

MEMORANDUM

Date:	June 24, 2021	File No.:	NB102-00181/71-A.01
		Cont. No.:	NB21-00559
To:	Mr. Christopher Murray		
Copy To:	Mr. Connor Devereaux, Mr. Allan Knowlton		
From:	Toby Perkins		
Re:	Hydrology Assessment - Effects of Proposed Mine Site Water Management Measures on Flows in Sheardown Lake Tributary 1 - Mary River Project		

1.0 INTRODUCTION

Baffinland Iron Mines Corporation (Baffinland) recently commissioned the development of an Interim Water Management Plan (WMP) for the Mine Site (KP, 2021). The Interim WMP proposed various measures to manage erosion and sedimentation as well as mine effluents within the mine site.

Several proposed water management features are located within the Sheardown Lake Tributary 1 (SDLT-1) catchment, including ponds that may discharge to SDLT-1 and diversions that will redirect flows either into or out of the catchment. The pre-development SDLT-1 catchment is shown on Figure 1.

Knight Piésold Ltd. (KP) was requested by Baffinland to assess the effects of proposed mine site water management measures on the flows in SDLT-1 relative to the effects predicted in the Final Environmental Impact Statement (FEIS) for the Project (Baffinland, 2012).

2.0 BACKGROUND

The Approved Project involves the development of an open pit at Deposit No. 1. Water reporting to the pit will be pumped to an East Pond located on the eastern side of the waste rock facility (WRF). Effluent in the East Pond will be discharged to the fishless tributary of the Mary River (tributary F). Runoff from ore stockpiles is discharged to the mainstem of the Mary River. The development of both facilities will direct flow out of the SDLT-1 catchment. The FEIS predicted that 0.95 km² (26%) of catchment area will be diverted out of the SDLT-1 catchment once the pit has been fully developed. The assessment determined that flows would be reduced 27% on an annual basis relative to baseline as shown on Table 1. The flow reduction is larger than the area reduction due to the predicted higher unit runoff from the pit area.

3.0 PROPOSED WATER MANAGEMENT MEASURES

The measures currently proposed in the Interim Water Management Plan (KP, 2021) are expected to impact the magnitude and timing of flow at the outlet of SDLT-1 catchment differently than those predicted in the FEIS (Baffinland, 2012). Key water management features that will affect streamflow in SDLT-1 are summarized in Table 2.

Table 1 FEIS Predictions of Flow Reduction in SDLT-1 (Baffinland, 2012)

Baseline Upstream Catchment Area (km ²)	SDLT-1 Catchment Area MAUR (l/s/km ²)	Activity	Diverted Upstream Catchment Area (km ²)	Diverted Sub-catchment Area MAUR (l/s/km ²)	Change in Mean Annual Discharge (%)
3.7	7.0 ¹	Open Pit	-0.31	10	-12%
		Mine infrastructure area	-0.64	6	-15%
		Total Diversion	-0.95	-	-27%

Note(s):

- The mean annual unit runoff was estimated from measured data collected at various locations within the freshwater regional study area, as presented in the Volume 7, Section 1 of the FEIS (Baffinland, 2012).

Table 2 Proposed Water Management Features

Infrastructure /Measure	Description	Change to SDLT-1
Open Pit	A portion of the open pit is within the SDLT-1 catchment.	Water collected within the open pit is diverted to Tributary F of the Mary River via the East Pond and will reduce flows in SDLT-1.
Mine Haul Road (MHR) Ditch	A ditch on the inside of the MHR will convey runoff to KM105 Pond. The ditch will be lined with non-woven geotextile and riprap to avoid erosion. Existing culverts under the MHR will be removed or plugged.	The catchment of non-contact water upgradient the MHR that currently reports to the Mary River will be diverted to KM105 Pond and will be discharged to SDLT-1. This will result in an increase in flows to SDLT-1.
KM105 Pond	Sedimentation ponds will be constructed downstream MHR ditch and collect upstream runoff. Each pond will be sized to retain the design flood and equipped with a pump and pipeline system to drain the pond and release the water to the environment once settling has been achieved.	The pond is not expected to substantially affect the magnitude of runoff to SDLT-1 but will attenuate the water diverted from the MHR and reduce peak flows. The pumped release is expected to increase flows during the period following high flows, when the ponds are dewatered.
Mine Infrastructure Area	Runoff from this area will report to the proposed SDLT-1 Sedimentation Pond. The SDLT-1 Sedimentation Pond will discharge to the Mary River.	Water collected in the SDLT-1 Sedimentation Pond will be diverted to Mary River and will reduce flows in SDLT-1.

