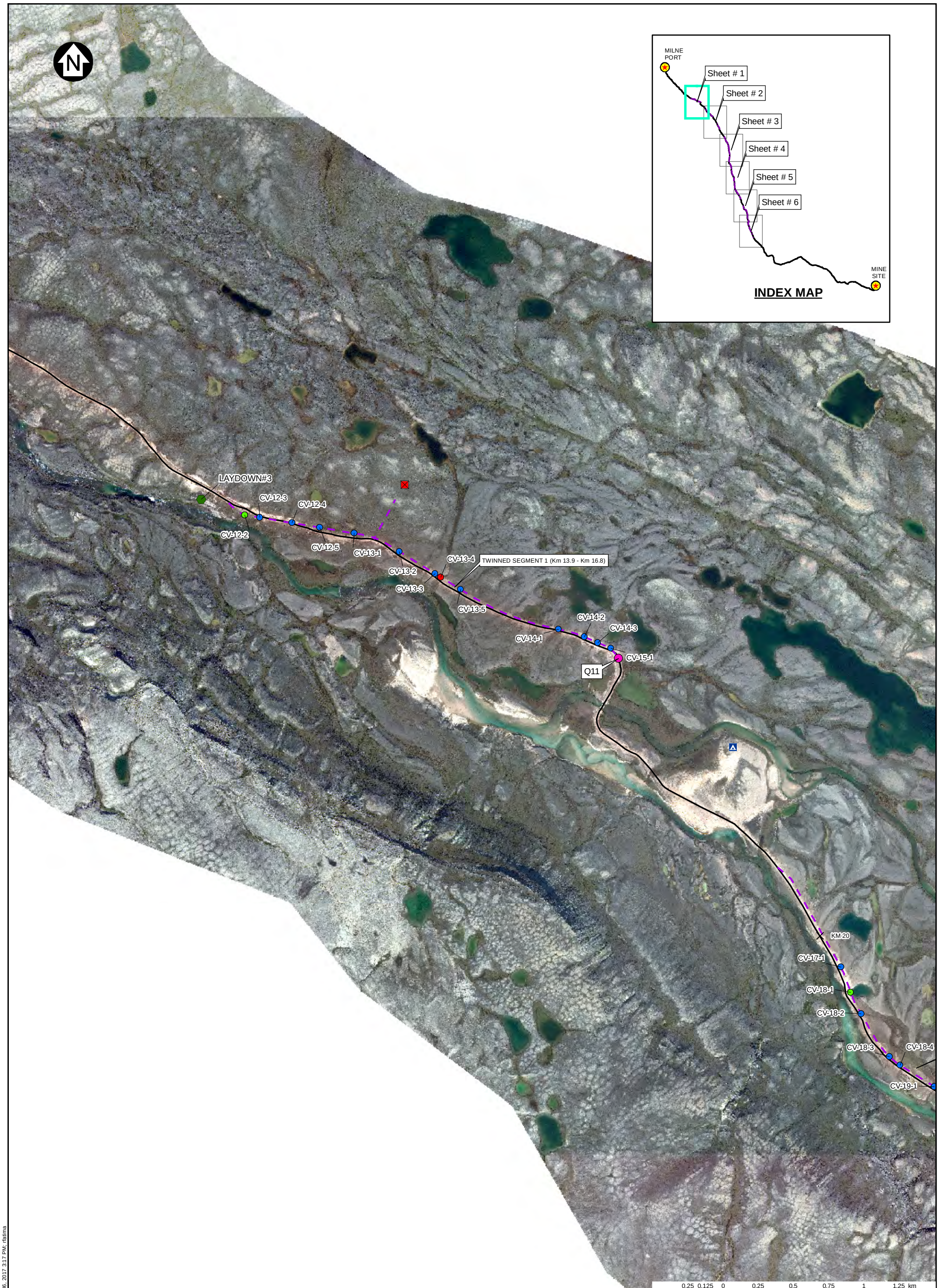
Baffinland

MARY RIVER PROJECT

MILNE PORT 2018 WORK PLAN

Knight Piésold CONSULTING

P/A NO. NB102-181/43
REF NO. NB17-00735
FIGURE A.1
REV 0



LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
- **QUARRIES AND BORROW PITS**
  - PROPOSED QUARRY
  - EXISTING BORROW PIT
  - EXISTING QUARRY
- 80 PERSON MOBILE CAMP
- HEATING FACILITY FOR EMULSION TRUCKS
- PROPOSED EXPLOSIVES MAGAZINE
- CONSTRUCTION FACILITIES
- LAYDOWN
- PROPOSED TEMPORARY EXPLOSIVE FACTORY
- MILNE INLET TOTE ROAD
- PROPOSED TOTE ROAD UPGRADES

NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA DEPARTMENT OF NATURAL RESOURCES (2009). ALL RIGHTS RESERVED.
3. DETAILED WATER AND ORTHO-IMAGERY BASED ON EAGLE MAPPING (2005).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 1 OF 6

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/43	NB17-00735

FIGURE A.2 REV 0

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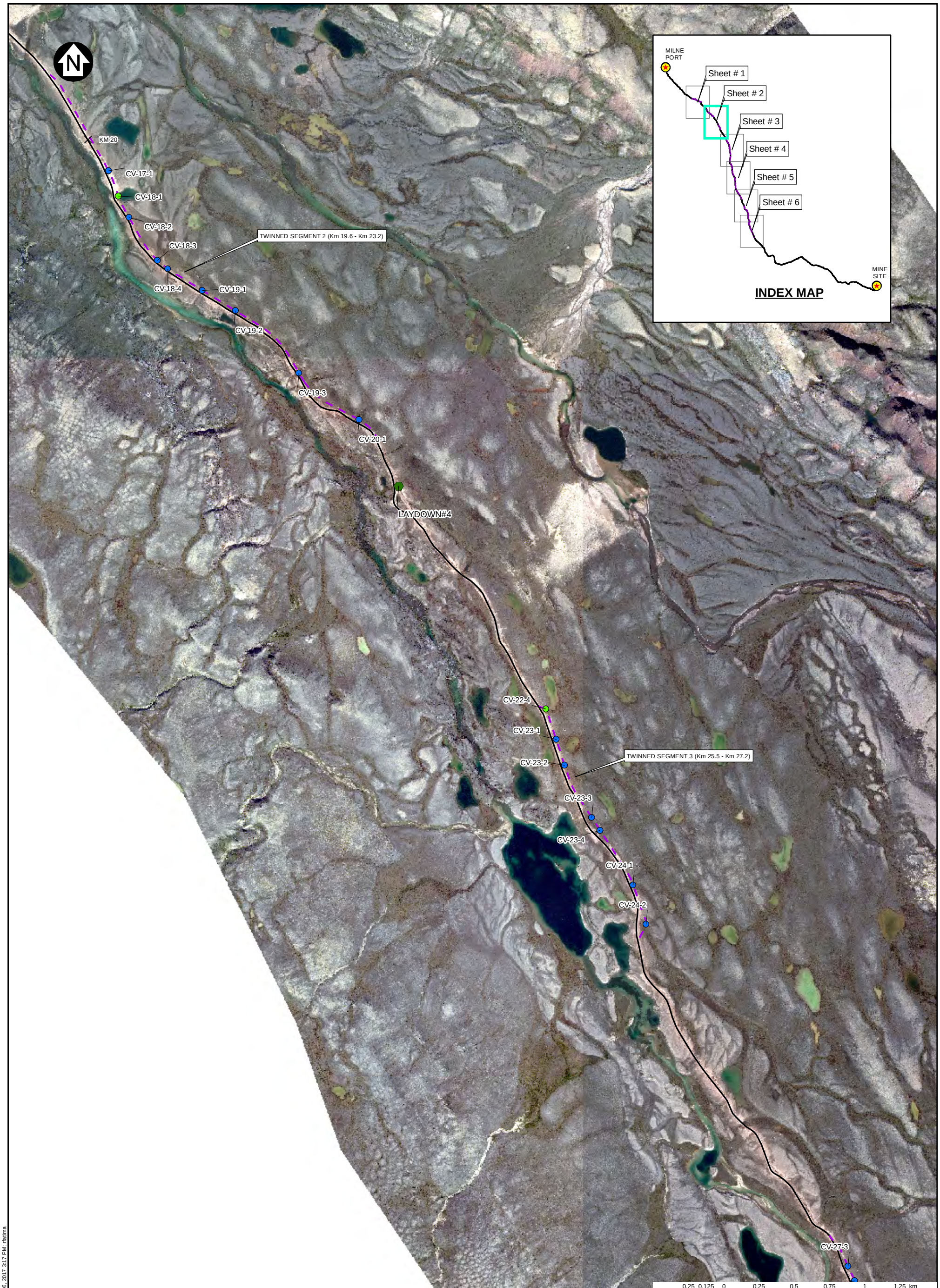

LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
- **QUARRIES AND BORROW PITS**
  - PROPOSED QUARRY
  - EXISTING BORROW PIT
  - EXISTING QUARRY
- 80 PERSON MOBILE CAMP
- HEATING FACILITY FOR EMULSION TRUCKS
- PROPOSED EXPLOSIVES MAGAZINE
- CONSTRUCTION FACILITIES
- LAYDOWN
- PROPOSED TEMPORARY EXPLOSIVE FACTORY
- MILNE INLET TOTE ROAD
- PROPOSED TOTE ROAD UPGRADES

NOTES:

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3. DETAILED WATER AND ORTHO-IMAGERY BASED ON EAGLE MAPPING (2005).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 2 OF 6

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/43	NB17-00735

FIGURE A.3 REV 0

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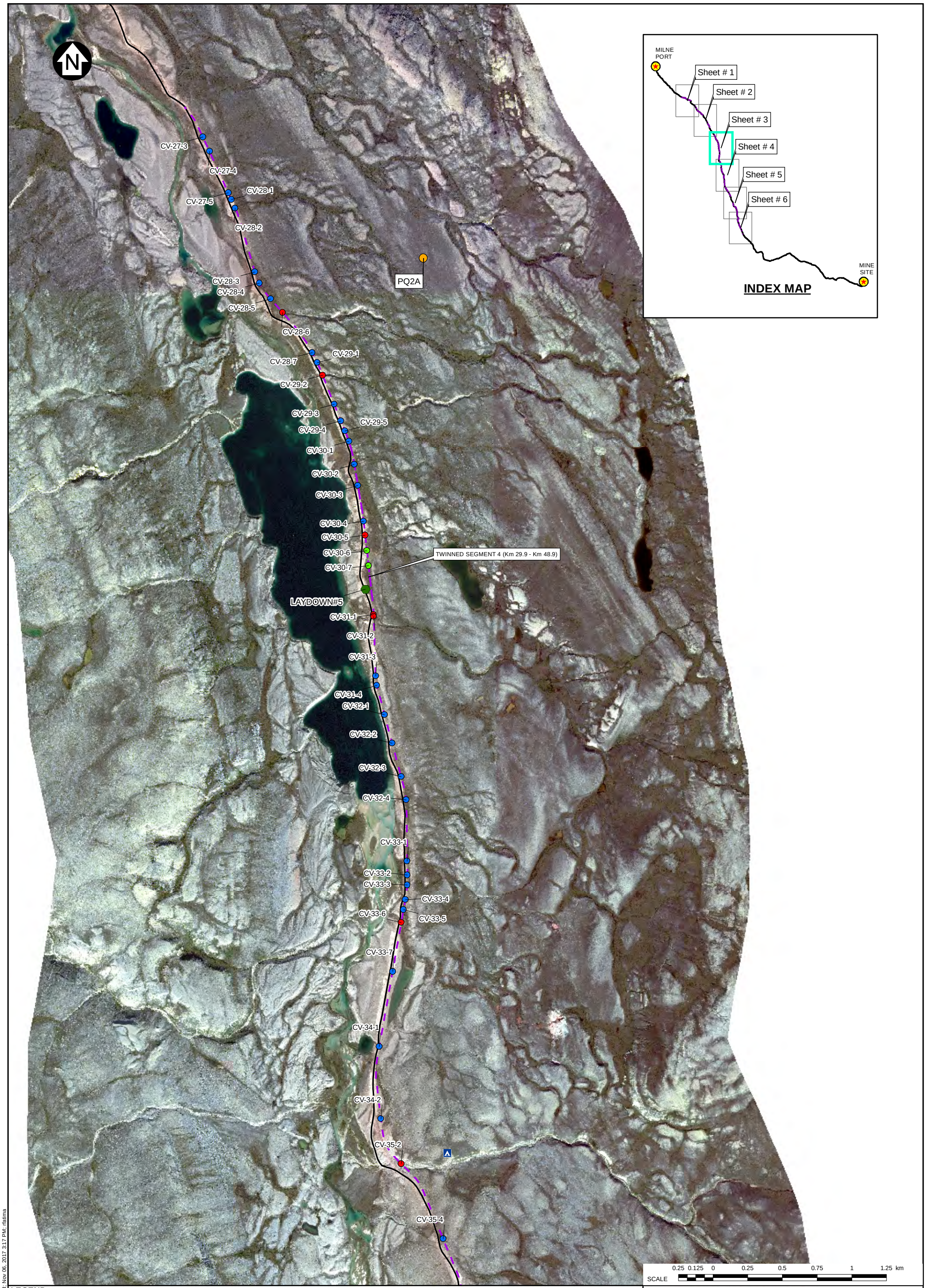

LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
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- MILNE INLET TOTE ROAD
- PROPOSED TOTE ROAD UPGRADES

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3. DETAILED WATER AND ORTHO-IMAGERY BASED ON EAGLE MAPPING (2005).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 3 OF 6

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/43	NB17-00735

FIGURE A.4 REV 0

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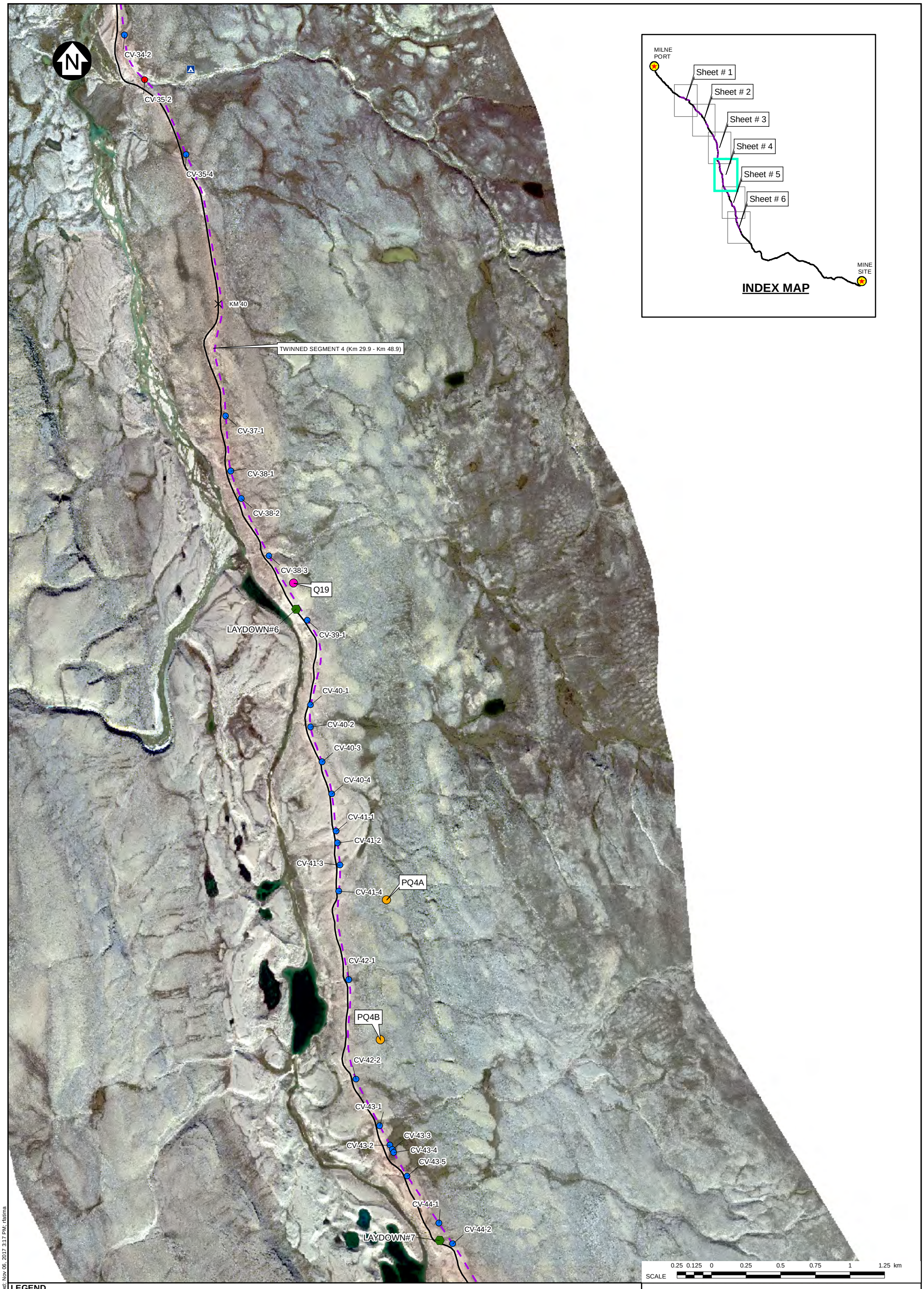

0.25 0.125 0 0.25 0.5 0.75 1 1.25 km

SCALE

LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
- **QUARRIES AND BORROW PITS**
  - PROPOSED QUARRY
  - EXISTING BORROW PIT
  - EXISTING QUARRY
- 80 PERSON MOBILE CAMP
- HEATING FACILITY FOR EMULSION TRUCKS
- PROPOSED EXPLOSIVES MAGAZINE
- CONSTRUCTION FACILITIES
- LAYDOWN
- PROPOSED TEMPORARY EXPLOSIVE FACTORY
- MILNE INLET TOTE ROAD
- PROPOSED TOTE ROAD UPGRADES

NOTES:

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA DEPARTMENT OF NATURAL RESOURCES (2009). ALL RIGHTS RESERVED.
3. DETAILED WATER AND ORTHO-IMAGERY BASED ON EAGLE MAPPING (2005).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 4 OF 6

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/43	NB17-00735

FIGURE A.5 REV 0

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CV-43-1
CV-43-2
CV-43-3
CV-43-5
CV-44-1
CV-44-2
LAYDOWN#7
TWINNED SEGMENT 4 (Km 29.9 - Km 48.9)
CV-44-3
CV-45-1
CV-46-1
PQ5A
PQ5B
CV-48-1
CV-48-5
CV-49-1
CV-49-2
CV-49-3
CV-49-4
CV-49-5
CV-50-1
CV-50-2
CV-50-3
CV-50-4
CV-50-5
CV-50-6
CV-51-1
CV-51-2
TWINNED SEGMENT 5 (Km 51.3 - Km 60.3)
CV-52-1
CV-52-2
CV-52-3
CV-53-1
KATIKTOK LAKE
LAYDOWN#8

MILNE PORT
Sheet # 1
Sheet # 2
Sheet # 3
Sheet # 4
Sheet # 5
Sheet # 6
MINE SITE

INDEX MAP

SCALE 0.25 0.125 0 0.25 0.5 0.75 1 1.25 km

LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
- **QUARRIES AND BORROW PITS**
  - PROPOSED QUARRY
  - EXISTING BORROW PIT
  - EXISTING QUARRY
- 80 PERSON MOBILE CAMP
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- PROPOSED EXPLOSIVES MAGAZINE
- CONSTRUCTION FACILITIES
- LAYDOWN
- PROPOSED TEMPORARY EXPLOSIVE FACTORY
- MILNE INLET TOTE ROAD
- PROPOSED TOTE ROAD UPGRADES

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REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 5 OF 6

Knight Piésold CONSULTING

P/A NO. NB102-181/43

REF NO. NB17-00735

FIGURE A.6

REV 0

TWINNED SEGMENT 5 (Km 51.3 - Km 60.3)

CV-51-2
CV-52-1
CV-52-2
CV-52-3
CV-53-1
LAYDOWN#8
CV-53-2
CV-54-1
CV-54-2
CV-55-1
CV-55-2
CV-55-3
KM 60
PQ6A
CV-56-1
LAYDOWN#9
PQ6B
CV-57-1
CV-57-2

KATIKTOK LAKE

MILNE PORT
Sheet # 1
Sheet # 2
Sheet # 3
Sheet # 4
Sheet # 5
Sheet # 6
MINE SITE

INDEX MAP

SCALE 0.25 0.125 0 0.25 0.5 0.75 1 1.25 km

LEGEND

- PROJECT FACILITY LOCATION
- **PROPOSED 2018 WORK PLAN CULVERTS**
- **FISH HABITAT DESIGNATION**
  - NO DATA
  - FISH BEARING
  - UNLIKELY
- **QUARRIES AND BORROW PITS**
  - PROPOSED QUARRY
  - EXISTING BORROW PIT
  - EXISTING QUARRY
- 80 PERSON MOBILE CAMP
- HEATING FACILITY FOR EMULSION TRUCKS
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- PROPOSED TEMPORARY EXPLOSIVE FACTORY
- MILNE INLET TOTE ROAD
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3. DETAILED WATER AND ORTHO-IMAGERY BASED ON EAGLE MAPPING (2005).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	06NOV'17	ISSUED WITH TRANSMITTAL	RAC	RF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

2018 WORK PLAN
ROAD UPGRADES - SHEET 6 OF 6

Knight Piésold CONSULTING

P/A NO. NB102-181/43

REF NO. NB17-00735

FIGURE A.7

REV 0

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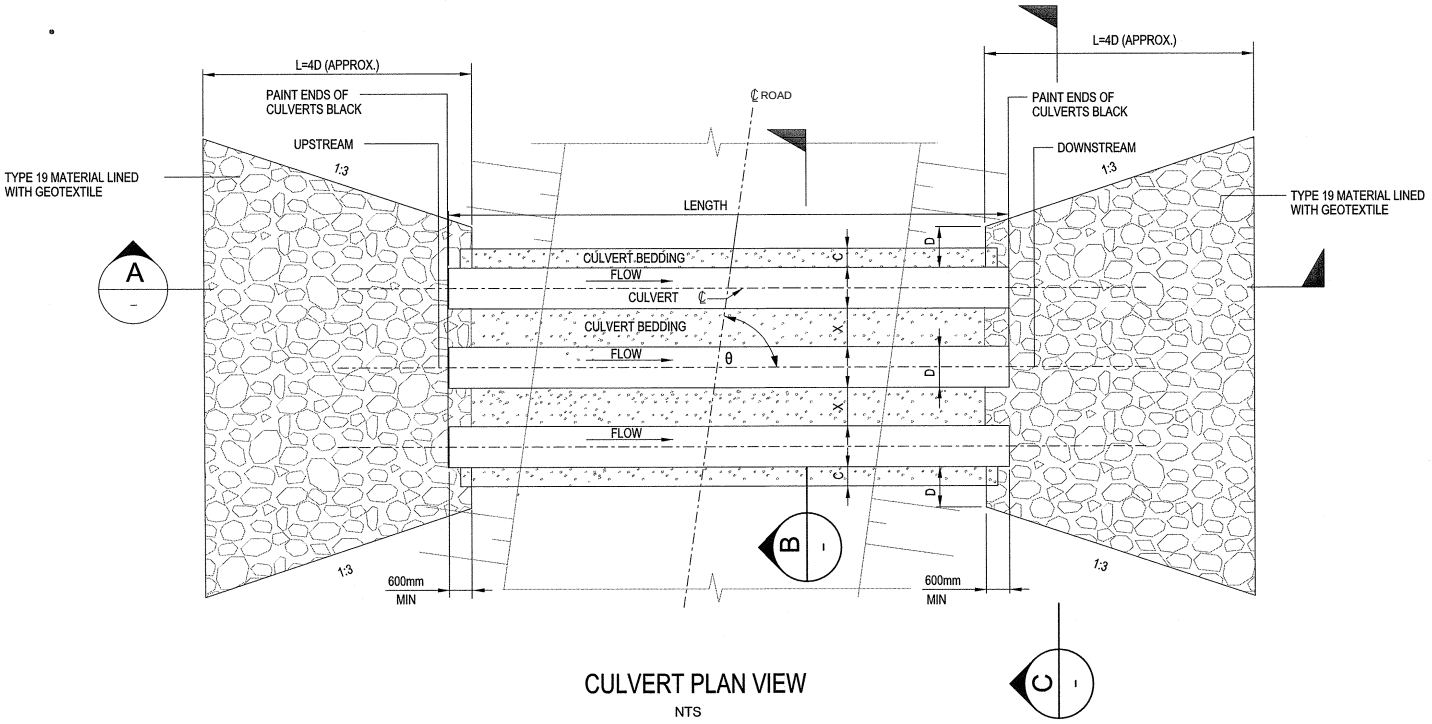
Attachment 2

