Knight Piésold CONSULTING

Management System Certified by: bsi ISO 9001 ISO 14001 ISO 45001 CERTIFIED

July 5, 2022

Knight Piésold Ltd.
200 - 1164 Devonshire Avenue
North Bay, Ontario
Canada, P1B 6X7
T +1 705 476 2165
E northbay@knightpiesold.com
www.knightpiesold.com

Mr. Allan Knowlton
Senior Project Manager
Baffinland Iron Mines Corporation
#300-2275 Upper Middle Road East
Oakville, Ontario
Canada, L6H 0C3

Dear Allan,

RE: Camp Lake Area Water Management Design Brief and Issued for Construction Drawings

1.0 INTRODUCTION

Knight Piésold Ltd. (KP) has been retained by Baffinland Iron Mines Corporation (Baffinland) to complete the detailed design and Issued for Construction (IFC) drawings for proposed water management measures in the Camp Lake area at the Mary River mine site. The proposed measures are largely consistent with Baffinland's Mine Site Water Management Plan (WMP; KP, 2021) approved by the Nunavut Water Board (NWB) in August 2021 as part of Modification Request No. 13 under Baffinland's Type A Water Licence 2AM-MRY1325. The general mine site arrangement can be seen in the attached Figure 1.

The purpose of these measures is to reduce potential erosion and sedimentation in the area, and minimize releases of total suspended solids (TSS) to Camp Lake and its tributaries. This letter provides a summary of the design, construction details, and general monitoring, inspection, and maintenance requirements for these measures.

2.0 AREAS OF CONCERN AND DESIGN CRITERIA

2.1 GENERAL

The Camp Lake area associated with the Project has been divided into three primary areas requiring additional water management measures as follows:

- Area 1 - North end of the airstrip
- Area 2 - Camp Lake Jetty
- Area 3 - Snow stockpile

All three areas of concern are shown on Drawing 551. Measures implemented by Baffinland to date have not been effective in managing erosion and the resulting transport of sediment into Camp Lake and its tributaries from those areas. Further, a sustained rainfall event on June 16, 2022, resulted in a previously undisturbed bank, eroding and exposing a buried ice lens directly west of the airstrip. The eroded material was transported down the natural slope and resulted in alluvial fan covering the adjacent shoreline of Camp Lake. KP was on site for related water management work at the time, and supported Baffinland by providing recommendations for short-term remediation work (KP, 2022). The short-term remediation work and other recent observations at the Camp Lake Jetty area have been incorporated into the longer-term water management measures described herein.

The site conditions, previous erosion on and sediment control measures, and proposed additional water management measures are described below.

2.2 DESIGN CRITERIA

The project design criteria were previously developed in conjunction with Baffinland for the WMP (KP, 2021), based on the following documents:

- The Mary River Project Civil Design Philosophy and Criteria (Hatch, 2018)
- The Crusher Pad Sedimentation Pond expansion design (Golder Associates, 2017)
- The Mary River Project Type A Water Licence 2AM-MRY1325 (NWB, 2015)
- The Metal and Diamond Mining Effluent Regulations (MDMER, 2018)
- The Nunavut Mine Safety and Health Act (MSHA, 2011)
- The Nunavut Waters and Nunavut Surface Rights Tribunal Act and Nunavut Waters Regulations (NWNSRTA, 2018)
- The Fisheries Act (2016)

The design criteria are summarized in Table 1.

2.3 DESIGN CONSTRAINTS

The Camp Lake area has several design constraints that limit the number and size of sediment and erosion control measures that can be successfully implemented, such as:

- Limited space between the airstrip and Camp Lake shoreline
- Elevation challenges
- Fish habitat extending inland from southeast corner of the lake
- Extensive ice-rich soils
- Significant dust deposition in the area, mainly due to airstrip operations

These design constraints have been considered in the development of the proposed water management measures for the Camp Lake area.

3.0 AREA 1 - NORTH END OF THE AIRSTRIP

3.1 SITE CONDITIONS

Area 1 is the area at the northwest end of the airstrip (Photo 1). Runoff from the northwestern portion of the airstrip currently collects at a low spot along the outer edge of the access road, as shown on Photo 1. This runoff cannot drain away because of the safety berm located along the outer bank of the access road that circles the end of the airstrip.

Breaching the safety berm is not a viable option, as the ground on the other side of the berm slopes steeply down to Camp Lake Tributary 1 (CLT-1). Water that has escaped the safety berm in the past has eroded the existing steep slope and has discharged sediment into the stream (Photos 2 and 3).

More recently, an area of subsidence has formed just north of the access road (Photos 1, 4, and 5). This area of subsidence has been partially backfilled with coarse rockfill and appears to have increased in size following a recent rainfall event. One possibility is that water has been seeping downward in this area, possibly through coarse rockfill used as backfill around the airstrip lighting standard and/or the roadbed, and this water may be melting the ice-rich soils known to exist in the general area. The subsidence area

should be backfilled with 3/4” minus fill rather than coarse fill to help limit infiltration of runoff into this location until further investigation (i.e., excavation by hand) and remediation can be completed.

Photo 1 Location of issues within Area 1

Photo 2 Eroded slope beneath the low area requiring drainage

Photo 3 **Eroded slope beneath the low area requiring drainage**

Photo 4 **Subsidence north of the access road and adjacent airstrip lighting**

Photo 5 Subsidence north of the access road and adjacent airstrip lighting

Additionally, on June 16, 2022, following a 30-hour rainfall event, a portion of the bank located between the access road around the north end of the airstrip and Camp Lake eroded (Photos 6 and 7), releasing sediment which was deposited over the shore of Camp Lake. An approximately 0.5 m thick massive ice lens was visible in the resultant erosion cavity before it was backfilled, and the slope rehabilitated.

This event and the recommended short-term remediation measures, have been documented separately (KP, 2022). Remediation of the eroded area has resulted in establishing a drainage ditch constructed with compacted foundation fill, non-woven geotextile, and surficial riprap. The ditch has been incorporated into the longer-term water management strategy described herein.

The ground conditions at Area 1 (i.e., north end of the airstrip, Weatherhaven camp, jetty and snow dump), much like other areas of the mine site, is characterized by glaciofluvial deposits that have the potential to contain ice-rich soils and massive ice. It is judged that the recent erosion event and area of local subsidence described above, may be indicative of surface water pooling and infiltrating into the ground may be impacting the thermal conditions, resulting in the melting ice-rich soils and/or massive ice deposits. A previous drillhole completed in this area drilled during April 2021 (Figure 2) encountered ice plus sand or ice below the active layer at a depth of 2.1 m. The presence of ice-rich soils and ice is an important consideration in planning water management measures in this area.

Photo 6 Erosion event on June 16, 2022

3.2 PROPOSED WATER MANAGEMENT MEASURES

The focus of water management measures in Area 1 is to eliminate pooling of water on the access road around the north end of the airstrip. This will be accomplished by re-contouring the north end of the airstrip and construction of collection ditches on the downstream side of the access road to direct flows to the two main drainage ditches in the area. The drainage ditches will convey collected runoff water down the slope toward either Camp Lake or Camp Lake Tributary 2 (CLT-2).

Photo 7 **June 16, 2022, erosion cavity; not visible in photo, an ice lens was visible**

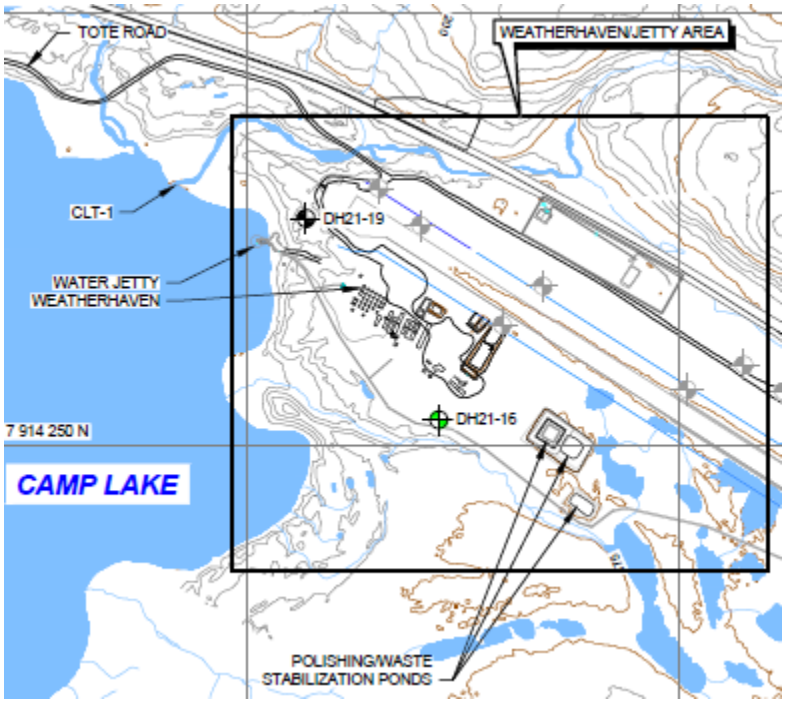


Figure 2 Camp Lake Area - 2021 Drillhole Locations

The proposed water management measures are shown on Drawing 555 and include the following:

- **Site Regrading -** The area between the north end of the airstrip and the access road will be regraded to promote drainage toward Ditch 2 (west side) or Ditch 3 (southwest side). Approximately 4,600 m^3 of fill will be required for the regrading, with minimal cut required.
- **Access Road Diversion Berm and Collection Ditches -** The diversion berm and shallow perimeter collection ditch on the downstream side of the road will be re-established to collect and convey sediment laden runoff to either Ditch 2 (west side) or Ditch 3 (southwest side). The collection ditch will be lined with finer grained riprap overlying non-woven geotextile.
- **Drainage Ditch 2**
  - Upgrade the temporary remedial measures implemented along the proposed Ditch 2 alignment. This will included the installation of rockfilled gabions baskets in the ditch invert. The gabion baskets will be installed lengthwise perpendicular to the direction of flow, at the approximate locations shown on the drawings. The rockfilled gabion baskets will provide energy dissipation on the steeper sections of the ditch. The remaining portions of the ditch will be lined with coarse riprap overlying non-woven geotextile.
  - The sediment (alluvial fan) deposited at the outlet of Ditch 2 from the recent erosion event will be excavated and removed. Appropriate temporary sediment control measures (i.e., silt fences) should be maintained downstream of the alluvial fan during and after excavation of the material.
  - Construct a sediment trap at the outlet of Ditch 2. The recently constructed rock berm at the base of the slope will be breached at its west end, to allow for runoff to enter the sediment trap, and additional internal berms will be constructed to increase the flow path and maximize the effectiveness of the sediment trap.