The pre-project (baseline) SDLT-1 catchment area is shown on Figure 1 and the areas affected by the water management plan are shown on Figure 2. The proposed water management plan would result in 1.27 km² of catchment being diverted out and 1.15 km² added into the SDLT-1 catchment for a net reduction in contributing area of 0.12 km² (3%). Based on the diversion areas and the unit runoff estimates for

sub-catchments of SDLT-1 presented in Table 3, flows in SDLT-1 are expected to be reduced by approximately 5% on an annual basis relative to baseline conditions.

Table 3 Flow Reduction Predictions in SDLT-1 for the Proposed Water Management Plan

Baseline Upstream Catchment Area (km ²)	SDLT-1 Catchment Area MAUR (l/s/ km ²)	Activity	Diverted Upstream Catchment (km ²)	Diverted Sub-catchment Area MAUR (l/s/ km ²)	Change in Mean Annual Discharge (%)
3.7	7.9	Open Pit	-0.3	10	-10%
		MHR Ditch	1.15	7.9	+31%
		Mine infrastructure area	-0.97	7.9	-26%
		Total Diversion	-0.12	-	-5%

Note(s):

1. The mean annual unit runoff (MAUR) at all areas except the Active Mining Area of 7.9 was estimated from updated hydrology estimates for station H05 (KP, 2017). This is an update from the MAUR value used in the FEIS and presented in Table 1.
2. The MAUR for the Active Mining Area is expected to be higher than other sub-catchments of SDLT-1 due to orographic precipitation increase and was based on values presented in the FEIS (Baffinland, 2012).

4.0 CONCLUSION

The mining and water management plans presented in the FEIS was predicted to divert 27% of the annual flows in SDLT-1 once the open pit reached its ultimate extent. The measures currently proposed in the Interim Water Management Plan (KP, 2021) are predicted to reduce flows in SDLT-1 by 5% relative to baseline. Thus, the proposed water management measures will result in an improvement relative to that of the Approved Project.

5.0 REFERENCES

- Baffinland Iron Mines Corporation (Baffinland), 2012. *Mary River Project - Final Environmental Impact Statement*. February.
- Knight Piésold Ltd. (KP), 2017. *Hydrologic Assessment for Water Crossings - Proposed North Railway - Phase 2 Proposal - Mary River Project*. September 1. Ref. No. VA17-01009 (NB102-181/39).
- Knight Piésold Ltd. (KP), 2021. *Mary River Project - Mine Site Interim Water Management Plan*. June 4. Ref. No. NB102-181/63-1, Rev 1.

6.0 CLOSING

We trust this meets with your present requirements. Please do not hesitate to contact the undersigned with questions.

Yours truly,
Knight Piésold Ltd.

Prepared:	Reviewed:
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Toby Perkins, M.A.Sc., P.Eng. Senior Engineer	Richard Cook, P.Geo. (Ltd.) Specialist Environmental Scientist Associate

