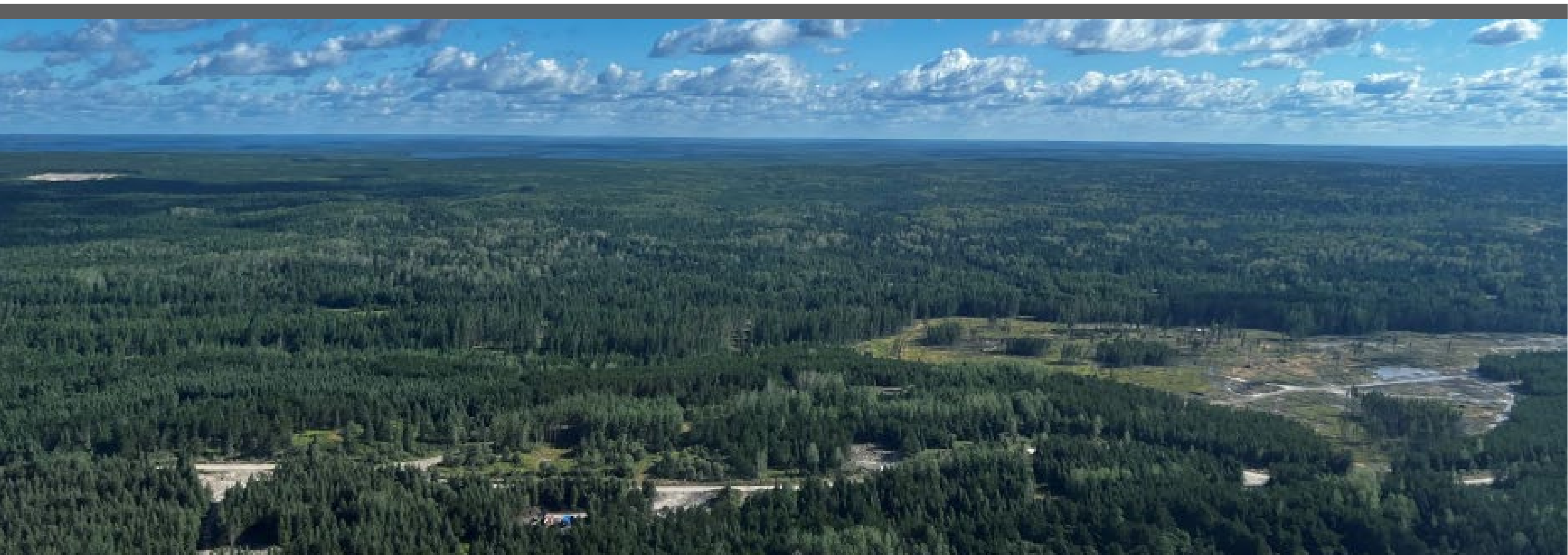
Kinross Great Bear

Great Bear Gold Project Impact Statement

Appendix U-1:

Tailings Inundation Study



GREAT BEAR RESOURCES

GREAT BEAR PROJECT

TAILINGS INUNDATION STUDY

FEBRUARY 2026

GREAT BEAR PROJECT

TAILINGS INUNDATION STUDY

GREAT BEAR RESOURCES

PROJECT NO.: OMEMA2303
JANUARY 2026

WSP CANADA INC.
6925 CENTURY AVENUE, SUITE 600
MISSISSAUGA, ON, CANADA L5N 7K2

T: +1 905-567-4444
WSP.COM

SIGNATURES

PREPARED BY:

Original Signed

Chris Muirhead, M.A.Sc., P.Eng (ON, NS)
Senior Water Resources Engineer

Original Signed

Rebecca Staring, P.Eng. (ON)
Senior Water Resources Engineer

Original Signed

David Simms, Ph.D.
Mining Environmental Fellow

REVIEWED BY:

Original Signed

Amy Elliott, Ph.D.
Senior Technical Manager, Water Quality

Original Signed

David Maarse, P.Eng. (ON)
Senior Technical Director, Water Resources

ABBREVIATIONS

CDA	Canadian Dam Association
Great Bear Resources	Great Bear Resources Ltd.
MWP	Mine water pond
PAL	Protection of aquatic life
PMP	Probably maximum precipitation
Project	Great Bear Project
TMF	Tailings management facility
WSP	WSP Canada Inc.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 PROJECT BACKGROUND

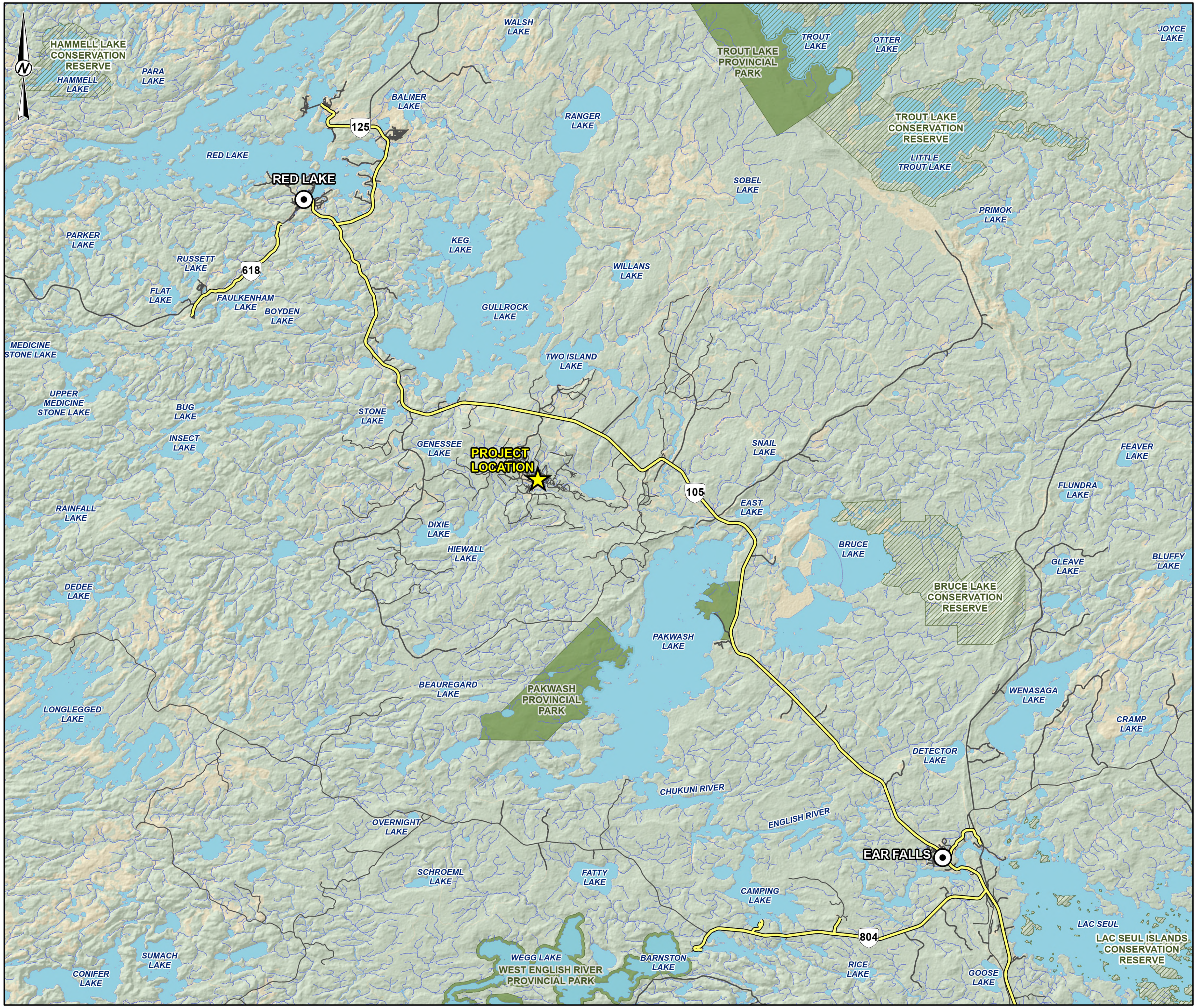
Great Bear Resources Ltd. (Great Bear Resources), a wholly (100%) owned subsidiary of Kinross Gold Corp., is developing a gold mine at the Great Bear Property. WSP Canada Inc. (WSP) was retained by Great Bear Resources to complete a tailings dam breach analysis and inundation mapping for the tailings management facility (TMF) for the Great Bear Project (Project) to support the submission of the Impact Statement and aid in quantifying potential environmental effects of the Project in the unlikely event of a tailings dam failure. The Project is located in the Red Lake mining district, in northwestern Ontario, approximately 25 km southeast of the Municipality of Red Lake (Figure 1-1).

1.2 PURPOSE

The purpose of the analysis was to evaluate the consequences of a hypothetical failure of the north, west and south TMF dams, to support early understanding of risk and potential environmental effects. The analysis was completed in accordance with the *Technical Bulletin of Tailings Dam Breach Analysis* (Canadian Dam Association; CDA 2021) based on information available in April 2025 and modified in July 2025 with updated failure slope assumptions and rheology data. The results of this analysis provide a screening level assessment of hypothetical runout extents and inundation mapping to help inform the Impact Assessment process and support the development of the accidents and malfunctions component of the documentation.

The scope of work included the following tasks:

- Review of currently available TMF design and geotechnical information
- Selection of credible hypothetical dam breach scenarios for the following dams:
  - North dam
  - West dam
  - South dam with cascading TMF pond dam
- Develop hypothetical volume released, failure times, and breach hydrographs
- Develop a numerical model in HEC-RAS 2D for inundation modelling of the dam breach
- Generate maps of the maximum inundation extent and depth-velocity product
- Discuss potential implications on downstream water quality.



KEY MAP

SCALE: 1:30,000,000

LEGEND

- PROJECT LOCATION
- TOWN
- CONSERVATION RESERVE
- PROVINCIAL PARK
- HIGHWAY
- LOCAL ROAD
- RESOURCE / RECREATION ROAD
- WATERCOURSE
- WATERBODY

0 2.5 5 10
1:250,000 KILOMETRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. WATERCOURSES AND WATERBODY ACQUIRED FROM LAND INFORMATION ONTARIO (MNRF) AND MODIFIED TO MATCH AERIAL IMAGERY AND LIDAR.
3. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
PROJECT LOCATION

CONSULTANT
wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	1-1

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

2 BACKGROUND INFORMATION

2.1 STUDY CONTEXT

Dam breach assessments are specific to the conditions of the Project, the design of the dam, and the properties of the material within the dam. The following sub-sections summarize data and design values used in the development of the dam breach assessment.