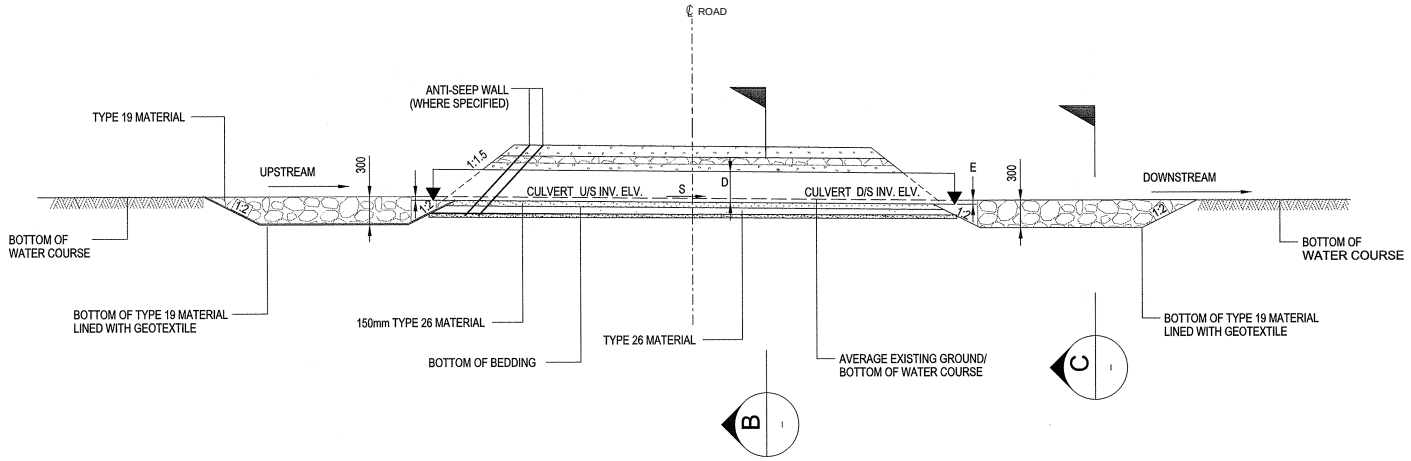
Culvert Details



CULVERT PLAN VIEW

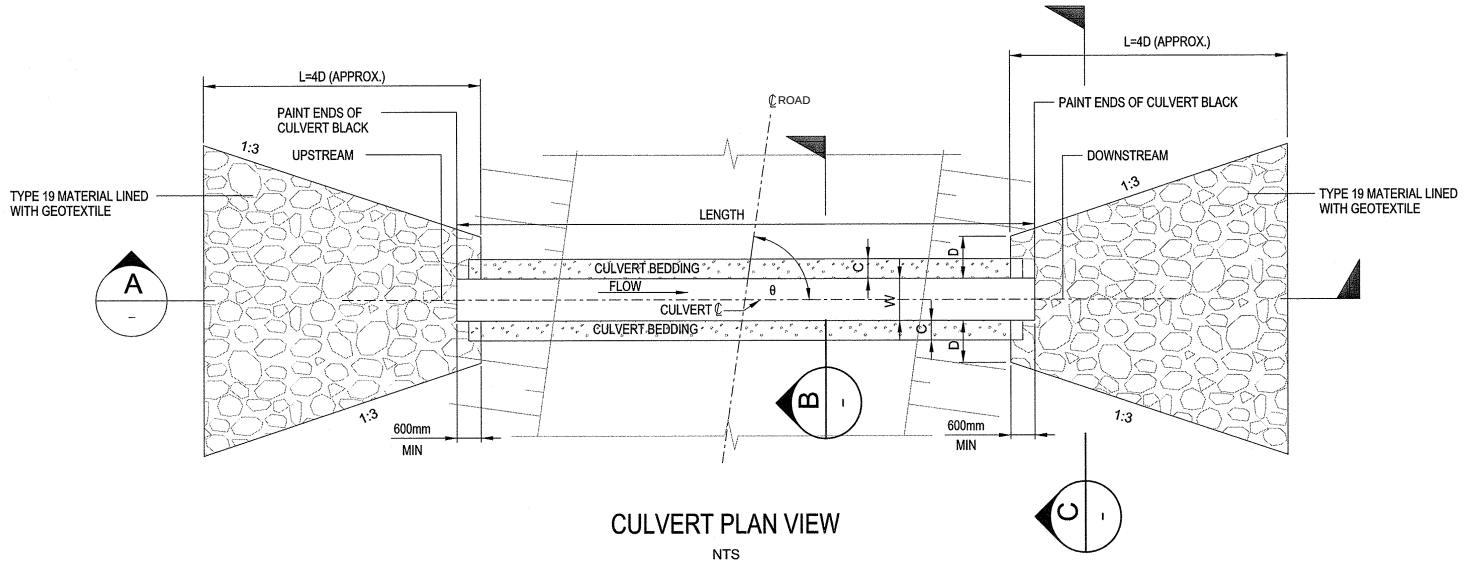
NTS

E



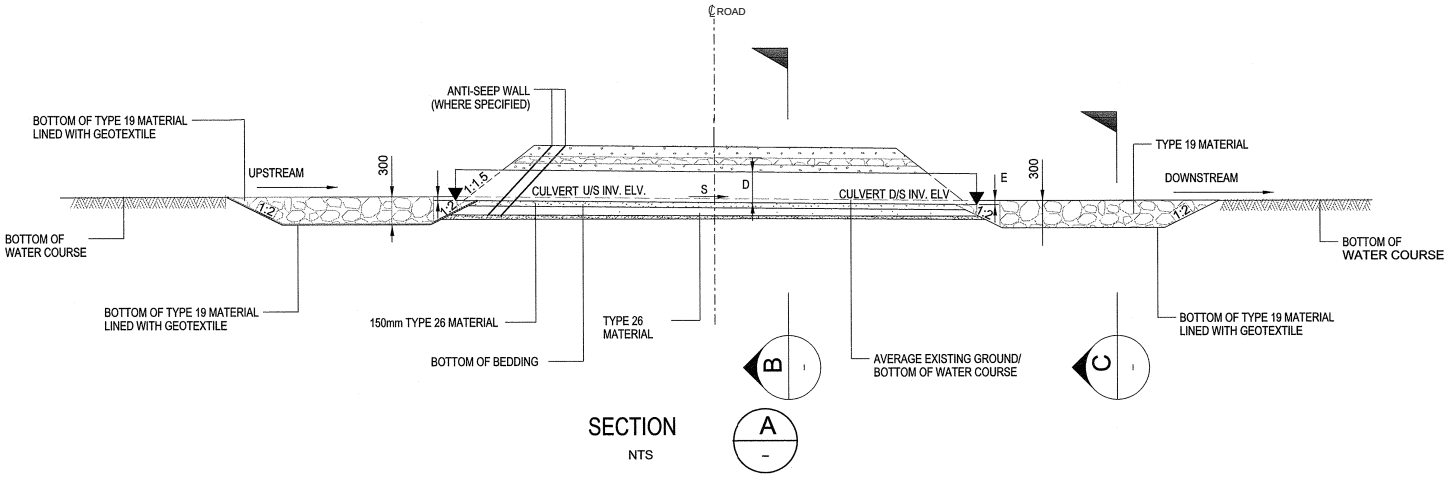
SECTION

NTS



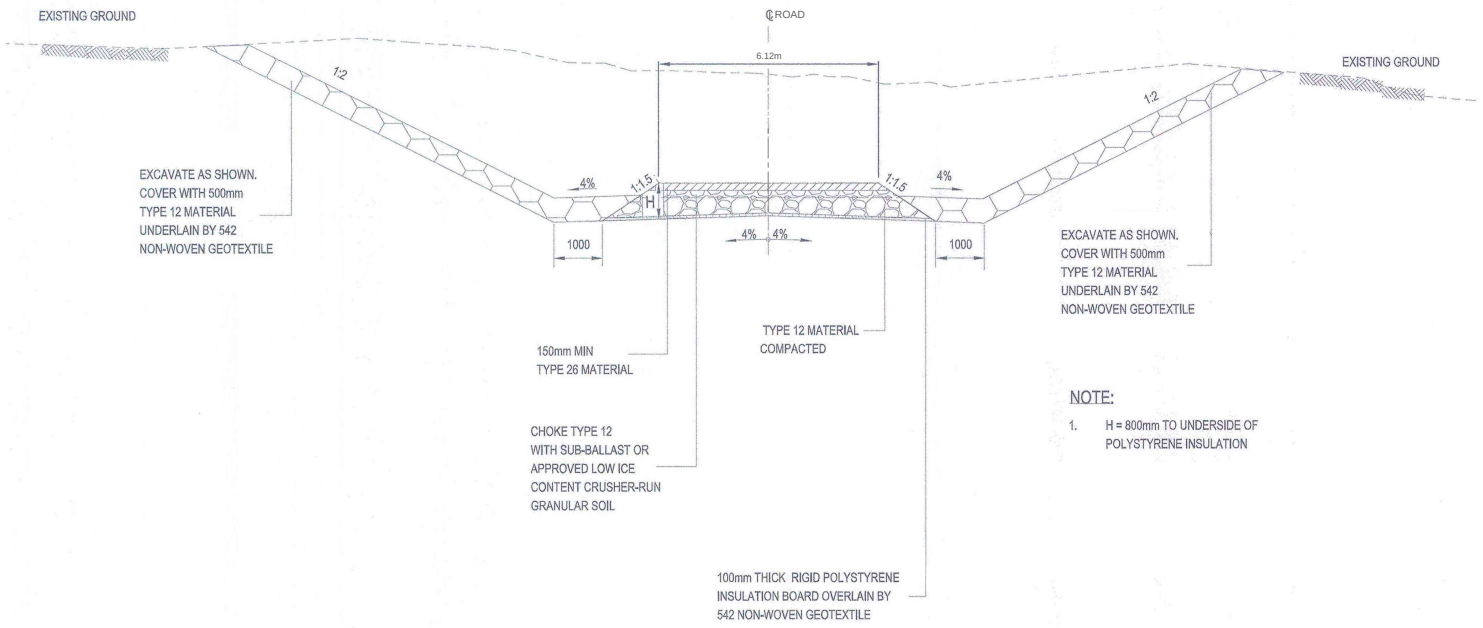
CULVERT PLAN VIEW

NTS



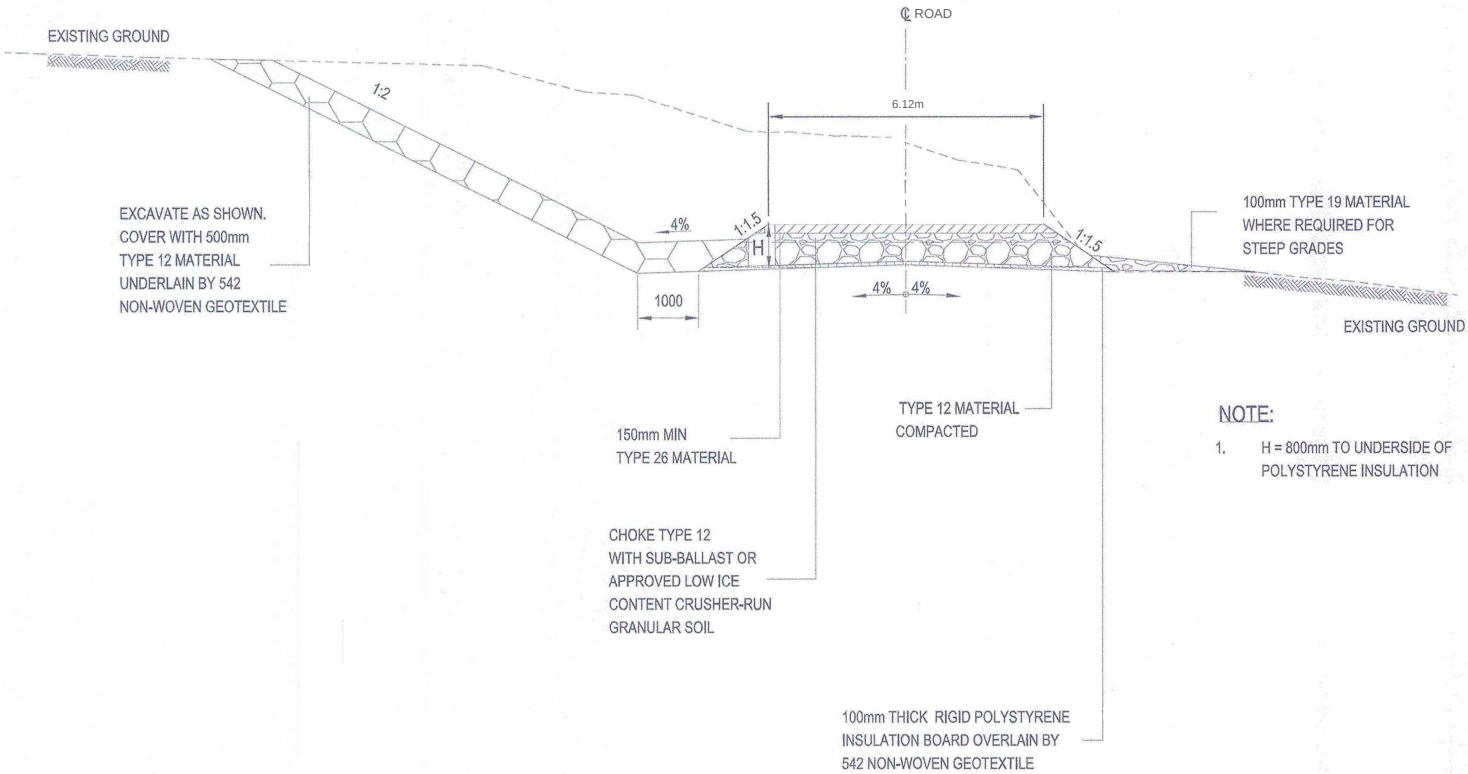
SECTION

NTS



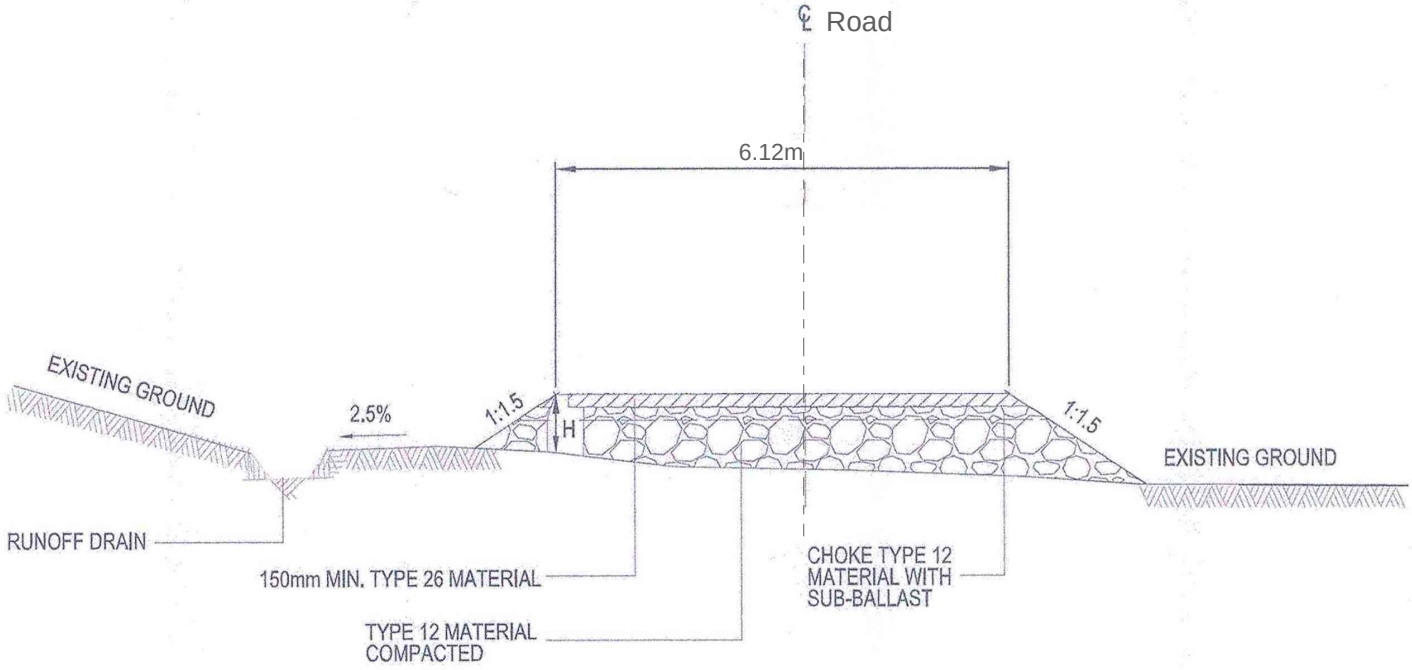
TYPICAL CROSS SECTION (CUT IN PERMAFROST)

NTS



TYPICAL CROSS SECTION (CUT IN PERMAFROST WITH DAYLIGHTING)

NTS



TYPICAL CROSS SECTION (FILL)

Baffinland

Attachment 3

Watercourse Crossings

TABLE 1

BAFFINLAND IRON MINES CORP.
MARY RIVER PROJECT

PROPOSED TOTE ROAD UPGRADES WATERCOURSE CROSSING DETAILS

No.	Culvert ID	Description	Twinned Section #	Waterbody Type	UTM Coordinates		Fish Bearing	Fish Habitat Quality
					Easting	Northing		
1	CV-12-2	Culvert	1	S	511019	7967241	Unlikely	None to Marginal
2	CV-12-3	Culvert	1	LP	511127	7967223	No	None
3	CV-12-4	Culvert	1	LP	511355	7967185	No	None
4	CV-12-5	Culvert	1	S	511552	7967152	No	None
5	CV-13-1	Culvert	1	LP	511798	7967111	No	None
6	CV-13-2	Culvert	1	LP	512120	7966981	No	None
7	CV-13-3	Culvert	1	S	512375	7966823	No	None
8	CV-13-4	Culvert	1	S	512415	7966799	Yes	Important
9	CV-13-5	Culvert	1	S	512556	7966712	No	None
10	CV-14-1	Culvert	1	S	513252	7966428	No	None
11	CV-14-2	Culvert	1	P	513436	7966375	No	None
12	CV-14-3	Culvert	1	P	513532	7966333	No	None
13	CV-15-1	Culvert	1	LP	513624	7966294	No	None
14	CV-17-1	Culvert	2	P	515261	7964025	No	None
15	CV-18-1	Encroachment	2	P	515331	7963846	Unlikely	None to Marginal
16	CV-18-2	Culvert	2	S	515405	7963693	No	None
17	CV-18-3	Culvert	2	S	515607	7963389	No	None
18	CV-18-4	Culvert	2	S	515682	7963328	No	None
19	CV-19-1	Culvert	2	S	515927	7963175	No	None
20	CV-19-2	Culvert	2	P	516161	7963031	No	None
21	CV-19-3	Culvert	2	S	516613	7962587	No	None
22	CV-20-1	Culvert	2	LP	517040	7962255	No	None
23	CV-22-4	Encroachment	3	P	518370	7960198	Unlikely	None to Marginal
24	CV-23-1	Culvert	3	S	518441	7959981	No	None
25	CV-23-2	Culvert	3	S	518501	7959798	No	None
26	CV-23-3	Culvert	3	LP	518695	7959425	No	None
27	CV-23-4	Culvert	3	S	518754	7959335	No	None
28	CV-24-1	Culvert	3	S	518988	7958946	No	None
29	CV-24-2	Culvert	3	S	519077	7958678	No	None
30	CV-27-3	Culvert	4	LP	520516	7956235	No	None
31	CV-27-4	Culvert	4	LP	520564	7956131	No	None
32	CV-27-5	Culvert	4	S	520699	7955833	No	None
33	CV-28-1	Culvert	4	LP	520722	7955784	No	None
34	CV-28-2	Culvert	4	S	520749	7955722	No	None
35	CV-28-3	Culvert	4	LP	520891	7955261	No	None
36	CV-28-4	Culvert	4	LP	520924	7955182	No	None
37	CV-28-5	Culvert	4	P	521005	7955067	No	None
38	CV-28-6	Culvert	4	S	521092	7954969	Yes	Important
39	CV-28-7	Culvert	4	S	521305	7954680	No	None
40	CV-29-1	Culvert	4	S	521341	7954608	No	None

PROPOSED TOTE ROAD UPGRADES WATERCOURSE CROSSING DETAILS

41	CV-29-2	Culvert	4	S	521379	7954516	Yes	Important
42	CV-29-3	Culvert	4	S	521464	7954306	No	None
43	CV-29-4	Culvert	4	S	521512	7954187	No	None
44	CV-29-5	Culvert	4	S	521541	7954115	No	None
45	CV-30-1	Culvert	4	S	521569	7954040	No	None
46	CV-30-2	Culvert	4	LP	521609	7953873	No	None
47	CV-30-3	Culvert	4	S/LP	521635	7953720	No	None
48	CV-30-4	Culvert	4	S	521676	7953461	No	None
49	CV-30-5	Culvert	4	S	521687	7953363	Yes	Important
50	CV-30-6	Culvert	4	S	521700	7953250	Unlikely	None to Marginal
51	CV-30-7	Encroachment	4	S/P	521712	7953143	Unlikely	None to Marginal
52	CV-31-1	Culvert	4	S	521748	7952788	Yes	Important
53	CV-31-2	Culvert	4	S	521749	7952776	Yes	Important
54	CV-31-3	Culvert	4	LP	521763	7952346	No	None
55	CV-31-4	Culvert	4	LP	521772	7952278	No	None
56	CV-32-1	Culvert	4	LP	521827	7952066	No	None
57	CV-32-2	Culvert	4	LP	521882	7951861	No	None
58	CV-32-3	Culvert	4	LP	521946	7951620	No	None
59	CV-32-4	Culvert	4	S	521983	7951453	No	None
60	CV-33-1	Culvert	4	LP	521990	7951011	No	None
61	CV-33-2	Culvert	4	LP	521991	7950911	No	None
62	CV-33-3	Culvert	4	LP	521990	7950839	No	None
63	CV-33-4	Culvert	4	S	521976	7950733	No	None
64	CV-33-5	Culvert	4	S	521964	7950662	No	None
65	CV-33-6	Culvert	4	S	521947	7950568	Yes	Important
66	CV-33-7	Culvert	4	P	521885	7950215	No	None
67	CV-34-1	Culvert	4	S	521789	7949673	No	None
68	CV-34-2	Culvert	4	S	521801	7949153	No	None
69	CV-35-2	Culvert	4	S	521947	7948828	Yes	Important
70	CV-35-4	Culvert	4	S	522249	7948287	No	None
71	CV-37-1	Culvert	4	LP	522533	7946398	No	None
72	CV-38-1	Culvert	4	S	522570	7946000	No	None
73	CV-38-2	Culvert	4	S	522646	7945802	No	None
74	CV-38-3	Culvert	4	S	522846	7945387	No	None
75	CV-39-1	Culvert	4	S	523125	7944922	No	None
76	CV-40-1	Culvert	4	LP	523148	7944309	No	None
77	CV-40-2	Culvert	4	S	523147	7944150	No	None
78	CV-40-3	Culvert	4	LP	523231	7943898	No	None
79	CV-40-4	Culvert	4	LP	523301	7943665	No	None
80	CV-41-1	Culvert	4	S	523332	7943397	No	None
81	CV-41-2	Culvert	4	S	523342	7943311	No	None
82	CV-41-3	Culvert	4	LP	523359	7943152	No	None
83	CV-41-4	Culvert	4	LP	523351	7942963	No	None
84	CV-42-1	Culvert	4	S	523423	7942323	No	None
85	CV-42-2	Culvert	4	S	523475	7941603	No	None
86	CV-43-1	Culvert	4	S	523647	7941268	No	None
87	CV-43-2	Culvert	4	LP	523721	7941127	No	None
88	CV-43-3	Culvert	4	S	523738	7941095	No	None
89	CV-43-4	Culvert	4	S	523749	7941075	No	None