- **Drainage Ditch 3** - Construct Ditch 3 to collect runoff from the northeast corner of the airstrip and convey the water into CLT-2. Two options for this ditch are shown on the drawings as follows:
  - Option 1 would be constructed along the existing road, and either excavated into the existing ground or formed by placing Transition Zone 2 fill berms on either side and then lining the ditch invert formed by the berms with riprap overlying non-woven geotextile.
  - Option 2 would be formed by placing Transition Zone 2 along the downslope side, and then lining the ditch with riprap overlying non-woven geotextile. The upslope side of the ditch would be formed by the natural slope. Rockfilled gabions will be installed perpendicular to the ditch at various locations along the ditch length to provide energy dissipation.
- **General Slope and Ditch Repairs**
  - The remaining eroded north-facing slopes located northeast of the airstrip will be backfilled with ¾" minus fill material and a flatter overall slope will be established than the original slope. The regraded slope will be covered with geotextile and fine riprap.
  - The ditch on the southwest side of the Tote Road will be recontoured using ¾" minus fill material, as required, then covered with non-woven geotextile and riprap.
  - A gabion berm will be constructed at the bottom of the slope (north of the Ditch 2 outlet) to slow down the runoff coming down the slope (or even potentially temporarily cause it to pool against the berm). By doing so, some settling of TSS is anticipated to occur upstream of the berm. For the gabion berms, the Transition Zone 1 and Filter Material layers will act as sacrificial layers which can be easily removed (or partially removed) to facilitate sediment removal and repaired.
- Typical sections and details of the diversion berm, sediment trap, ditches and gabion berm are presented on Drawing 570. Materials specifications are presented on Drawing 575.

4.0 AREA 2 - CAMP LAKE JETTY

4.1 SITE CONDITIONS

The Camp Lake Jetty Area is shown on Photo 8. Runoff from the west side of the Weatherhaven Camp has historically reported to the small valley where the access road to the Camp Lake Jetty is located.

The current erosion and sediment control measures present include rock check dams along the side of the jetty road and an existing sediment trap at the bottom of the road (Photo 8). A safety berm has been constructed along the north side of the jetty access road (Photo 9), thereby preventing runoff along the road from draining into the rock check dams. As a result, the rock check dams receive minimal runoff and thus are reported to be operating effectively as-is, according to Baffinland. Also, the existing rock check dams are not anticipated to settle the TSS in the runoff to adequate levels. Secondly, the runoff from the road reports directly to Camp Lake, resulting in increased TSS in the lake (Photo 10).

The bottom of the Camp Lake jetty road has limited space for an appropriately sized sediment trap and inadequate space for a proper sedimentation pond. Additionally, the sediment and erosion control measures cannot be expanded to the west due to the presence of fish habitat on the vegetated flats.

Photo 8 Camp Lake Jetty Area

Photo 9 Camp Lake Jetty Road with Safety Berm

Photo 10 Bottom of Camp Lake Jetty

Previously, KP's proposed measures in the jetty area included upgrading the access road to slope towards the existing rock check dams and sediment trap, which would in turn be upgraded to have additional capacity to manage the higher flows (KP, 2021). However, since the September 2020 site visit, Baffinland has constructed a shallow berm at the top of this valley (that the jetty access road is in), that redirects flows away from this area and to the access road around the airstrip instead.

4.2 PROPOSED WATER MANAGEMENT MEASURES

The proposed water management measures are shown on Drawing 560 and include the following:

- **Gabion Berm -** A gabion berm (similar to the one proposed for Area 1) will be installed south of the jetty, adjacent to the Camp Lake shoreline.
- **Ditch 1 Upgrades -** The existing rock check dams in the ditch adjacent to the jetty road will be removed and replaced with riprap and rockfilled gabions. Riprap, overlying non-woven geotextile, will be placed along the base and side slopes of the ditch, and rockfilled gabions placed periodically across the ditch to act as an overflow weir. A line of rockfilled gabions will be placed parallel to the road, along the length of the ditch, to act as a safety berm while allowing runoff from the jetty road to enter the ditch.
- **Sediment Trap Upgrades -** The existing sediment trap northeast of the jetty will be reconfigured to be 1.1 m deep and include a non-woven geotextile over the upstream slope of the berm closest to Camp Lake. Runoff will slowly filter through the cloth, removing some of the sediment prior to the runoff entering Camp Lake. For larger rainfall events, an overflow swale will be incorporated into the berm, and lined with geotextile and riprap. Additional settling of solids will occur as the runoff leaving the sediment trap flows through the vegetated wetland before entering into Camp Lake.

- **Slope Protection Measures -** Riprap will be placed on highly eroded areas of the hillside (sloping down towards the jetty) to reduce further erosion of those slopes.

The locations of the gabion berms, rockfilled gabions, sediment trap and riprap placement can be seen on Drawing 560. Typical sections and details of the gabion berms and sediment trap are presented on Drawing 570.

5.0 AREA 3 - WEATHERHAVEN CAMP SNOW STOCKPILE

5.1 SITE CONDITIONS

In the WMP, KP proposed constructing a sedimentation pond on the west side of the Weatherhaven Camp snow stockpile. During the July 2021 site visit, it was noted that the topography north of the snow stockpile would prevent runoff from the Weatherhaven Camp from reporting to such a pond (Photo 11). For this reason, the pond proposed in the WMP for this area is no longer recommended.

Photo 11 Weatherhaven Camp and Snow Stockpile Area

Currently runoff from the northern half of the stockpile reports to and forms ponds in a number of low lying areas around the stockpile, or drains towards the Weatherhaven Camp (Photo 11). The southern half of the snow stockpile drains along natural swales located south of the snow stockpile (Photo 12).

Photo 12 Drainages South of the Snow Stockpile

5.2 PROPOSED WATER MANAGEMENT MEASURES

The proposed water management measures are shown on Drawing 565 and include the following:

- **Swale Construction**
  - A swale is proposed to be constructed north of the snow stockpile to drain ponded water from north of the stockpile.
  - A second swale will be constructed northeast of the stockpile to drain ponded water. This second swale will likely need to be re-established each spring.
  - Runoff from the north half of the stockpile will be directed through the swales towards the natural drainages located southeast of the snow stockpile and flow by gravity towards the Camp Lake tributary (Photo 11).
- **Rock check dams -** The rock check dams will be installed along the existing drainages that connect the south and east sides of the snow stockpile to the Camp Lake Tributary (Photo 12).
- **Western Pond Outlet Modifications -** The outlet of the natural pond located to the west of the snow stockpile will be lowered in elevation to allow for water to drain more freely from it (Photo 11). A geotextile and riprap lined ditch will be established at this outlet to minimize erosion as the water drains by gravity towards the Camp Lake tributary.

The rock check dams and riprap lined ditch will reduce the flow velocity of the runoff and assist in settling of TSS. The location of the rock check dams, swales and ditches can be seen on Drawing 565, while typical sections and details are provided on Drawing 570.

6.0 CONSTRUCTION DETAILS

6.1 GENERAL

The locations and configurations of the proposed water management measures will be optimized based on actual encountered site conditions. The following sections provide general construction requirements and recommendations related to the Camp Lake area water management measures. Additional details including material specifications and compaction requirements, are provided on the Drawings.

6.2 EROSION AND SEDIMENT CONTROL

Baffinland will employ a combination of sediment and erosion control measures as outlined in Baffinland's Environmental Protection Plan (Baffinland, 2021a), and Surface Water and Aquatic Ecosystems Management Plan (Baffinland, 2021b), to address and manage sedimentation concerns during construction of the Camp Lake Area water management measures.

6.3 SURVEYING

The regrading around the north end of the airstrip and locations of various measures will be set out by Baffinland using suitably accurate surveying methods.

An as-built survey will be required following construction of the Camp Lake Area water management measures. The survey will be sufficiently detailed to properly document the completed construction.

6.4 FOUNDATION PREPARATION

The site investigation results completed to date suggest that a significant portion of the overburden soils located in the Camp Lake area are ice rich, including the presence of massive ice deposits. As such, disturbance to the original ground during the warmer months (excavation, scarifying, etc.) should be minimized so as to not impact current permafrost conditions. The actual foundation preparation requirements will be minimal and, if required, will depend on the conditions encountered at the time of construction.

6.5 CONSTRUCTION MATERIALS

It is understood that materials recently used to construct other structures at site, including the KM105 Pond, will be available for construction of the Camp Lake area water management measures. In general, all fill materials shall meet the following requirements:

- Fill materials used for construction shall not be potentially acid generating (PAG) or metal leaching (ML). Throughout construction, daily inspections should be carried out to verify the suitability of the fill materials.
- All materials shall consist of hard, durable fill material, free of clay, loam, stumps, roots and other deleterious materials or organic matter, and shall contain no ice or snow, and be maintained free of visible ice, snow and other deleterious materials prior to placement.

The materials to be used for the Camp Lake water management measures include; Filter Material, Transition Zone 1, Transition Zone 2, Rockfill, Riprap and Gabion Rockfill. Grain size specifications, and material placement and compaction requirements are provided on Drawing 575.

All materials shall be produced and sourced from an approved construction material source as required under Water License No. 2AM-MRY1325-Amendment No. 1 (NWB, 2015).

Geotextiles must be protected from UV exposure, and stored and handled in accordance with the manufacturer's recommendations.

6.6 MATERIALS AND QUANTITIES

A summary of materials and quantity estimates for construction of the Camp Lake water management measures will be provided separately. The materials and quantities will be based on the Drawings included herein. In general, quantities will be estimated using neat line measurements from the Drawings and based on the typical sections and details provided on the Drawings. No contingencies will be included.

6.7 CONSTRUCTION ITEMS

6.7.1 GABION BERMS

The gabion berms will be constructed using Filter Material, Transition Zone 1 material and a 1 m wide rockfilled gabion basket. The berm will be 1 m tall, and the Filter and Transition Zone 1 material will be placed with a 2H:1V slope. The gabion baskets will be installed by a qualified installer and filled with rock ranging in size from 100 to 200 mm, with a D_{50} of 150 mm. The typical sections and details of the gabion berm are provided on Drawing 570.

6.7.2 ROCK CHECK DAMS

The rock check dams will be constructed using clean Rockfill material placed within a ditch or swale. The Rockfill will be approximately 0.45 m in height with a non-woven geotextile liner placed on top of the Rockfill. Approximately 0.15 m of Rockfill will be placed overtop of the non-woven geotextile which will act as the rock check dam overflow. The upstream slope of the rock check dam, will be sloped at 1.5H:1V and the downstream slope at 4H:1V. The typical sections and details of the rock check dams are provided on Drawing 570.

6.7.3 ROCKFILLED GABIONS

The gabion baskets will be installed by a qualified installer and filled with rock ranging in size from 100 to 200 mm, with a D_{50} of 150 mm. The typical sections and details of the rockfilled gabions are provided on Drawing 570.

6.7.4 DITCHES

The ditches will have a 2H:1V side slope and will be lined with non-woven geotextile overlain by riprap. The typical sections and details of each ditch and associated riprap D_{50} are provided on Drawing 570.

6.7.5 SEDIMENT TRAPS

The sediment traps will be constructed using Transition Zone 1, Transition Zone 2 and riprap material and 1 m wide rockfilled gabion baskets. The Transition Zone 1 and Transition Zone 2 materials will be placed with a 2H:1V slope. The surrounding berm will be approximately 0.8 m height, and non-woven geotextile

will be placed on the upstream slope and crest of the berm. Overlaying the non-woven geotextile on the top of the berm will be a 0.3 m thick layer of riprap (D_{50} of 150 mm). The gabion baskets will be installed by a qualified installer and filled with rock ranging in size from 100 to 200 mm, with a D_{50} of 150 mm. The typical sections and details of the sediment traps are provided on Drawing 570.