2.2 CLIMATE AND HYDROLOGY

The climate in northern Ontario is primarily continental, with generally cold winters and mild summers. The site receives mean annual precipitation of 633 millimetre (mm). The 100-year 24-hour storm event is 96 mm, and the probable maximum precipitation (PMP) 2-day duration event has been estimated to be 319.6 mm (WSP 2025a).

The majority of the Project is located within the watershed of Dixie Creek and its tributaries. Dixie Creek crosses the southern portion of the Property and flows into the Chukuni River, east of the Project. Figure 2-1 presents the limits of the Dixie Creek watershed and its tributaries. The Dixie Creek watershed at the confluence with the Chukuni River has a contributing drainage area of 363 km^2.

The Chukuni River is a relatively large, regulated system, with flow controlled by the Snowshoe Rapids Dam which is managed by the provincial Ministry of Natural Resources. The Chukuni River watershed at the confluence with Dixie Creek has a contributing drainage area of 4,400 km^2. The Chukuni River discharges into Pakwash Lake. Pakwash Lake discharges into the English River system through the Manitou Falls power generating station (WSP 2023).

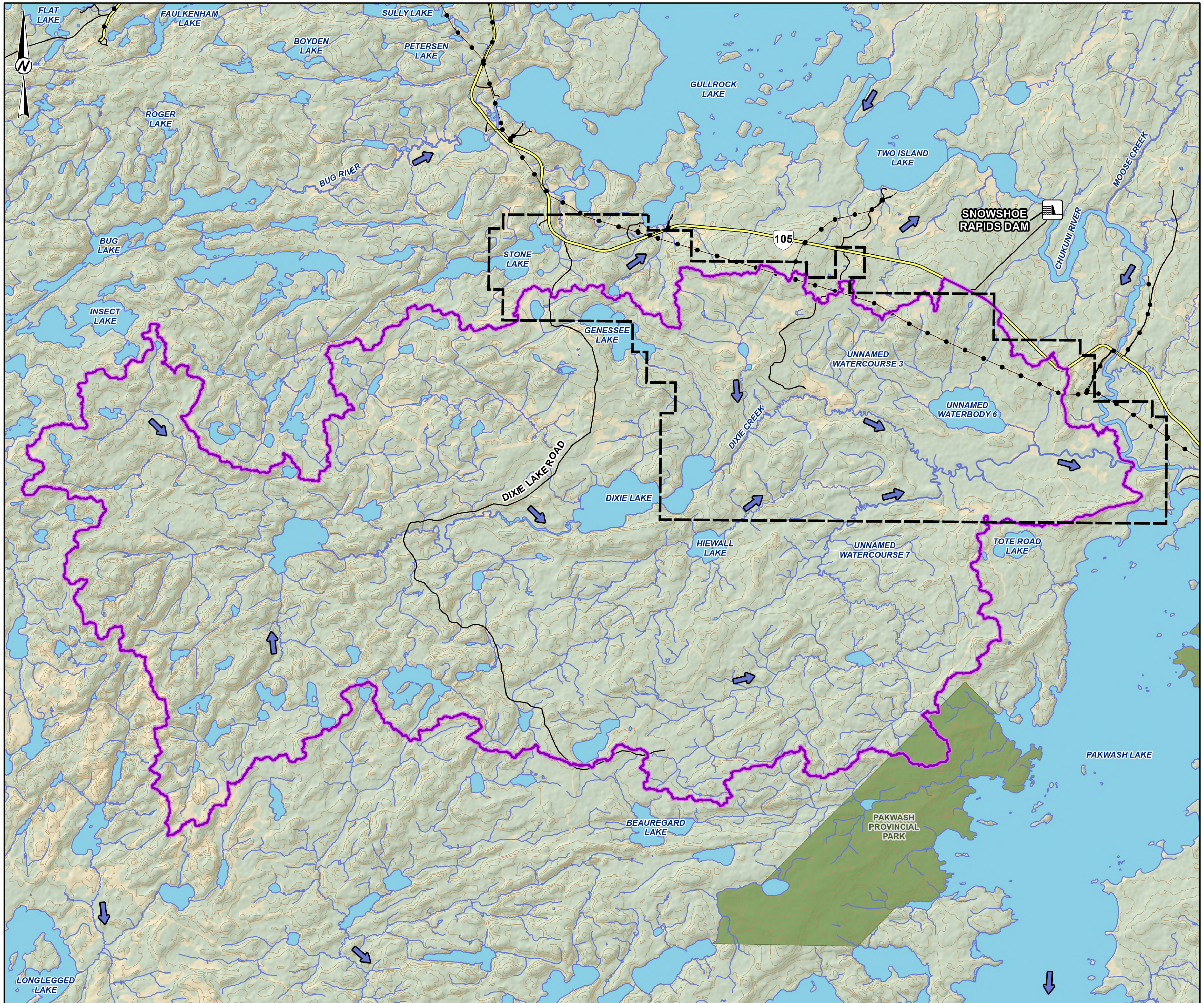
2.3 TAILINGS MANAGEMENT FACILITY

A plan view of the proposed TMF is presented in Figure 2-2. The TMF will consist of three granular containment dams: north dam, west dam and south dam. High-density thickened, desulphurized tailings from the process plant will be conveyed via pipeline to the northwest side of the TMF where they will be sub-aerially discharged from the TMF north dam for storage within the TMF containment dams. Runoff and process water from the TMF will collect in the TMF pond, located south of the TMF for re-circulation to the process plant as process water, or sent for treatment before being discharged to the Chukuni River (the proposed receiver; WSP 2024). A summary of TMF and TMF pond dam characteristics is presented in Table 2-1.

The TMF dams have a rockfill shell with vertical sand and gravel filters to retain tailings solids. This design will let water pass through the embankment, while retaining the tailings and allowing tailings to consolidate. The dams are proposed to be raised along the centerline. The north and south starter dams will be constructed before process plant commissioning while the west dam will not include a starter dam.

The TMF pond is located downstream from the TMF. Sheet piles driven through a sand core into the underlying foundation or other means will be used to reduce contact water losses through the TMF pond dam as needed. To facilitate dam construction and driving of the piles, the cross section will have a wide rockfill shell. The dam is proposed to be constructed to the final height in one season (i.e., no starter dam or subsequent construction stages; WSP 2024).

The mine water pond (MWP) will be constructed if needed later in the mine life, directly downstream of the TMF pond (Figure 2-2). The MWP will provide supplemental water storage if necessary (WSP 2024). The MWP has not been included in the hypothetical dam breach scenarios as it is a contingency facility.



LEGEND

- PROPERTY BOUNDARY
- SNOWSHOE RAPIDS DAM
- DIXIE CREEK WATERSHED
- HIGHWAY
- LOCAL ROAD
- POWER LINE
- CONTOURS (10 M INTERVAL)
- WATERCOURSE
- WATERBODY
- PROVINCIAL PARK
- FLOW DIRECTION

0 1 2 4

1:118,000 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. WATERCOURSES AND WATERBODY ACQUIRED FROM LAND INFORMATION ONTARIO (MNRF) AND MODIFIED TO MATCH AERIAL IMAGERY AND LIDAR.
3. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
4. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
DIXIE CREEK WATERSHED

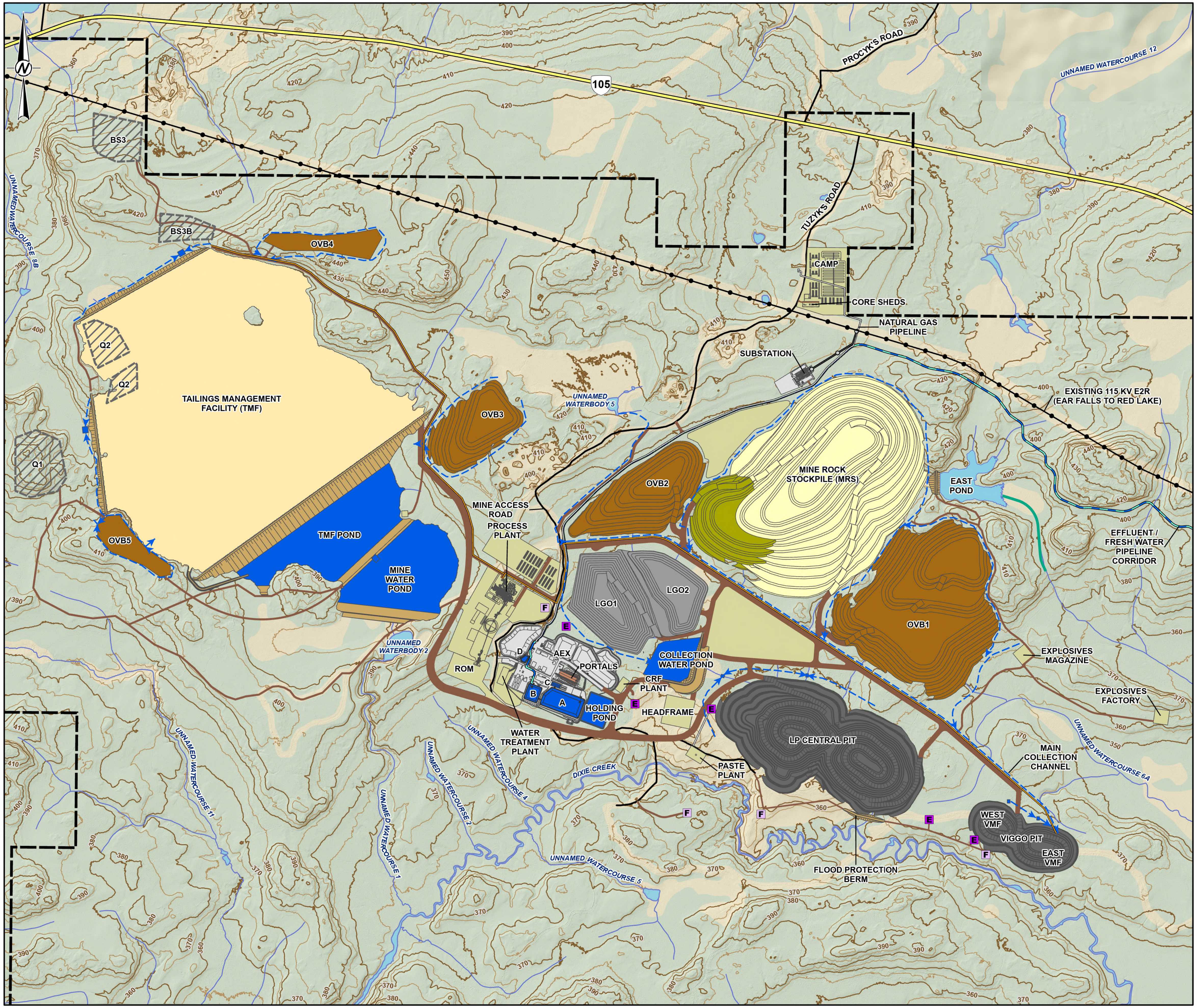
CONSULTANT

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

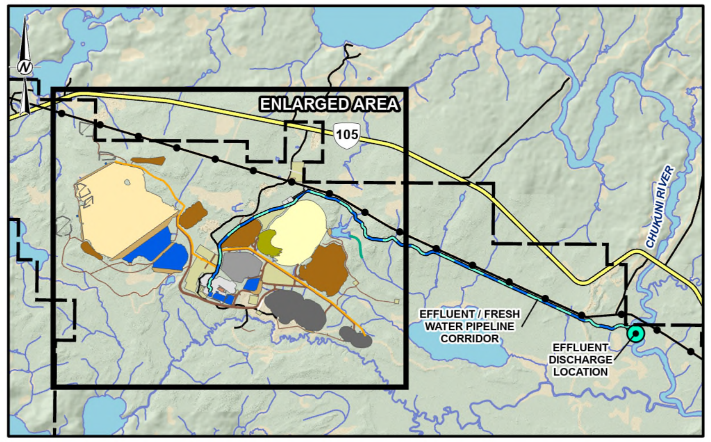
PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	2-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm 0