PROPOSED TOTE ROAD UPGRADES WATERCOURSE CROSSING DETAILS

90	CV-43-5	Culvert	4	S	523846	7940904	No	None
91	CV-44-1	Culvert	4	S	524074	7940563	No	None
92	CV-44-2	Culvert	4	S	524174	7940415	No	None
93	CV-44-3	Culvert	4	S	524536	7939827	No	None
94	CV-45-1	Culvert	4	LP	525004	7938965	No	None
95	CV-46-1	Culvert	4	LP	525118	7938743	No	None
96	CV-48-1	Culvert	5	S	525696	7937112	Yes	Important
97	CV-48-5	Culvert	5	S	525924	7936382	No	None
98	CV-49-1	Culvert	5	S	525958	7936097	No	None
99	CV-49-2	Culvert	5	S	525981	7935920	No	None
100	CV-49-3	Encroachment	5	L	526097	7935754	Yes	Important
101	CV-49-4	Culvert	5	LP	526240	7935697	No	None
102	CV-49-5	Culvert	5	S	526586	7935521	Yes	Marginal
103	CV-50-1	Culvert	5	S	526798	7935085	No	None
104	CV-50-2	Culvert	5	LP	526826	7934984	No	None
105	CV-50-3	Culvert	5	LP	526844	7934917	No	None
106	CV-50-4	Culvert	5	LP	526857	7934871	No	None
107	CV-50-5	Culvert	5	S	526924	7934630	Yes	Marginal
108	CV-50-6	Culvert	5	S	526926	7934620	Yes	Important
109	CV-51-1	Culvert	5	LP	527006	7934331	No	None
110	CV-51-2	Culvert	5	LP	527054	7933628	No	None
111	CV-52-1	Culvert	5	S	527080	7932998	No	None
112	CV-52-2	Culvert	5	S	527132	7932787	No	None
113	CV-52-3	Culvert	5	LP	527180	7932698	No	None
114	CV-53-1	Culvert	5	LP	527366	7932476	No	None
115	CV-53-2	Culvert	5	P	527274	7932000	No	None
116	CV-54-1	Culvert	5	S	527333	7931375	No	None
117	CV-54-2	Culvert	5	S	527529	7930869	No	None
118	CV-55-1	Culvert	5	LP	527583	7930653	No	None
119	CV-55-2	Culvert	5	LP	527632	7930421	No	None
120	CV-55-3	Culvert	5	S	527650	7930339	Yes	Important
121	CV-56-1	Culvert	5	S	528085	7929337	Yes	Marginal
122	CV-57-1	Culvert	5	S	528309	7928841	Yes	Marginal
123	CV-57-2	Culvert	5	S	528345	7928683	Yes	Marginal

Attachment 4

Quarry Details

TABLE 1

BAFFINLAND IRON MINES CORP.
MARY RIVER PROJECT

2018 QUARRY AND BORROW PIT QUANTITIES

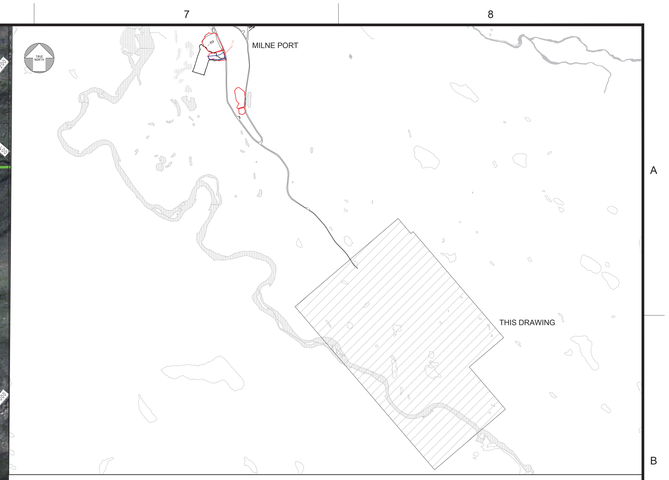
Quarry Summary	km Location	Permitted	Q1	Q2	Q3	Q4	Total	Estimated Surface Area Increase	Estimated Breakdown Of Specified Substances
UNITS			**m^3**	**m^3**	**m^3**	**m^3**	**m^3**	**m^2**	
Q5	4	Proposed	0	60,000	60,000	60,000	**180,000**	15,000	Rock
Q12	23.9	Proposed	0	20,000	10,000	10,000	**40,000**	20,000	Rock
PQ2A	28	Proposed	0	25,000	24,000	21,000	**70,000**	35,000	Rock
PQ4A	41.75	Proposed	0	15,000	18,000	17,000	**50,000**	25,000	Rock
PQ4B	42.5	Proposed	0	17,000	16,000	17,000	**50,000**	25,000	Rock
PQ5A	46.4	Proposed	0	20,000	40,000	20,000	**80,000**	40,000	Rock
PQ5B	47.5	Proposed	0	20,000	40,000	20,000	**80,000**	40,000	Rock
PQ6A	55.5	Proposed	0	16,250	32,500	16,250	**65,000**	32,500	Rock
PQ6B	57.3	Proposed	0	16,250	32,500	16,250	**65,000**	32,500	Rock
P8	73.8	Proposed	0	15,000	15,000	30,000	**60,000**	30,000	Rock
PQ12B	74.8	Proposed	0	15,000	15,000	30,000	**60,000**	30,000	Rock
PQ14A	87.2	Proposed	0	15,000	15,000	30,000	**60,000**	30,000	Rock
PQ14B	87.7	Proposed	0	15,000	15,000	30,000	**60,000**	30,000	Rock
Tote Road	0-100	Proposed	0	217,000	217,000	216,000	**650,000**	325,000	Granular/Rock
Q1	1	Permitted	50,000	175,000	175,000	50,000	**450,000**	30,000	Rock
Km 2	2	Permitted	1,000	1,000	0	1,000	**3,000**	1,500	Granular
Q7	7	Permitted	10,000	10,000	10,000	10,000	**40,000**	20,000	Rock
Q11	21	Permitted	10,000	10,000	10,000	10,000	**40,000**	20,000	Rock
Q19	93.5	Permitted	0	10,000	15,000	15,000	**40,000**	20,000	Rock
Km 97	97	Permitted	1,000	1,000	0	1,000	**3,000**	1,500	Granular
QMR2	102	Permitted	50,000	75,000	75,000	50,000	**250,000**	15,625	Rock
Total			**122,000**	**768,500**	**835,000**	**670,500**	**2,396,000**	**818,625**	

Baffinland

Attachment 5

Explosives Magazines and Truck Parking Details

DWG. No. H353004-40000-220-262-0002-0001



KEY PLAN
NTS

DISTANCE FROM THE HEATING FACILITY	
SIZE OF HEATING FACILITY FOR EMULSION	131m x 49m
DISTANCE FROM TOTE RD TO THE HEATING FACILITY	220m
DISTANCE FROM EXPLOSIVE LAYDOWN TO HEATING FACILITY	753m
DISTANCE FROM EXPLOSIVE LAYDOWN TO HEATING FACILITY	311m

R3
753m
220m
311m
131m
49m
HEATING FACILITY FOR EMULSION TRUCKS
AREA: 6,400 m²

REFERENCE DRAWINGS	
DRAWING No.	DRAWING TITLE
H353004-40000-220-262-0001-0001	MILNE PORT - 2017 LAYDOWN AREAS - DIAGRAM - SHEET 1
H353004-10000-220-262-0001-0002	MINE SITE - 2017 LAYDOWN AREAS - DIAGRAM - SHEET 2
H353004-10000-220-262-0001-0001	MINE SITE - 2017 LAYDOWN AREAS - DIAGRAM - SHEET 1
H353004-000-454-060-0001	REGISTER - EXISTING AND PROPOSED LAYDOWNS AT MILNE PORT & MINE SITE

NOT FOR CONSTRUCTION

0 20 40 60 80 100
SCALE IN METRES

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE
A	APPROVED FOR USE	FH	IB	22/08/2017

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	F HUGO	NR	22/08/2017
DESIGNER	F HUGO	NR	22/08/2017
CHECKER	I BARNARD		22/08/2017
DESIGN COORD.	R GOOSEN		22/08/2017
RESP. ENG.	R HALIM		22/08/2017
LEAD DISC. ENG.	A GROBBELAAR		22/08/2017
ENG. MANAGER	J HOWES		22/08/2017
PROJ. MANAGER			
CLIENT			

DRAWING APPROVAL STATUS: Approved for Use

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

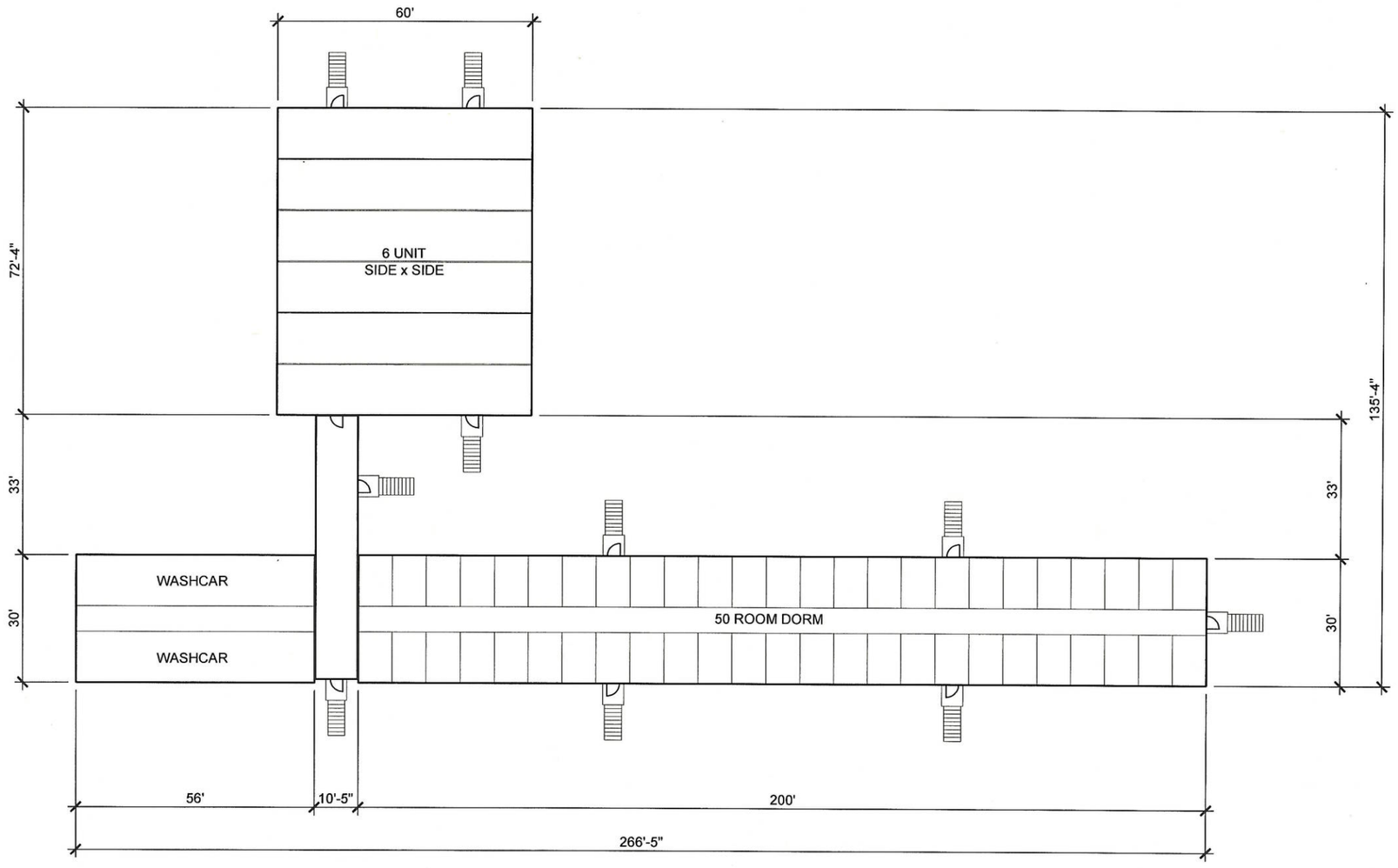
MILNE PORT
HEATING FACILITY FOR EMULSION TRUCKS - DIAGRAM

SCALE 1:2,000 OR AS NOTED
DWG. No. H353004-40000-220-262-0002-0001
REV A
SHEET SIZE: A0

$USERNAME$
$DATE$
$FILES$
$TIME$

Attachment 6

Mobile Construction Camp Details



DIMENSIONS ARE NOMINAL
SAMPLE DRAWING - TO BE USED AS A GUIDE ONLY

No.	Y	M	D	REVISION	BY	CHKD
1		170829		ISSUED FOR REVIEW	TS	DG

HORIZON NORTH

PROJ # :	
TN # :	
SCALE :	1" = 30'-0"
DRAWN BY :	TS
CHECKED :	DG

BAFFINLAND IRON MINES

BAFFINLAND SHORT TERM ACCOMMODATION CAMP SITE PLAN

DWG No.:

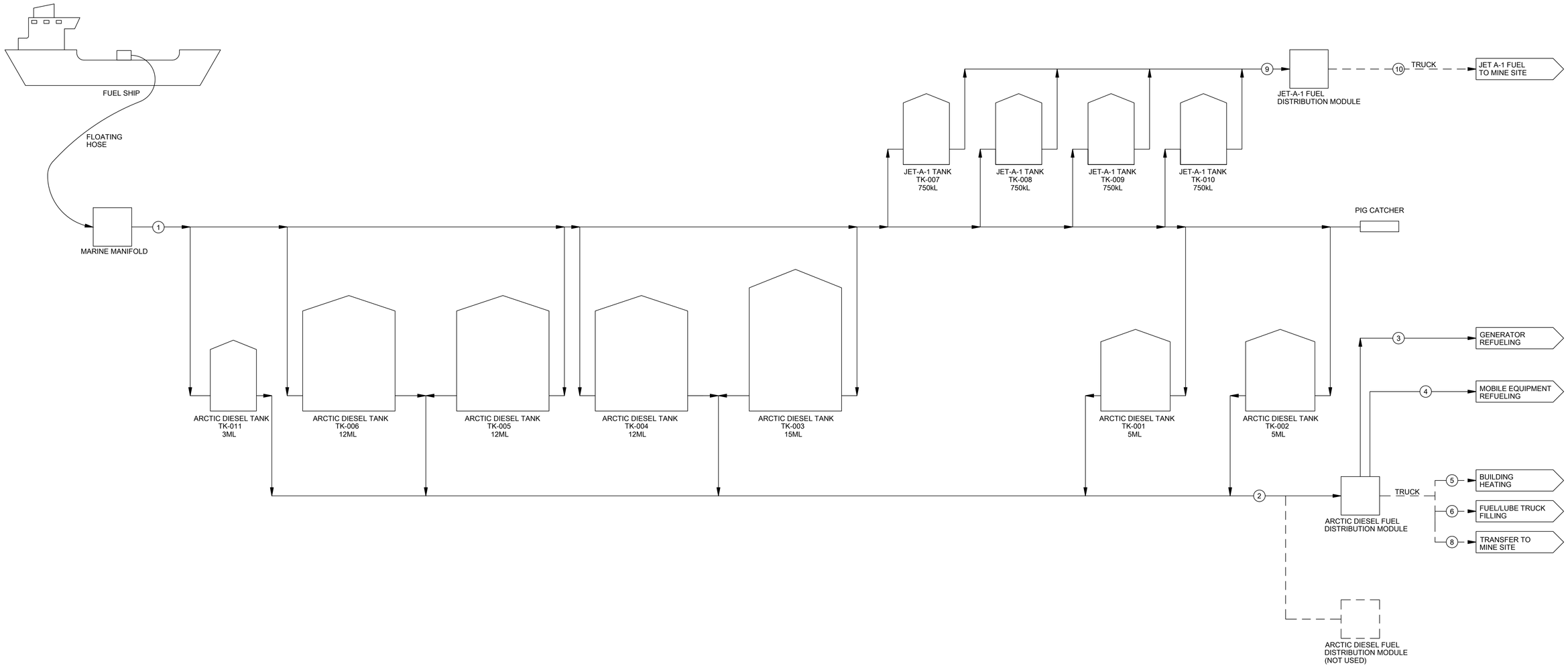
AF-011-010

Attachment 7

Port Site TM001 Fuel System Process Flow Diagram

(H353004-48000-210-282-0001-0001, Rev. 1)

DWG. No. H353004-48000-210-282-0001-0001



STREAM NUMBER	UNIT	1	2	3	4	5	6	7	8	9	10
DESIGN FLOW	L/min	2,500	1,600	100	100	1,500	1,500	1,500	1,500	1,500	1,500
MAX FLOW	ML/YR	55,3	-	8	1,8	1,4	4,4	4,4	38,7	-	3
DESIGN TEMPERATURE(MAX)	°C	20	20	20	20	20	20	20	20	20	20
DESIGN TEMPERATURE(MIN)	°C	-54	-54	-54	-54	-54	-54	-54	-54	-54	-54

NOTES

1. TANKS ARE FILLED ONE AT A TIME
2. TANKS ARE DRAWN DOWN ONE AT A TIME
3. TANKS FILLED TO 95% OF NOMINAL CAPACITY

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

Reserved space for Issue Reason stamp applied by Document Control

No.	DESCRIPTION	BY	CHK'D	DATE
1	APPROVED FOR USE			
0	APPROVED FOR FEASIBILITY STUDY	N.M.		27-03-2017

REVISIONS

HATCH

DRAFTSPERSON	N. MDLULI	NR	02-03-17
DESIGNER		NR	
CHECKER			
DESIGN COORD.			
RESP. ENG.			
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS:

Baffinland

MARY RIVER PROJECT
BAFFINLAND IRON MINES LP

PORT SITE
TM001 FUEL SYSTEM
PROCESS FLOW DIAGRAM

SCALE	DWG. No.	REV
1:1 OR AS NOTED	H353004-48000-210-282-0001-0001	1

SHEET SIZE: A1

Attachment 8

Port Site TM001 Fuel System Overall Layout

(H353004-48400-240-272-0001, Rev. 2)

DWG. No.
H353004-48000-240-272-0001

NOTES:

1. REFER TO THE FOLLOWING DRAWINGS FOR GENSET PIPING DETAILS:
H353004-48400-240-270-0014
H353004-48400-240-270-0015

2. REFER TO THE FOLLOWING DRAWING FOR FUEL SYSTEM PIPING SYSTEM:
H353004-48400-240-272-0002

PLAN VIEW
SCALE 1:750

REGISTERED PROFESSIONAL ENGINEER F.E. BUTTS LICENSEE NT/NU

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

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No.	DESCRIPTION	BY	CHK'D	DATE
2	GENERAL UPDATE; ISSUED FOR CONSTRUCTION	S.S.	MMI	07/06/17
1	MANIFOLD RELOCATION AND MARINE FUEL LINE ON HOLD			
0	ISSUED FOR CONSTRUCTION			

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	S. LEY	NR	
DESIGNER	M. MACINTYRE	NR	
CHECKER		Michael MacIntyre	07/06/17
DESIGN COORD.			
RESP. ENG.		F. Butts	07/06/17
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

MARY RIVER PROJECT
BAFFINLAND IRON MINES LP

PORT SITE
TM001 FUEL SYSTEM
OVERALL LAYOUT

SCALE 1:750 OR AS NOTED

DWG. No. H353004-48400-240-272-0001

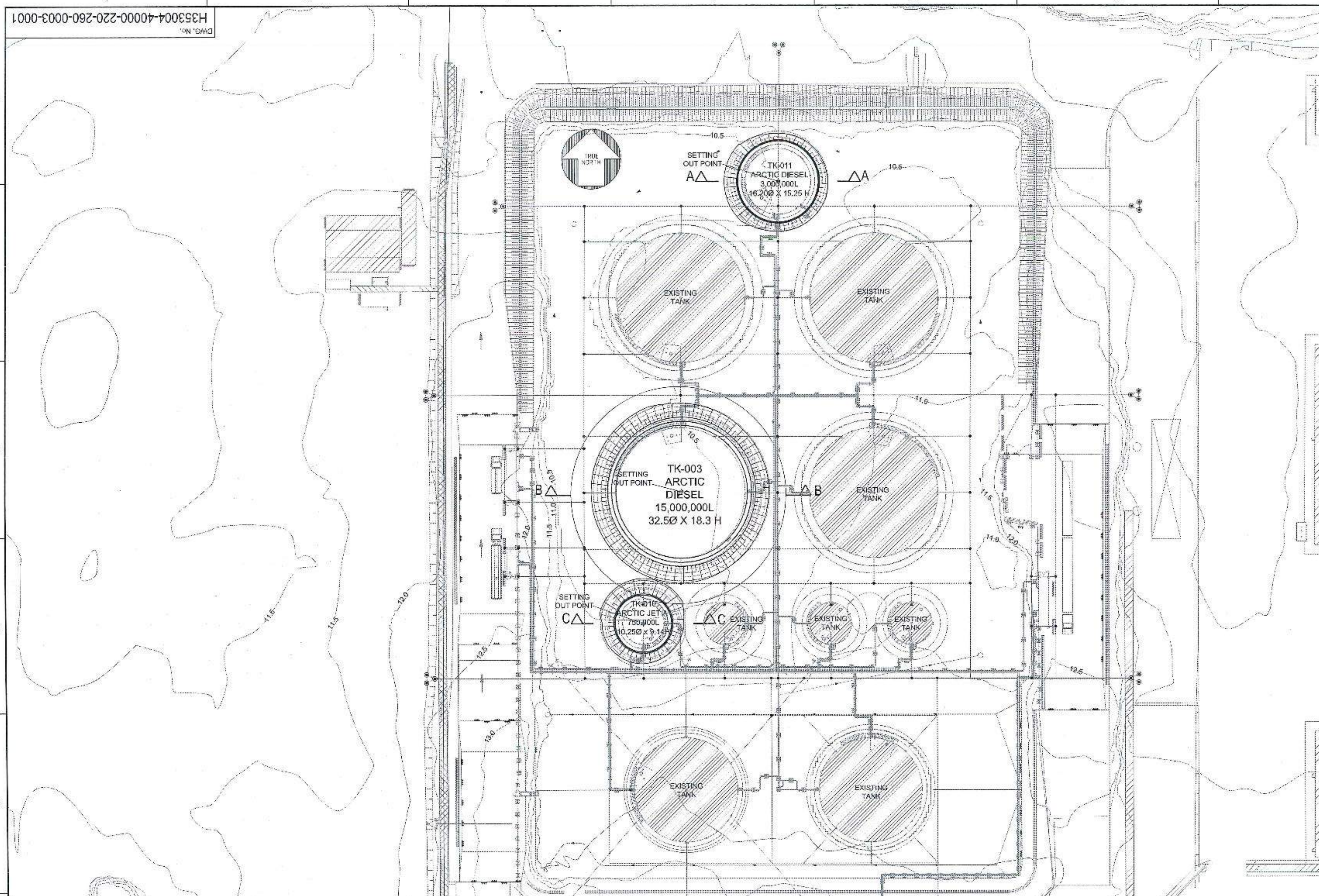
REV 2

SHEET SIZE: A0

Attachment 9

Milne Port Fuel Tanks 003, 010 & 011 Setting Out Earthworks

(H353004-40000-220-260-0003-0001, Rev. 0)



MATERIAL VOLUMES

CRUSHER FINES MATERIAL (-2mm)	= 160m3
FILL MATERIAL (TYPE 5)	= 3822m3
TOTAL FILL MATERIAL REQUIRED	= 3982m3
TOTAL SURFACE AREA	= 2490m2

TANK EARTHWORKS SETTING OUT POINT (CENTRE OF TANK)

TANK No.	N	E	TANK PERIMETER LEVEL (EL)
TANK 011	7976273.168	503641.393	11.95
TANK 003	7976197.158	503617.743	12.55
TANK 010	7976164.948	503608.206	12.30

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016)
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
4. FOR TYPICAL CROSS SECTIONS REFER TO DRAWING No. H353004-40000-220-273-0001-0001

PERMIT TO PRACTICE
HATCH LTD.
Signature [signature]
Date July 3, 2017
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REGISTERED PROFESSIONAL ENGINEER — L1247 — R. A. HALIM — LICENSEE — 03/07/2017 — NWT/NU

DRAWING No.	DRAWING TITLE
H353004-40000-220-273-0001-0001	FUEL TANK No. 3,10 & 11 DETAILS - TYPICAL SECTIONS

REFERENCE DRAWINGS

REG. PROFESSIONAL: NAME R. HALIM; SIGNATURE [signature]; ENG REG NUMBER L1247; REVISION DATE 03/07/2017; ORIGINAL DATE –

No.	DESCRIPTION	BY	CHK'D	DATE
0	APPROVED FOR CONSTRUCTION	FH	MB	30/06/2017

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	S HALL	NR	30/06/2017
DESIGNER	S HALL	NR	30/06/2017
CHECKER	M BRONDANI	[signature]	30/06/2017
DESIGN COORD.	R GOOSEN	[signature]	30/06/2017
RESP. ENG.	R. HALIM	[signature]	03/07/2017
LEAD DISC. ENG.	A GROBBELAAR	[signature]	30/06/2017
AREA MANAGER	T BRUCE	[signature]	30/06/2017
PROJ. MANAGER	S HEINER	[signature]	30/06/2017
CLIENT			