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

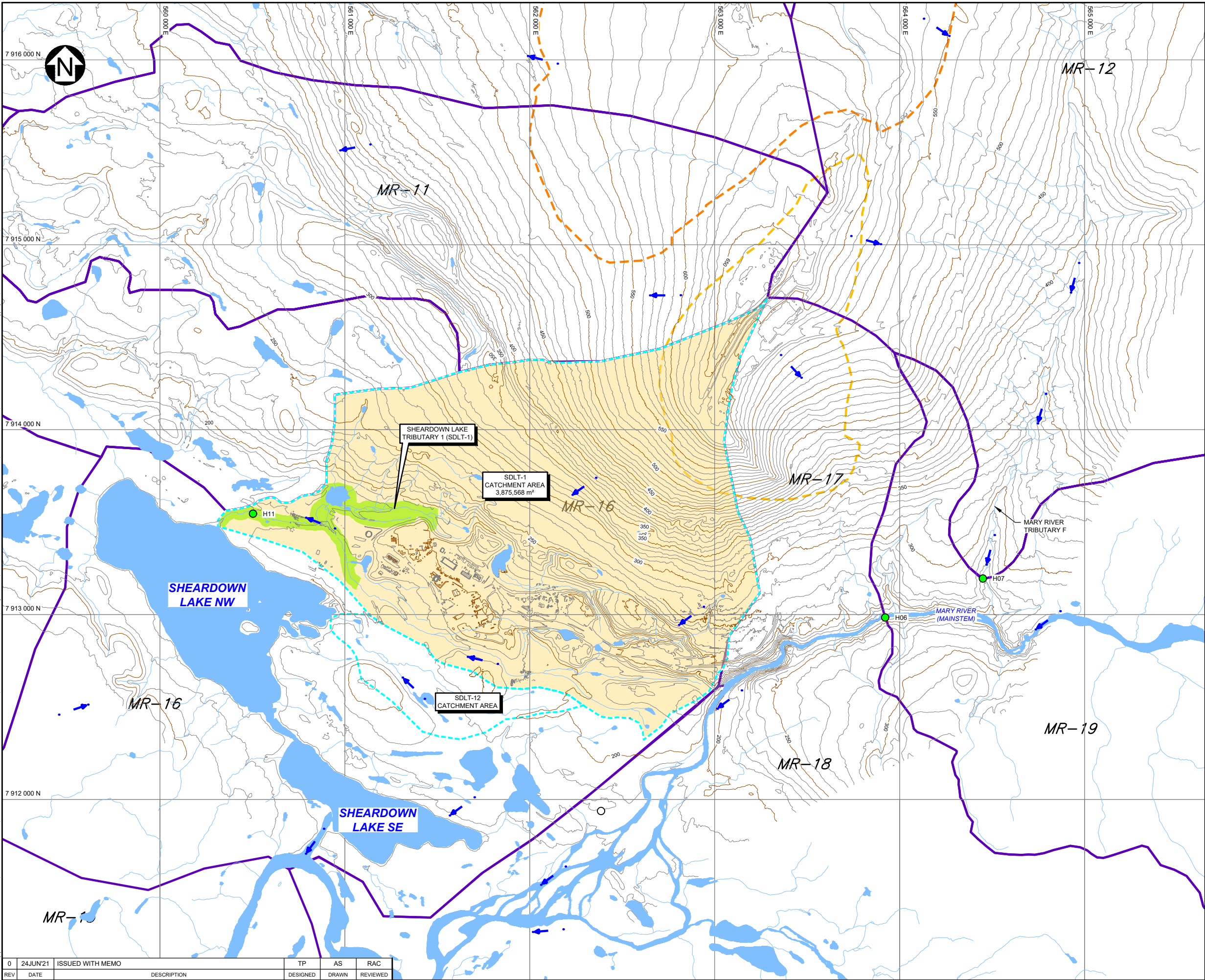
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Attachments:

Figure 1 Rev 0	SDLT-1 Baseline Catchment
Figure 2 Rev 0	SDLT-1 Catchment Changes due to Proposed Water Management Plan

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LEGEND:

- WATER / ESTIMATED POND EXTENTS
- FISH HABITAT WITHIN SDLT-1
- SDLT-1 CATCHMENT
- DRAINAGE DIRECTION
- SDLT-1 AND SDLT-12 CATCHMENT BOUNDARY
- PRE-MINE WATERSHED
- ULTIMATE DEPOSIT NO. 1 PIT LIMITS
- ULTIMATE WASTE ROCK STOCKPILE LIMITS
- HYDROMETRIC MONITORING STATION