KEY MAP



SCALE: 1:175,000

LEGEND

- PROPERTY BOUNDARY
- HIGHWAY (INCLUDING ENBRIDGE PIPELINE)
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- MAJOR CONTOURS (10 M INTERVAL)
- MINOR CONTOURS (5 M INTERVAL)

PROPOSED MINE FEATURE

- OPEN PIT
- MINE ROCK STOCKPILE (NPAG)
- MINE ROCK STOCKPILE (PAG)
- LOW GRADE ORE STOCKPILE (LGO)
- OVERBURDEN STOCKPILE (OVB)
- TAILINGS MANAGEMENT FACILITY (TMF)
- DAM
- POND
- COLLECTION DITCH
- MINE FACILITIES / INFRASTRUCTURE
- ROAD
- PORTAL
- ADVANCED EXPLORATION SITE (AEX)
- ROCK QUARRY (Q) / SAND AND GRAVEL PIT (B)
- DIVERSION CHANNEL
- EXHAUST VENT RAISE
- FRESH AIR VENT RAISE
- TRANSMISSION LINE
- TAILINGS PIPELINE
- PASTE PLANT PIPELINE
- EFFLUENT / FRESH WATER PIPELINE CORRIDOR
- EFFLUENT DISCHARGE LOCATION

0 0.25 0.5 1

1:26,500 KILOMETRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. VMF: VIGGO MANAGEMENT FACILITY
3. ROM: RUN OF MINE ORE
4. AEX PONDS: A-AEX MINE WATER POND, B-AEX TREATED WATER POND, C-AEX SETTLING POND, D-AEX SEDIMENT POND

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
SITE PLAN (TOPOGRAPHY)

CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	2-2

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

25mm

Table 2-1: TMF Dam Sizing and Characteristics

	North Dam		South Dam		West Dam	TMF Pond Dam
	Starter	Ultimate	Starter	Ultimate	Ultimate	Ultimate
Spillway invert elevation (masl)	N/A		384 (1)	394.5 (1)	N/A	388
Dam crest elevation (masl)	407	418	385	397	402 - 411	385 (2)
Approximate height at maximum section elevation (m)	7	18	3.2	15.2	13	5
Total dam volume (m^3)	89,500	482,000	673,800	2,720,900	236,100	294,100

Source: Tailings and Mine Waste Engineering - Pre-feasibility Study (WSP 2024)

Notes:

1. *Top elevation of sill*
2. *Top elevation of sheet pile elevation is at 389 m*

N/A = not applicable; m = metre; masl = metres above sea level

2.4 TAILINGS PROPERTIES AND RHEOLOGY

The tailings geotechnical properties are included in Table 2-2. The percent solids by weight of the deposited tailings is estimated to be approximately 76%.

The rheological properties of the tailings will influence the behaviour of the tailings outflow if a TMF dam were to fail. CDA (2021) describes the behaviour of the breach flow as a function of the tailings solids concentration. Depending on the tailings solids concentration, the runout may take the form of a landslide, mudflow, or mud flood. According to the solids concentration of the deposited tailings (76% by weight), the tailings at the TMF would be expected to act as a mud flow.

Rheology test work was completed on the desulphurized tailings to support the dam breach assessment. Details of the testing are included in WSP (2025b). Two tailings samples were tested. The average of the values measured at approximately 75% by weight, Bingham yield stress of 103 Pa and viscosity of 0.45 Pa·s, were used for the dam breach assessment scenarios presented in this document.

This yield stress (103 Pa) is within the typical range of yield stress for high-density thickened tailings (40 Pa and 200 Pa) reported in Klohn Crippen Berger (2017). Yield stress and viscosity data from 30 samples of gold tailings are provided in Zengeni (2016). The upper limit of the solids concentration was approximately 70% by weight, which is less than the value estimated for the TMF tailings (76%). The measurements for yield stress and viscosity at 70% solids concentration (by weight) approximately ranged from 30 Pa to 80 Pa and from 0.1 Pa·s to 0.2 Pa·s, respectively.

Table 2-2: Tailings Properties for the Desulphurized Tailings

Desulphurized Tailings Properties	Value
Tailings specific gravity	2.83
Deposited tailings dry density	1.49 t/m^3
Tailings discharge density (solids by mass)	60%
Water content of the deposited tailings (mass water / mass of solids)	31.8%
Deposited tailings solids content (by mass)	76%
Deposited tailings solids content (by volume)	53%

Source: WSP (2024)

3 HYPOTHETICAL FAILURE METHODOLOGY

3.1 OVERVIEW

Potential dam failure modes and resulting breach processes were evaluated to define dam failure scenarios for the tailings dam breach analysis. A dam failure mode is a combination of a triggering event and a failure mechanism (CDA 2021):

- A triggering event could be caused by external loading (e.g., earthquake or extreme flood event), and / or structural or foundation weakness.
- A failure mechanism is an event that could (but does not necessarily) lead to a breach of a dam, either by overtopping or deformation of the dam. Limited overtopping may not breach the dam or release the stored contents. Similarly, deformation of a dam may be localized or not large enough to discharge the stored contents (water and / or tailings). For the purposes of this study and as per CDA (2021), it is assumed that these processes lead to a physical breach of the dam and the eventual loss of containment.

The hydrologic conditions at the time of failure will affect the magnitude of the potential peak outflow and quantity of the runout volume. As such, the tailings dam breach analysis considers failures under normal operating conditions and during an extreme flooding event. These scenarios are typically referred to as fair-weather and flood-induced.

- Fair-weather: Failure due to dam collapse is assumed to occur during fair-weather conditions as it does not depend on a previous storm or flood event. Therefore, the dam breach hydrograph will represent only tailings plus porewater, with no flow from runoff.
- Flood-induced: Failure due to dam overtopping is tied to extreme precipitation or flooding event. Therefore, the dam breach hydrographs will represent tailings, porewater as well as the additional flow from runoff from the inflow design flood.

3.2 ASSESSMENT OF FAILURE MODES

As stated in CDA (2021), the failure mechanisms which may lead to the release of the impounded materials are:

- Collapse resulting from:
  - Foundation instability
  - Liquefaction of foundation or dam fill materials (due to a seismic event or other triggering event)
  - Surface erosion
  - Internal erosion (piping)
- Overtopping:
  - Wave action / insufficient freeboard
  - Flood event
  - Spillway failure / blockage
  - Settlement of the crest.

To identify and model a reasonable dam breach, the applicability of each of these failure modes for each of the TMF dams has been evaluated (WSP 2026). The results are provided in Table 3-1.

Table 3-1: Preliminary Assessment of Failure Modes

Failure Mode	North Dam	West Dam	South Dam
Foundation instability	Applicable – assuming unforeseen foundation conditions between current boreholes.	Applicable – assuming unforeseen foundation conditions between current boreholes.	Applicable – assuming unforeseen foundation conditions between current boreholes.
Liquefaction of foundation or dam fill materials	Applicable – assuming possibility of weak unidentified liquefiable layer beneath the prepared foundation.	Applicable – assuming possibility of weak unidentified liquefiable layer beneath the prepared foundation.	Applicable – assuming possibility of weak unidentified liquefiable layer beneath the prepared foundation.
Surface erosion	Applicable – tailings line running on the dam crest breaks which erodes the dam.	Not applicable – assumed that the clean mine rock used for the dam construction is resistant to surface erosion.	Not applicable – assumed that the clean mine rock used for the dam construction is resistant to surface erosion.
Internal erosion (piping)	Applicable – seepage is allowed to pass through the rockfill zones, which can transport the fines, leading to the formation of voids.	Applicable – seepage is allowed to pass through the rockfill zones, which can transport the fines, leading to the formation of voids.	Applicable – seepage is allowed to pass through the rockfill zones, which can transport the fines, leading to the formation of voids.
Dam overtopping	Not applicable – tailings are sloped away from the dam (no pond present).	Not applicable – tailings are sloped away from the dam (no pond present).	Applicable – assumed applicable as tailings are sloped towards this dam. Also risk for the spillway (located at southwest abutment of dam) to be blocked.

3.3 DAM BREACH LOCATIONS

Hypothetical breach scenarios were selected for each TMF dam (north, west and south). The locations for the hypothetical breach were selected based on where the height of the dam was greatest and where the potential breach volume of tailings to be released is higher. The selected potential breach locations are shown on Figure 3-1.

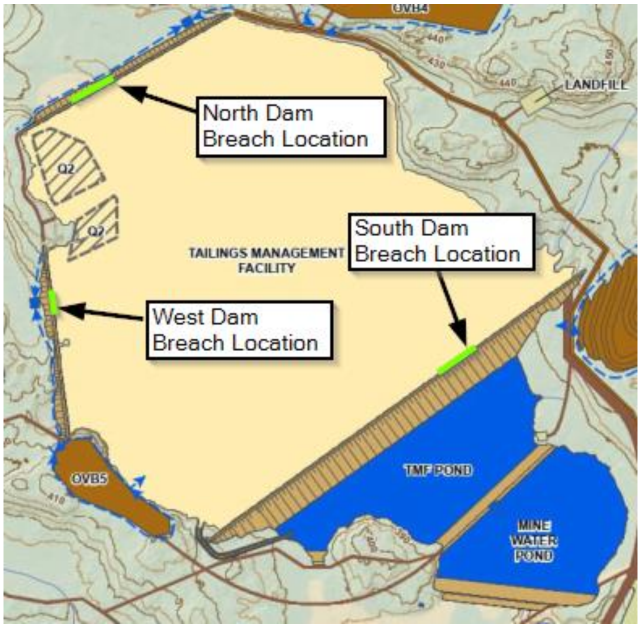


Figure 3-1: TMF Breach Locations

3.4 MODELLED FAILURE SCENARIOS

The tailings will be deposited so the surface is sloping from north to south at approximately 1.3% (WSP 2024). As a result, the north dam and west dam will not have ponded water against the dam surface. Therefore, no flood-induced failure scenarios were included for either the north dam or west dam.