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

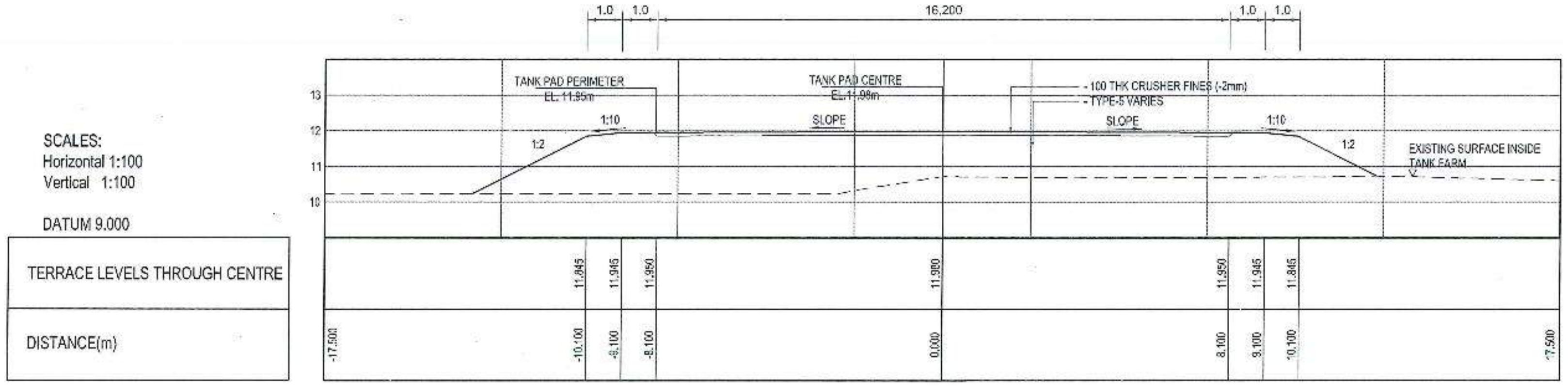
BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
FUEL TANKS 003, 010 & 011 SETTING OUT EARTHWORKS

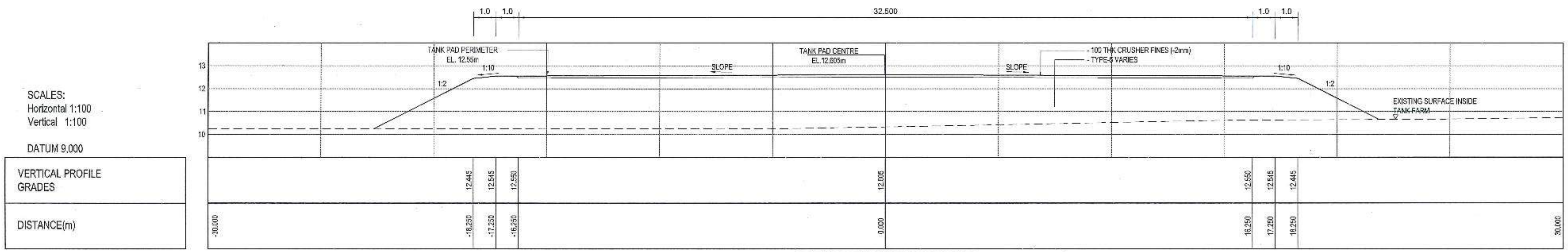
SCALE 1:500 OR AS NOTED — DWG. No. H353004-40000-220-260-0003-0001 — REV 0

SHEET SIZE: D

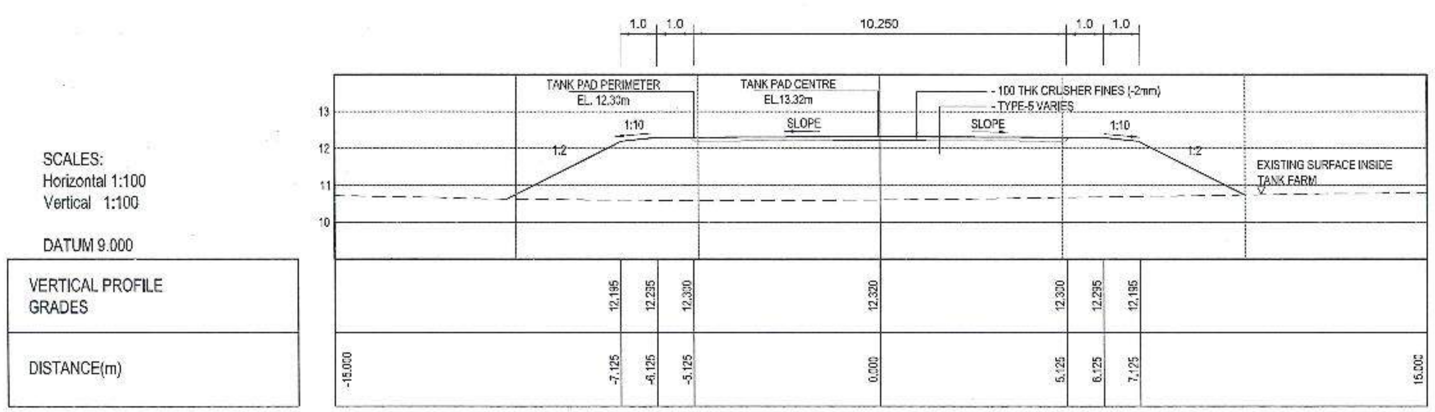
H353004-40000-220-273-0001-0001
DWG. No.



SECTION A-A THROUGH TK011 TERRACE
FROM -17.500 TO +17.500



SECTION B-B THROUGH TK003 TERRACE
FROM -30.000 TO +30.000



SECTION C-C THROUGH TK010 TERRACE
FROM -15.000 TO +15.000

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HATCH LTD.
Signature ____
Date July 3, 2017
PERMIT NUMBER: P 512
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REGISTERED PROFESSIONAL ENGINEER
L1247
R. A. HALIM
LICENSEE
03/07/2017
NWT/NU

DRAWING No.	DRAWING TITLE
H353004-40000-220-260-0003-0001	NEW FUEL TANKS SETTING OUT DETAILS

REFERENCE DRAWINGS

NAME	R. HALIM
SIGNATURE	RAH
ENG REG NUMBER	L1247
REVISION DATE	03/07/2017
ORIGINAL DATE	–

REG. PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE
0	APPROVED FOR CONSTRUCTION	FH	MB	30/06/2017

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	S HALL	NR	30/06/2017
DESIGNER	S HALL	NR	30/06/2017
CHECKER	M BRONDANI		30/06/2017
DESIGN COORD.	R GOOSEN		30/06/2017
RESP. ENG.	R. HALIM	RAH	03/07/2017
LEAD DISC. ENG.	A GROBBELAAR		30/06/2017
AREA MANAGER	T BRUCE		30/06/2017
PROJ. MANAGER	S HEINER		30/06/2017
CLIENT			

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
FUEL TANKS 003, 010 & 011 DETAILS
TYPICAL SECTIONS

SCALE	DWG. No.	REV
1:100 OR AS NOTED	H353004-40000-220-273-0001-0001	0

SHEET SIZE: D

Attachment 10

Memo: Calculations of Tank Farm Containment Capacity

(H353004-00000-240-202-0001, Rev. A)

Baffinland HATCH

Calculation Cover Sheet

Client:	Baffinland Iron Mines LP		
Project Title:	Mary River Project		
Discipline:	Mechanical		
Calculation No.:		**File No:**	**Number of Sheets:** 7

Description:

The Mary River tank farm located on Baffin Island will be modified to include the installation of one 15 ML Marine Diesel Tank, one 3ML Marine Diesel Tank and one 750,000l Jet Fuel tank. The attached calculations provide the volume required by code, and the approximate available volume within the dyke.

Category of calculation verification required *tick box* ☑ 1 ☐ 2 ☐ 3 ☐ 4

Prepared by:	Michael Doodeman	**Date:**	22 June 2017
Print Name >	(Responsible Engineer)		
Preliminary Review by:	James Cleland	**Date:**	22 June 2017
Print Name >			

Can the calculation now be released for work? ☑ Yes ☐ No **To the Client?** ☑ Yes ☐ No

Checked by: by:		**Date:**	
Print Name >			
Reviewed by:	M. MacIntyre	**Date:**	27 June 2017
Print Name >	Michael MacIntyre		
Approved by:	J. Butts	**Date:**	27 June 2017
Print Name >	Floyd Butts		

General Notes:

The referenced 3d model (Baffinlands_Dyke_Storage_17_06_27.dwg) was utilized to establish overall available dyke volume based on As-Built data. The available dyke volume is 4.73 % greater than code requirements.
Required Liquid Volume: 20,461m3
Actual Dyke Liquid Volume: 21,476m3

Revisions

Rev.	Date	Prepared by	Checked by	Approved by	Description

Superseded by Calculation No. **Date:**

Reason voided:

Milne Port Dyke Calculations to NFC Requirements

11 Tank Combined Dyke (two tier)		**353004 Earth Dyke**
Tanks 4, 5 & 6 Diameter (3 Tanks)	31.80	m
Tanks 4, 5 & 6 Height	15.3	m
Tanks 3 Diameter (1 Tank)	32.65	m
Tanks 3 Height	18.15	
Tanks 1 & 2 Diameter (2 Tanks)	25.6	m
Tanks 1 & 2 Height	9.76	m
Tanks 7, 8, 9 & 10 Diameter (4 Tanks)	10.25	
Tanks 7, 8, 9 &10 Height	9.14	
Tanks 11 Diameter (1 Tank)	16.25	
Tanks 11 Height	15.10	
Tanks 4, 5 & 6 Capacity	12,151,658	Litre
Tank 3 Capacity	15,196,126	
Tanks 1 & 2 Capacity	5,023,653	Litre
Tanks 7, 8, 9 & 10 Capacity	754,195	
Tanks 11 Capacity	3,131,652	
Total Tank Volume	67,846,841	Litre
Tank Volume	67,847	m^3
Required Volume	20,461	m^3
Number of Tanks	11	
Dyke - Overall Height	1.7	m
Dyke - Crest Width	0.6	m
Max Liquid Height	1.400	m
Freeboard	0	m

Useable volume from 3D Model	21,476 m3	
Difference	1,014.803	4.73%
	1,015	

Pad Containment Volume (m^3)							
Zone / Area	Dimension	Length of Zone	Width of Zone	Elevation	Height	Volume	Notes & Assumptions
Blue Zone	Top of Dyke	125.20	141.10	12.35	1.55	26,597.37	**Used dyke liner elevation as top. Elevation change along width of pad ignored for conservative estimate. Floor length is measured from edge of the dyke at the top of the 350 THK Type 5 fill.
	Toe/Floor of Dyke	120.20	138.60	10.80			
Green Zone	Top of Dyke	125.20	49.10	12.35	0.80	4,855.50	**Volume found by using cross section trapezoidal area across the zones.
	Toe/Floor of Dyke	123.80	48.40	11.55			

Tank Pedestal Volume & Tank Volume (Below Top of Dyke) m^3								
Tank	Tank # / Zone	Dimension	Radius	Height	Quantity	Unit Volume	Volume	Notes & Assumptions
750000 L	TK 7,8 - Blue	Top/Inner Radius	7.16	0.95	2.00	197.00	394.00	**No 150 THK Type 7 Fill as floor of pedestal. **Truncated cone volume used i.e trapezoidal cross section assumed.
		Floor/Outer Radius	9.06					
	Tank Volume	Constant Radius	5.16	0.60	2.00	50.11	100.22	
	TK 9,10 - Blue	Top/Inner Radius	7.16	1.50	2.00	356.62	713.23	** Constant floor elevations assumed for each pedestal; if the height of the pad is greater than the dyke liner height, the dyke liner height governs for height/volume calculation. ** Tank Pad Perimeter Elevation used as constant top height of truncated cone. Top radius includes distance to pad perimeter until meeting slope from base.
		Floor/Outer Radius	10.16					
	Tank Volume	Constant Radius	5.16	0.05	2.00	4.18	8.35	
3 ML	TK 11 - Blue	Top/Inner Radius	10.10	1.15	1.00	458.84	458.84	
		Floor/Outer Radius	12.40					
	Tank Volume	Constant Radius	8.10	0.40	4.00	82.45	329.79	
5 ML	TK 1,2 - Green	Top/Inner Radius	14.01	0.80	1.00	555.66	555.66	
		Floor/Outer Radius	15.71					
	Tank Volume	Constant Radius	12.80					
12 ML	TK 4 - Blue	Top/Inner Radius	18.00	1.45	1.00	1,726.48	1,726.48	
		Floor/Outer Radius	20.90					
	Tank Volume	Constant Radius	16.00	0.10	1.00	80.42	80.42	
	TK 5,6 - Blue	Top/Inner Radius	18.00	1.15	2.00	1,326.50	2,653.00	
		Floor/Outer Radius	20.30					
	Tank Volume	Constant Radius	16.00	0.40	2.00	321.70	643.40	
15 ML	TK 3 - Blue	Top/Inner Radius	18.25	1.55	1.00	1,952.76	1,952.76	
		Floor/Outer Radius	21.75					
	Tank Volume	Constant Radius	16.25					

Other Volumes (m^3)			
Zone / Area	Dimension	Volume	Notes & Assumptions
Access Ramp	Whole Ramp	418.93	**See attatched hand calculation for details & assumptions. Note this calculation is very rough, likely within 20% of actual value (doesn't take into account overlapping volume with dyke i.e conservative estimate)

Diesel Volume (L)	Diesel Volume w/o 15ML (biggest tank)	Minimum Volume Needed	Spill Volume Available	
			m^3	L
67,000,000.00	52,000,000.00	20,200,000.00	**21,417.78**	**21,417,782.47**

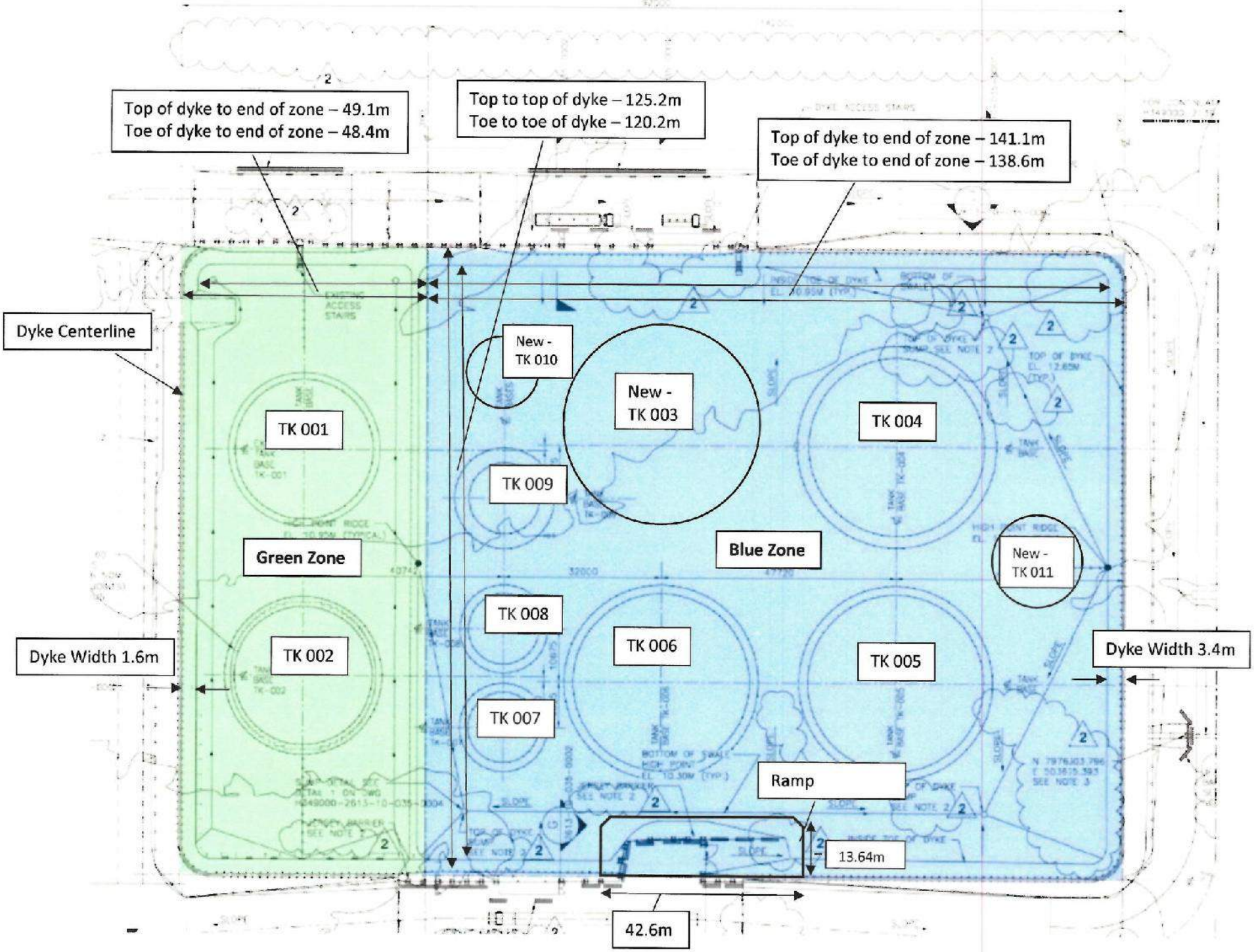
Spill Volume Available > Minimum Volume Needed

Pad Containment Volume (m^3)							
Zone / Area	Dimension	Length of Zone	Width of Zone	Elevation	Height	Volume	Notes & Assumptions
Blue Zone	Top of Dyke	125.20	141.10	12.35	1.55	26,597.37	**Used dyke liner elevation as top. Elevation change along width of pad ignored for conservative estimate. Floor length is measured from edge of the dyke at the top of the 350 THK Type 5 fill.
	Toe/Floor of Dyke	120.20	138.60	10.80			
Green Zone	Top of Dyke	125.20	49.10	12.35	0.80	4,855.50	**Volume found by using cross section trapezoidal area across the zones.
	Toe/Floor of Dyke	123.80	48.40	11.55			

Tank Pedestal Volume & Tank Volume (Below Top of Dyke) m^3								
Tank	Tank # / Zone	Dimension	Radius	Height	Quantity	Unit Volume	Volume	Notes & Assumptions
750000 L	TK 7,8 - Blue	Top/Inner Radius	7.16	0.95	2.00	197.00	394.00	**No 150 THK Type 7 Fill as floor of pedestal. **Truncated cone volume used i.e trapezoidal cross section assumed. ** Constant floor elevations assumed for each pedestal; if the height of the pad is greater than the dyke liner height, the dyke liner height governs for height/volume calculation. ** Tank Pad Perimeter Elevation used as constant top height of truncated cone. Top radius includes distance to pad perimeter until meeting slope from base.
		Floor/Outer Radius	9.06					
	Tank Volume	Constant Radius	5.16	0.60	2.00	50.11	100.22	
	TK 9,10 - Blue	Top/Inner Radius	7.16	1.50	2.00	356.62	713.23	
		Floor/Outer Radius	10.16					
	Tank Volume	Constant Radius	5.16	0.05	2.00	4.18	8.35	
3 ML	TK 11 - Blue	Top/Inner Radius	10.10	1.15	1.00	458.84	458.84	
		Floor/Outer Radius	12.40					
	Tank Volume	Constant Radius	8.10	0.40	4.00	82.45	329.79	
5 ML	TK 1,2 - Green	Top/Inner Radius	14.01	0.80	1.00	555.66	555.66	
		Floor/Outer Radius	15.71					
	Tank Volume	Constant Radius	12.80					
12 ML	TK 4 - Blue	Top/Inner Radius	18.00	1.45	1.00	1,726.48	1,726.48	
		Floor/Outer Radius	20.90					
	Tank Volume	Constant Radius	16.00	0.10	1.00	80.42	80.42	
	TK 5,6 - Blue	Top/Inner Radius	18.00	1.15	2.00	1,326.50	2,653.00	
		Floor/Outer Radius	20.30					
	Tank Volume	Constant Radius	16.00	0.40	2.00	321.70	643.40	
15 ML	TK 3 - Blue	Top/Inner Radius	18.25	1.55	1.00	1,952.76	1,952.76	
		Floor/Outer Radius	21.75					
	Tank Volume	Constant Radius	16.25					

Other Volumes (m^3)			
Zone / Area	Dimension	Volume	Notes & Assumptions
Access Ramp	Whole Ramp	418.93	**See attatched hand calculation for details & assumptions. Note this calculation is very rough, likely within 20% of actual value (doesn't take into account overlapping volume with dyke i.e conservative estimate)

Diesel Volume (L)	Diesel Volume w/o 15ML (biggest tank)	Minimum Volume Needed	Spill Volume Available	
			m^3	L
67,000,000.00	52,000,000.00	20,200,000.00	**21,417.78**	**21,417,782.47**


Top of dyke to end of zone – 49.1m
Toe of dyke to end of zone – 48.4m
Top to top of dyke – 125.2m
Toe to toe of dyke – 120.2m
Top of dyke to end of zone – 141.1m
Toe of dyke to end of zone – 138.6m
Dyke Centerline
New - TK 010
New - TK 003
TK 001
TK 004
TK 009
Green Zone
Blue Zone
New - TK 011
TK 008
TK 006
TK 005
TK 002
Dyke Width 1.6m
Dyke Width 3.4m
TK 007
Ramp
13.64m
42.6m

HATCH

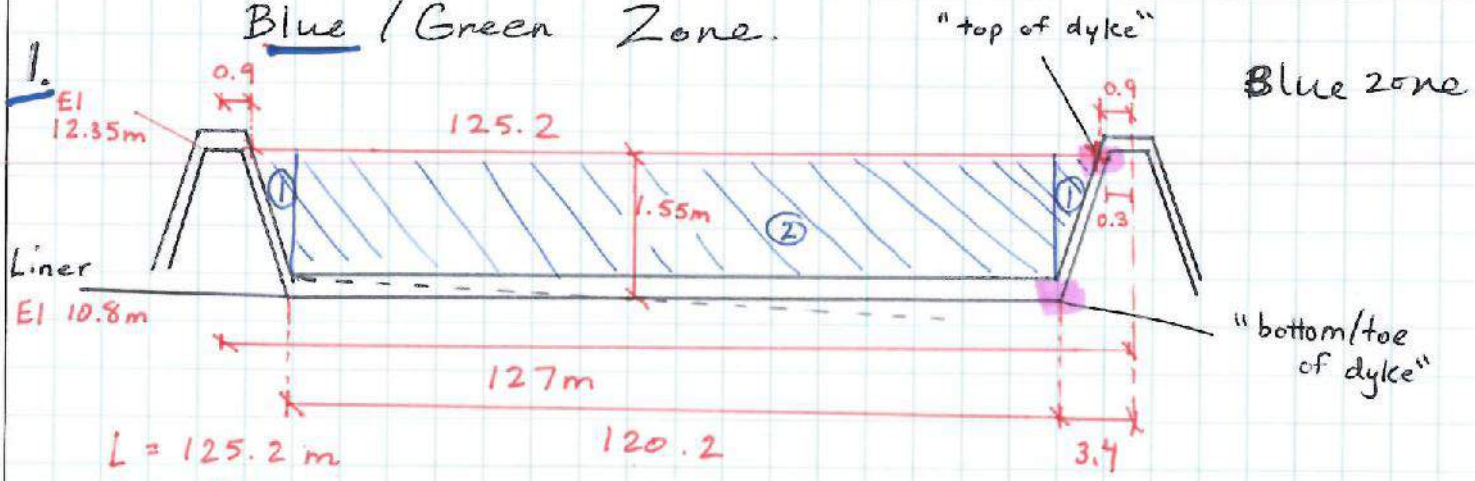
CALCULATION SHEET

SHEET NO. 1 OF 3

DESCRIPTION	PROJECT NO	MADE BY	CHECKED BY
"Fuel Pad Containment Volume"	"H353004"	"MD" DATE	DATE

Blue / Green Zone.

1.