7.0 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Construction Quality Assurance/Quality Control (QA/QC) will be completed in general accordance with the specifications for other similar facilities for the Project. Technical specifications specific to the Camp Lake Area water management measures have been provided as notes and details on the attached drawings. The following general comments are provided relative to the QA/QC requirements:

- Qualified personnel under supervision of a qualified Engineer licensed in Nunavut will oversee and document construction of the measures.
- Daily inspections will be carried out during construction to verify the suitability of the fill materials.
- The foundation must be approved and documented by a qualified Engineer that is licensed in Nunavut or qualified personnel under the supervision of a qualified Engineer that is licensed in Nunavut prior to fill placement.
- Non-woven geotextile, and gabion baskets shall be installed as per the manufacturer's specifications and recommendations.
- Qualified personnel under the supervision of a qualified Engineer licensed in Nunavut will be responsible for conducting the QC testing and inspections required on all construction material sources as well as placed and compacted fill materials.
- A qualified Engineer that is licensed in Nunavut will be responsible for preparing and sealing as-built documentation for the completed work.

8.0 INSPECTIONS AND MAINTENANCE

Operation of the Camp Lake area water management measures will need to be closely monitored, especially during freshet and rainfall events. Ongoing inspections and maintenance will be required to ensure the water management measures are performing as designed. The recommended inspections are described below:

- As required, based on Baffinland's standard operating procedures:
  - Inspect the berms, rockfilled gabion baskets, rock check dams, sediment traps and ditches to ensure they are in good condition and maintain their design configuration.
- Prior to freshet, following freshet and after any large storm event:
  - Inspect the berms, rockfilled gabion baskets, rock check dams, sediment traps and ditches to ensure there is no erosion or displacement of the water management structures. Complete any and all repairs as necessary.

Any erosion, areas of settlement, missing material, etc. noted during the aforementioned inspections, or at any other time, must be repaired as soon as it is feasible to do. Periodic maintenance will likely be required to repair any fill materials which may have eroded, sloughed or settled. Maintenance may include placing rockfill or riprap to stabilize those areas.

Sediment which accumulates upstream of the water management measures will need to be removed on a regular basis and must not be allowed to accumulate to any great amount. If excessive sediment accumulates in the gabion baskets such that it impedes flows, then the rockfill may need to be replaced.

9.0 CLOSING

The locations and details of the water management measures proposed for the Camp Lake Area will depend on the actual site conditions at each location. The proposed measures will help to settle out a portion of the TSS in the stormwater runoff prior to the runoff reporting to Camp Lake. The measures will also help to reduce flow velocities in some areas which in turn will reduce the potential for erosion of those areas. However, depending on the effectiveness of the proposed measures, additional measures may be required in the future.

We trust that this letter provides you with the information you require for the Camp Lake Area water management measures at this time. Please feel free to contact us if you require any additional information.

10.0 REFERENCES

Baffinland Iron Mines Corporation (Baffinland), 2021a. *Environmental Protection Plan*. April 30. Ref. No. BAF-PH1-830-P16-0008, Rev 2.

Baffinland Iron Mines Corporation (Baffinland), 2021b. *Surface Water and Aquatic Ecosystems Management Plan*. March 31. Ref. No. BAF-PH1-830-P16-0026, Rev 7.

Canadian Dam Association (CDA), 2013*. 2007 Dam Safety Guidelines*. 2013 Revision.

Fisheries Act, 2016. R.S.C., 2016. c. F-14. Fisheries and Oceans Canada.

Golder Associates Ltd. (Golder), 2017. Technical Memorandum to: Steven Dew, Baffinland Iron Mines Corporation. Re: *Crusher Pad Sedimentation Pond Expansion Detailed Design Brief, Mary River Project, Nunavut*. August 28. Mississauga, Ontario. Project No. 1775699.

Golder Associates Ltd. (Golder), 2018. *WRF Pond Expansion Drainage System*. June 15. Mississauga, Ontario. Ref. No. 1790951 DOC029, Rev 0.

Hatch Ltd. (Hatch), 2013. *Mine Haul Road*. August 25. 17 Drawings. File No. H349000-4221-10-014-0001, Rev 0.

Hatch Ltd. (Hatch), 2018. *Baffinland Iron Mines Corporation - Mary River Expansion Project - Design Criteria: Civil Design Philosophy*. March 12. Ref. No. H353004-00000-200-210-0001, Rev 2.

Knight Piésold Ltd. (KP), 2012. *Baffinland Iron Mines Corporation - Mary River Project - Baseline Hydrology Report*. January 4. North Bay, Ontario. Ref. No. NB102-181/30-7, Rev 1.

Knight Piésold Ltd. (KP), 2021. *Baffinland Iron Mines Corporation - Mary River Project - Mine Site Water Management Plan Report*. June 30. North Bay, Ontario. Ref. No. NB102-181/63-1, Rev 2.

Knight Piésold Ltd. (KP), 2022. Letter to: Connor Devereaux, Baffinland Iron Mines Corporation. Re: *Short-Term Remediation of Erosion of a Previously Undisturbed Bank of Camp Lake.* In Progress. North Bay, Ontario. Ref. No. NB22-00673, Rev A (NB102-181/83).

Metal and Diamond Mining Effluent Regulations (MDMER), 2018. *SOR/2002-22*.

Mine Safety and Health Act (MSHA), 2011. Consolidation of Mine Health and Safety Regulations R-125-95. October 17.

Nunavut Water Board (NWB), 2015. *Type A Water Licence 2AM-MRY1325 - Amendment 1*. July 30.

Nunavut Waters and Nunavut Surface Rights Tribunal Act (NWNSRTA), 2018. S.C. 2002, c.10.

Yours truly,
Knight Piésold Ltd.

Prepared:
Greg Johnstone, EIT
Geological Engineering

Reviewed:
Deena Duff, P.Eng.
Senior Engineer

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

Reviewed and Approved:
Kevin Hawton, P.Eng.
Specialist Engineer | Associate

Approval that this document adheres to the Knight Piésold Quality System:

Attachments:

Table 1 Rev 0	Proposed Design Criteria
Figure 1 Rev 0	Mine Site - Overall Arrangement
Drawing 550 Rev 0	Camp Lake Area - Water Management - Drawing List
Drawing 551 Rev 0	Camp Lake Area - General Arrangement
Drawing 555 Rev 0	Camp Lake Area - Water Management - Area 1: North End of Airstrip - Plan
Drawing 560 Rev 0	Camp Lake Area - Water Management - Area 2: Camp Lake Jetty - Plan
Drawing 565 Rev 0	Camp Lake Area - Water Management - Area 3: Snow Stockpile - Plan
Drawing 566 Rev 0	Camp Lake Area - Water Management - Ditch Profiles
Drawing 570 Rev 0	Camp Lake Area - Water Management - Typical Sections and Details
Drawing 575 Rev 0	Camp Lake Area - Water Management - Fill Material Specifications

Copy To: Baruck Wile, Baffinland Iron Mines Corporation
Emmanuel Ocran, Baffinland Iron Mines Corporation
Connor Devereaux, Baffinland Iron Mines Corporation
Kendra Button, Baffinland Iron Mines Corporation
Steve Borcsok, Baffinland Iron Mines Corporation

/gmj

Knight Piésold CONSULTING

TABLE 1

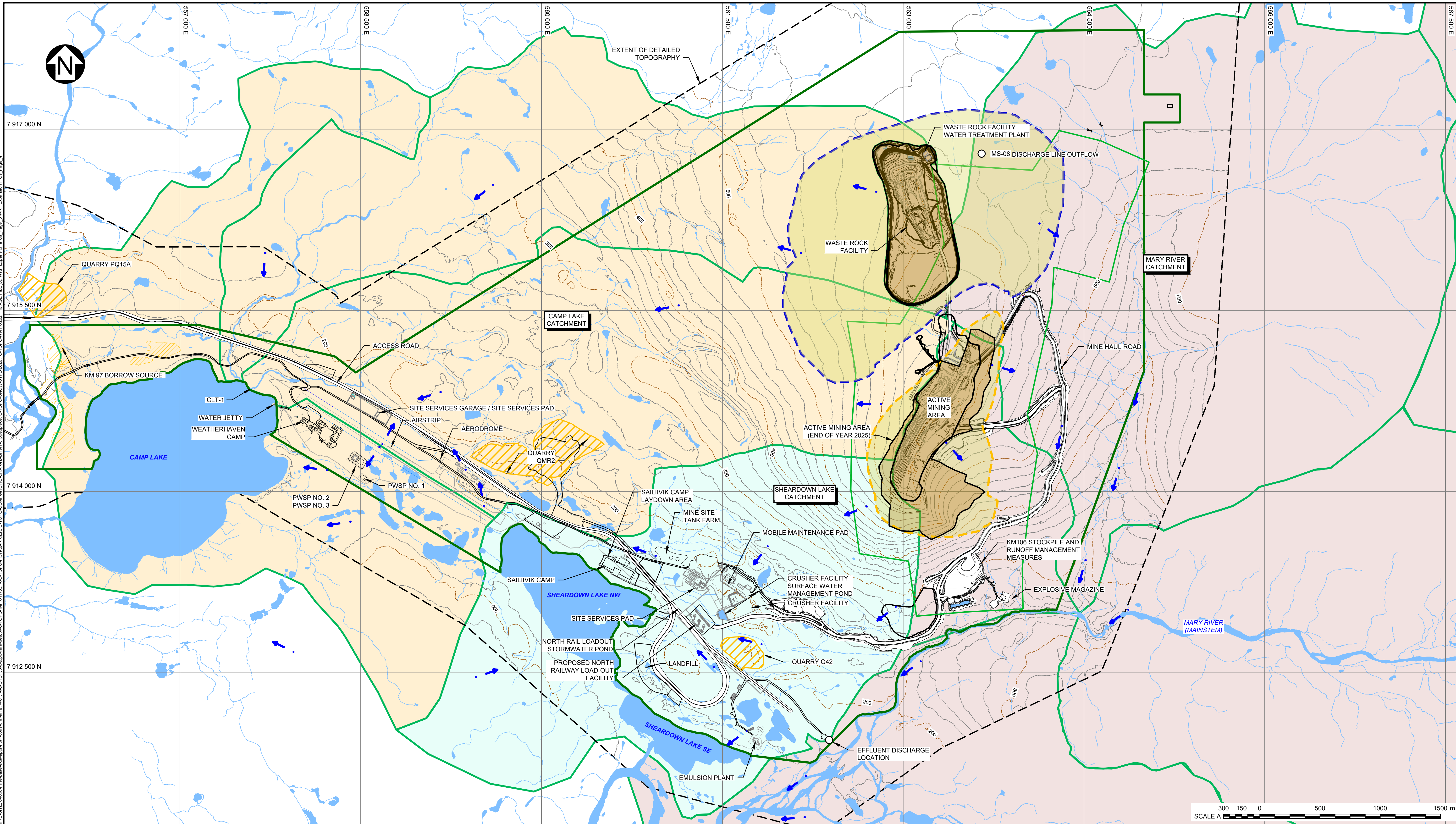
BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