Since the tailings slope towards the south dam and water may temporarily pond against the dam under storm event conditions, a flood-induced failure scenario as well as a fair-weather scenario were included for the south dam.

Details about each of the hypothetical failure scenarios, including the selected failure mode and the breach geometry is included in the following sections.

3.4.1 NORTH DAM – FAIR-WEATHER

The following defines the selected hypothetical breach scenario for the TMF north dam:

- *Hydrologic Condition:* Fair-weather scenario. Tailings will be deposited sloping away from the north dam (WSP 2024), therefore there is no potential for upgradient ponding or flood-induced overtopping.
- *Failure Mode*: Liquefaction of the foundation soils due to an unidentified weak layer causes deformation of the dam. It is expected that such a failure would occur almost instantaneously, and this failure mode was selected as the critical failure mode for the north dam.
- *Breach Height:* The starter dam is assumed to remain in place. Therefore, the breach height is approximately 11 m: from the ultimate dam crest (418 masl) to the starter dam crest (407 masl).
- *Breach Bottom Width:* A width of 250 m was selected as the maximum breach width based on input from the geotechnical design team. This width corresponds to the spacing between boreholes along the dam alignment. As the design was completed using all borehole data, any unidentified layers would be between investigated locations.
- *Cascade Potential:* None. No dams are downstream of the north dam.

Estimated volumes of potential tailings release are presented in Section 3.5.

3.4.2 WEST DAM – FAIR-WEATHER

The following defines the selected hypothetical breach scenario for the TMF west dam:

- *Hydrologic Condition:* Fair-weather scenario. Tailings will be deposited sloping parallel and away from the west dam (WSP 2024), therefore no potential for upgradient ponding or flood-induced overtopping.
- *Failure Mode*: Liquefaction of the foundation soils due to an unidentified weak layer causes deformation of the dam. It is expected that such a failure would occur almost instantaneously, and this failure mode was selected as the critical failure mode for the west dam.
- *Breach Height:* From the ultimate dam crest to the dam foundation. The height of the dam and, therefore, the breach height varies over the length. The approximate breach height is 11 m.
- *Breach Bottom Width:* A width of 30 m was selected as the maximum breach width based on input from the geotechnical design team for the Project. This width corresponds to the spacing between boreholes and test pits (bedrock is shallow) along the dam alignment. As the design was completed using all borehole data, any unidentified layers if present, would be between the investigated locations.
- *Cascade Potential:* None. No dams are downstream of the west dam.

Estimated volumes of potential tailings release are presented in Section 3.5.

3.4.3 SOUTH DAM – FAIR-WEATHER

For the hypothetical breach of the TMF south dam in fair-weather conditions, the following defines the selected breach scenario:

- *Hydrologic Condition:* Fair-weather scenario. The tailings surface will be generally free of ponding as contact water will drain to the spillway located at the northern abutment which discharges to the TMF pond and the dams will be free draining (WSP 2024).
- *Failure Mode*: Liquefaction of the foundation soils due to an unidentified weak layer causes deformation of the dam. It is expected that such a failure would occur almost instantaneously, and this failure mode was selected as the critical failure mode for the south dam.
- *Breach Height:* The starter dam is assumed to remain in place. Therefore, the breach height is approximately 12 m: from the ultimate dam crest (Elevation; El. 397 masl) to the starter dam crest (El. 385 masl).
- *Breach Bottom Width:* A width of 250 m was selected as the maximum breach width based on input from the geotechnical design team. This width corresponds to the spacing between boreholes along the dam alignment. As the design was completed using all borehole data, any unidentified layers would be between investigated locations.
- *Cascade Potential:* The TMF pond is directly downstream of the south dam. The TMF pond dam is assumed to breach once the released tailings have caused the water level elevation in the TMF pond to rise and overtop the rockfill in the TMF pond dam cross-section, releasing contact water and tailings towards Dixie Creek. A bottom width of 25 m was assumed for the TMF pond dam breach. The TMF pond is assumed to be at the average water level elevation of 383.5 m at the time of the south dam fair-weather breach scenario.

The estimated volumes anticipated to be released during a dam breach, including the volume of tailings and pond water volumes are presented in Section 3.5.

3.4.4 SOUTH DAM – FLOOD-INDUCED

For the hypothetical breach of the TMF south dam flood-induced scenario, the following defines the selected breach scenario:

- *Hydrologic Condition:* Flood-induced scenario. The PMP is occurring on the TMF catchment area.
- *Failure Mode*: Dam overtopping during a PMP due to spillway failure or blockage.
- *Breach Height:* The starter dam is assumed to remain in place. Therefore, the breach height is approximately 12 m: from the ultimate dam crest (El. 397 masl) to the starter dam crest (El. 385 masl).
- *Breach Bottom Width:* A breach width of 100 m was estimated from empirical equations for overtopping.
- *Cascade Potential:* The TMF pond is directly downstream of the south dam. The TMF pond is assumed to have a water level elevation of 388 m (at the spillway invert) at the time of the south dam breach. Based on the proposed cross-section of the TMF pond dam (sheet piles will not erode), it is assumed to remain in place (i.e., it does not breach). Water and tailings are assumed to flow over the dam crest and through the emergency spillway towards Dixie Creek.

The estimated volumes anticipated to be released during a dam breach, including the volume of tailings and pond water volumes are presented in Section 3.5.

3.5 HYPOTHETICAL RELEASE VOLUME

The hypothetical released volume of tailings was estimated using Muk3D assuming the following:

- Breach side slopes of 1H:1V.
- The slope of the post-failure tailings surface is 3.5%. Previous tailings facility failures at some other locations have documented average post-failure slopes in the range of 3.5% to 9% (CDA 2021). The selected value is the lower bound of the range included in CDA (2021) as this will result in a higher hypothetical volume of tailings being released.

Table 3-2 includes an estimate for the volume of water and solids released from the TMF for each hypothetical scenario. For the south dam, the volume of water was estimated based on storage-elevation curves provided in the *Mine Site Water Balance* (WSP 2025c). The volumetric content of solids is estimated for each scenario.

A summary of assumed breach parameters used for modelling are shown in Table 3-2.

Table 3-2: Failure Scenario Breach Parameters

Parameter	North Dam	West Dam	South Dam – Fair-weather	South Dam – Flood-induced
Breach Height	11 m	11 m	12 m	12 m
Breach Width	250 m	30 m	250 m	100 m
Breach Side Slopes (H:V)	1:1	1:1	1:1	1:1
Volume of Mobilized Tailings	0.99 Mm^3	0.70 Mm^3	2.7 Mm^3	1.5 Mm^3
Volume of Solids in Mobilized Tailings	0.52 Mm^3	0.37 Mm^3	1.4 Mm^3	0.78 Mm^3
Volume of Porewater in Mobilized Tailings	0.47 Mm^3	0.33 Mm^3	1.3 Mm^3	0.70 Mm^3
Volume of Water from PMP	N/A	N/A	N/A	1.7 Mm^3
Volume of Water in TMF Pond	N/A	N/A	0.9 Mm^3	3.1 Mm^3
Total Released Volume	0.99 Mm^3	0.70 Mm^3	3.6 Mm^3	3.2 Mm^3 (1)
Runout Solids Content (by volume)	53%	53%	53% (2)	13%
Runout Solids Content (by mass)	76%	76%	76% (2)	29%

Note:

1. Since in the flood-induced scenario the TMF Pond Dam is assumed to remain in place, the total released volume accounts for the volume (mix of tailings and pond water) remaining within the TMF Pond area.

2. In the fair-weather scenario, the water and tailings are modelled as separate flood waves. The runout solids content presented here is for the tailings.

3.6 DAM BREACH HYDROGRAPHS

Dam breach hydrographs were developed through the HEC-HMS software (Version 4.12). HEC-HMS is a software designed to simulate complex hydrologic processes. For this analysis, each dam was simulated to fail through the Dam Break function within HEC-HMS. The following sections present and discuss the hydrographs for each respective dam breach scenario assessed. While using HEC-HMS to develop the dam breach hydrographs does not account for rheology, modelling each breach as water in HEC-HMS is a conservative assumption as this method would result in an increased discharge occurring immediately in the hydrograph, creating a larger flood wave of fluid and ultimately resulting in a conservative estimate due to a potential failure of the TMF.

The development time of each hypothetical breach was assumed to be 0.1 hours or 6 minutes, resulting in a near-instantaneous breach of the dam. This is representative of the worst-case scenario as all tailings and water are simulated to release immediately rather than release over time, as would be the case with a slower developing breach.

3.6.1 NORTH DAM BREACH – FAIR-WEATHER

The peak flow of tailings leaving the TMF due to the hypothetical north dam breach was simulated to be 4,197 m^3/s and occurred 7 minutes after the dam breach. The hydrograph for the North Dam breach is shown below on Figure 3-2. The total release volume for the north dam breach was 0.99 Mm^3 of tailings.

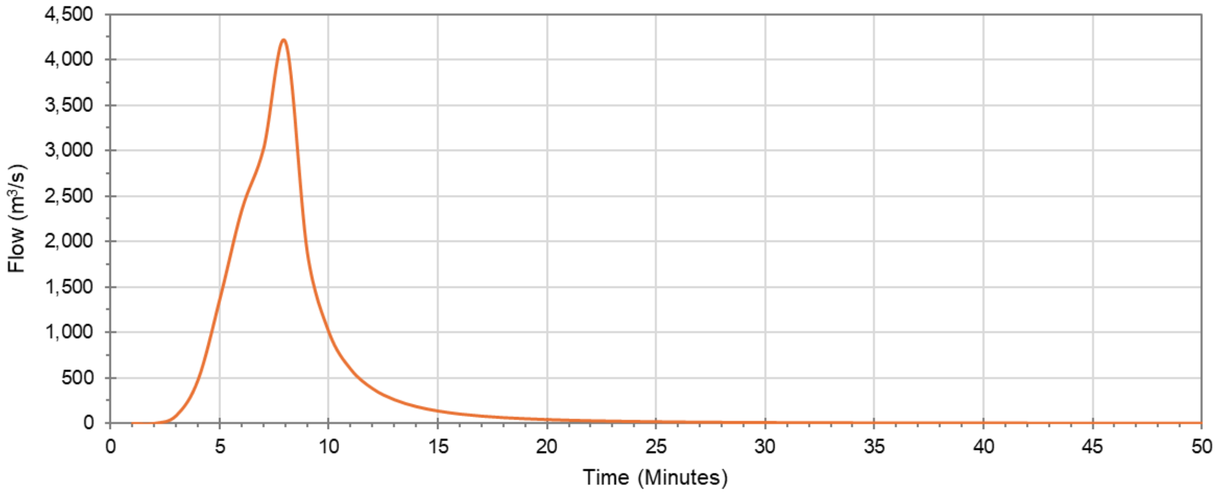


Figure 3-2: North Dam Breach Hydrograph

3.6.2 WEST DAM BREACH – FAIR-WEATHER

The peak flow of tailings leaving the TMF due to the west dam breach was simulated to be 1,539 m^3/s and occurred 7 minutes after the dam breach. The hydrograph for the west dam breach is shown below on Figure 3-3. The total release volume for the west dam breach was 0.70 Mm^3 of tailings.