NOTES:

- COORDINATE GRID IS UTM NAD83, ZONE 17.
- DETAILED WATER FROM EAGLE MAPPING (2005). CONTOUR PROVIDED BY BAFFINLAND (2019) INTERVAL IS 10 m.
- CURRENT MINE AREA FROM THE WASTE DUMP TO THE CRUSHER PAD, AND DITCHES ALONG THE HAUL ROAD PROVIDED BY BIM (MARCH 12, 2018).
- MINE HAUL ROAD AS-BUILT PROVIDED BY BAFFINLAND IRON MINES CORPORATION (MAY 2021).
- ALL OTHER SITE INFRASTRUCTURE PROVIDED BY HATCH (AUGUST 2, 2016) AND SIMPLIFIED BY KP STAFF (JANUARY 2018).
- LOCATIONS AND DETAILS OF PROPOSED WATER MANAGEMENT MEASURES TO BE CONFIRMED BASED ON ACTUAL SITE CONDITIONS.
- HISTORIC CATCHMENTS BASED ON INFORMATION PROVIDED IN THE 2012 FINAL ENVIRONMENTAL IMPACT STATEMENT.

SCALE A 200 100 0 200 400 600 800 1000 m

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

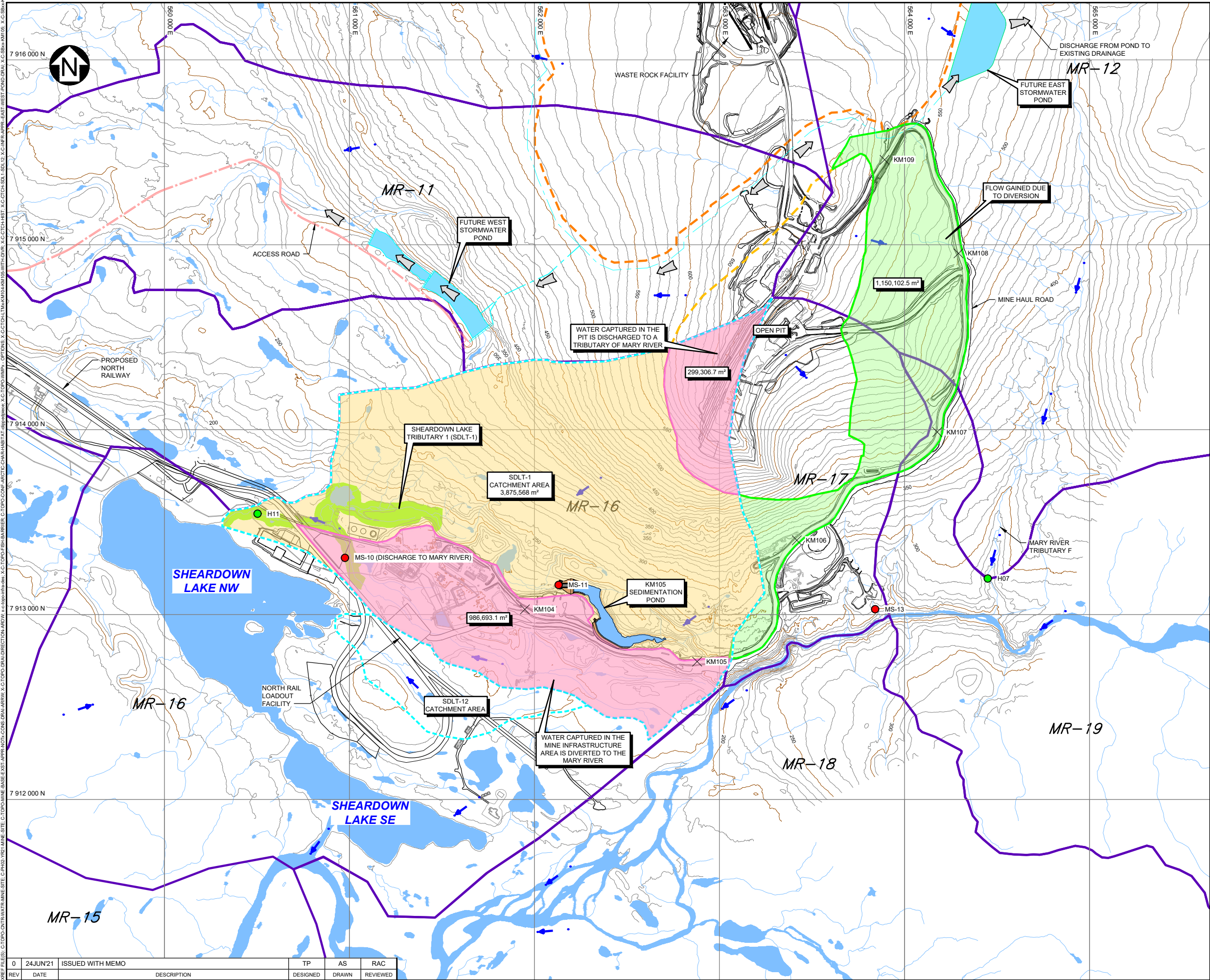
SDLT-1 BASELINE CATCHMENT



P/A NO. NB102-181/71	REF NO. NB21-00559
FIGURE 1	
REV 0	

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P:\FILES\GIS\PROJECTS\WATER\B10 R0_6/24/2021 10:19:05 AM - ASIMPSON PRINTED 6/24/2021 10:19:38 AM, FIG 2, ASIMPSON ACAD VERSION 23.1S (LMS TECH)

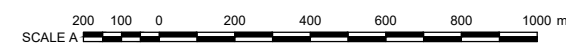


LEGEND:

- WATER / ESTIMATED POND EXTENTS
- SEDIMENTATION POND EMBANKMENT (APPROXIMATE)
- AREA DIVERTED OUT OF THE SDLT-1 CATCHMENT