$L = 125.2\ m$

$h = 1.55m$

width top = 141.1m

width floor = 138.6m

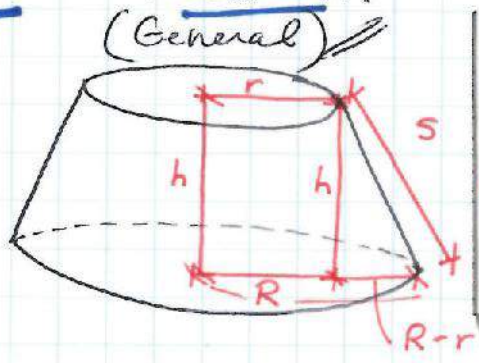
$V = A \times l_{avg}$

$= (① + ②)\, l_{avg}$

$= \left[\frac{1.55(125.2-120.2)}{2} + 120.2(1.55)\right]\left(\frac{141.1+138.6}{2}\right)$

$= 26,597.37\ m^3$

2. Tank or (General)



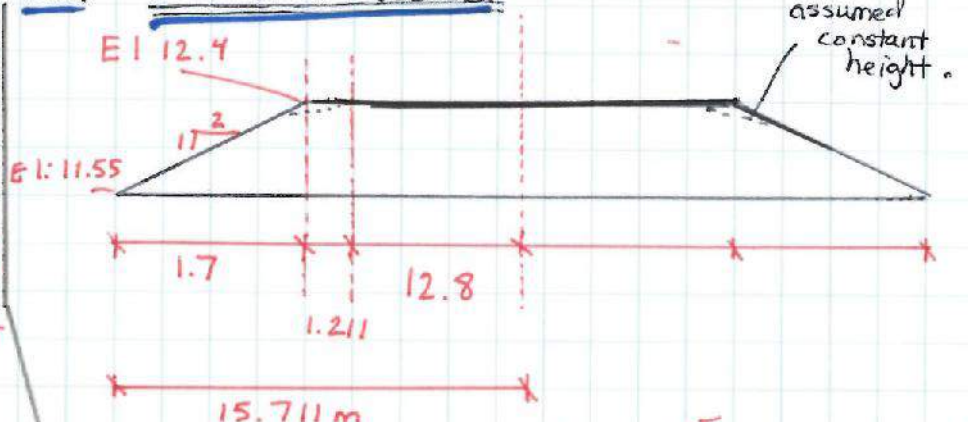
$S = \sqrt{(R-r)^2+h^2}$

LAT S.A. $= \pi(R+r)S$

~~Fo~~

$V = \frac{\pi h}{3}\left[Rr + R^2 + r^2\right]$

2a. 5 ML Pedestal



$R = 15.711m$

$r = 14.01m$

Since El > 12.35

use 12.35 as top elevation

& 11.55 as floor elevation

$\therefore h = 0.8$

$\Rightarrow V = \frac{\pi(0.8)}{3}\left[(15.711)(14.01) + 15.711^2 + 14.01^2\right]$

$= 555.62\ m^3$

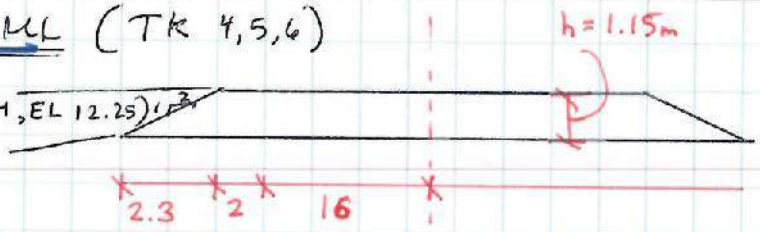
HATCH

CALCULATION SHEET

SHEET NO. 2 OF 3

DESCRIPTION	PROJECT NO	MADE BY	CHECKED BY
" "	" "	" "	
		DATE	DATE

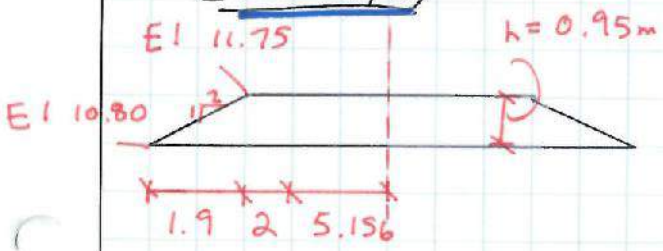
2b 3-12 ML (TK 4,5,6)



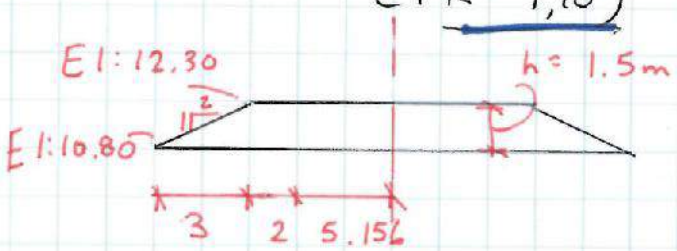
R = 20.3
r = 18

R = 20.90
r = 18

2c ~~4~~ x750 kL

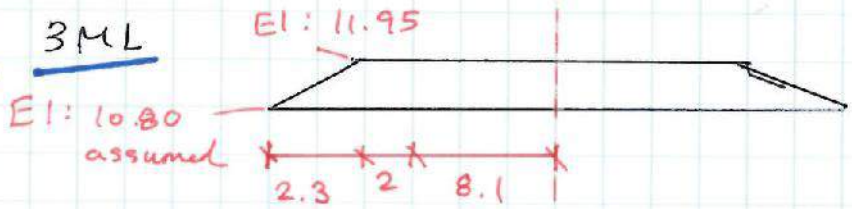


R = 9.056m
r = 7.156m



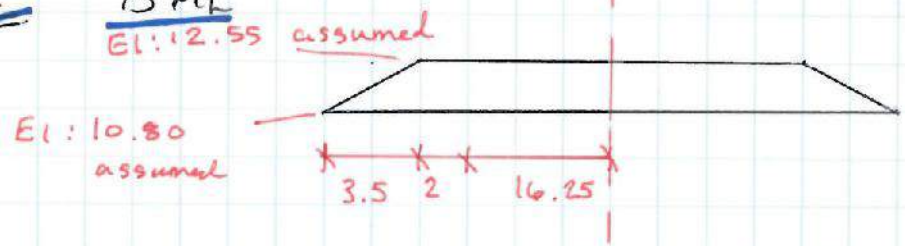
R = 10.156 m
r = 7.156 m

2d 3ML



R = 10.1 m
r = 12.4 m

2e 15 ML



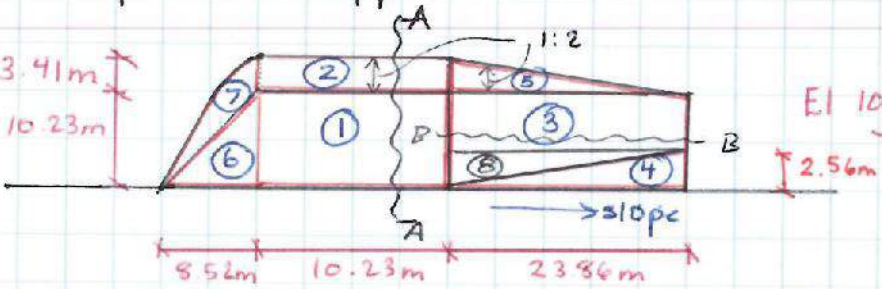
R = 21.75m
r = 18.25m

HATCH | CALCULATION SHEET | SHEET NO. 3 OF 3

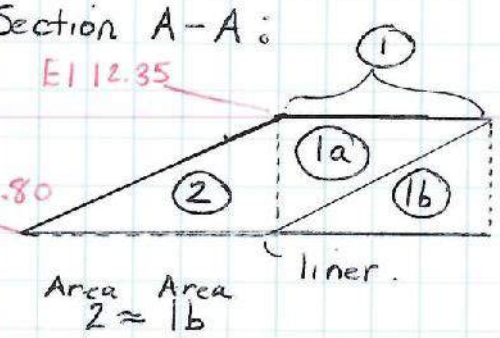
DESCRIPTION | PROJECT NO | MADE BY / DATE | CHECKED BY / DATE

3 Ramp

Top View Approximated



Section A-A:



Area 2 ≈ Area 1b

* Since (1b) already calculated with dyke volume consideration & since (2) ≈ (1b) ∴ total volume of (1) & (2) can be approximated by (1a) + (1b)

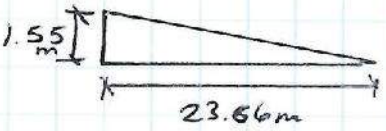
Volume (1) & (2)

$V = 10.23m(10.23m)(12.35-10.8) = 162.21m^3$.

* Assume (4) is at top elevation ~~∴ (4) ≈ (5)~~ ∴ let's assume full height (4) ≈ (4) + (8) + (5)

~~Slope~~ : B : B

Volume (4), (5), (8)



$V = \left[\frac{1}{2}(23.86)(2.56)\right]1.55$

$= 47.34m^3$.

Total Volume $= \sum_{i=1}^{8} V_i$

$= 418.93m^3$.

Volume (3) using section B : B :

$V = \frac{1}{2}(1.55)(23.86)(10.23-2.56)$

$= 141.83m^3$

Volume (6) (7) Since overestimate used for ~~4, 5, 8~~, neglect (7).

So (6):

$V = \frac{1}{2}(8.52)(10.23)(1.55)$

$= 67.55m^3$.

Attachment 11

Construction Methodology Milne Inlet Fuel Storage Facility System

(H353004-40000-400-050-0002, Rev. 0)

Plan

Construction Methodology Milne Inlet Fuel Storage Facility

2017-07-11	0	Approved for Use	L Langlois	T Bruce	S Heiner	M Weaver
Date	Rev.	Status	Prepared By	Checked By	Approved By	Approved By
			HATCH			Employer

Construction Methodology – Milne Inlet Fuel Storage Facility

1. Overview

Capacity increase of the current Milne Inlet Fuel Storage Facility (Fuel Storage Facility) is required to ensure sufficient fuel is available to achieve full production (4.2 Mtpa) and execute operational plans for the upcoming year from September 2017 until July 2018.

2. Scope of Work

The scope of work encompasses the construction and placement of three (3) additional fuel tanks at the Milne Inlet Fuel Storage Facility. The 3 fuel tanks to be added to the Fuel Storage Facility include: a 15M litre diesel fuel tank, a 3M litre diesel fuel tank and a 750K litre Jet-A1 fuel tank along with all associated piping.

All three (3) tanks will be placed within the existing containment of the Fuel Storage Facility and in the specific positions as shown in Hatch document: Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks (H353004-40000-220-260-0003-0001). Tanks 003 and 011 will be fabricated onsite. Tank 010 will arrive to site prefabricated and will be placed in the Fuel Storage Facility using onsite equipment (cranes).

In addition, one (1) existing piping sub-system will need to be relocated and three (3) new piping sub-systems will need to be installed within the Fuel Storage Facility's containment in order to tie in the three (3) new tanks into the existing piping system and ultimately into the existing Fuel Storage Facility's fuel distribution module(s). Moreover, the incomplete diesel piping system between the Fuel Storage Facility and the Milne Port diesel generators will be completed.

Tag Number	Description	Fuel Stored	Diameter	Height
TK-003	15,000,000 Litre Tank	Arctic Diesel	32.50m	18.30m
TK-010	750,000 Litre tank	Jet A-1	10.25m	9.14m
TK-011	3,000,000 Litre Tank	Arctic Diesel	16.20m	15.25m

3. Planning, Coordination & Security

Perimeter fencing will be maintained throughout the execution of the scope of work. A section of the existing perimeter fence near the equipment access ramp, as shown in Figure 1, will be removed and replaced with a similar height and type fencing which can be opened and closed. This will allow the required mobile equipment to access the Fuel Storage Facility during construction. This equipment access route (gate) will be kept locked when not in use, with care and control of the keys to be maintained by the Construction Manager, the HS&E lead and the responsible Baffinland Operations person designated as the authority. Under no

circumstances will other personnel have access to the keys for this equipment access route (gate).

All signs and lighting will be maintained throughout the execution of the scope of work. All construction personnel will access the construction area through the existing man gates.

An authorized person as designated by the responsible Baffinland Operations department will deliver an area specific orientation program. All personnel involved with the scope of work will be required to attend before they can participate with construction. Should any additional training requirements be required, all relevant personnel will be required to attend. The identity of these authorized personnel will be maintained on a registry which will be held by the Contractor's HS&E lead.

Due to the nature of the scope of work and its execution methodology, the entire Fuel Storage Facility will be considered a Hot Work Zone. At the start of each shift, a JHA (Job Hazard Analysis) will be developed with the involvement of all relevant personnel. A Hot Work Permit process will be approved and implemented in coordination with the Baffinland Health & Safety department and the relevant contractors. A Hot Work Permit will be required to start work at the beginning of each shift. The Contractor's H&SE lead will be present and will ensure that all personnel participating in the JHA have signed the document, are identified on the hot work permit and are also listed on the authorized personnel registry.

The existing Baffinland card identification system will be implemented for this scope of work. All personnel, will participate as required in the scheduled security drills and security exercises.

Upon completion of the scope of work, the Fuel Storage Facility will be reinstated by installing the facility's original perimeter fencing.

Targeted planning sessions will be held between relevant Baffinland Operations personnel and the responsible contractors to develop strategies and coordinate activities for the scope of work and subsequent fuel deliveries (sealifts).

Reference(s):
Milne Inlet Marine Facility Security Plan (BAF-PH1-310-P16-0001, Rev. 7)
Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks
(H353004-40000-220-260-0003-0001)

4. Construction Methodology

4.1 Civil

Construction of the tanks will commence upon completion of the decontamination activities within the Fuel Storage Facility's containment. Decontamination activities will consist of treating hydrocarbon impacted storm water within the Fuel Storage Facility's containment using the onsite mobile Oily Water Treatment System operated by Baffinland.

The contract for the mechanical scope of work has been awarded to an experienced tank fabricating contractor (Mechanical Contractor) that has substantial northern experience and significant previous experience constructing tanks at the Milne Inlet Fuel Storage Facility.

Upon completion of the decontamination activities, a small contingent of the Mechanical Contractor's personnel will be mobilized for a brief period to reroute the existing marine receiving piping system which is located inside the facility's containment area. This relocation is required since the current route of the piping system is in the location planned for the new 3M litre diesel tank.

A civil contract has been awarded to a contractor (Civil Contactor) with significant previous experience onsite.

Prior to the execution of any earthworks related activities, a topographical survey will be undertaken to determine the elevation of the existing contours within the Fuel Storage Facility's containment. This activity will assist in safeguarding the integrity of the underlying HDPE liner when the placed materials (i.e., access ramp, crane pads) are recovered.

Along the west side of the Fuel Storage Facility, a temporary access ramp, as shown in Figure 1, will be built on top of the existing berm using fine material and configured in a diagonal direction to enable entry of light equipment such as a tracked Skid Steer and crane. This temporary access ramp will facilitate the access and egress of equipment, materials, and consumables during the construction of the tanks and associated piping. This overbuild approach will ensure that mobile equipment used for the scope of work do not come in contact with any hydrocarbon impacted soils present within the Fuel Storage Facility's containment and do not transfer the impacted soils outside the boundaries of the existing Fuel Storage Facility's containment.

Refer to Section 4.5 for details on the decommissioning and recovery of the temporary access ramp and crane pads.

Reference:
Milne Inlet Marine Facility Security Plan (BAF-PH1-310-P16-0001, Rev 7)
New foundations (pedestals) will be constructed of fine material for all three (3) tanks, as shown in Hatch document: Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks (H353004-40000-220-260-0003-0001). No heavy, steel tracked equipment will be utilized within the Fuel Storage Facility's containment and all material will be transported into the

facility's containment using rubber tired loaders and rubber tracked Skid Steers. The tank foundation design (pedestal) will be constructed of the same material and in the same configuration as the Fuel Storage Facility's existing tanks.

Determined by the capacity of the cranes being used, 2 locations, as shown in Figure 1, have been identified for the crane position and pads at the Fuel Storage Facility. Construction of the crane pads will involve the placement of fine material followed by the placement of wooden crane pads on top of the fine material to ensure the weight is distributed evenly and consistently. The selected locations for the crane positions and pads will enable a 360° swing radius and enable the crane to pick up and place materials within the Fuel Storage Facility.

References:
Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks
(H353004-40000-220-260-0003-0001)

4.2 Plate Work

For all hot work (i.e., welding) associated with the Fuel Storage Facility, a Hot Work Policy (referenced below) will be instated, and all relevant procedures followed.

Upon completion of the civil scope of work the Mechanical Contractor will be mobilized to the Fuel Storage Facility to begin tank construction of Tanks 003 and 011. All associated equipment such as welding units, compressors and tooling will be set up. Plate work will commence with the placement and tack welding of the floor plates. Upon placement of the floor, the installation and fitment of the first course shell section will occur. In parallel, the complete fabrication of the floor will be ongoing. All shell plate welding will start with the vertical joints and then, upon completion, will be fitted and welded to the floor.

The erection of each course will start with the fitting and welding of all external vertical welds followed by the welding of the same vertical welds on the inside of the tank. Upon completion of the vertical welds, the horizontal welds will be completed in the same sequence, starting with the external welds and ending with the internal welds. Each course will follow this same sequence.

Upon completion of the shell section, internal columns and roof purlins will be installed and bolted for alignment and welded followed by the fitment and welding of the roof section.

Phased array ultrasonic testing will be ongoing throughout the construction process as well as the installation of the prefabricated nozzles.

During the tank construction and placement, the fabrication and installation of the external circular staircase, complete with hand rails, and the roof top handrails and walkways will be completed. All material will be constructed of pre-galvanized steel.

Taking into account labour densities and respecting the crane hoisting location and activities, installation of concrete pipe supports and pre-spooled piping will be completed during the construction of the tanks.

4.3 Electrical

The earth grounding system for the new tanks will be similar to the Fuel Storage Facility's existing system. As-built documentation for the Fuel Storage Facility will be consulted to determine the location of the buried grounding system. Once the location is determined, the existing buried grounding system will be manually exposed with shovels. The new system will be joined with the existing grounding system with CADWELD connections and hand covered with shovels to reinstate.

4.4 Miscellaneous Piping

The diesel piping system that runs from the Fuel Storage Facility to the Milne Port diesel generators was not completed during the construction of the Fuel Storage Facility in 2013. Currently the diesel piping system exits the Fuel Storage Facility on its south side over a berm via a pipe bridge and follows a previously constructed pipe bench but terminates short of the Milne Port diesel generators. The diesel piping system, consisting of 2" diameter piping, will be extended to the Milne Port diesel generators and commissioned.

4.5 Completion

Upon completing the scope of work detailed above, all material previously placed in the Fuel Storage Facility for the crane pads and access ramp will be recovered. Recovered material will be assessed for hydrocarbon contamination. Material determined to be contaminated will be transferred to the Milne Port Landfarm Facility or transferred into Quatrex bags for shipment offsite for proper disposal at a licensed waste facility.

If during execution, any mobile equipment comes in contact with hydrocarbon impacted soils contained in the Fuel Storage Facility's containment, contaminated components (i.e., wheels, tracks) will be wash-down within the Fuel Storage Facility's containment prior to demobilization.

5. Reference Documents

Table 5-1: Reference Documents

Document Identification	Document Title	Author
BAF-PH1-310-P16-0001, Rev.7	***Milne Inlet Marine Facility Security Plan***	***Baffinland***
H353004-40000-220-260-0003-0001	***Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks***	***Hatch***

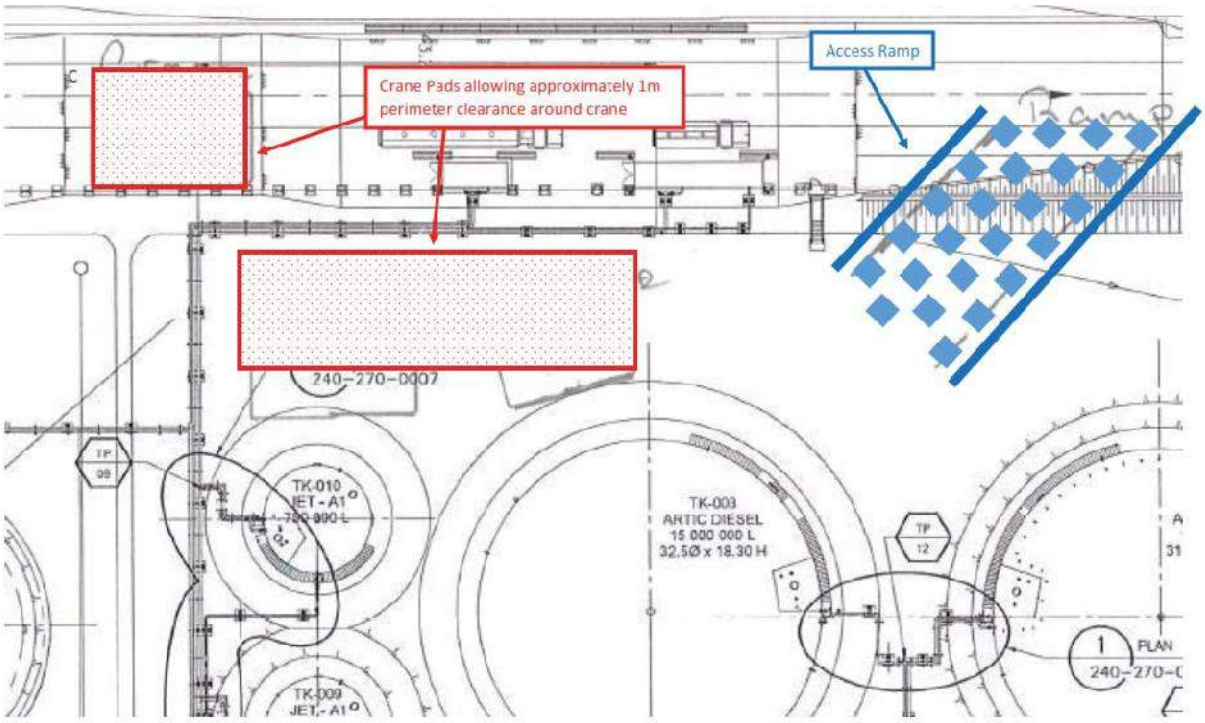


Figure 1: Crane Pad Locations and Access Ramp

Attachment 12

Banner Environmental Engineering Consultants Ltd. – Baffin WWTP Review

BANNER
environmental engineering consultants ltd.

August 4th, 2017

Mr. Justin MacPherson
Operations Supervisor Water Resources
Horizon North Logistics Inc. – Camps and Catering
1802 - 8 St
Nisku, AB T9E7W2
(780) 955-2992

Dear Mr. MacPherson,

Banner Environmental Engineering Consultants Ltd. (Banner) has been retained by Horizon North Camps and Catering (HNCC) to perform a 3rd-party design review of the Baffin Wastewater Treatment Plant (WWTP) constructed in 2011 by Filterboxx Water & Environmental Corporation (Filterboxx). Banner has over 25 years in collective experience in designing, constructing, commissioning and operating water and wastewater treatment plants all over Western Canada, as well as the arctic.

The Baffin camp shall have the following expected operating parameters:

Maximum Camp Population:	400-persons
Consumption per Capita:	225 L/person-day
Maximum Volume to be Treated:	90 m^3/day
Biochemical Oxygen Demand:	300 mg/L
Total Suspended Solids:	500 mg/L

The required effluent treatment parameters are as follow:

Biochemical Oxygen Demand:	100 mg/L
Total Suspended Solids:	120 mg/L
Oil and Grease:	No Visible Sheen
pH:	6.0 – 9.5
Toxicity:	Not acutely toxic

HNCC has provided Banner a WWTP design using GE's Zeeweed membrane bioreactor. The Baffin WWTP was previously in operation in HNCC's Black Sands camp located in Fort McMurray, AB. Banner has had experience commissioning and operating plants based on GE's Zeeweed membrane bioreactor technology. And upon completion of our review, Banner has determined that the provided design by HNCC for operation of the Baffin WWTP is suitable and should meet and exceed the requirements for treatment of wastewater effluent.

To initiate the 3rd-party design review, HNCC has provided Banner with the following information in-regards to the WWTP:

- Piping and Instrumentation Diagrams
- General Arrangement Drawings
- Control Narrative
- Operation Manual
- Historical Operation

Shown in this review are Banner's comments in-regards to the design of the plant.