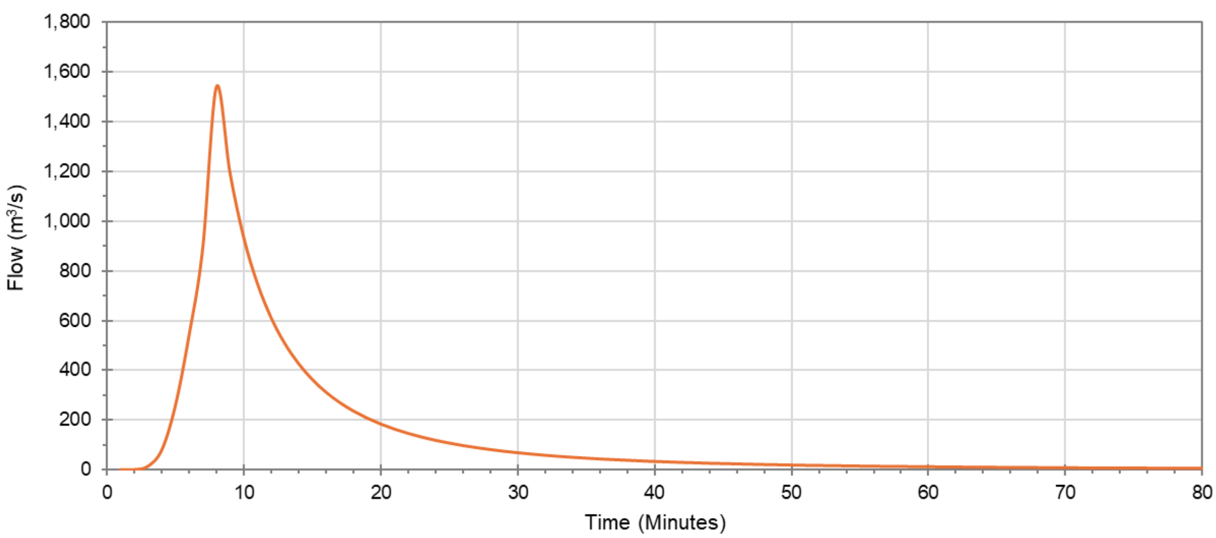


Figure 3-3: West Dam Breach Hydrograph

3.6.3 SOUTH DAM BREACH – FAIR-WEATHER

The hypothetical failure of the south dam during fair-weather conditions releases tailings into the TMF pond, resulting in a breach of the downstream TMF pond dam as well. The TMF pond is assumed to have an initial water elevation of 383.5 masl (average water level). The flow of tailings from south dam breach will displace the water in the TMF pond. Once the water level rises to 389 masl (crest of the TMF pond dam) the TMF pond dam is simulated to breach, initially releasing water and later releasing tailings as the cascade continues. The water and tailings are modelled as separate flood waves flowing into Dixie Creek and the receiving environment. Figure 3-4 presents the hydrographs for the water and tailings which will breach from the south dam during fair-weather conditions.

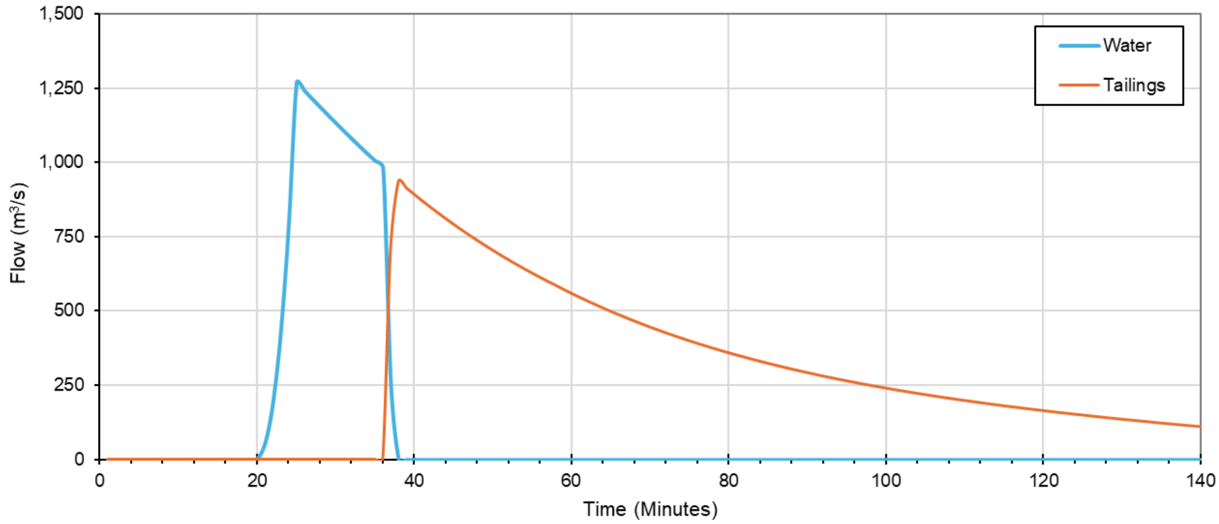


Figure 3-4: South Dam Fair-weather Breach Hydrograph

3.6.4 SOUTH DAM BREACH – FLOOD-INDUCED

The hypothetical failure of the south dam during flood-induced conditions releases tailings into the TMF pond; however, it is assumed this does not result in a breach of the TMF pond dam. Due to the additional water present in the system during the flood-induced scenario compared with the fair-weather scenario, it has been assumed the tailings and water will mix creating a slurry which discharges through the TMF pond spillway and overtops the TMF pond dam without breaching it. The TMF pond is assumed to have an initial water elevation of 388 masl (TMF pond spillway invert). The flow of tailings from the south dam breach will displace the water in the TMF pond, resulting in discharge through the TMF pond spillway. Once the water level rises to 389 masl, the slurry begins to overtop the TMF pond dam crest flowing into Dixie Creek and the receiving environment. Figure 3-5 presents the hydrographs for the discharge through the spillway and over the crest of the TMF pond dam during the flood-induced scenario.

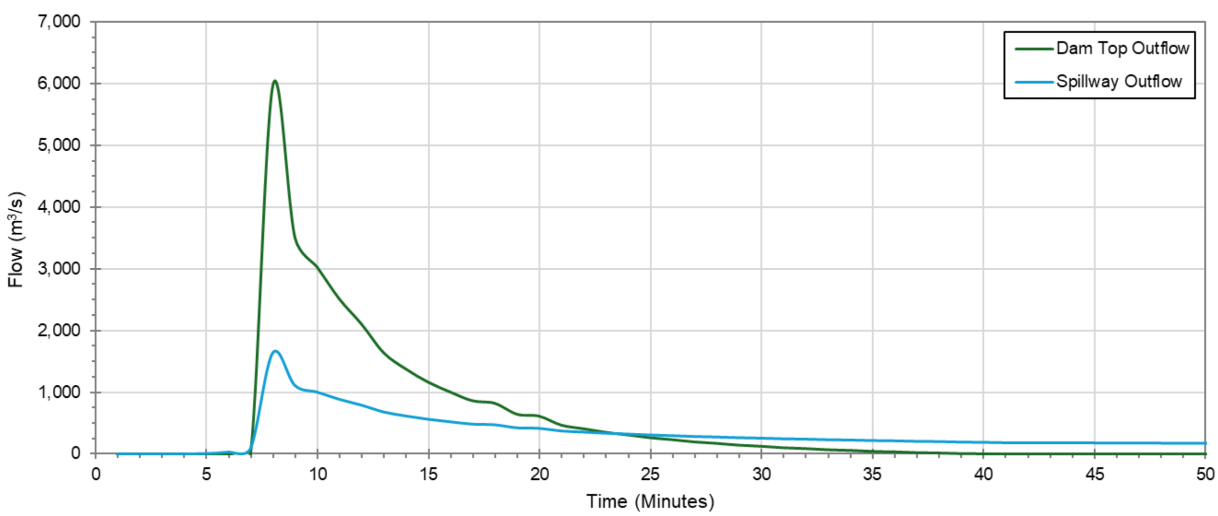


Figure 3-5: South Dam Flood-induced Hydrograph

4 INUNDATION MODELING HEC-RAS

4.1 MODEL SELECTION

Based on the characteristics of the study area and requirements of the model, the use of the two-dimensional component of the HEC-RAS, Version 6.5, was selected as the optimal model to determine the extent of effluent release due to the theoretical dam breach discussed in this report. HEC-RAS is the industry-standard software for a variety of hydraulic analysis, including dam breach assessments. HEC-RAS is suitable for modelling both Newtonian fluid flows (water or water with low concentrations of solids) and non-Newtonian fluid flows (sludge or water with high concentrations of solids). The following sections will discuss the inputs to the HEC-RAS model.

4.2 MODEL INPUTS AND ASSUMPTIONS

The HEC-RAS model inputs and assumptions consisted of:

- A digital elevation model developed from the following terrain data:
  - LiDAR data collected on September 19, 2022 for the area within the Project boundary; provided to WSP by Great Bear Resources.
  - Publicly available digital elevation data for the province.
- A model domain with a 10 m x 10 m computational mesh.
- A model domain surface roughness (i.e., Manning's n) coefficient of 0.06. The Project area is rural with vegetated floodplains, including both previously cut and undisturbed forested areas and low-lying wetland areas.
- Model boundary conditions:
  - Inflow boundary conditions were applied to the cells located along the breach location of the hypothetical failure for each scenario. The hydrographs included in Section 3.6 were assigned to these boundary conditions.
  - Outflow boundary conditions were included where the hypothetical breach flow path would enter lakes. Therefore, an outflow boundary condition was included at Gullrock Lake (north dam and west dam scenarios) and Pakwash Lake (south dam scenarios). The Gullrock Lake boundary condition consisted of the normal depth boundary condition (slope of 1.5%). The Pakwash Lake boundary conditions consisted of the average water level of Pakwash Lake, taken as 346.3 masl (Lake of the Woods Control Board 2002). The lakes are not included in the model.
  - During the south dam flood-induced scenario, peak flows from Dixie Creek, Unnamed Watercourse 7, and the Chukuni River under the 100-year 24-hour storm event were included as boundary conditions to the model to represent an elevated flow condition due to flooding in the area. The 100-year 24-hour flows were obtained from the *Hydrology Baseline Study* (WSP 2025d). The flows included as baseflow for the hypothetical south dam flood-induced breach are shown below in Table 4-1.