CAMP LAKE AREA WATER MANAGEMENT
PROPOSED DESIGN CRITERIA

Print Jul-05-22 12:03:14

Item No.	Item	Design Criteria	Reference
1.0	**GENERAL**		
1.1	Regulatory	• Water Licence No. 2AM-MRY1325 Amendment No. 1	NWB, 2015
		• *Nunavut Mine Health and Safety Act* and Regulations	MHSA, 2011
		• *Nunavut Waters and Surface Rights Tribunal Act* and Nunavut Waters Regulations	NWNSRTA, 2018
		• Metal and Diamond Mining Effluent Regulations	MDMER, 2018
		• *Fisheries Act*	*Fisheries Act* , 2016
1.2	Guidelines and Reference	• Civil Design Philosophy and Criteria	Hatch, 2013 and 2018
		• Canadian Dam Association's Dam Safety Guidelines	CDA, 2013
2.0	**WATER MANAGEMENT**		
2.1	General	• Stormwater runoff will be directed to Camp Lake using berms/ditches	-
		• Erosion and Sediment Control Measures will manage runoff from disturbed areas	
2.2	Design Storm Events and Discharge Criteria	• Berms and ditches will be sized to convey flows resulting from the 1 in 100-year flood event (64.2 mm for 24-hour duration)	Hatch, 2018; KP, 2012
		• The discharge limit for TSS released is TSS <30 mg/L (single sample) and <15 mg/L (monthly average). Settling aids such as flocculants or geotubes may be required meet discharge limits.	Type A Water Licence (NWB, 2015)
2.3	Hydrological Parameters	• Catchment areas estimated from mapping provided by Baffinland	Baffinland, 2019, 2020 and 2021
		• Runoff Coefficients: 1.0 for frozen, undisturbed and disturbed areas	KP Estimate
		• SCS Curve Number:	
		o Buildings, Prepared Ground Surfaces (including Mine Haul Road): 97	Golder, 2018; KP Estimate
		o Non-Contact/Upstream (Frozen Tundra): 90 (unfrozen = 86)	KP Estimate
		• Time of Concentration Method:	
		o Disturbed Areas: Kirpich (1940)	KP Estimate
		o Upstream Areas: USDA SCS (1972)	KP Estimate
		• Rainfall Distribution: SCS Type I	KP Estimate
3.0	**OTHER WATER MANAGEMENT STRUCTURES**		
3.1	Diversion/Collection Ditches	• Shape: Trapezoidal or Triangular cross section	KP
		• Base Width: 1 m minimum (trapezoidal)	KP
		• Side Slopes: 2H:1V (soil); 1H:4V (rock)	Hatch, 2018
		• Grade: 2% minimum	Baffinland
		• Depth: 0.3 m minimum	Hatch, 2013
		• Freeboard: 0.3 m	Hatch, 2018
		• Minimum set back distance of structures from top of ditch slopes: 3 m	Hatch, 2018
		• Riprap and other energy dissipation measures shall be provided to protect against erosion (as required)	Hatch, 2018
		• Manning's "n" Value: 0.025 (gravel); 0.040 (riprap)	Hatch, 2018
3.2	Diversion/Collection Berms	• Shape: Trapezoidal cross section	Hatch, 2013
		• Side slopes: 2H:1V	Hatch, 2018
		• Freeboard: 0.3 m	Hatch, 2018
		• Height: 0.75 m minimum (including 0.3 m freeboard)	Hatch, 2013
		• Top Width: 0.5 m	Hatch, 2018
		• Riprap and other energy dissipation measures shall be provided to protect against erosion (as required)	Hatch, 2018
3.3	Rock Check Dams	• Shape: Trapezoidal cross section	KP, 2022
		• Side slopes: 2H:1V	KP, 2022
		• Height: 0.3 m minimum	KP, 2022
		• Top Width: 0.3 minimum	KP, 2022
		• Riprap and other energy dissipation measures shall be provided to protect against erosion (as required)	KP, 2022
3.4	Sediment Traps	• Side Slopes: 2H:1V	KP, 2022
		• Depth: 0.8 m	KP, 2022
		• Riprap and other energy dissipation measures shall be provided to protect against erosion (as required)	KP, 2022
4.0	**CONSTRUCTION**		
4.1	General	• During construction, sediment and erosion control measures will be used as outlined in the following:	
		o Environmental Protection Plan	Baffinland, 2021a
		o Surface Water and Aquatic Ecosystems Management Plan	Baffinland, 2021b
4.2	Source of Materials	• Approved sources following Water Licence No. 2AM-MRY1325 Amendment No. 1	NWB, 2015
4.3	Quality of Materials	• Clean, free of debris and organics	KP Estimate
4.4	Description of Materials	• Potential Construction Materials (to be confirmed with Baffinland and design analyses):	
		o 500 mm (20 in.) Minus Rockfill: Well graded; consisting of hard, durable, fresh rockfill	KP Estimate
		o Transition Zone 2: Well graded, 150 mm (6 in.) minus processed rockfill	KP Estimate
		o Transition Zone 1: 32 mm (1 1/4 in.) minus medium sand and gravel, locally borrowed and processed	Baffinland and KP Estimate
		o Filter Material: 19 mm (3/4 in.) minus sand and gravel	Baffinland and KP Estimate
		o Gabion Rockfill: Stone size 100 to 200 mm (4 to 8 in.); D_{50} of 150 mm (6 in.)	KP Estimate
		o Riprap: Maximum particle diameter not exceeding one and a half times the specified D_{50} value, well graded, with a fines content not exceeding 5%	KP Estimate (based on Golder, 2018)
		- Fine Riprap: D_{50} of 150 mm	KP Estimate
		- Coarse Riprap: D_{50} of 300 mm	KP Estimate
5.0	**OPERATING CRITERIA**		
5.1	Inspections and Maintenance	• As required, based on Baffinland's standard operating procedures (in progress):	
		o Inspect the ditches and berms, rock check dams, rockfilled gabion baskets and sediment traps to ensure there is no erosion or displacement of the water management structures.	
		o Inspect the ditches and berms, rock check dams, rockfilled gabion baskets and sediment traps to ensure they are in good condition and maintain their design configuration.	
		• Prior to, during or following freshet, and after any large storm event:	
		o Inspect the ditches and berms, rock check dams, rockfilled gabion baskets and sediment traps to ensure there is no erosion or displacement of the water management structures.	
		o Inspect the ditches and berms, rock check dams, rockfilled gabion baskets and sediment traps to ensure they are in good condition and maintain their design configuration.	
5.2	Operations	• Flocculants, geotubes or other approved methods may be required in order to meet sedimentation requirements	

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	05JUL'22	ISSUED WITH LETTER NB22-00346	GMJ	DMMD



LEGEND:

- EXISTING BORROW AREA
- WATER
- ULTIMATE DEPOSIT NO. 1 PIT LIMITS
- ULTIMATE WASTE ROCK STOCKPILE LIMITS
- CONTOUR
- CAMP LAKE CATCHMENT
- SHEARDOWN LAKE CATCHMENT
- MARY RIVER CATCHMENT
- DRAINAGE DIRECTION
- EFFLUENT DISCHARGE LOCATION

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. DETAILED WATER FROM EAGLE MAPPING (2019).
3. CONTOURS PROVIDED BY BAFFINLAND IRON MINES CORPORATION (2005). CONTOUR INTERVAL IS 20 m.
4. CURRENT MINE AREA FROM THE WASTE DUMP TO THE CRUSHER PAD, AND DITCHES ALONG THE HAUL ROAD PROVIDED BY BAFFINLAND IRON MINES CORPORATION (MARCH 12, 2018).
5. AS-BUILT MINE HAUL ROAD PROVIDED BY BAFFINLAND IRON MINES CORPORATION (MAY 2021).
6. 2021 WASTE ROCK FACILITY AND 2025 ACTIVE MINING AREA PROVIDED BY BAFFINLAND IRON MINES CORPORATION (OCT 9, 2020).
7. ALL OTHER SITE INFRASTRUCTURE PROVIDED BY HATCH (AUGUST 2, 2016). AND SIMPLIFIED BY KP (JAN, 2018).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	05JUL'22	ISSUED WITH LETTER	DMMD	AS	KEH

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MINE SITE
OVERALL ARRANGEMENT

Knight Piésold CONSULTING

P/A NO.	REF NO.	
NB102-181/76	NB22-00346	
FIGURE 1		REV 0

SAVED: I:\102\00181\76\A\Acad\FIGS\B06 R0, 7/4/2022 5:03:19 PM , ASIMPSON PRINTED: 7/4/2022 5:04:46 PM, FIG 1, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)
XREF FILE(S): C-TOPO-CNTR-WATR-MINE-SITE; C-PH02-YR21-MINE-SITE; c-topo-mine-base-exst-appr-not~cons-drai-arrw; W01; X-C-CTCH; x-c-topo-infra-des; X-C-TOPO-INFR-YR05; X-C-TOPO-FISH-BARRIER; C-TOPO-CONF-ARCTIC-CHAR-HABITAT-clippedpiece; C-TOPO-SNOW-STPL-2020; C-TOPO-WATR-2021 IMAGE FILE(S): WRF Expansion IFCs_Page_3 WRF Expansion IFCs_Page_4

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE - WATER MANAGEMENT

DRAWING NO.	REVISION	TITLE
550	0	CAMP LAKE AREA - WATER MANAGEMENT - DRAWING LIST
551	0	CAMP LAKE AREA - GENERAL ARRANGEMENT
555	0	CAMP LAKE AREA - WATER MANAGEMENT - AREA 1: NORTH END OF AIRSTRIP - PLAN
560	0	CAMP LAKE AREA - WATER MANAGEMENT - AREA 2: CAMP LAKE JETTY - PLAN
565	0	CAMP LAKE AREA - WATER MANAGEMENT - AREA 3: SNOW STOCKPILE - PLAN
566	0	CAMP LAKE AREA - WATER MANAGEMENT - DITCH PROFILES
570	0	CAMP LAKE AREA - WATER MANAGEMENT - TYPICAL SECTIONS AND DETAILS
575	0	CAMP LAKE AREA - WATER MANAGEMENT - FILL MATERIAL SPECIFICATIONS

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-05
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

ISSUED FOR CONSTRUCTION

– DISCLAIMER –

THIS DRAWING WAS PREPARED BY KNIGHT PIESOLD LTD. FOR THE ACCOUNT OF THE CLIENT LISTED ON THIS DRAWING. THE MATERIAL ON IT REFLECTS KNIGHT PIESOLD'S BEST JUDGEMENT IN THE LIGHT OF THE INFORMATION AVAILABLE TO IT AT THE TIME OF PREPARATION. ANY USE WHICH A THIRD PARTY MAKES OF THIS DRAWING, OR ANY RELIANCE ON OR DECISIONS TO BE MADE BASED ON IT, ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES. KNIGHT PIESOLD ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY THE THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS BASED ON THIS DRAWING. COPIES RESULTING FROM ELECTRONIC TRANSFER OR REPRODUCTION OF THIS DRAWING ARE UNCONTROLLED AND MAY NOT BE THE MOST RECENT REVISION OF THIS DRAWING.