- AREA DIVERTED INTO THE SDLT-1 CATCHMENT
- FISH HABITAT WITHIN SDLT-1
- SDLT-1 CATCHMENT
- PRE-MINE WATERSHED
- SDLT-1 AND SDLT-12 CATCHMENT BOUNDARY
- DRAINAGE DIRECTION
- ULTIMATE DEPOSIT NO. 1 PIT LIMITS
- ULTIMATE WASTE ROCK STOCKPILE LIMITS
- PROPOSED EFFLUENT DISCHARGE LOCATION
- HYDROMETRIC MONITORING STATION

CATCHMENT AREAS	
DESCRIPTION	AREA (m²)
SDLT-1 (BASELINE)	3,875,568
AREA DIVERTED OUT OF SDLT-1 CATCHMENT DUE TO OPEN PIT	- 299,306
AREA DIVERTED OUT OF SDLT-1 CATCHMENT DUE TO PUMPING OF EFFLUENT IN SDLT-1 POND TO THE MARY RIVER	- 986,693
MINE HAUL ROAD CATCHMENT DIVERTED INTO SDLT-1 CATCHMENT	+1,150,102

- NOTES:**
- COORDINATE GRID IS UTM NAD83, ZONE 17.
 - DETAILED WATER FROM EAGLE MAPPING (2005). CONTOUR PROVIDED BY BAFFINLAND (2019) INTERVAL IS 10 m.
 - CURRENT MINE AREA FROM THE WASTE DUMP TO THE CRUSHER PAD, AND DITCHES ALONG THE HAUL ROAD PROVIDED BY BIM (MARCH 12, 2018).
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 - HISTORIC CATCHMENTS BASED ON INFORMATION PROVIDED IN THE 2012 FINAL ENVIRONMENTAL IMPACT STATEMENT.



BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

SDLT-1 CATCHMENT CHANGES DUE TO PROPOSED WATER MANAGEMENT PLAN

P/A NO. NB102-181/71	REF NO. NB21-00559
FIGURE 2	
REV 0	