Table 4-1: 100-year Flows for Nearby Watercourses

Watercourse	Flow (m^3/s)
Dixie Creek	57.0
Unnamed Watercourse 7 (Dixie Creek tributary)	50.2
Chukuni River	221.8

Source: Hydrology Baseline Study (WSP 2025d).

4.3 MODEL RESULTS

Results of the hypothetical dam breach simulations are included in the following sections. Figures showing the results are included in Appendix A. Two figures are shown for each scenario:

- Inundation Boundary: shows the maximum inundation boundary that may be covered by tailings or water for some time during the breach. The inundation boundary represents the extents of the affected area, but it does not represent a specific time (i.e., it is not the footprint after the flood wave has passed).
- Depth Velocity Product: shows the maximum depth velocity product as the flood wave passes. The depth velocity product helps quantify the potential effects of flooding by assessing the risk to life and property, as higher depth velocity product values indicate more dangerous conditions.

4.3.1 NORTH DAM BREACH – FAIR-WEATHER

The model indicates that a hypothetical breach of the north dam potentially results in flow across the Hydro One Networks Inc. regional transmission line corridor, and deposited tailings on Highway 105 and in Gullrock Lake (Figure A-1). The flood wave arrives at the transmission line and Highway 105 approximately 15 minutes after the breach. The anticipated maximum depth at the transmission line is about 2.2 m, with a maximum velocity of 2.8 m/s. The anticipated maximum depth at the highway is about 1.2 m, as the flood wave passes but the depth decreases to approximately 0.8 m after 30 minutes. The maximum velocity and depth velocity product of the flood wave as it passes the highway are 3.0 m/s and 3.2 m^2/s, respectively. The depth velocity product is shown in Figure A-2. Approximately 0.49 Mm^3 of tailings potentially enters Gullrock Lake. A flood-induced failure scenario was not included since there is no potential for upgradient ponding or flood-induced overtopping.

4.3.2 WEST DAM BREACH – FAIR-WEATHER

The model indicates that a hypothetical breach of the west dam potentially results in flow across the transmission line corridor and deposited tailings on Highway 105 and in Gullrock Lake (Figure A-3). The flood wave arrives at the transmission line approximately 40 minutes after the west dam breach. The maximum depth and velocity of the flood wave as it passes the transmission line corridor is about 1.3 m and 1.1 m/s, respectively. About 8 minutes later (48 minutes after the breach) the flood wave arrives at the Highway 105. The potential depth at the highway is about 0.4 m. The maximum velocity and depth velocity product of the flood wave as it passes the highway is 1.4 m/s and 0.4 m^2/s, respectively (Figure A-4). Approximately 0.09 Mm^3 of tailings potentially flows into Gullrock Lake. A flood-induced failure scenario was not included since there is no potential for upgradient ponding or flood-induced overtopping.

4.3.3 SOUTH DAM BREACH – FAIR-WEATHER

The model indicates that a hypothetical breach of the south dam and the cascade failure of the TMF pond dam potentially results in flows downstream into Dixie Creek (Figure A-5). For the fair-weather failure scenario, the flood wave is modelled as two components: comprised mostly of TMF pond water displaced by tailings arrives at Dixie Creek first, approximately 55 minutes after the breach; and the second tailings runout component arrives 25 minutes later (80 minutes after the breach).

The water component flows downstream and enters the Chukuni River after approximately 20 hours. The more viscous tailings runout is estimated to stop south of the proposed open pit location and does not enter the Chukuni River. The inundation extent of both the water and tailing component of the flood wave are illustrated on Figure A-5, with the maximum depth and velocities shown at key locations. The depth velocity product is shown on Figure A-6 (tailings) and Figure A-7 (water).

4.3.4 SOUTH DAM BREACH – FLOOD-INDUCED

Given the wet conditions associated with the hypothetical breach of the South Dam, it is assumed that the ambient water and tailings will fully mix and that only the south dam will breach. The combined water and tailings mix will have Newtonian properties (i.e., the mix will flow like water) and will flow downstream toward Dixie Creek (Figure A-8). The flood wave arrives at Dixie Creek approximately 30 minutes after the breach. The flood wave flows downstream and enters the Chukuni River after approximately 15 hours. The inundation extent of the flood wave is illustrated on Figure A-8, with the maximum depth and velocities shown at key locations. In interpreting the results, it is important to note that the breach is occurring during an extremely unlikely flood event (probable maximum precipitation) and that flow in Dixie Creek and the Chukuni River are already at 100-year return period flood levels. The extent of inundation resulting from the breach is represented by the increase in the extent from the 100-year limit and to maximum extent of inundation shown on Figure A-8. The depth velocity product is shown on Figure A-9.

5 WATER QUALITY CONSIDERATIONS

5.1 APPROACH

The purpose of this section is to provide a screening-level evaluation of potential impacts on surface water quality arising from a hypothetical failure of the TMF dam(s). This evaluation is intended to inform an early understanding of potential risks and possible environmental consequences, supporting proactive consideration of mitigation and management strategies. Inputs and assumptions of modelled failure scenarios are presented in Section 3.4 and hypothetical release volumes are presented in Table 3-2.

This water quality assessment focuses on the hypothetical south dam fair-weather scenario, as it represents the largest potential release from the TMF, with an estimated total volume of approximately 3.6 Mm^3 (Table 3-2). This scenario assumes a cascade failure of the TMF pond dam, increasing the hydraulic load and potential for transport of tailings and associated water quality parameters downstream. Fair-weather failure scenarios are associated with an assumed reduced dilution and assimilation capacity in the receiving environment compared to the flood-induced failure scenarios (Section 3.4.4).

The hypothetical south dam fair-weather breach scenario poses the greatest risk to downstream watercourses, given the magnitude of solids and water released, and is therefore considered the most conservative basis for evaluating potential water quality outcomes.

The following maximum TMF component releases have been defined for this hypothetical scenario (Table 3-2):

– 1.4 Mm^3 of tailings solids

– 1.3 Mm^3 of tailings porewater

– 0.9 Mm^3 of TMF pond water.

Desulphurized tailings will be deposited in the TMF. Due to the desulphurization process, these tailings are classified as non-potentially acid generating, and do not pose a risk of acid generation. Water quality conditions within the TMF, as predicted by the mine site water quality model (WSP 2025e), are presented in Table 5-1 and form the basis of this assessment.

Inundation modelling indicated that the released water and desulphurized tailings would flow downslope, enter Dixie Creek, and continue downstream to enter the Chukuni River. The tailings would also flow downslope, but the runout would end south of Unnamed Waterbody 6 and tailings would not be continue further downstream and be deposited in the Chukuni River or Pakwash Lake.

In general, potential water quality effects resulting from a hypothetical failure are as follows:

– *High Suspended Sediment Load:* The large solids volume (~1.4 Mm^3) will result in extreme turbidity and sedimentation in downstream channels, potentially smothering aquatic habitats, reducing light penetration and having a detrimental effect on species present at the time.

– *Loadings of Metals and other Constituents:* The release of tailings and porewater containing metals and cyanide (WSP 2025e) could result in concentrations greater than water quality guidelines for the protection of aquatic life (WQG PAL) guidelines in the downstream surface water environments, including a potential for acute toxicity.

– *Potential Long-term Effects:* Fine tailings particles could potentially remain in suspension for an extended period of time, potentially resulting in chronic turbidity and facilitating downstream transport of contaminants associated with suspended particulate matter.

Potential water quality effects were considered in three parts:

– Hypothetical effects to Dixie Creek

– Hypothetical effects to the Chukuni River

- Hypothetical effects to Pakwash Lake.

5.2 RESULTS

5.2.1 IDENTIFICATION OF KEY PARAMETERS OF CONCERN

A focused subset of parameters was selected based on the maximum predicted concentrations in the TMF (WSP 2025e) and the likelihood that these concentrations would be greater than WQG PAL in the downstream environment under the hypothetical fair-weather failure scenario. The identification of key parameters also considered each parameter's toxicity, mobility and persistence in the environment.

For most parameters, TMF porewater is predicted to have poorer quality (higher concentrations of metals and cyanide) compared to TMF pond water (Table 5-1). To support this assessment, it has been conservatively assumed that waters released during the hypothetical fair-weather failure scenario are equivalent to the maximum predicted concentrations of TMF porewater during operations.

Key parameters were determined by comparing their concentrations in TMF porewater against WQG PAL criteria (recognizing that WQG PAL do not apply to TMF water quality and are referenced here solely to assist in identifying parameters of concern). The WQG PAL used in this assessment are presented in Table 5-2, noting that these guidelines are lower than the Ontario Drinking Water Standards, that are protective of human health. This targeted approach focuses the assessment on parameters that present the greatest potential risk and streamlines this screening-level evaluation. Based on that review, most parameters are less than WQG PAL (Table 5-1), indicating a low risk to the downstream receiving environment. The following parameters have the predicted concentrations greater than relative to WQG PAL criteria, and are considered further:

- Arsenic: 0.097 mg/L
- Cobalt: 0.039 mg/L
- Cyanide (free): 0.1 mg/L
- Phosphorus: 0.56 mg/L
- Sulphate: 1, 209 mg/L

The WQG PAL adopted by the provincial and federal governments for arsenic is 0.005 mg/L. WQG PAL are established such that they are protective of all aquatic species, whether present in the system or not, for all life stages, for a period of indefinite exposure. This PAL guideline for arsenic is dated 1997, and is based on the most sensitive species tested, an algal species wherein a growth inhibition effect was noted at a concentration of 0.05 mg/L to which a 10 times safety factor was added to generate the PAL value of 0.005 mg/L. A more recent assessment of arsenic toxicity to aquatic life has been carried out by Lee et al. (2019), using the species sensitivity distribution approach method currently used by the federal government. The more scientifically defensible WQG PAL arsenic value developed by Lee et al. (2019) is 0.077 mg/L. This criterion is higher than the maximum predicted TMF porewater arsenic concentration of 0.01 mg/L and arsenic is therefore considered not a driving factor in dam break risk to the environment.