Piping and Instrumentation Diagram

Capacity and Operability

- The provided design indicates that the membranes are able to treat a total 130 m^3/day at 100% redundancy, and 260 m^3/day at 0% redundancy.
- Piping size and materials is typical for the required application, and meet the required pressure and flow requirements of the system.
- Single blower provided for each aeration tank. It is recommended that the blowers are provided with 100% redundancy, but not a requirement for effective operation. It is noted that HNCC operations group ensures back-up blowers are always kept in stock on site due to the remote location to provide the additional redundancy recommended.
- Single blower provided for each membrane for scouring. It is recommended that the blowers are provided with 100% redundancy, but not a requirement for effective operation. It is noted that HNCC operations group ensures back-up blowers are always kept in stock on site due to the remote location to provide the additional redundancy recommended.
- Design provides sufficient process gauges and instrumentation for optimal operation of the system.
- Valving used are typical for the required application.
- Single effluent pump provided with level alarm reporting. It is recommended that all pumps are provided with 100% redundancy, but not a requirement for effective operation. It is noted that HNCC operations group ensures back-up pumps are always kept in stock on site due to the remote location to provide the additional redundancy recommended.
- Adequate level alarms are provided.

Treatment

- Equalization and pre-treatment provided
- Based on the provided required flows, up to a 30-hour hydraulic residence time is provided on the aeration tanks, using both aeration tanks. Actual hydraulic residence time must be controlled by the plant operator. Aeration treatment is considered sufficient to meet the necessary effluent parameters.
- Process redundancy recommended, but not required for treatment tanks. Membrane bioreactors can operate at 100% redundancy, based on the design volumes produced by the camp.
- Aerobic sludge digestion is provided.
- Nominal operating flux rates for the ZeWeed membrane bioreactors are met based on the design.
- UV Disinfection provided for membrane permeate.

Mailing Address:
PO Box 40026 Southridge RPO
Okotoks, AB T1S 2G2

Courier Address:
Unit 217, 220 - 3rd Street, NE
Black Diamond, AB T0L 0H0

Phone: (403) 933-4199
Fax: (403) 933-4177
Website: www.banneree.com

General Arrangement Drawings

- WWTP to be provided in sea containers for housing. Foundation details of the housing are not provided.
- General arrangement of the plant is separated into equalization/pre-treatment, membrane bioreactor, and a mechanical container skid (blower housing). No immediate deficiencies in terms of access and spacing are required to be corrected at this time.
- HVAC and HVAC controls to be tested before putting into service. Insulation must be checked for any damages prior to operation.

Control Narrative

- Control narrative provided is typical for the operation of membrane bioreactor WWTPs.
- Alarming provided is sufficient and typical of operation.

Operation Manual

- Sufficient information provided for the operation along with typical operating parameters.
- Operation health and safety requirements are provided, including MSDS.
- Maintenance schedule provided, but is general and sufficient for operation.
- Vendor/supplier list of equipment and motors to be kept with operations manual.
- Remote log-in to the camp has been provided.

Historical Operation

- The plant was operated historically on HNCC's Black Sands Camp
- No historical contraventions to the previous operational approval of the WWTP
- Last testing performed showed effluent BOD results of <2.0 mg/L and TSS results of <3.0 mg/L
- Since the plant has not been in operation for some time, Banner recommends that structural integrity of piping and tanks be checked prior to operation. In addition, all mechanical and electrical equipment be checked prior to operation.

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Conclusions

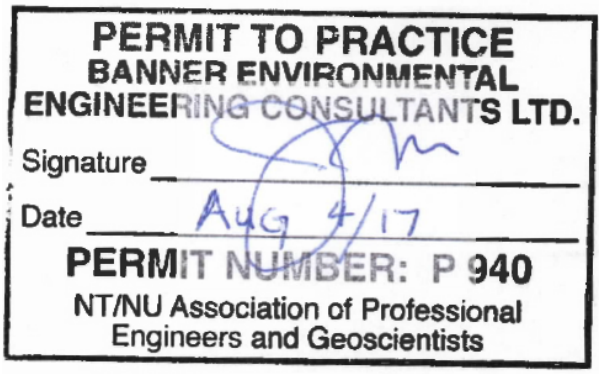
Based on the provided data and Banner's previous history of operating and commissioning GE Zeeweed Membrane Bioreactors, Banner can confidently confirm that the Baffin WWTP is suitable for operation in HNCC's Baffin camp. In addition, Banner can also confidently confirm that the provided design for the Baffin WWTP should meet and exceed the required effluent discharge requirements for the plant.

If you require any additional questions, please do not hesitate to contact us at (403) 933-4199.

Sincerely,

James Marr, M. Sc., P. Eng.
President and Chief Engineer
Banner Environmental Engineering Consultants Ltd.

CC: Joseph P. Manacsa



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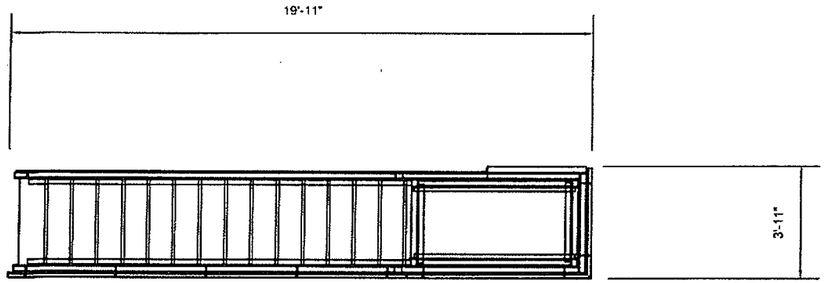
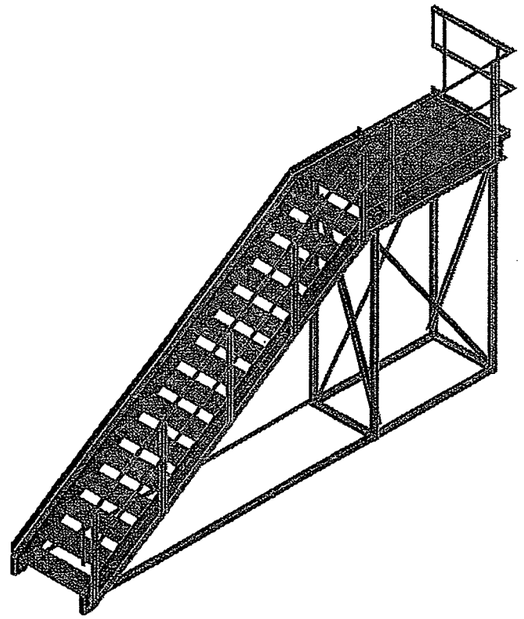
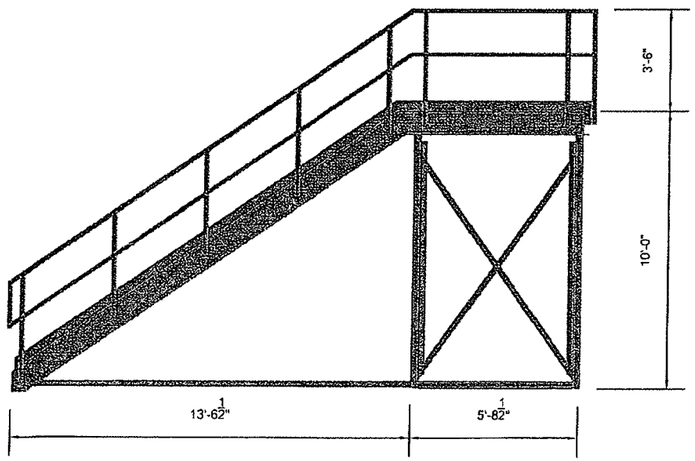
Attachment 13

Horizon North – FilterBoxx WWTP General Arrangement Drawings

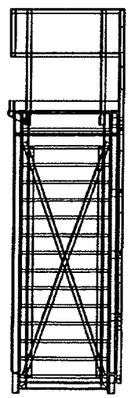


PLAN VIEW





ELEVATION



FRONT

NOTES

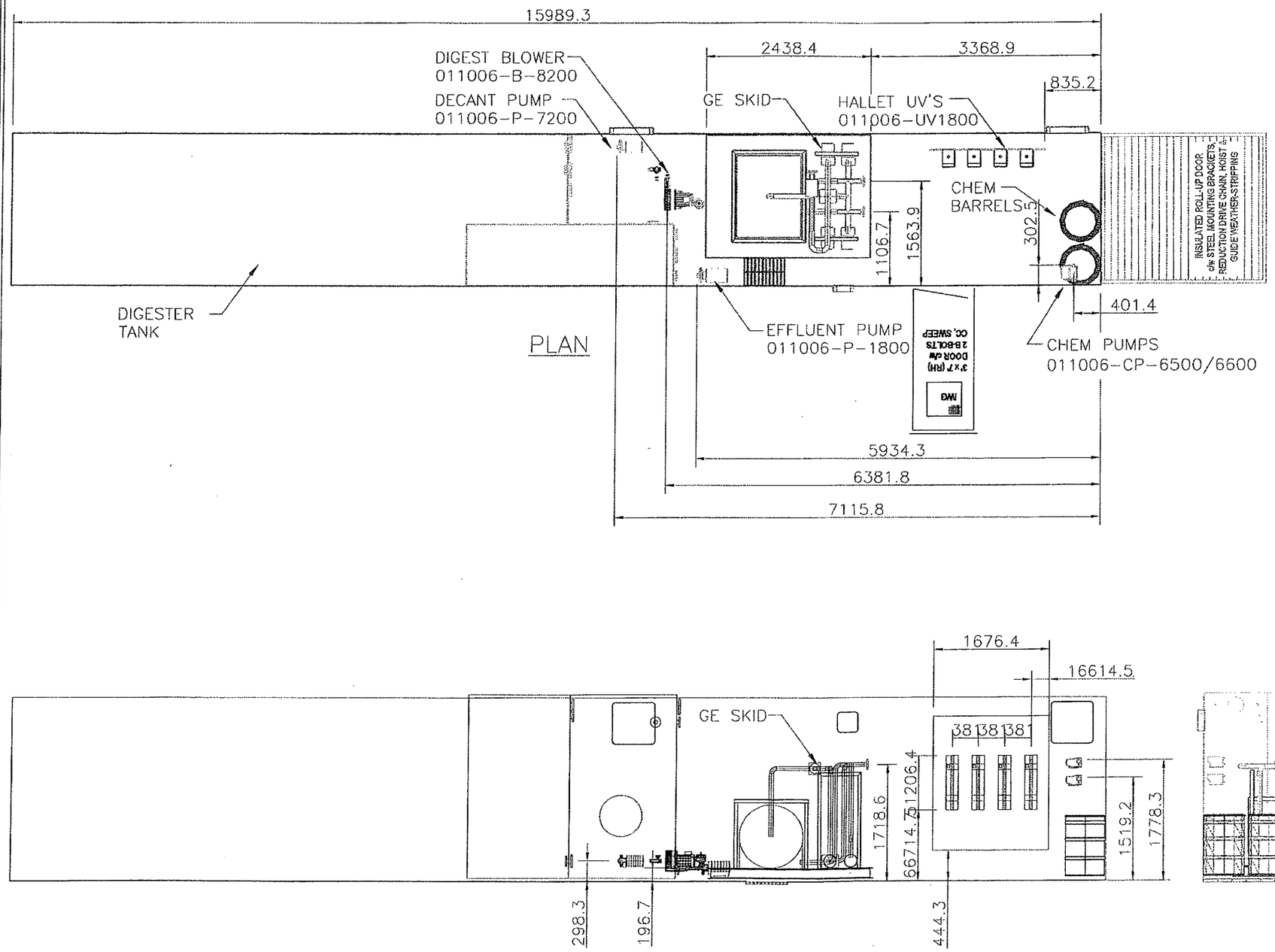
REFERENCE DRAWINGS

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK	ENG.	APP.

TITLE
STAIRS
HORIZON NORTH
TYPICAL GENERAL ARRANGEMENT

PLANT AREA

SCALE NTS		
DRAWN BY PSH	CHECKED BY	APPROVED
SHEET 1 OF	DRAWING NO. 011006-LAY-011	REV. 0



NOTES

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.

FilterBoxx

TITLE

GERERAL ARRANGEMENT
HORIZON NORTH
DIGESTER CONTAINER GA

PLANT AREA		
SCALE NTS		
DRAWN BY PH	CHECKED BY	APPROVED
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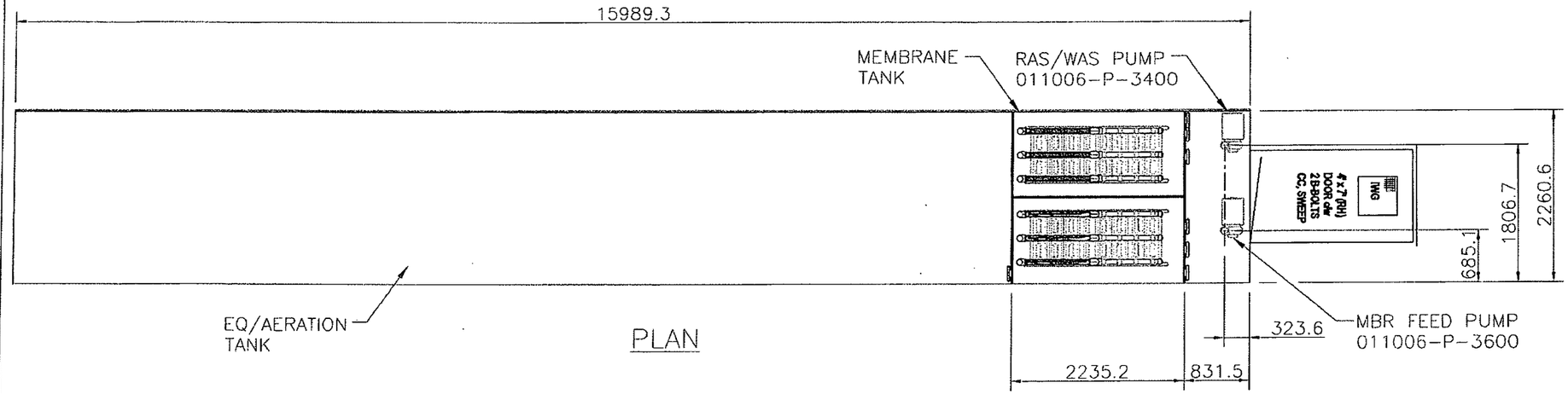

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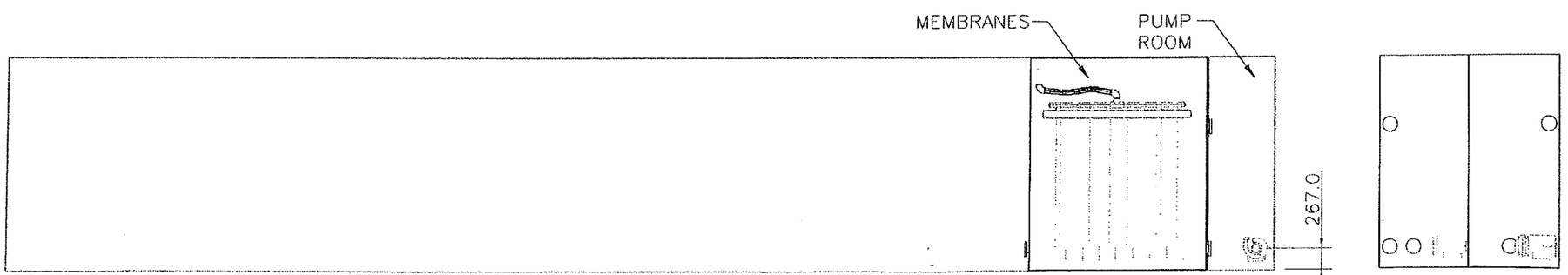

ELEVATION

SIDE

NOTES

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.

FilterBoxx™

TITLE
GERERAL ARRANGEMENT
HORIZON NORTH
EQ/AERATION CONTAINER GA

PLANT AREA

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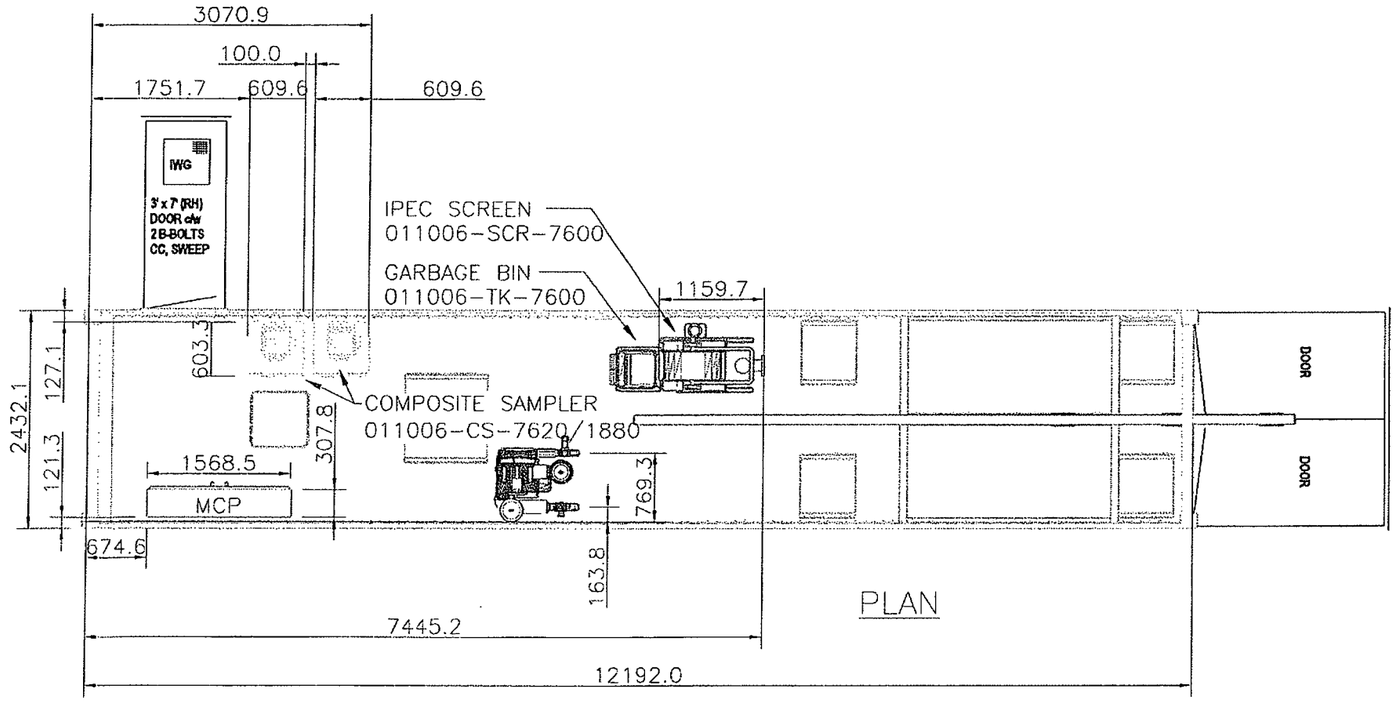
DRAWN BY	CHECKED BY	APPROVED
PH		
SHEET	DRAWING NO.	REV.
1 OF	011006-LAY-009	0



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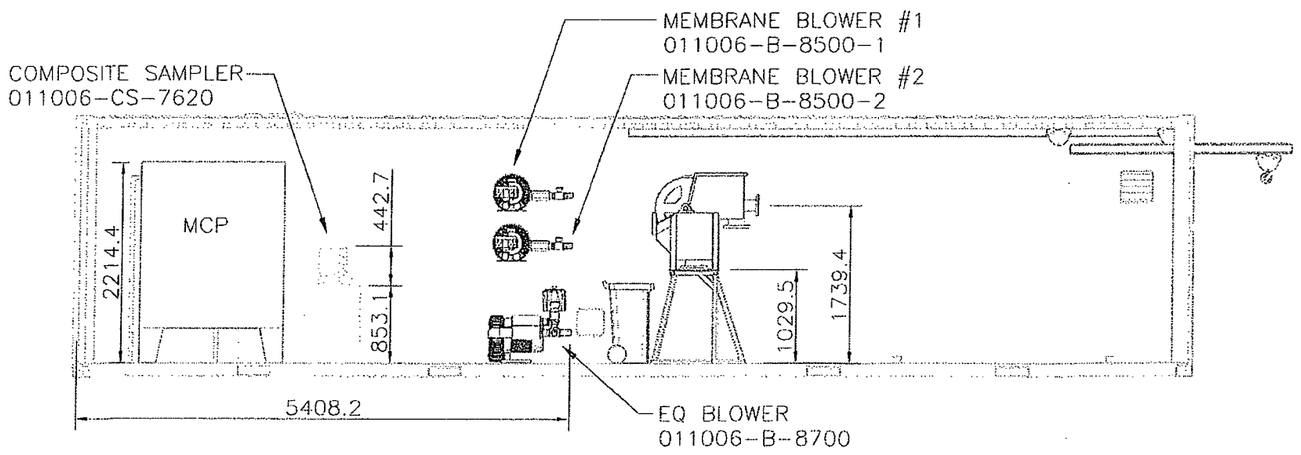

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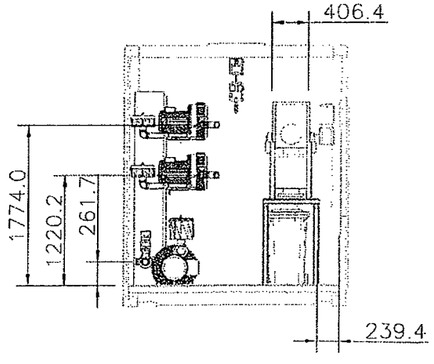

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TITLE
GERERAL ARRANGEMENT
HORIZON NORTH
MECHANICAL CONTAINER GA

PLANT AREA

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DRAWN BY	CHECKED BY	APPROVED
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SHEET	DRAWING NO.	REV.
1 OF	011006-LAY-008	0

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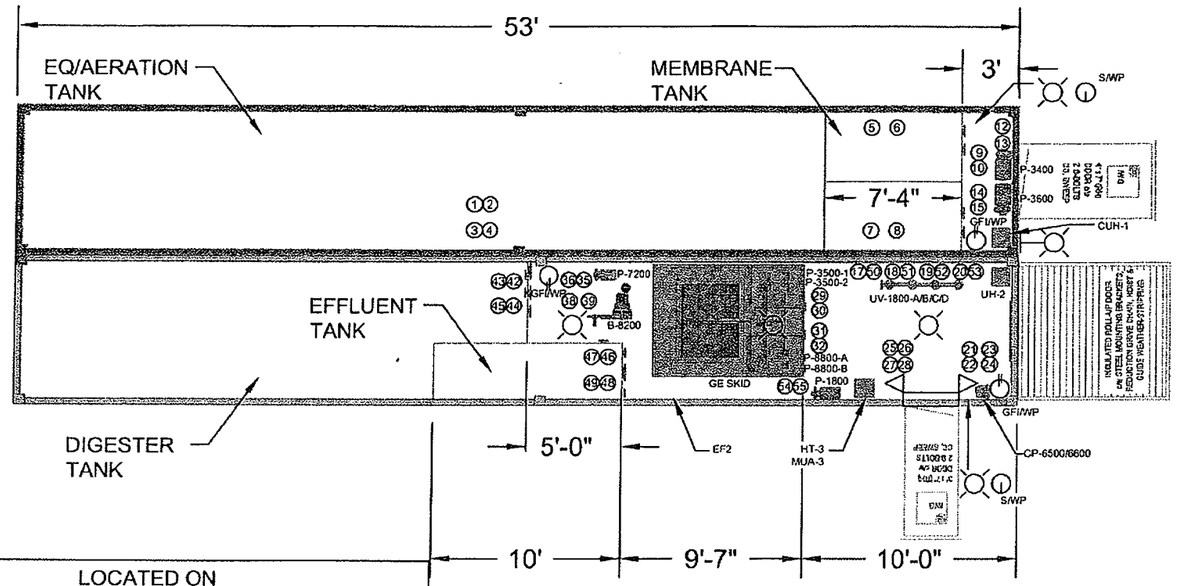

LOCATED ON GE SKID			
(56) PE-3523-1	(64) LSH-8802	(72) DI-3500-1	(80) DO-3561-1
(57) PIT-3523-1	(65) LSL-8803	(73) DO-3500-1	(81) DO-3561-2
(58) PE-3523-2	(66) FV-3560	(74) DI-3500-2	
(59) PIT-3523-2	(67) DO-3560	(75) DO-3500-2	
(60) AI-3523-1	(68) FIT-3520	(76) DI-8800-A	
(61) AI-3523-2	(69) AI-3520	(77) DO-8800-A	
(62) DI-8802	(70) FV-3561-1	(78) DI-8800-B	
(63) DI-8803	(71) FV-3561-2	(79) DO-8800-B	