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

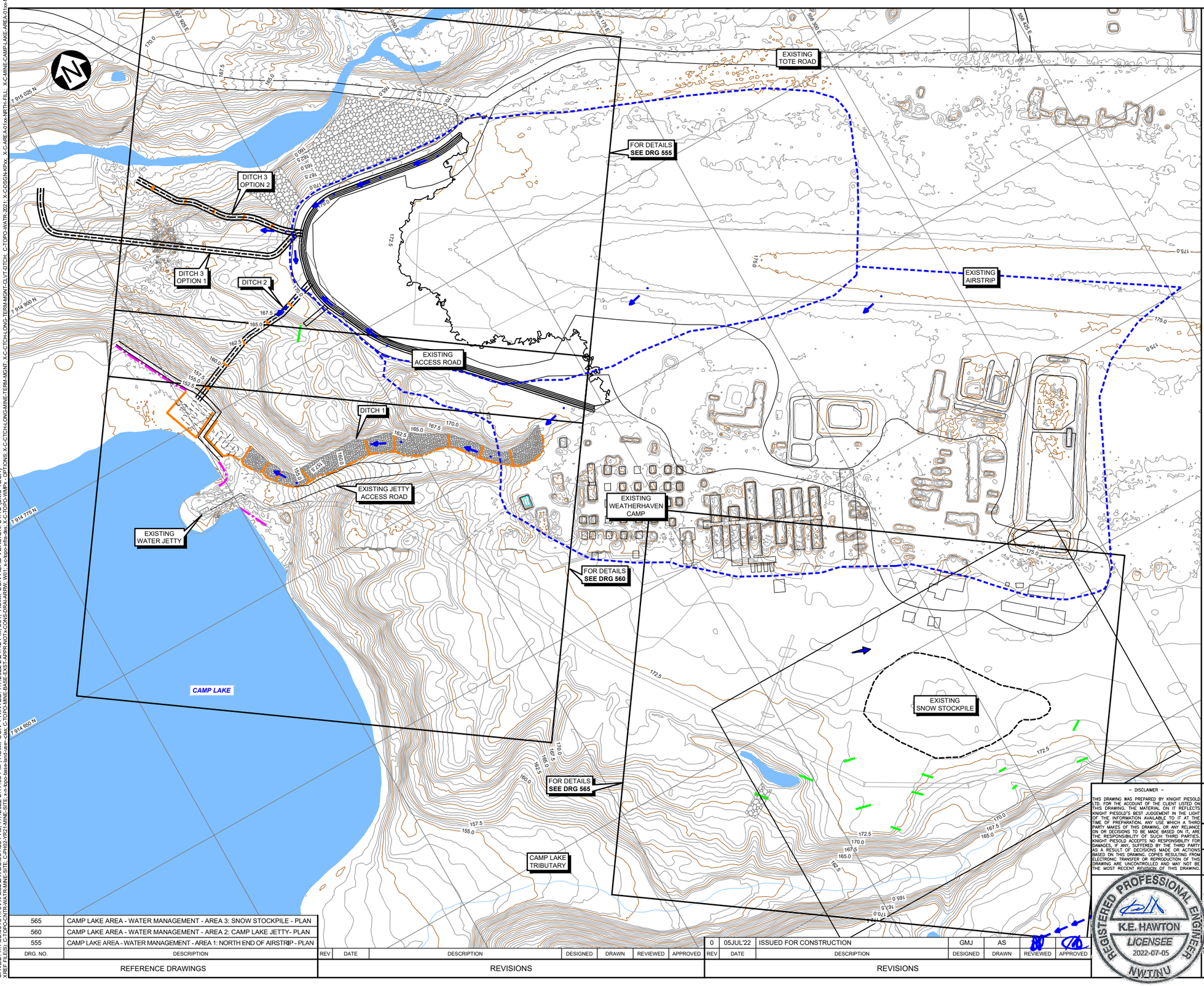
CAMP LAKE AREA
WATER MANAGEMENT
DRAWING LIST

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	550	0

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
REVISIONS						

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS	AW	AW
REVISIONS						



PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature _____
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

LEGEND:

- CATCHMENT AREA BOUNDARY (ESTIMATED)
- SEDIMENT TRAP
- APPROXIMATE LIMIT OF SNOW STOCKPILE
- ROCK CHECK DAM
- GABION BERM
- ROCKFILLED GABION
- DRAINAGE DIRECTION
- DITCH ALIGNMENT (APPROXIMATE)

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. DETAILED WATER FROM EAGLE MAPPING (2005).
3. TOPO FROM JUNE 2022. CONTOUR INTERVAL IS 0.1 m IN REGRADED AREAS AND CONTOUR INTERVAL IS 0.5 m ELSEWHERE.
4. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.

ISSUED FOR CONSTRUCTION

SCALE A: 25 12.5 0 25 50 75 100 125 m

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE AREA
GENERAL ARRANGEMENT

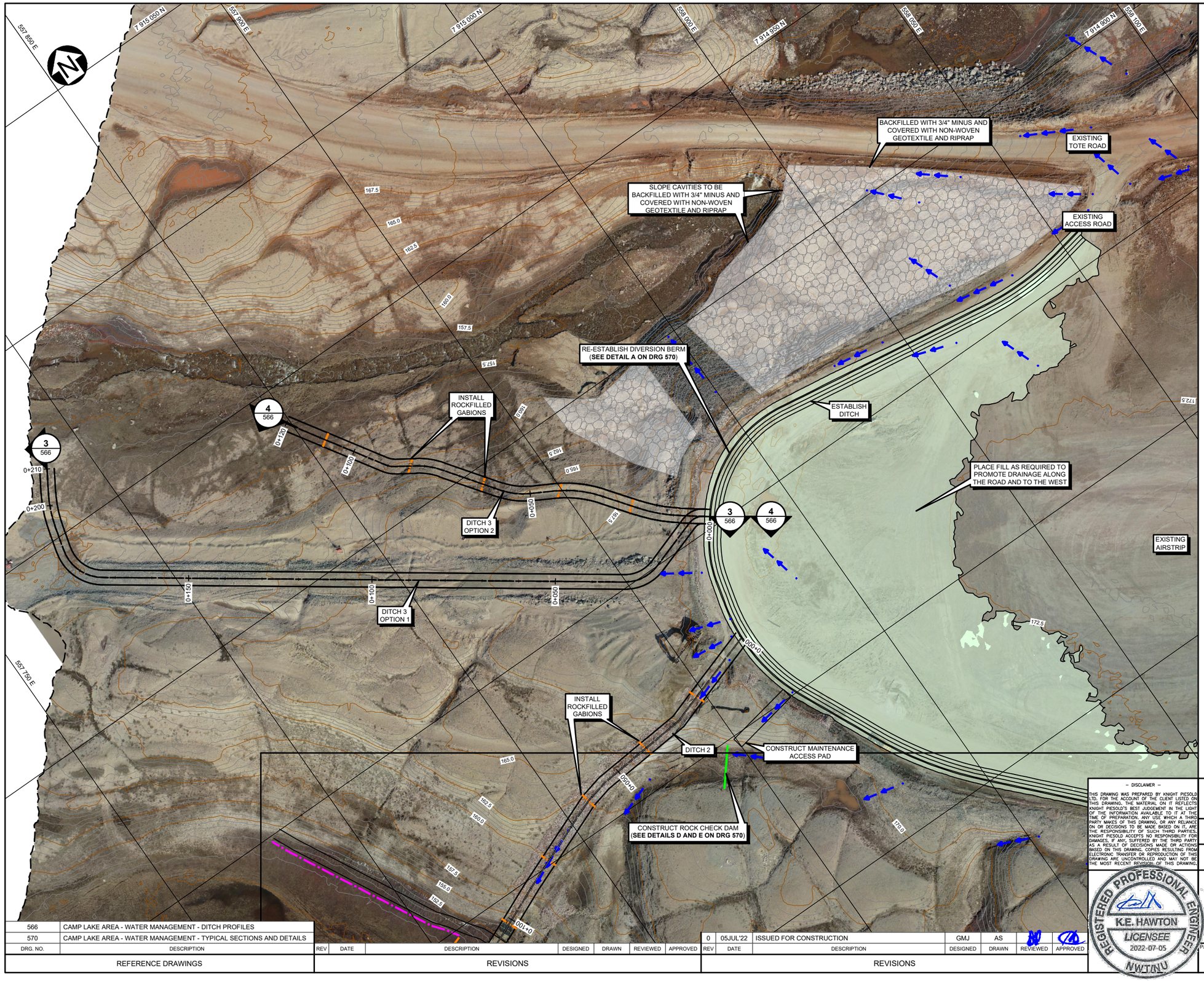
P/A NO.	DRAWING NO.	REVISION
NB102-181/76	551	0

REFERENCE DRAWINGS

DRG. NO.	DESCRIPTION
565	CAMP LAKE AREA - WATER MANAGEMENT - AREA 3: SNOW STOCKPILE - PLAN
560	CAMP LAKE AREA - WATER MANAGEMENT - AREA 2: CAMP LAKE JETTY- PLAN
555	CAMP LAKE AREA - WATER MANAGEMENT - AREA 1: NORTH END OF AIRSTRIP - PLAN

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS		



PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

LEGEND:

- SLOPE CAVITIES BACKFILLED WITH 3/4" MINUS AND COVERED WITH GEOTEXTILE AND RIPRAP
- FILL
- ROCK CHECK DAM
- ROCKFILLED GABION
- GABION BERM
- DRAINAGE DIRECTION

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. IMAGERY PROVIDED BY BAFFINLAND IRON MINES CORPORATION, (DIGITAL GLOBE, INC., JUNE 19, 2022).
3. TOPO FROM JUNE 2022. CONTOUR INTERVAL IS 0.1 m IN REGRADED AREAS AND CONTOUR INTERVAL IS 0.5 m ELSEWHERE.
4. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.

ISSUED FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

DRG. NO.	DESCRIPTION
566	CAMP LAKE AREA - WATER MANAGEMENT - DITCH PROFILES
570	CAMP LAKE AREA - WATER MANAGEMENT - TYPICAL SECTIONS AND DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS		

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

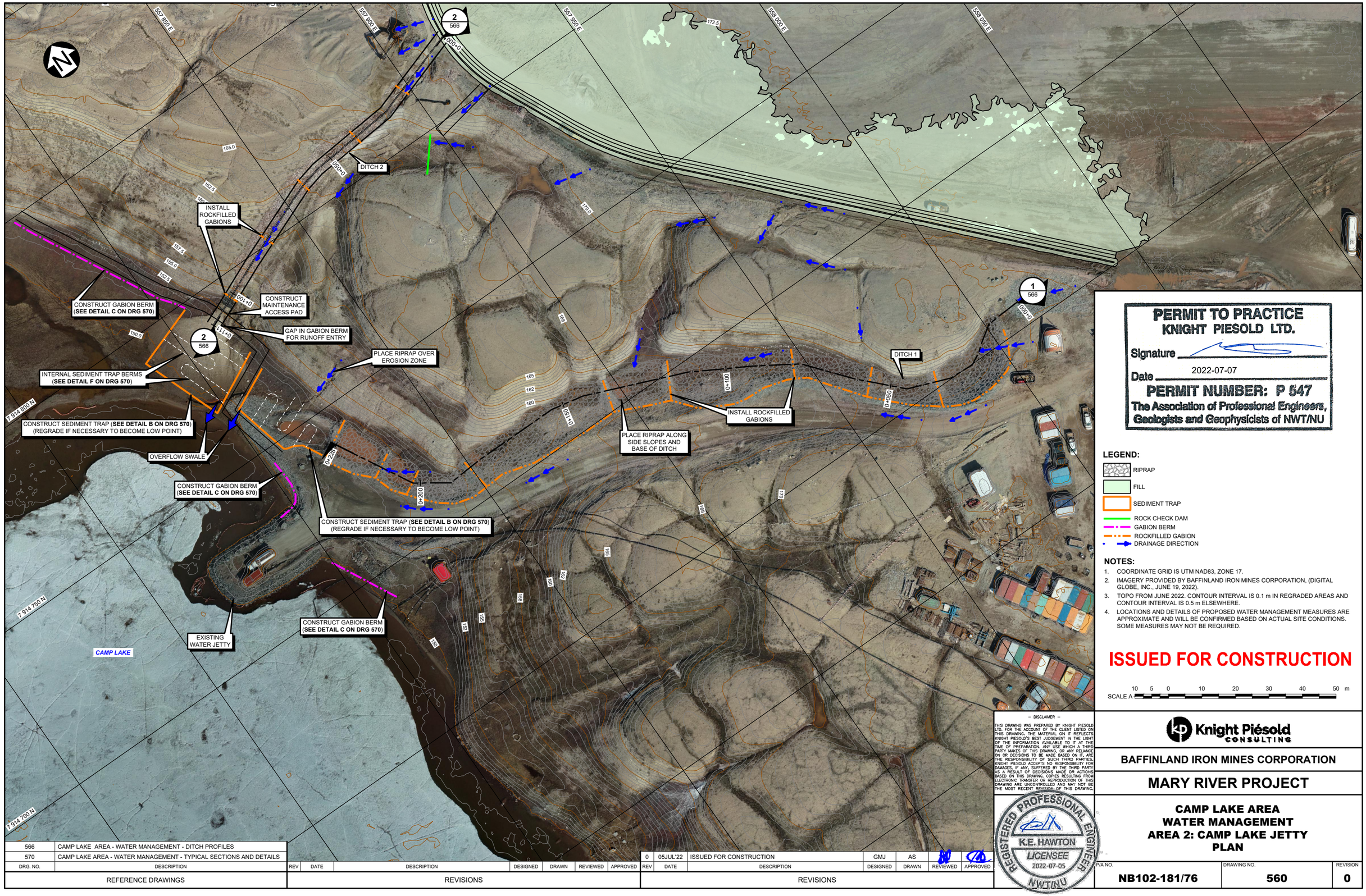
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE AREA
WATER MANAGEMENT
AREA 1: NORTH END OF AIRSTRIP
PLAN