The federal PAL guideline for cobalt is hardness dependent, but for typical waters with a hardness of less than 52 mg/L, the guideline is 0.00078 mg/L (Environment Canada 2017). A more recent and more scientifically defensible PAL guideline of 0.0018 mg/L is recommended by Stubblefield et al. (2020). Data presented by Stubblefield et al. (2020) show a median lethal concentration of 1.51 mg/L for the most sensitive fish species (rainbow trout) and 2.15 mg/L for the most sensitive invertebrate species (*Ceriodaphnia dubia*). Some algal species and duckweed show much greater sensitivity, with median lethal concentrations as low as 0.09 mg/L. These plant species drive the very low 2017 PAL guideline of 0.00078 mg/L. TMF pond effluent cobalt concentrations of 0.04 mg/L poses a limited risk to the vast majority of aquatic life, and is therefore not a driving factor in dam break risk to the environment.

The WQG PAL for free cyanide adopted by both the provincial and federal governments is 0.005 mg/L. As described above, WQG PAL are established such that they are protective of all aquatic species, whether present in the system or not, for all life stages, for a period of indefinite exposure. Acute toxicity effects to fish from exposure to free cyanide would be expected to occur at concentrations ranging from 0.020 mg/L to 0.076 mg/L (Eisler 1991). Acute toxic effects to aquatic invertebrates are expected to occur at free cyanide concentrations similar to those recorded for fish, notably from 0.030 mg/L to 0.10 mg/L (Eisler 1991). Thus, in considering potential toxicity effects, free cyanide is identified as a critical parameter to support this water quality assessment as the maximum cyanide concentrations of TMF porewater are 0.1 mg/L, above these thresholds. Further, unlike dissolved metals, many of which may exhibit reduced bioavailability under certain conditions (e.g., due to adsorption or precipitation), free cyanide remains highly soluble and readily bioavailable.

Total phosphorus concentrations of 0.6 mg/L do not pose a direct toxic risk to aquatic life, as plant, invertebrate and fish species are tolerant of exposures to phosphorus at concentrations well above 100 mg/L. The concern with elevated concentrations of total phosphorus is with indirect effects relating to algal blooms and the resultant potential for low water oxygen levels generated by bacterial consumption of organic detrital matter generated as a result of algal blooms. This is of concern for the bottom waters of deeper lakes that stratify, and for slow moving waterbodies under ice cover.

The tolerance of aquatic organisms to sulphate exhibits considerable variability across taxa. Most fish species demonstrate relatively high tolerance, with reported LC_{50} values generally exceeding 7,000 mg/L. Invertebrates tend to be more sensitive, with many species showing LC_{50} values around 2,000 mg/L; however, a subset of particularly sensitive taxa exhibit LC50 values as low as approximately 500 mg/L (Meays and Nordin 2013). Given this range of sensitivities, the potential for acute sulphate toxicity in the Chukuni River is expected to be negligible. Even under conservative assumptions, where mixed TMF porewater entering the river approaches the WQG PAL for sulphate, resulting concentrations would remain well below levels associated with acute lethality for the vast majority of aquatic species. As a result, an acute and chronic toxicity effect from sulphate in the Chukuni River is not anticipated.

When considering maximum parameters predicted in TMF porewater, free cyanide is identified as a critical parameter to support this water quality assessment which is discussed further in the subsections that follow. As discussed above, other parameters are predicted to be greater than WQG PAL, and though these constituents also pose ecological risks (such as chronic toxicity, bioaccumulation and eutrophication), their effects are generally less immediate compared to potential acute toxicity effects of cyanide. Similarly, bioavailability of metals is potentially reduced, as they may bind to sediments or precipitate under certain conditions during a TMF failure scenario reducing short-term bioavailability, whereas cyanide remains in solution and potential effects occur more rapidly.

5.2.2 POTENTIAL EFFECTS TO DIXIE CREEK WATER QUALITY

Dixie Creek downstream of the modelled dam breach inflow point is approximately 20 km in length and exhibits an approximate average width and depth of 12 m and 2 m, respectively, yielding an estimated standing water volume of approximately 500,000 m^3. To be very conservative, the fair-weather failure scenario has been assumed to occur under extreme low-flow conditions. Dixie Creek at the Tributary 3 inflow has a prorated 7-day average 20-year return low flow (7Q20) of 0.14 m^3/s, or 12,096 m^3/d (WSP 2022). This inflow rate is negligible compared to the standing water volume. Consequently, under the 7Q20 low flow condition, Dixie Creek can be effectively regarded as a static system (i.e., at this inflow rate it would take 41.3 days to displace the downstream creek volume under the 7Q20 low flow condition).

The approximately 3.6 Mm^3 of solids, pore water and pond water released in association with the hypothetical TMF south dam fair-weather scenario is more than sufficient to displace the entire downstream Dixie Creek volume, wherein creek water quality under a low flow condition would approximate TMF water quality, with a free cyanide concentration of 0.1 mg/L. At such concentrations, it would be expected that all, or nearly all, fish and aquatic invertebrates inhabiting Dixie Creek would be likely to succumb to acute toxic effects.

5.2.3 POTENTIAL EFFECTS TO THE CHUKUNI RIVER WATER QUALITY

The Chukuni River downstream of its confluence with Dixie Creek but upstream of Pakwash Lake, has a length of 2.2 km and exhibits average widths and depths of 100 m and 4.66 m, respectively, for a total reach volume of 1.025 Mm^3. To be very conservative, the fair-weather failure scenario has been assumed to occur under extreme low-flow conditions. Under a 7Q20 low flow condition of 1.8 m^3/s, the river would have an average velocity of 0.0039 m/s which is almost stagnant (i.e., behaving like a standing body of water).

Under the hypothetical fair-weather TMF south dam failure scenario, 2.2 Mm^3 of TMF water is released (Table 3-2). Assuming a free cyanide concentration of 0.1 mg/L for the TMF pond water, and a Chukuni River background concentration of <0.0001 mg/L, with a reach volume of 1.025 Mm^3, this would yield a theoretical peak Chukuni River free cyanide concentration of 0.068 mg/L. As stated above, acute toxicity effects to fish from exposure to free cyanide would be expected to occur at concentrations ranging from 0.020 mg/L to 0.076 mg/L (Eisler 1991). Thus, under this hypothetical scenario, concentrations of free cyanide could be lethal, or substantively lethal, to both fish and aquatic invertebrates in this section of the river. As free cyanide is inherently unstable and is readily volatized to the atmosphere under non-winter conditions or is converted to the much less toxic cyanate form, and cyanide within this section of the Chukuni River would be rapidly flushed from the reach during periods of higher river flows, recolonization of this section of the Chukuni River by fish and invertebrates from upstream river reaches would be expected to occur quickly. Concentrations would be expected to decrease to values approaching or less than the PAL guideline of 0.005 mg/L within a year or less of the breach event.

5.2.4 POTENTIAL EFFECTS TO PAKWASH LAKE WATER QUALITY

Pakwash Lake is a large waterbody, with a surface area of more than 98 km^2, average depth of 7.3 m, and a maximum recorded depth of 17.4 m. It has a watershed area of approximately 8,020 km^2 and receives inflows from the Chukuni River, Troutlake River, Lac Seul and Cedar River. The volume of water released under the hypothetical TMF south dam breach fair-weather scenario (including both pond water and pore water) would represent a small contribution relative to the overall water volume of background inflows and overall volume of Pakwash Lake.

At a maximum, immediately after the release, free cyanide concentrations at the Chukuni River inflow to Pakwash Lake could reach up to 0.068 mg/L, which is approximately 13 times greater than the PAL guideline. In this near-field area of the lake, water quality would be most influenced by TMF-sourced water, resulting in free cyanide levels higher than background conditions. At the time of the hypothetic breach, these elevated concentrations could pose temporary toxicity risks to fish and invertebrates in the vicinity of the inflow.

Water quality within the breach pulse is expected to improve rapidly with distance from the inflow. As the released water disperses into the main body of Pakwash Lake, it mixes with the substantially larger lake volume, reducing concentrations as it moves away from the Chukuni River outlet. In addition, free cyanide degrades relatively quickly in natural waters through processes such as volatilization, oxidation, and photodecomposition (e.g., Rangel-González et al. 2024). Together, these dispersion and degradation processes are expected to materially reduce concentrations over short distances. Short-term localized reduced water quality effects are possible near the Chukuni River outlet immediately following a breach, but natural degradation and natural mixing would lead to a steady and predictable improvement in water quality with increasing distance from the Chukuni River outlet, ultimately reducing concentrations to levels that would not be expected to pose ecological risk by water quality monitoring station PL-03, which is downstream of the Inlet of Troutlake River.

Table 5-1: Predicted TMF Water Quality in Operations

Parameter	Water Quality Guidelines for the Protection of Aquatic Life	Tailings Porewater [2]	TMF Pondwater [3]
pH	6.5 to 8.5	8.0	8.0
Aluminum	0.98	0.0091	0.0091
Antimony	0.07	0.037	0.029
Arsenic	0.005	0.0097 [1]	0.0091 [1]
Beryllium	0.011	0.0000047	0.0000056
Boron	1.5	0.046	0.044
Cadmium	0.000067	0.000023	0.000014
Calcium	-	131	105
Chloride	120	25	22
Chromium	0.0089	0.00097	0.00093
Cobalt	0.0009	0.034 [1]	0.026 [1]
Copper	0.005	0.0032	0.0028
Cyanide (WAD) [4]	0.005	0.1 [1]	0.1 [1]
Iron	0.8	0.018	0.017
Lead	0.012	0.00000016	0.00000016
Magnesium	-	6.2	5.6
Manganese	-	0.1	0.093
Mercury	0.000025	0.000008	0.0000078
Molybdenum	31	0.035	0.028
Nickel	0.025	0.00086	0.00078
Phosphorus	0.02	0.55 [1]	0.49 [1]
Potassium	-	28	25
Selenium	0.002	0.0031 [1]	0.0025 [1]
Silver	0.00025	0.000048	0.000046
Sodium	-	387	331
Sulphate	218	1,209 [1]	1,005 [1]
Thallium	0.008	0.000019	0.000016
Tungsten	0.03	0.0068	0.0053
Uranium	0.015	0.0039	0.0033
Vanadium	0.012	0.0024	0.0023
Zinc	0.03	0.0007	0.00069

Source: Mine Site Water Quality Model Report (WSP 2025e)

All concentrations are totals and all units are mg/L, except for pH (standard units)

- indicates no value available.

[1] Grey highlighted values are greater than identified WQG PAL, recognizing that PAL guidelines are applicable to downstream receiving waters only. The PAL guidelines are referenced here solely to assist in identifying potential parameters of concern.