(1) LT-3626	(29) FV-1860	(42) LSHH-7201	
(2) AI-3626	(30) DO-1860	(43) DI-7201	
(3) LSHH-3601	(31) FIT-1880	(44) LT-7226	
(4) DI-3601	(32) AI-1880	(45) AI-7226	
(5) LSLL-3404-1		(46) LSHH-1801	
(6) DI-3404-1		(47) DI-1801	
(7) LSLL-3404-2	(35) DI-7200	(48) LT-1826	
(8) DI-3404-2	(36) DO-7200	(49) AI-1826	
(9) DO-3400		(50) DO-1800A	
(10) DI-3400	(38) DI-8200	(51) DO-1800B	
	(39) DO-8200	(52) DO-1800C	
(12) DO-3461		(53) DO-1800D	
(13) FV-3461		(54) DO-1800	
(14) DI-3600		(55) DI-1800	
(15) DO-3600			
(17) DI-1800A			
(18) DI-1800B			
(19) DI-1800C			
(20) DI-1800D			
(21) DI-6500			
(22) DO-6500			
(23) DI-6600			
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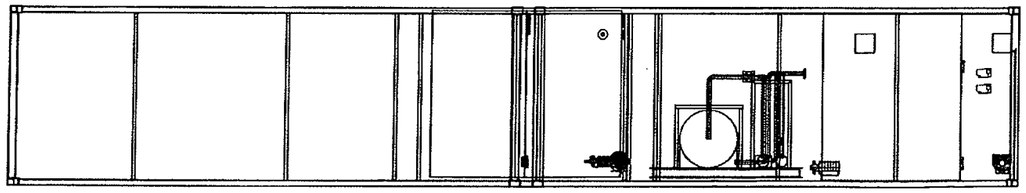
ELEVATION



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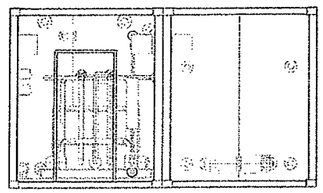


NOTES

- WALL PACK (W70SPL120M6/LITHONIA)
- FLOURESCENT FIXTURE
- EXIT/COMBO (3LER3000/LUMACELL)
- GFI - GROUND FAULT PROTECTED RECEPTACLE
- WP - WEATHER PROOF COVER & ENCLOSURE
- (1)S - 1 POLE SWITCH

REFERENCE DRAWINGS

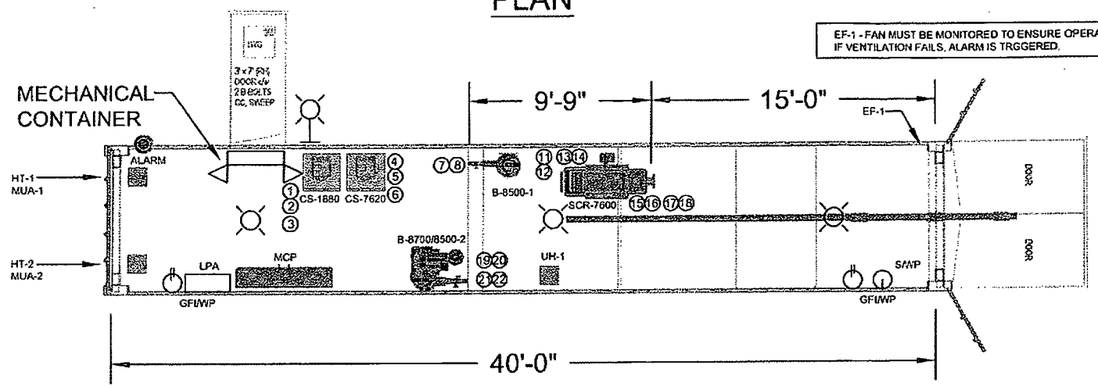
REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
0	10	07	27	ISSUED FOR INFO				

TITLE
ELECTRICAL LAYOUT
600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

PLANT AREA

SCALE NTS		
DRAWN BY PSH	CHECKED BY	APPROVED
SHEET 1 OF	DRAWING NO. 011006-LAY-007	REV. 0

PLAN



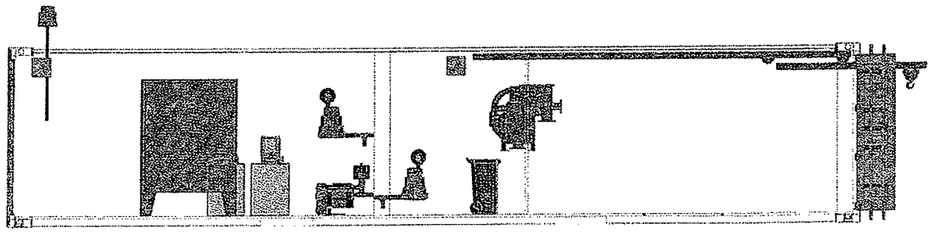
EF-1 - FAN MUST BE MONITORED TO ENSURE OPERATION. IF VENTILATION FAILS, ALARM IS TRGGERED.

1. FV-1826
2. DO-1826
3. DO-1880
4. FV-7626
5. DO-7626
6. DO-7620
7. DO-8500-1
8. DI-8500-1
11. FIT-7620
12. AI-7620
13. FV-7660
14. DO-7660
15. DO-7600
16. DI-7600
17. LSHH-7602
18. DI-7602
19. DO-8500-2
20. DI-8500-2
21. DO-8700
22. DI-8700

NOTES

- WALL PACK (W70SPL120M6/LITHONIA)
- FLOURESCENT FIXTURE
- EXIT/COMBO (3LER3000/LUMACELL)
- GFI - GROUND FAULT PROTECTED RECEPTACLE
- WP - WEATHER PROOF COVER & ENCLOSURE
- S - 1 POLE SWITCH

REFERENCE DRAWINGS



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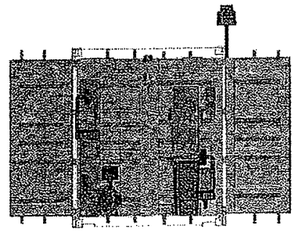


SIDE

REV.	DATE	DESCRIPTION	BY	CHK.	ENG.	APP.
0	10 07 27	ISSUED FOR INFO				

TITLE
ELECTRICAL LAYOUT
600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

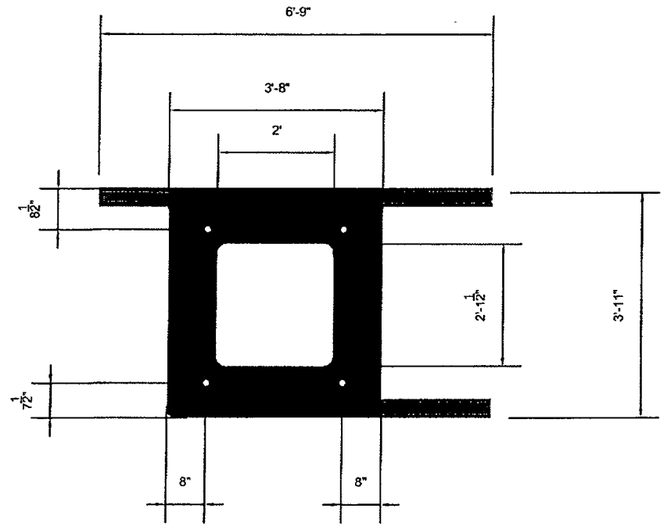
PLANT AREA

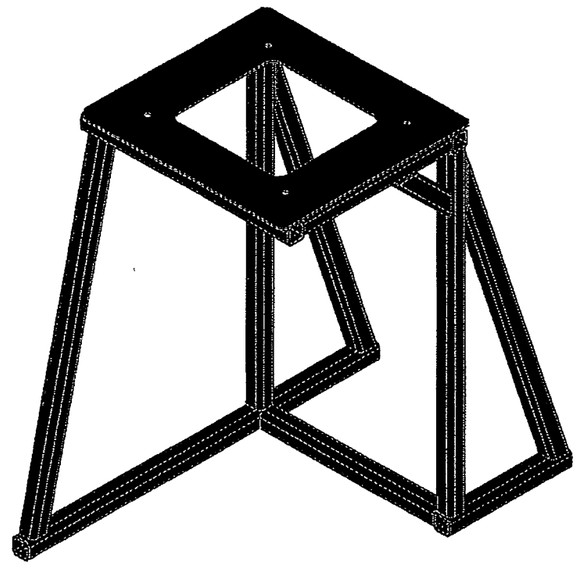
SCALE		
NTS		
DRAWN BY	CHECKED BY	APPROVED
PSH		
SHEET	DRAWING NO.	REV.
1 OF	011006-LAY-006	0

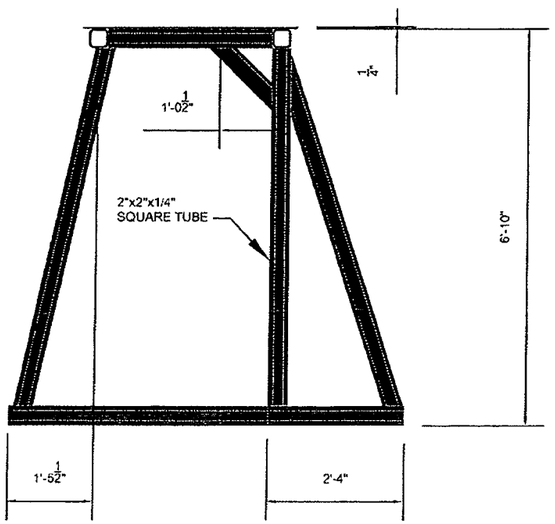
SHT

DRAWING NO.

PLAN VIEW







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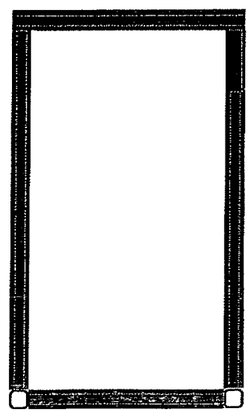

FRONT

NOTES

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TITLE

IPEC STAND
600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

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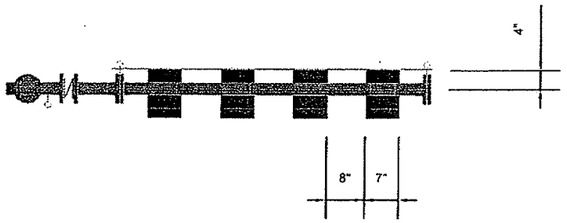
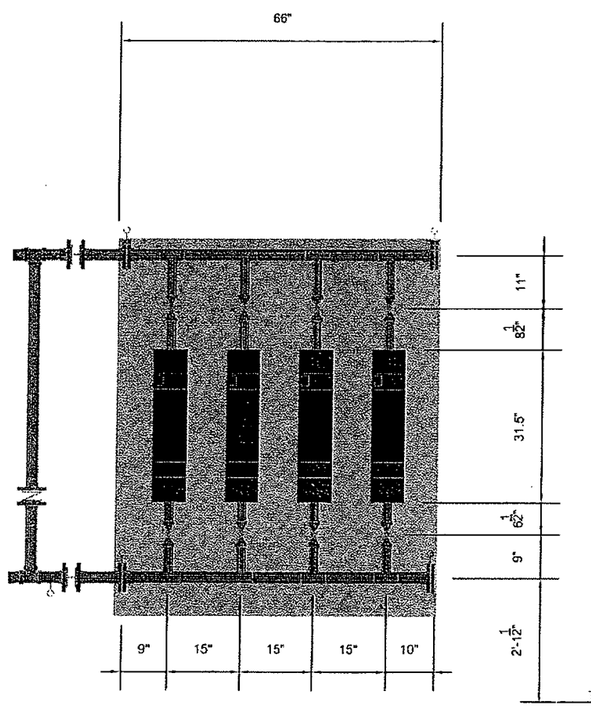
DRAWN BY PSH	CHECKED BY	APPROVED
SHEET 1 OF	DRAWING NO. 011006-LAY-005	REV. 0

PLAN VIEW





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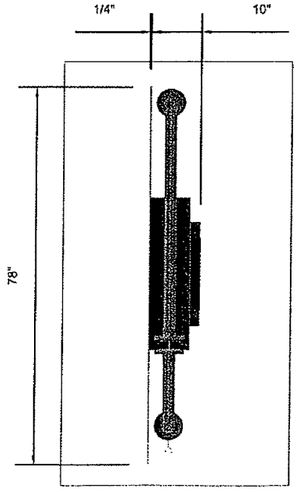

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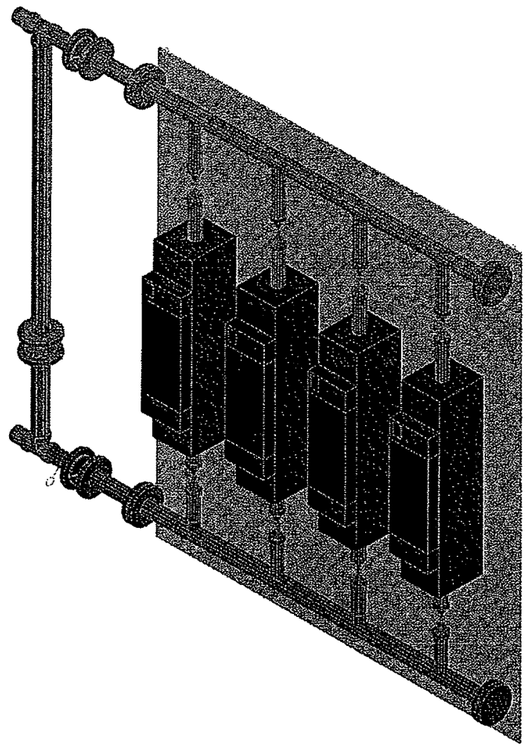

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TITLE
UV SYSTEM
600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

PLANT AREA

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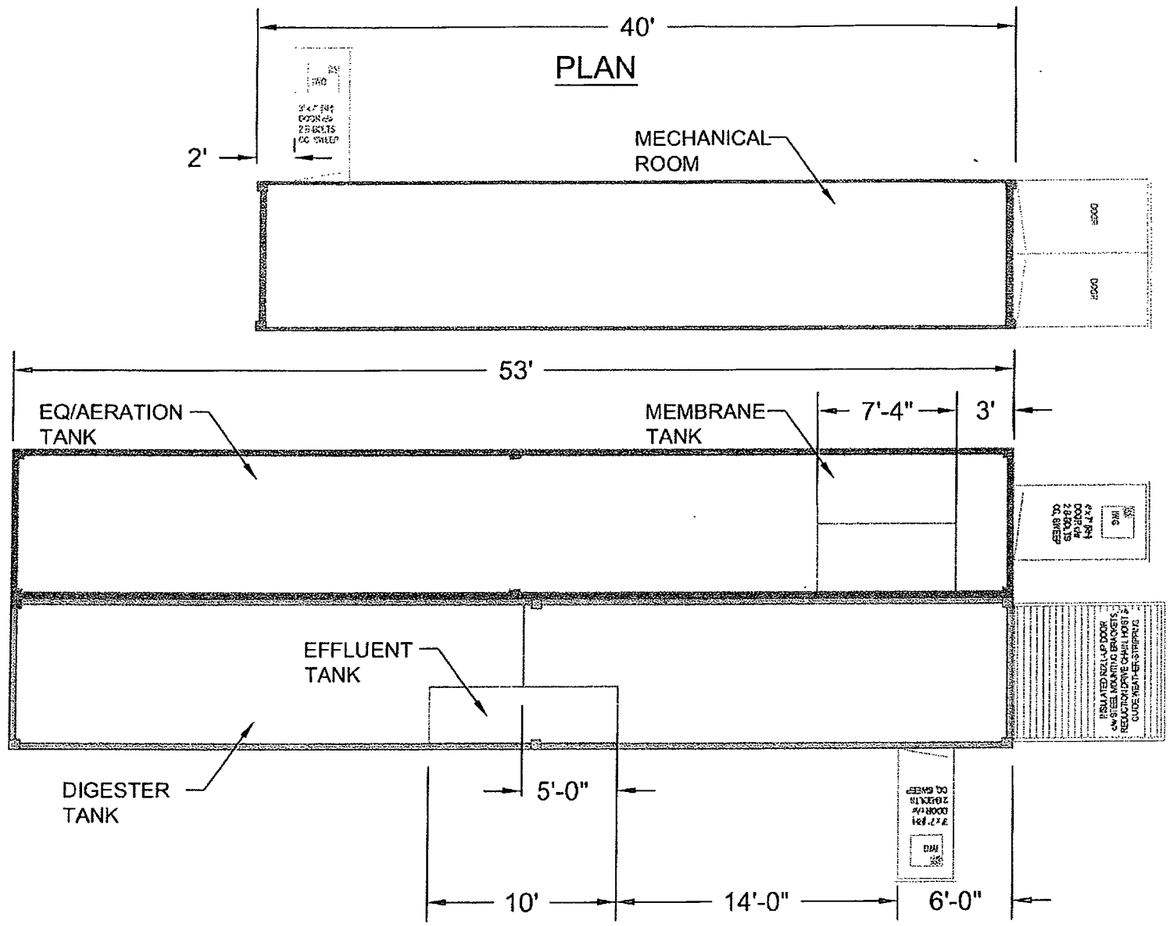
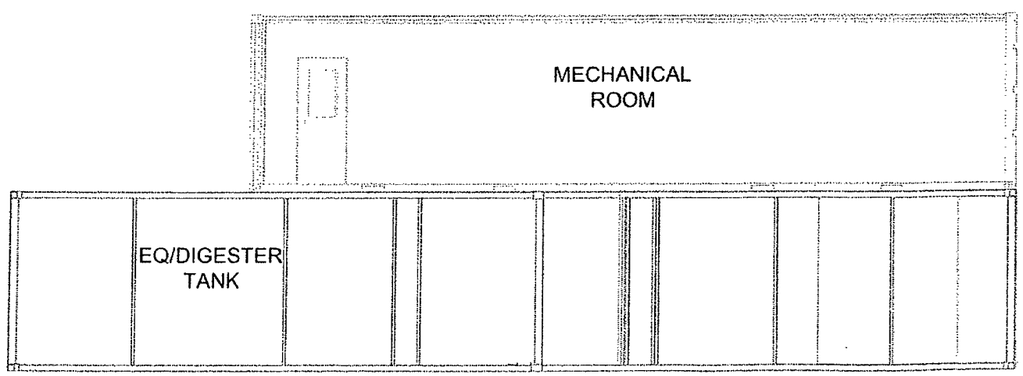
PSH		
SHEET	DRAWING NO.	REV.
1 OF	011006-LAY-004	0





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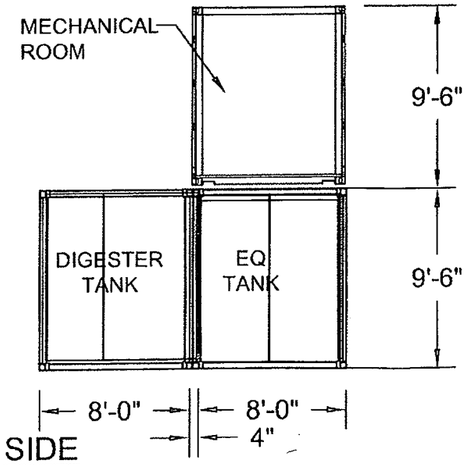

SIDE

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0	10 07 23	ISSUED FOR INFO				

TITLE

600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

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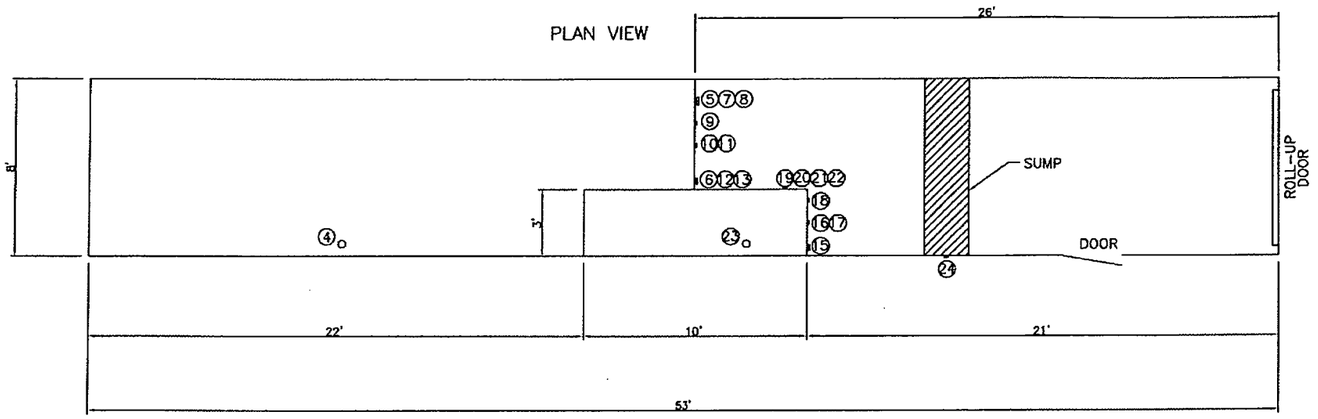
SHEET 1 OF	DRAWING NO. 011006-LAY-003	REV. 0

PLAN VIEW



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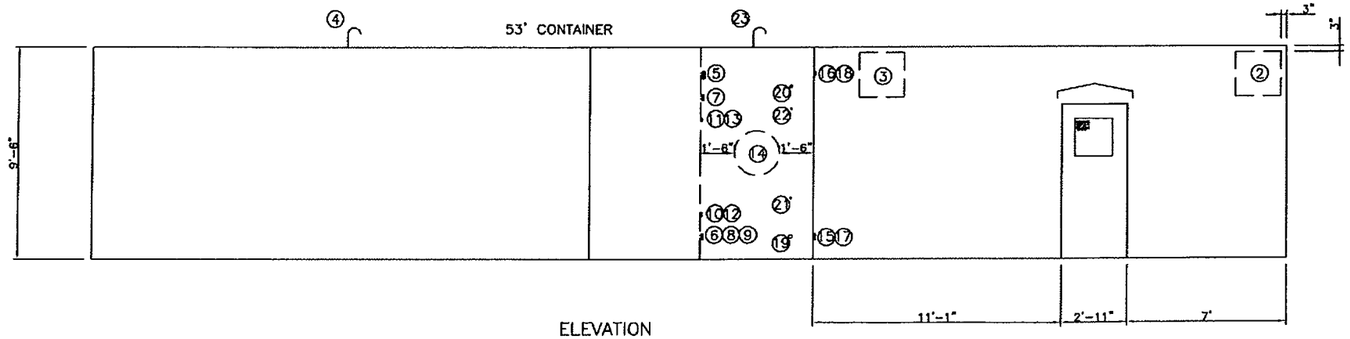

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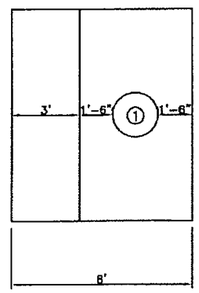

DIGESTER CONTAINER NOZZLES VENTS AND MANWAYS

1. 24" MANWAY
2. 24"x24" CUTOUT
3. 24"x24" CUTOUT
4. ?" FLANGE (VENT)
5. 4" MALE CAMLOCK (OVERFLOW)
6. 3" FLANGE (DRAIN)
7. 3" FLANGE (P201 DISCHARGE)
8. 2" FLANGE (P100 SUCTION)
9. 2" FLANGE (BLOWER)
10. 2" FLANGE (LT)
11. 1.5" FNPT (LAHH)
12. 3/4" FNPT
13. 3/4" FNPT
24. 2" MNPT

EFFLUENT TANK NOZZLES VENTS AND MANWAYS

14. 24" MANWAY
15. 3" FLANGE (DRAIN)
16. 2" FLANGE (UV RETURN)
17. 2" FLANGE (P300 SUCTION)
18. 2" FLANGE (GE SKID)
19. 2" FLANGE (LT)
20. 1.5" FNPT (LAHH)
21. 3/4" FNPT
22. 3/4" FNPT
23. ?" FLANGE (VENT)