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	555	0

SAVED: I:\1\02\00181\76\A\Acad\DWGS\555 560 565 566\555 560 565 566 R0, 7/7/2022 1:58:02 PM, ASIMPSON PRINTED: 7/7/2022 1:58:35 PM, 555, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)



DRG. NO.	DESCRIPTION
566	CAMP LAKE AREA - WATER MANAGEMENT - DITCH PROFILES
570	CAMP LAKE AREA - WATER MANAGEMENT - TYPICAL SECTIONS AND DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS		

REVISIONS

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

LEGEND:

- RIPRAP
- FILL
- SEDIMENT TRAP
- ROCK CHECK DAM
- GABION BERM
- ROCKFILLED GABION
- DRAINAGE DIRECTION

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. IMAGERY PROVIDED BY BAFFINLAND IRON MINES CORPORATION, (DIGITAL GLOBE, INC., JUNE 19, 2022).
3. TOPO FROM JUNE 2022. CONTOUR INTERVAL IS 0.1 m IN REGRADED AREAS AND CONTOUR INTERVAL IS 0.5 m ELSEWHERE.
4. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.

ISSUED FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE AREA WATER MANAGEMENT AREA 2: CAMP LAKE JETTY PLAN

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	560	0

SAVED: I:\1\02\00181\76\A\Acad\DWGS\555 560 565 566\555 560 565 566 R0, 7/7/2022 2:00:32 PM, ASIMPSON PRINTED: 7/7/2022 2:39:47 PM, 560, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-05
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

LEGEND:

- GEOTEXTILE AND RIPRAP LINED DITCH
- ROCK CHECK DAM
- DRAINAGE DIRECTION
- SWALE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. IMAGERY PROVIDED BY BAFFINLAND IRON MINES CORPORATION, (DIGITAL GLOBE, INC., JUNE 19, 2022).
3. TOPO FROM JUNE 2022. CONTOUR INTERVAL IS 0.1 m IN REGRADED AREAS AND CONTOUR INTERVAL IS 0.5 m ELSEWHERE.
4. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.

ISSUED FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

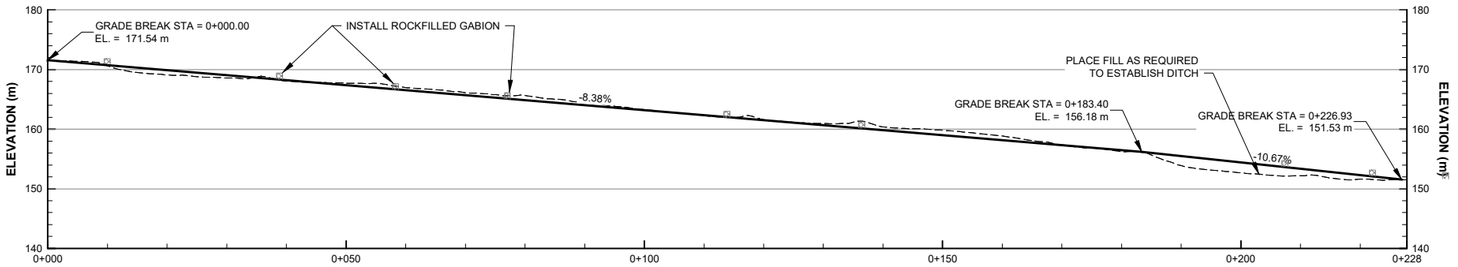
CAMP LAKE AREA WATER MANAGEMENT AREA 3: SNOW STOCKPILE PLAN

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	565	0

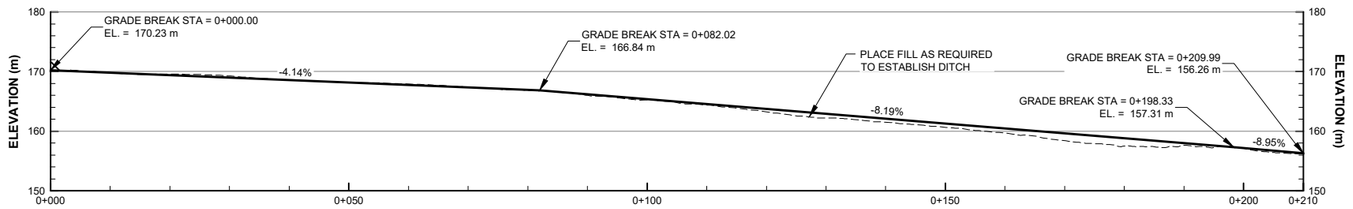
REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
570	CAMP LAKE AREA - WATER MANAGEMENT - TYPICAL SECTIONS AND DETAILS

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

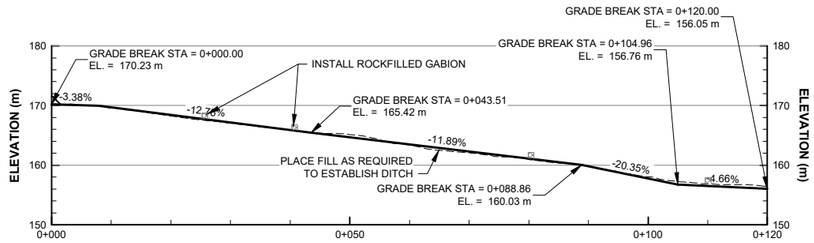
REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS		



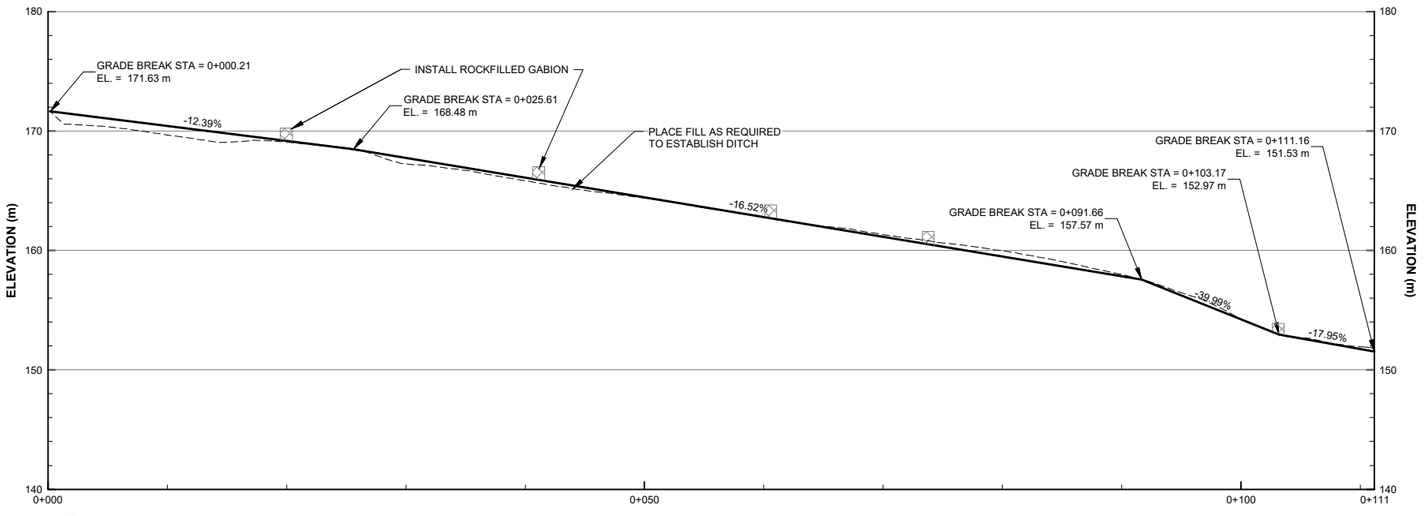
1 / 560 **SECTION**
DITCH 1 PROFILE
SCALE A



3 / 555 **SECTION**
DITCH 3 - OPTION 1 PROFILE
SCALE A



4 / 555 **SECTION**
DITCH 3 - OPTION 2 PROFILE
SCALE A



2 / 555/560 **SECTION**
DITCH 2 PROFILE
SCALE B

LEGEND:

ROCKFILLED GABION BASKET

EXISTING GROUND

NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. FOUNDATION PREPARATION: PROVIDED THE AMOUNT OF ORGANICS AND UNSUITABLE MATERIAL ON THE GROUND IS NEGLIGIBLE, DISTURBANCE TO THE ORIGINAL GROUND (EXCAVATION, SCARIFYING, ETC.) SHOULD BE MINIMIZED SO AS NOT TO IMPACT CURRENT PERMAFROST CONDITIONS. ALTERNATIVE METHODS OF FOUNDATION PREPARATION MAY BE NECESSARY FOR SOME AREAS, AT THE DISCRETION OF THE OWNER'S REPRESENTATIVE. ALL FOUNDATIONS MUST BE MAINTAINED CLEAR OF SNOW, PONDED WATER AND ICE.
3. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

ISSUED FOR CONSTRUCTION

SCALE A: 10 5 0 10 20 30 40 50 m
SCALE B: 5 2.5 0 5 10 15 20 25 m

DRG. NO.	DESCRIPTION
555	CAMP LAKE AREA - WATER MANAGEMENT - AREA 1: NORTH END OF AIRSTRIP - PLAN
560	CAMP LAKE AREA - WATER MANAGEMENT - AREA 2: CAMP LAKE JETTY - PLAN

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS	MH	CA

REVISIONS

– DISCLAIMER –
THIS DRAWING WAS PREPARED BY KNIGHT PIESOLD LTD. FOR THE ACCOUNT OF THE CLIENT LISTED ON THIS DRAWING. THE MATERIAL ON IT REFLECTS KNIGHT PIESOLD'S BEST JUDGEMENT IN THE LIGHT OF THE INFORMATION AVAILABLE TO IT AT THE TIME OF PREPARATION. ANY USE WHICH A THIRD PARTY MAKES OF THIS DRAWING, OR ANY RELIANCE ON OR DECISIONS TO BE MADE BASED ON IT, ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES. KNIGHT PIESOLD ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY THE THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS BASED ON THIS DRAWING. COPIES RESULTING FROM ELECTRONIC TRANSFER OR REPRODUCTION OF THIS DRAWING ARE UNCONTROLLED AND MAY NOT BE THE MOST RECENT REVISION OF THIS DRAWING.

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

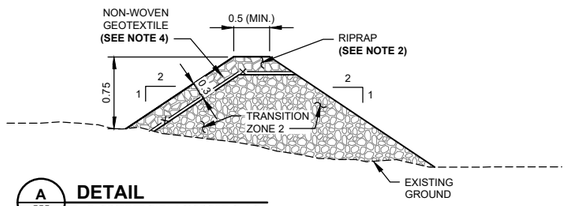
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

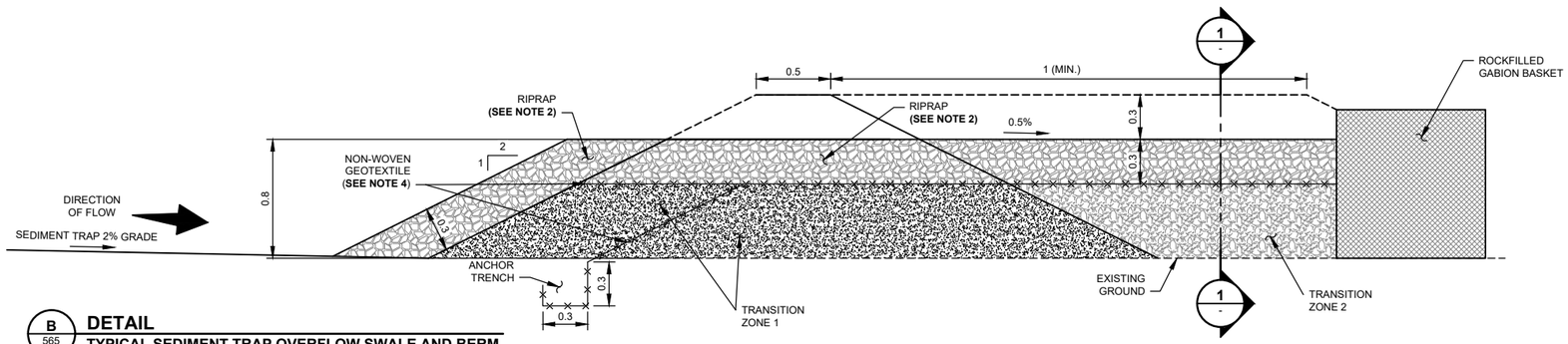
CAMP LAKE AREA
WATER MANAGEMENT
DITCH PROFILES

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	566	0

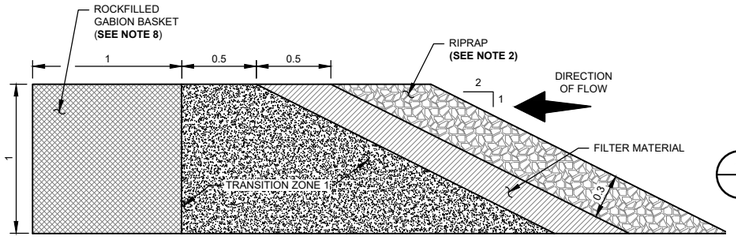
SAVED: I:\1102\00181\76\A\Acad\DWGS\555 560 565 566\555 560 565 566 R0, 7/7/2022 1:58:02 PM , ASIMPSON PRINTED: 7/7/2022 2:00:20 PM, 566, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)



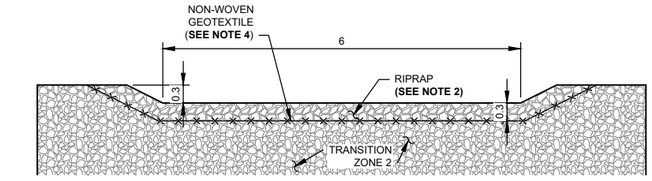
A 555 DETAIL
TYPICAL DIVERSION BERM
NTS



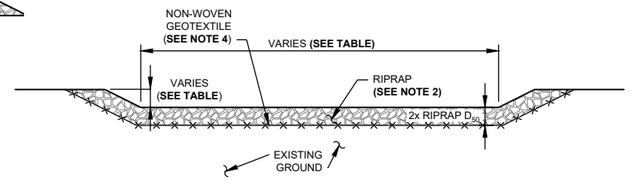
B 565 DETAIL
TYPICAL SEDIMENT TRAP OVERFLOW SWALE AND BERM
SCALE A



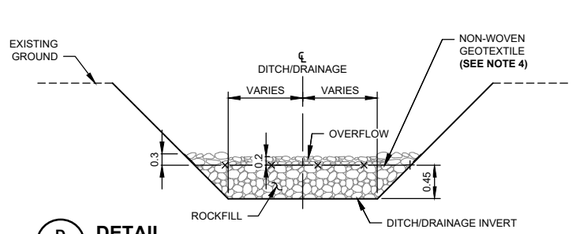
C 560 DETAIL
TYPICAL GABION BERM
SCALE A



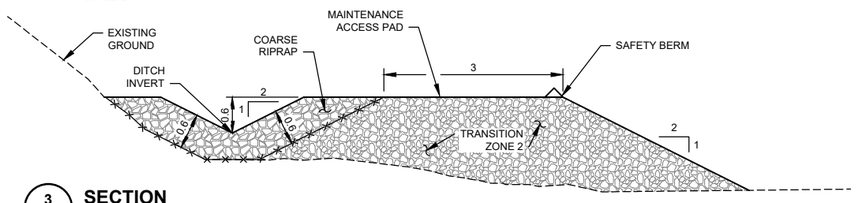
1 - SECTION
SEDIMENT TRAP OVERFLOW SWALE
SCALE B



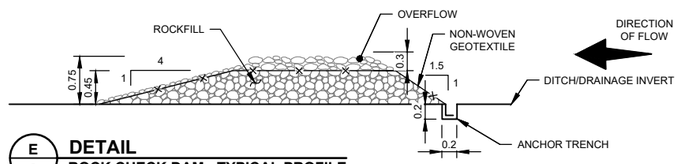
2 - SECTION
TYPICAL TRAPEZOIDAL DITCH
SCALE B



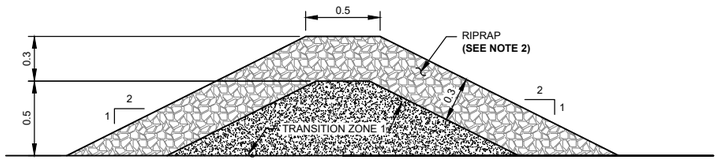
D - DETAIL
ROCK CHECK DAM - TYPICAL SECTION
SCALE A



3 - SECTION
DITCH 3 OPTION 2
SCALE B



E - DETAIL
ROCK CHECK DAM - TYPICAL PROFILE
SCALE A



F - DETAIL
TYPICAL INTERNAL SEDIMENT TRAP BERM
SCALE C

TABLE			
DITCH	BASE WIDTH (m)	RIPRAP D_{50} (mm)	MINIMUM DEPTH (m)
1	6	150	0.5
2	2	300	0.5
3 - OPTION 1	1	150	0.5
3 - OPTION 2	N/A (TRIANGULAR)	300	0.6

LEGEND:

- RIPRAP/COARSE RIPRAP
- **TRANSITION ZONE 1**
- TRANSITION ZONE 2
- FILTER MATERIAL
- ROCKFILLED GABION BASKET
- ROCKFILL
- NON-WOVEN GEOTEXTILE
- EXISTING GROUND

NOTES:

1. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. RIPRAP TO BE CLEAN, DURABLE AND ANGULAR. RIPRAP TO BE TIGHTLY PLACED **SEE DRG 575**.
3. DIVERSION BERMS TO BE GRADED AT 1% (MINIMUM) IN DIRECTION OF FLOW.
4. NON-WOVEN GEOTEXTILE TO BE 12 oz/yd^2. NON-WOVEN GEOTEXTILE TO BE INSTALLED AS PER MANUFACTURER'S SPECIFICATIONS.
5. FOUNDATION PREPARATION: PROVIDED THE AMOUNT OF ORGANICS AND UNSUITABLE MATERIAL ON THE GROUND IS NEGLIGIBLE, DISTURBANCE TO THE ORIGINAL GROUND (EXCAVATION, SCARIFYING, ETC.) SHOULD BE MINIMIZED SO AS NOT TO IMPACT CURRENT PERMAFROST CONDITIONS. ALTERNATIVE METHODS OF FOUNDATION PREPARATION MAY BE NECESSARY FOR SOME AREAS, AT THE DISCRETION OF THE OWNER'S REPRESENTATIVE. ALL FOUNDATIONS MUST BE MAINTAINED CLEAR OF SNOW, PONDED WATER AND ICE.
6. SLOPES OF BERMS TO BE TRIMMED AND NOMINALLY COMPACTED.
7. LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES ARE APPROXIMATE AND WILL BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS. SOME MEASURES MAY NOT BE REQUIRED.
8. THE NEED TO PARTIALLY BURY GABION BASKETS WILL DEPEND ON ACTUAL SITE CONDITIONS.

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-07
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

ISSUED FOR CONSTRUCTION

SCALE A 0.8 0.4 0 1 2 3 4 m
SCALE B 1 0.5 0 1 2 3 4 5 m
SCALE C 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 m

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE AREA
WATER MANAGEMENT
TYPICAL SECTIONS AND DETAILS

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	570	0

DRG. NO.	DESCRIPTION
555	CAMP LAKE AREA - WATER MANAGEMENT - AREA 1: NORTH END OF AIRSTRIP - PLAN
560	CAMP LAKE AREA - WATER MANAGEMENT - AREA 2: CAMP LAKE JETTY - PLAN
565	CAMP LAKE AREA - WATER MANAGEMENT - AREA 3: SNOW STOCKPILE - PLAN
575	CAMP LAKE AREA - WATER MANAGEMENT - FILL MATERIAL SPECIFICATIONS

REFERENCE DRAWINGS

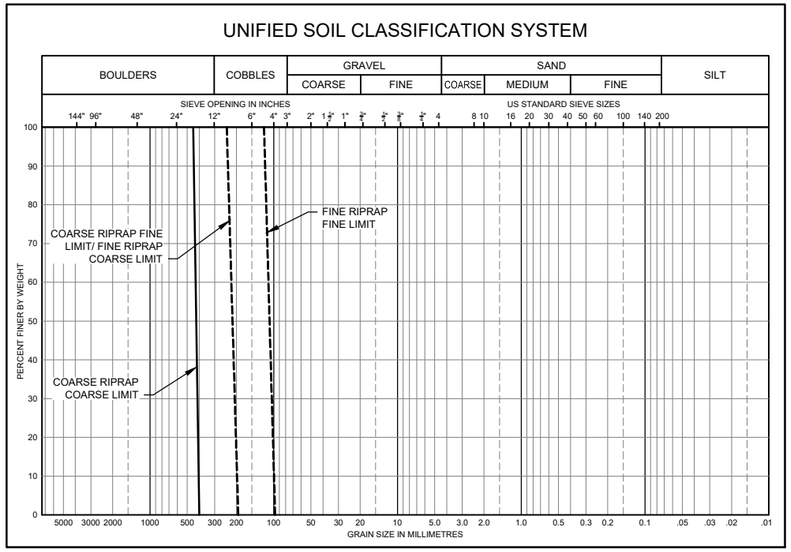
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