NOTES

REFERENCE DRAWINGS

REV.	DATE (Y M D)	DESCRIPTION	BY	CHK.	ENG.	APP.
0	10 07 23	ISSUED FOR INFO				

FilterBoxx

TITLE: DIGESTER CONTAINER 600 PERSON C-SERIES TYPICAL GENERAL ARRANGEMENT

PLANT AREA

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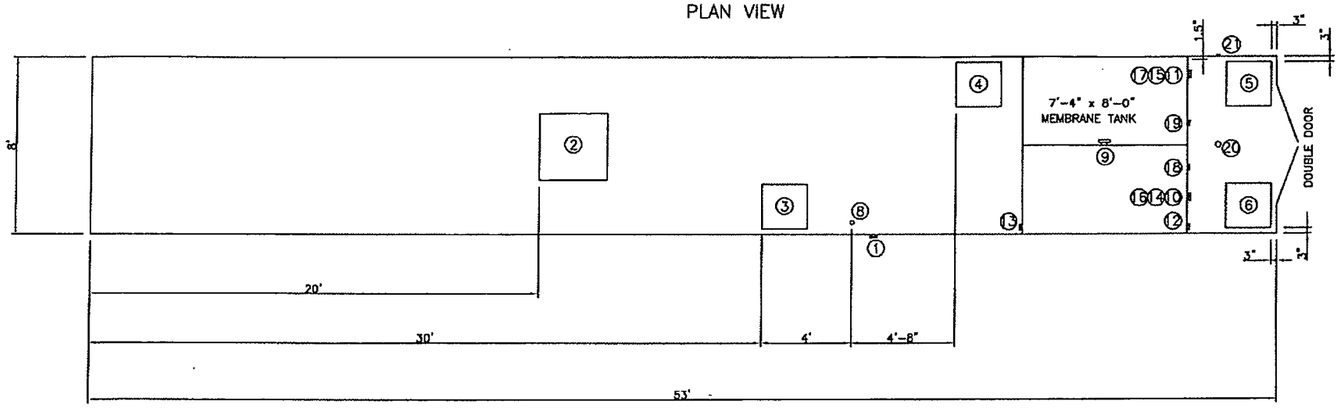
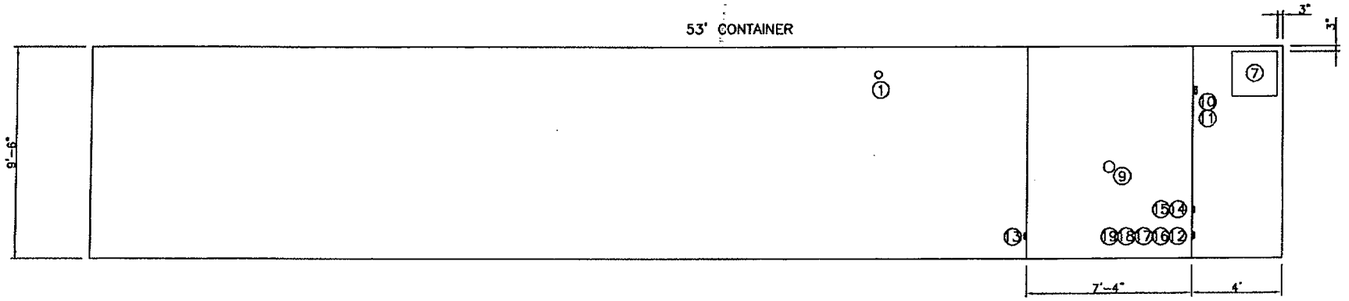
NTS		
DRAWN BY: PSH	CHECKED BY	APPROVED
SHEET: 1 OF	DRAWING NO.: 011006-LAY-002	REV.: 0

PLAN VIEW

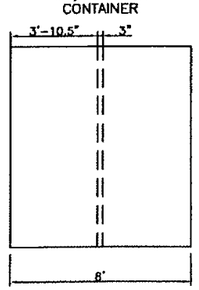


53' CONTAINER



ELEVATION

EQ/AERATION CONTAINER



SIDE

EQ/AERATION
CONTAINER NOZZLES
VENTS AND MANWAYS

1. 4" MALE CAMLOCK
2. 36"x36" MANWAY
3. 24"x24" CUTOUTS
4. 24"x24" CUTOUTS
5. 24"x24" CUTOUTS
6. 24"x24" CUTOUTS
7. 24"x24" CUTOUTS
8. 2" FLOOR DRAIN
20. 2" FLANGE (DRIAIN)
21. 3" FLOOR DRAIN

MEMBRANE
TANKS NOZZLES
VENTS AND MANWAYS

9. 6" FLANGE (CONNECTING TANKS)
10. 4" FLANGE
11. 4" FLANGE
12. 3" FLANGE (PASS THROUGH PIPE)
13. 3" FLANGE (PASS THROUGH PIPE)
14. 3" FLANGE (P200 DISCHARGE)
15. 3" FLANGE (P200 DISCHARGE)
16. 3" FLANGE (P201 SUCTION)
17. 3" FLANGE (P201 SUCTION)
18. 3" FLANGE (DRAIN)
19. 3" FLANGE (DRAIN)

NOTES

REFERENCE DRAWINGS

REV.	DATE (Y M D)	DESCRIPTION	BY	CHK	ENG.	APP.
0	10 07 23	ISSUED FOR INFO				

FilterBoxx

TITLE
EQ/AERATION CONTAINER
600 PERSON C-SERIES
TYPICAL GENERAL ARRANGEMENT

PLANT AREA

SCALE		
NTS		
DRAWN BY	CHECKED BY	APPROVED
PSH		
SHEET	DRAWING NO.	REV.
1 OF	011006-LAY-001	0

Attachment 14

FilterBoxx WWTP – Process Description (Section 3 of O&M Manual)

3.0 Introduction

This Sewage Treatment Plant (STP) is designed to treat the sewage water from the BlackSand 600m Craft Camp. The facility consists of the following micro systems:

- Influent Prescreening
- Equalization / Aeration Bioreactor
- GE Process Skid
- Ultrafiltration Membranes (UF)
- Treated Water Effluent Disinfection and Distribution
- Sludge Aerobic Digestion and Decant
- Programmable Logic Controller (PLC)
- Human Machine Interface (HMI)
- Motor Control Centre (MCC)

The FilterBoxx Ultrafiltration (UF) STP consists of three buildings assembled together to form the STP. The buildings are equipped with pumps, motors, process control equipment, heating, lighting and monitoring instrumentation which are to be wired directly to the PLC and MCC control panels.

The pre-screened sewage is discharged into the Equalization (EQ)/Aeration Process Tank, TK-3600, where the sewage feed flow will be attenuated. The pre-screen will also be backwashed via sprayer system using the STP's treated water effluent. The majority of the sewage treatment will be performed in the EQ/Aeration Tanks as a suspended growth biological treatment process. The process utilizes aerobic or oxygen using bacteria to remove organic contaminants through a process of biological oxidation.

The air required to meet the oxygen demands of the system and to provide the mixing of the mixed liquor suspended solids (MLSS) is supplied by Aeration Blower, B-8700, and fine bubble diffusers.

The operating level in the EQ/Aeration process tank are monitored by a submerged level transmitter, LT-3626, and a High-High level switch, LSHH-3601. The transmitter and switch control the operation of the membrane trains and warn of potential tank overflow. The EQ tank is also equipped with an overflow line that connects it to the digester.

The sewage is pumped from the EQ/Aeration tanks to the two Ultrafiltration (UF) Membrane Tanks, TK-3400-1/2, via the Membrane Feed Pump, P-3600. The feed to the membrane trains can be controlled via a Flow Control Valve, HCV-3680. The membrane tanks have an overflow back to the EQ/Aeration tank that serves as the Return Activated Sludge or RAS flow.

The two (2) UF Membrane process trains are each designed to handle up to the average daily flow of the plant. They can be operated in either of two modes, Dedicated or Common. The preferred normal operating mode is the Common mode of operation. In this mode the blower and permeate/backpulse lines are connected and the two membrane cassettes work together. The plant will run 0, 1 or 2 permeate pumps depending on the level in the EQ/Aeration tank pulling from both cassettes at the same time. Both backpulse pumps will be in operation when in common mode. The dedicated mode of operation treats each membrane cassette and permeate pump as a separate train. This mode is to be used if a membrane cassette needs to be taken offline for service or cleaning.

Once in the UF membrane tanks the final effluent is processed or filtered through the GE UF Membrane Elements. The UF Membranes are physical barriers designed to filter out suspended solids in the sewage larger than 0.04 µm.

The UF membranes are immersed in the sewage and are referred to as "outside in" filters; therefore the solids that are filtered out of the sewage are retained in the UF Membrane tank and recirculated back to the EQ/Aeration tank via the overflow weir.

The membrane tanks are equipped with low level alarm switches LSLL-3404-1/2. These switches protect the membranes from being exposed to the air. Exposed membranes will dry out and can be permanently damaged.

The final treated effluent drawn through the UF Membranes by the UF Permeate pumps, P-3500-1/2, is discharged into the UF Backwash or Treated Water Effluent tanks via a three-way motorized control valve, FV-3560. Permeate is used to periodically Backwash the UF membrane system by means of the Backwash pumps, P-8800-A/B, and a pair of three-way motorized control valves, FV-3561-1/2. The UF membrane Backwash sequence is performed automatically by the PLC.
The system is equipped with two Membrane Blowers, B-8500-1/2, to provide air scour for the membranes.

The UF Membranes will undergo a scheduled Maintenance Clean with Sodium Hypochlorite or Citric Acid which is dosed directly into the UF Membrane tanks. These chemicals are used to remove the build-up of organic and inorganic foulants on the surface of the UF membranes. This cleaning sequence is performed automatically by the system PLC according to the maintenance cleaning schedule. Maintenance cleans should be scheduled daily at a time of low flow to the system.

The UF Permeate or final effluent is pumped from the Treated Water Tank via the Treated Water Effluent Pump, P-1800, to the four (4) parallel Ultraviolet (UV) disinfection system units. As the final effluent passes around the quartz UV light tubes, the bacteria or viruses that were not filtered by the UF Membrane system will be rendered "inactive" or dead prior to discharge. The effluent pump runs continuously, the level in the effluent tank is controlled by the effluent control valve FV-1860. When this valve is open the effluent is sent out of the system for discharge in the effluent field. When this valve is closed the effluent recirculates through the UV's and PRV-1879 back to the effluent tank.

To prevent the accumulation of solids and to control sludge age within the biological system, the Waste Activate Sludge pump, P-3400 is used to send solids from the bottom of the membrane tanks to the Sludge tank, TK-7200. The pump operates on a frequency and duration control.

Periodically, supernate can be decanted from the Sludge via the Decant Pump, P-7200 and directed to the EQ/Aeration Tanks. The digested solids are to be periodically hauled off site.

The STP is to be operated under automatic controls by the Programmable Logic Controller or PLC unit during normal operating conditions. All screening, aeration and pump systems are monitored and controlled by the PLC unit and operation may be monitored via the Motor Control Centre or MCC. Equipment should not be operated in MANUAL/HAND mode unless under direct operator attention for equipment test purposes or due to instrumentation failure **(i.e. Alarms/Alerts do not affect MANUAL/HAND control)**. AUTO operation is where the system PLC is in full control of the system devices **(i.e. all Alarms/Alerts will control devices)**.

3.1 System Equipment List

- **Main Control Panel**

- Programmable Logic Controller (PLC)
- Human-Machine Interface (HMI) Operator Interface Screen
- All electrical equipment/devices within system provided by FilterBoxx

- **Sewage Water Influent and Pre-Screening System**
  - Sampling Points
  - Level and Flow monitoring Instrumentation
  - Pre-Screening and Handling
  - Influent Composite Sampler

- **Equalization and Aeration Process Tank and Inlet Screen**
  - Coated Carbon Steel EQ/Aeration Tank
  - Tank Aeration System
  - Membrane Feed Pump
  - WAS Pump
  - Raw Water Screen
  - Sampling Points
  - Level, Flow and Pressure Control Instrumentation and Monitoring Equipment

- **Ultrafiltration (UF) Membrane System**
  - 2 x 100% Process Equipment Supply
  - Skid mounted package
  - 2 x 6module 500A GE Zenon Ultrafiltration membrane cassettes
  - UF Membrane Support Structures
  - Pumps/Aeration Blowers
    - Permeate Pumps
    - Backpulse Pumps
    - Aeration Blowers
    - Chemical Dosing
      - Sodium Hypochlorite pump
      - Citric Acid pump
  - Polyethylene Backpulse Tank
  - Sampling Points
  - Level, Flow and Pressure Control Instrumentation and Monitoring Equipment

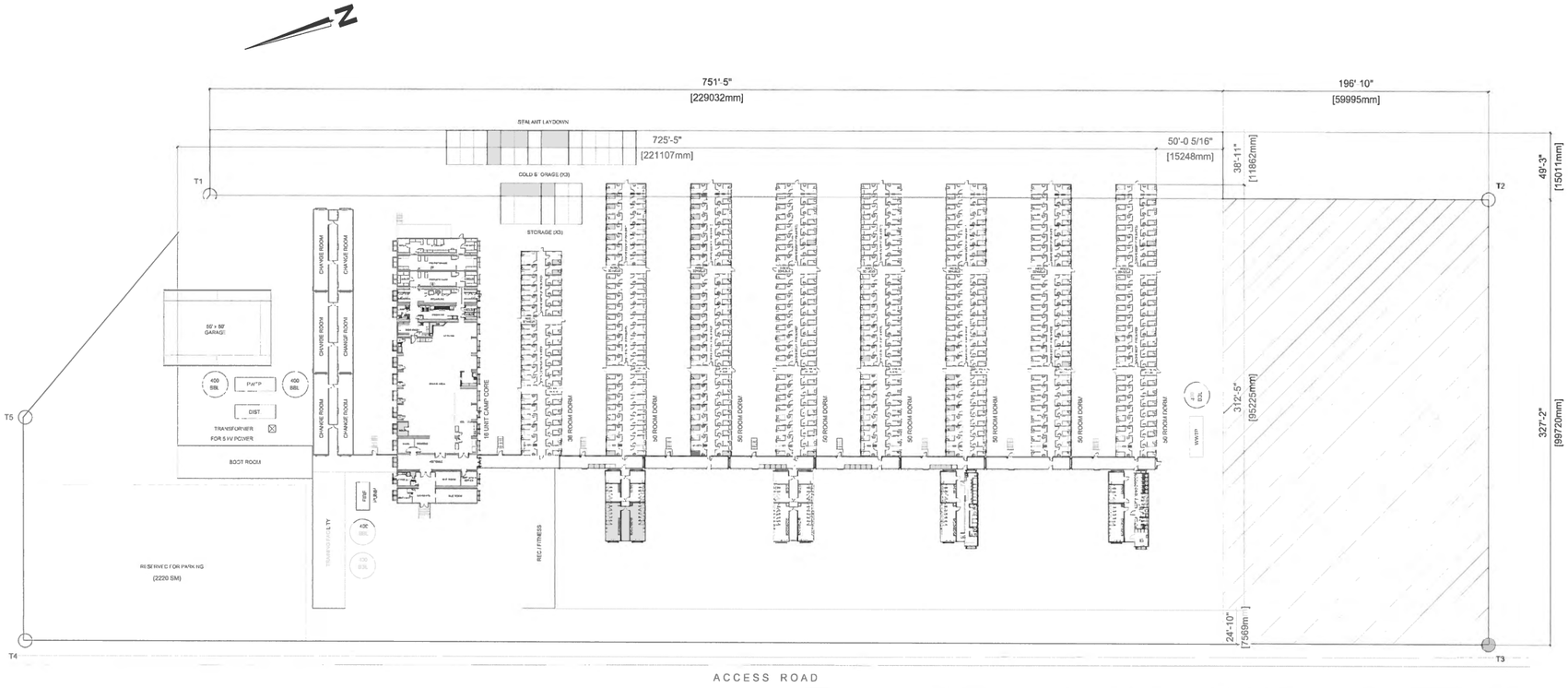
- **Aerobic Digester and Sludge Handling System**
  - Coated Carbon Steel Sludge Holding Tank
  - Pumps/Aeration Blowers
    - Decant Pump
    - Aeration Blower
  - Sampling Points
  - Level, Flow and Pressure Control Instrumentation and Monitoring Equipment

- **Treated Water Effluent Storage and Discharge System**
  - Coated Carbon Steel Effluent Tank
  - Pumps
    - Treated Water Effluent Pump
    - Level, Flow and Pressure Control Instrumentation and Monitoring Equipment

- **Treated Water Effluent Disinfection System**
  - 4 x Ultraviolet (UV) Disinfection System
    - Level, Flow and Pressure Control Instrumentation and Monitoring Equipment

Attachment 15

Milne Port Accommodations Camp Site Plan



SITE DEVELOPMENT PLAN
1/40" = 1'-0"

DesignWorks
Engineering + Inspections Ltd.
P: 780 814 55 33 F: 780 800 2112
9905-97 Avenue,
Grande Prairie, AB T8V 0N2
info@designworkseng.com
www.designworkseng.com

NOTES:

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNTIL SIGNED AND SEALED OR ADVISED IN WRITING BY THE ENGINEER.

DO NOT SCALE THIS DRAWING.

VERIFY ALL DIMENSIONS, DATUMS, AND LEVELS PRIOR TO COMMENCEMENT OF WORK. REPORT ANY DISCREPANCIES OR OMISSIONS TO THE DESIGNER IMMEDIATELY.

ALL WORK MUST COMPLY WITH THE MOST RECENT EDITION OF THE APPLICABLE BUILDING CODE, AND ANY OTHER GOVERNING AUTHORITY.

No.	Description	Date

CONTRACTOR

SEAL

CLIENT

Horizon North

DRAWN BY:	CVP
CHECKED BY:	CM VALIENTE
ENGINEER	JOHN LEHNERS, P. ENG.
PROJECT No.:	170109
SHEET ISSUE DATE:	JUNE 7, 2017
PROJECT STATUS:	FOR REVIEW

PROJECT

Baffinland Iron Mines

DESCRIPTION

Site Plan

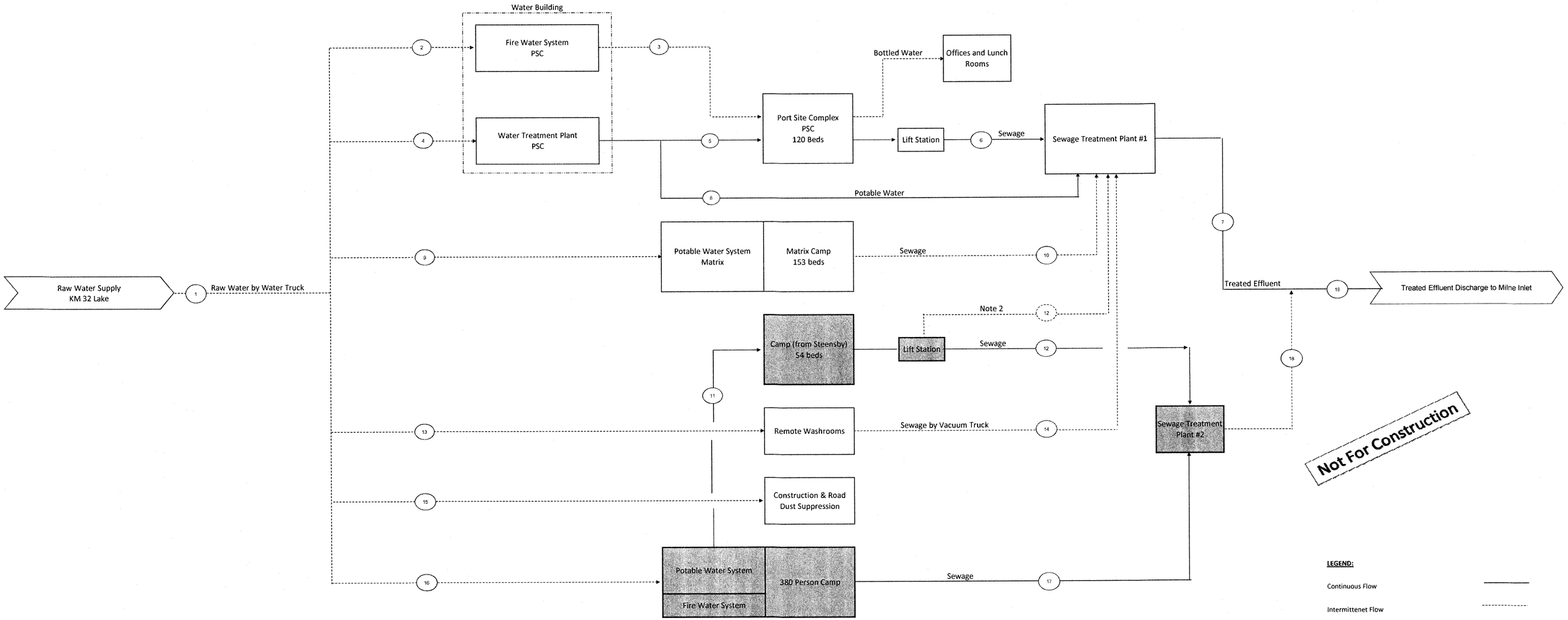
DRAWING NO: A1.10

SHEET: 1 / 1

Baffinland

Attachment 16

Milne Port Water and Sewage Process Flow Diagram



Stream No.	1	2	3	4	5	6	7	8	9	10
Stream Description	RAW WATER FROM KM32 LAKE	RAW WATER TO FIRE TANKS	FIRE WATER TO PSC	RAW WATER TO PSC	POTABLE WATER TO PSC	SEWAGE FROM PSC	TREATED EFFLUENT FROM STP #1	POTABLE WATER TO STP	RAW WATER TO MATRIX	SEWAGE FROM MATRIX
Fluid	RAW WATER	RAW WATER	RAW WATER	RAW WATER	POTABLE WATER	SEWAGE	TREATED EFFLUENT	POTABLE WATER	RAW WATER	SEWAGE
Units	m^3/day	m^3/day	m^3/hour	m^3/day	m^3/day	m^3/day	m^3/day	m^3/hour	m^3/day	m^3/day
Current Permit Limit	367.5	-	-	-	-	-	-	-	-	-
Calculated Flow	192	One off fill	113	30	24	24	58	6	31	31
Stream No.	11	12	13	14	15	16	17	18	19	20
Stream Description	POTABLE WATER TO NEW CAMP	SEWAGE FROM NEW CAMP	RAW WATER TO WASHRMS	SEWAGE FROM WASHRMS	CONST. & ROAD DUST	RAW WATER TO 380 PERSON CAMP	SEWAGE FROM 380 PERSON CAMP	TREATED EFF. FROM STP #2	TREATED EFFLUENT TO ENVIRONMENT	
Fluid	POTABLE WATER	SEWAGE	RAW WATER	SEWAGE	RAW WATER	RAW WATER	SEWAGE	TREATED EFFLUENT	TREATED EFFLUENT	
Units	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	
Current Permit Limit	-	-	-	-	Note 1	-	-	-	-	
Calculated Flow	11	11	3	3	20	109	95	136	194	

Notes:

1. Included in Stream # 1
2. Stream No. 12 flows will be directed to Sewage Treatment Plant #1 by Sewage Vacuum Truck until Sewage Treatment Plant #2 becomes online

REGISTERED PROFESSIONAL ENGINEER
M. J. BUYKX
LICENSEE
19/7/17
NTNU

REV	ISSUE FOR	AUTH. BY		DATE
2	PERMITTING	JH	MB	19/7/2017
1	PERMITTING	TB	MB	13/7/2017
0	PERMITTING	TB	MB	26/6/2017
	ISSUE AUTHORIZATION			

HATCH

Baffinland

DESIGNED BY T. BRUCE DATE:	DRAWN BY T. BRUCE DATE:
CHECKED BY M. BUYKX DATE:	DISCIP ENGR. DATE:
PROJ. DES. COORD. DATE:	PROJ. ENGR. N. MASON DATE:
PROJ. MGR S. HEINER DATE:	

BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
WATER AND SEWAGE
PROCESS FLOW DIAGRAM

SCALE NTS OR AS NOTED | DWG NO. H353004-40000-221-282-0001 | REV. 2

Attachment 17

Newterra Vendor Guarantee for Camp Water Treatment System (Potable)

newterra
clean water. modular solutions. *simple:*

1291 California Avenue, P.O. Box 1517
Brockville, ON, K6V 5Y6
T: 800.420.4056 F: 289.203.1319

Baffinland Iron Mines Corporation

newterra Project #:1704653
Project Name: Baffinland - Mary River Project 430 Man WTP
C/O
Horizon North Camps and Catering
5637-67 Avenue NW
Edmonton Alberta

newterra guarantees that when the supplied water treatment system is operated during a performance test in accordance with the designed conditions, the facility will be capable of producing the designed water quality at the designed flowrate. The plant shall be operated within the design conditions listed in the tables below, and must be operated in accordance with newterra operations manual.

The system shall process 100% of the design flow listed when that flow consists of water with constituent concentrations equal to or lower than those listed in the Baffinland Hatch Raw water Properties of Camp Lake and km 32 Lake document H353004-00000-120-078-001 rev 0 received by newterra Ltd.

Table 1

Influent Flow Rate	Design Value	Metric Unit
Average Daily Flow (ADF)	99.25	m^3/d

Jeff Kempson P.Eng

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J. KEMPSON
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newterra BEST MANAGED COMPANIES