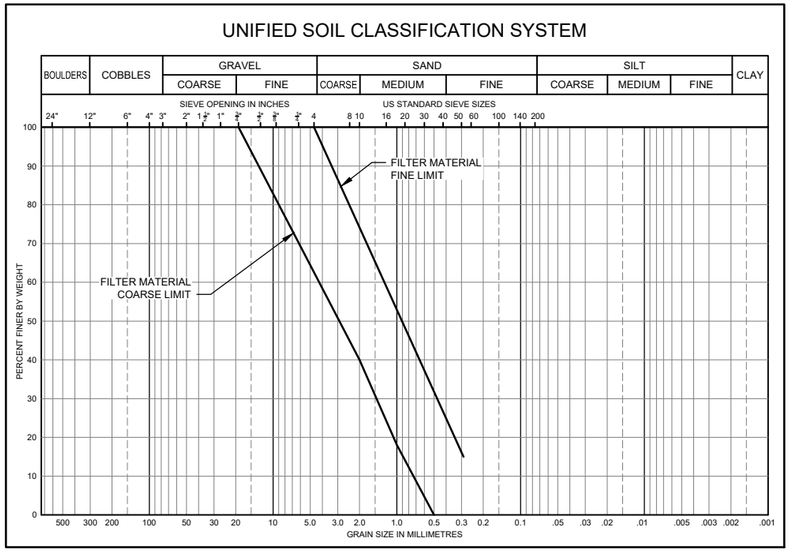
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	GMJ	AS		

REVISIONS

SAVED: \\1102001811760A\Acad\DWGS\570\570 R0_7/7/2022 2:37:37 PM, ASIMPSON PRINTED: 7/7/2022 2:38:09 PM, 570, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)
XREF FILE(S): X-C-TOPO-MINE SITE.X-C-TOPO-INFRA-DES; X-C-TOPO-INFRA-OTHRS; X-G-INT-DMND; X-G-INT-KEH IMAGE FILE(S): K Hawton_NT Seal-07-05



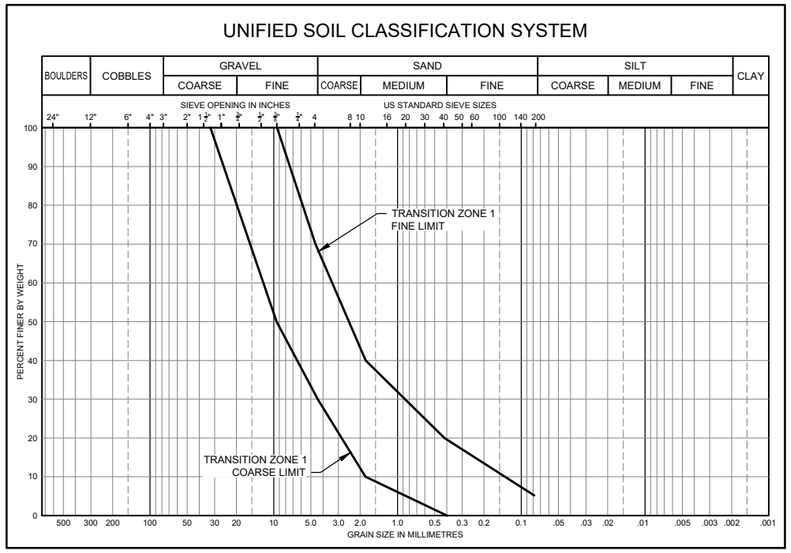
RIPRAP



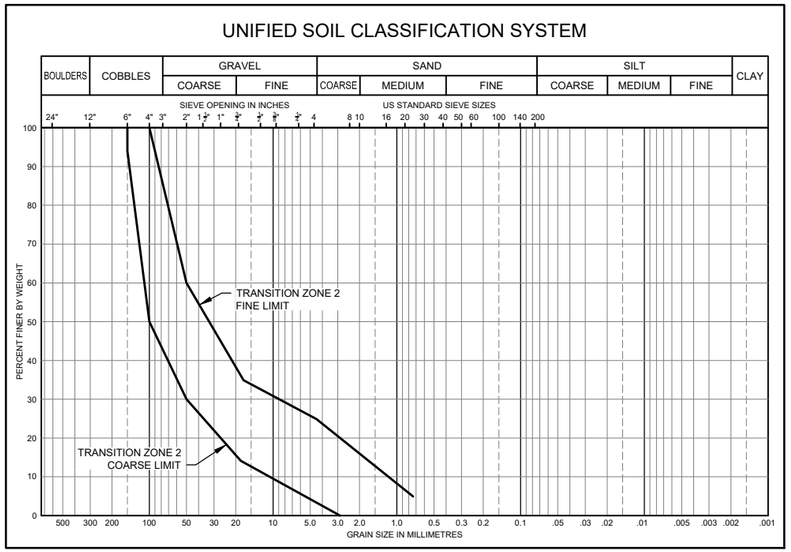
FILTER MATERIAL

MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

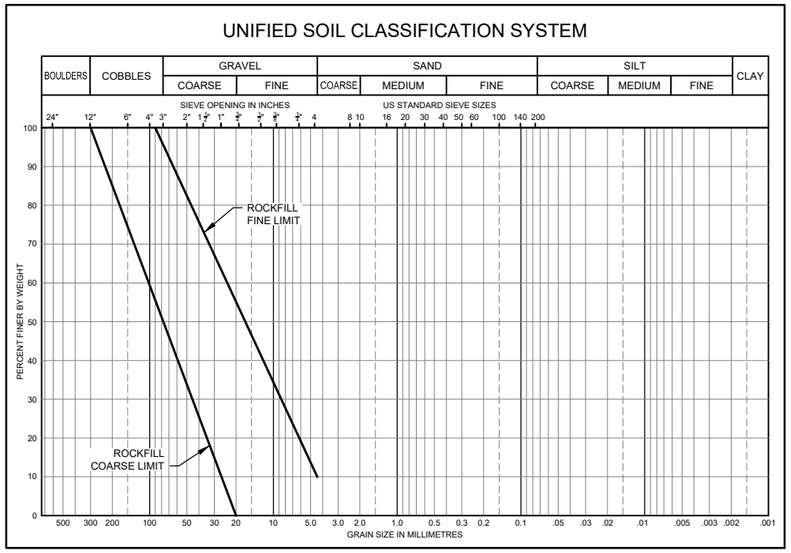
ZONE AND MATERIAL TYPE	PLACING AND COMPACTION REQUIREMENTS
RIPRAP	RIPRAP SHALL CONSIST OF CLEAN, DURABLE AND ANGULAR NON-WEATHERED ROCKFILL, FREE OF CLAY, LOAM, ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER. PLACED AND SPREAD IN MAXIMUM 2 x D_{50} LAYER. PLACED SELECTIVELY TO FORM A TIGHT INTERLOCKING LAYER. FINE RIPRAP D_{50} - 150 mm COARSE RIPRAP D_{50} = 300 mm
FILTER MATERIAL	MATERIAL SHALL BE WELL GRADED, CLEAN, DURABLE AND ANGULAR SAND AND GRAVEL. MATERIAL TO BE PLACED, SPREAD AND MOISTURE CONDITIONED IN MAXIMUM 100 mm LAYER AFTER COMPACTION, WITH A VIBRATORY ROLLER OR PLATE PACKER.
TRANSITION ZONE 1	MATERIAL SHALL CONSIST OF 32 mm MINUS, WELL GRADED, CLEAN, DURABLE AND ANGULAR, SAND AND GRAVEL FREE OF CLAY, LOAM, ORGANICS, AND OTHER DELETERIOUS MATERIAL. MATERIAL SHALL BE PLACED, SPREAD AND MOISTURE CONDITIONED IN MAXIMUM 200 mm LAYER AFTER COMPACTION FROM A VIBRATORY ROLLER OR PLATE COMPACTOR TO MINIMUM 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (ASTM D698).
TRANSITION ZONE 2	MATERIAL SHALL CONSIST OF CLEAN, WELL GRADED, DURABLE AND ANGULAR,150 mm MINUS PROCESSED ROCKFILL AND SHALL BE FREE OF CLAY, LOAM, ORGANICS, AND OTHER DELETERIOUS MATERIALS. MATERIAL TO BE PLACED AND SPREAD IN MAXIMUM 300 mm LAYERS AFTER COMPACTION. COMPACTION TO CONSIST OF MINIMUM 6 PASSES BY A 10 TONNE SMOOTH DRUM VIBRATORY ROLLER.
ROCKFILL	MATERIAL SHALL BE WELL GRADED AND CONSIST OF HARD, CLEAN, DURABLE, FRESH, AND ANGULAR ROCKFILL FREE OF DELETERIOUS MATERIALS. MATERIAL TO BE PLACED AND SPREAD IN MAXIMUM 600 mm LAYERS AFTER COMPACTION. COMPACTION TO CONSIST OF MINIMUM 6 PASSES BY A D9 DOZER.



TRANSITION ZONE 1



TRANSITION ZONE 2



ROCKFILL

ISSUED FOR CONSTRUCTION

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2022-07-06
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

NOTES:

1. THE DRAWING SHALL BE READ IN CONJUNCTION WITH THE ACCOMPANYING CONTRACT DOCUMENTS AND APPLICABLE TECHNICAL SPECIFICATIONS.
2. FILL MATERIALS USED FOR CONSTRUCTION SHALL NOT BE POTENTIALLY ACID GENERATING (PAG) OR METAL LEACHING (ML). THROUGHOUT CONSTRUCTION, ADEQUATE INSPECTION AND PERIODIC TESTING SHOULD BE CARRIED OUT TO DEMONSTRATE THE SUITABILITY OF THE FILL MATERIALS.
3. UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONSIST OF HARD, DURABLE FILL MATERIAL, FREE OF CLAY, LOAM, TREE STUMPS, ROOTS AND OTHER DELETERIOUS MATERIALS OR ORGANIC MATTER, AND CONTAIN NO MASSIVE ICE.

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
REVISIONS						

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	05JUL'22	ISSUED FOR CONSTRUCTION	DMMD	AS		
REVISIONS						

REGISTERED PROFESSIONAL ENGINEER
K.E. HAWTON
LICENSEE
2022-07-05
NWT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CAMP LAKE AREA
WATER MANAGEMENT
FILL MATERIAL SPECIFICATIONS

P/A NO.	DRAWING NO.	REVISION
NB102-181/76	575	0

SAVED: I:\1\02\00181176\A\cad\DWGS\575\575 RO_7.6\2022 1:13:48 PM , ASIMPSON PRINTED: 7/6/2022 1:14:10 PM, 575, ASIMPSON ACAD VERSION: 24.1S (LMS TECH)
XREF FILE(S): X-G-INIT-DMMD, X-G-INIT-KEH IMAGE FILE(S): Khawton_NT Seal-07-05