2 Corresponds to predictions presented in Table 5-7 of WSP 2025e (TMF Seepage Water Quality, Operations Phase)

3 Corresponds to predictions presented in Table 5-3 of WSP 2025e (TMF Pond – Equilibrium -Operations Phase, maximum extent predictions, Year 24)

4 The Ontario PAL is for free cyanide; it is conservatively assumed here that WAD cyanide predictions for TMF water quality are equivalent to free cyanide.

Table 5-2: Water Quality Guidelines for the Protection of Aquatic Life

Parameter	Unit	Protection of Aquatic Life Guidelines (1,2,3,4,5,6)	
		Value	Source
pH	s.u. [1]	6.5 – 8.5	PWQO
Sulphate [6]	mg/L	218	BC WQG
Ammonia (as N)	mg/L	1.8	CCME
Ammonia, Un-ionized (as N)	mg/L	0.019	CCME
Chloride	mg/L	120	CCME
Nitrate (as N)	mg/L	3	CCME
Nitrite (as N)	mg/L	0.06	CCME
Cyanide, WAD	mg/L	0.005	PWQO
Aluminum	mg/L	0.98	FEQG
Antimony	mg/L	0.07	BC WQG
Arsenic [7]	mg/L	0.005	iPWQO
Boron	mg/L	1.5	CCME
Beryllium	mg/L	0.011	PWQO
Cadmium	mg/L	0.000067	CCME
Chromium [8]	mg/L	0.0089	iPWQO
Cobalt	mg/L	0.0009	iPWQO
Copper	mg/L	0.005	iPWQO
Iron	mg/L	0.8	FEQG
Lead	mg/L	0.012	FEQG
Mercury	mg/L	0.000026	CCME
Methylmercury	ng/L	4	CCME
Molybdenum	mg/L	31	SEQG
Nickel	mg/L	0.025	CCME
Phosphorus	mg/L	0.03 (rivers); 0.02 (lakes)	iPWQO
Selenium [9]	mg/L	0.002	BC WQG
Silver	mg/L	0.00025	CCME
Thallium	mg/L	0.008	CCME
Uranium	mg/L	0.015	CCME
Vanadium	mg/L	0.12	FEQG
Tungsten	mg/L	0.03	iPWQO
Zinc	mg/L	0.03	CCME

Notes:
s.u.: standard units

1. *Ontario Provincial Water Quality Objectives (PWQO) and interim PWQO (iPWQO).*
2. *Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life (long-term exposure).*
3. *Federal Environmental Quality Guidelines (FEQG); these are issued to support federal environmental quality monitoring and risk assessment for parameters for which CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future.*
4. *British Columbia long-term exposure guidelines, freshwater (BC WQG).*
5. *Saskatchewan Environmental Quality Guidelines (SEQG).*
6. *BC WQG are accessed here in the absence of available suitable Ontario or Federal guidelines (sulphate).*
7. *Existing arsenic concentrations in the Chukuni River (the receiving environment) are greater than available water quality guidelines; the most appropriate environmental benchmark is the baseline condition (75th percentile arsenic = 0.0096 mg/L).*
8. *There is no guideline for concentrations of total chromium; it is most common to adopt the PWQO and CCME guidelines for hexavalent (0.001 mg/L) or trivalent (0.0089 mg/L) chromium, dependent on-site conditions and in consultation with regulators.*
9. *BC WQG are accessed here as the CCME guideline is an alert concentration and only applicable to sensitive lacustrine environments (selenium).*

6 CONCLUSIONS

Hypothetical potential failure modes for each of the TMF dams were selected for fair-weather (all dams) and flood-induced conditions (south dam only). The following are the main conclusions:

- For a breach of the north dam, it is estimated that 0.9 Mm^3 of tailings could be released with an estimated volumetric solids content of 53%. The breach would result in flow across the regional transmission line corridor and would deposit tailings on Highway 105 and in Gullrock Lake.
- For a breach of the west dam, it is estimated that 0.7 Mm^3 of tailings could be released with an estimated volumetric solids content of 53%. The breach could result in flow across the transmission line corridor and could deposit tailings on Highway 105 and in Gullrock Lake.
- For a breach of the south dam:
  - Under fair-weather conditions, it is estimated that 3.6 Mm^3 of tailings and water could be released with an estimated volumetric solids content of 53% for the tailings. The water and tailings would enter Dixie Creek. The water would flow downstream, mixing with Dixie Creek waters and enter the Chukuni River. The tailings runout would end south of Unnamed Waterbody 6 and tailings would not be deposited in the Chukuni River or further downstream.
  - Under flood-induced conditions, it is estimated that 3.2 Mm^3 of tailings and water could be released with an estimated volumetric solids content of 13%. The combined water and tailings mix would enter Dixie Creek and would eventually enter the Chukuni River.
  - The Project design includes segregation and deposition of only desulphurized tailings in the TMF. This planned mitigation to improve water quality during operations and in the long term, would also benefit the unlikely hypothetical failure of a TMF dam. The tailings pore water and tailings water from the Great Bear Project TMF is of much higher water quality than would be the case for a TMF from a project that contained potentially-acid generating tailings. The water quality of the pulse of breach waters would improve through natural processes as it flows downstream and over time, including natural degradation and mixing.

7 CLOSING

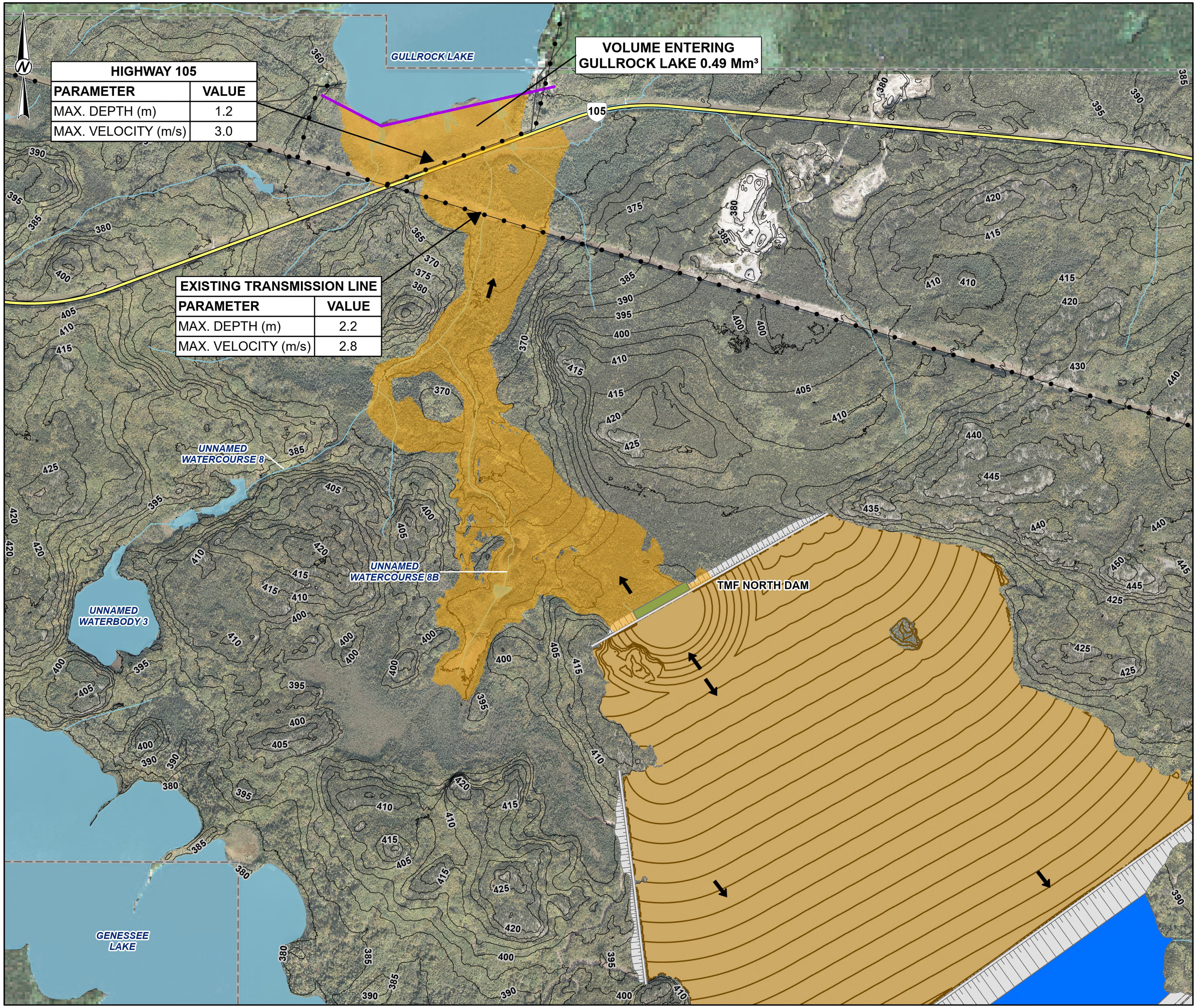
This report has been prepared for the exclusive use by the Great Bear Resources. This report is based on, and limited by, the interpretation of data, circumstances and conditions available at the time of completion of the work as referenced throughout the report. It has been prepared in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

This report and the tailings dam breach analysis herein, predicts hypothetical and extremely unlikely dam breach scenarios at the TMF. In no way is this report intended to suggest or indicate an expectation that the TMF dams may fail, nor does it indicate that any particular or general risk of failure has been identified.

8 REFERENCES

- British Columbia Ministry of Environment and Climate Change Strategy. 2019. Copper Water Quality Guideline for the Protection of Freshwater Aquatic Life-Technical Report. Water Quality Guideline Series, WQG-03-1. Prov. B.C., Victoria B.C.
- Canadian Dam Association (CDA). 2021. Technical Bulletin: “Tailings Dam Breach Analysis”, 2021.
- Eisler, R. 1991. Cyanide Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review Contaminant Hazard Reviews Report 23; Biological Report 85(1.23).
- Environment Canada. 2017. Federal Environmental Quality Guidelines: Cobalt.
- Klohn Crippen Berger (KCB). 2017. Mine Environment Neutral Drainage (MEND) Project. Study of Tailings Management Technologies. October 2017. MEND Report 2.50.1.
- Lake of the Woods Control Board. 2002. Winnipeg River Drainage Basin Schematic. https://www.lwcb.ca/schematic.html. Accessed April 2025.
- Lee, M-S., J-H. Lee, Y-J, An, C-H. Park, S-H. Lee, J-H., Park, J-R. Lee and T-J. Park. 2019. Development of water quality criteria for arsenic to protect aquatic life based on species sensitivity distribution. Ecotoxicology and Environmental Safety 189 (2020) 10933. Published by Elsevier Inc.
- Rangel-González, M. G., Solís-Domínguez, F. A., Herrera-Martínez, A., Carrillo-González, R., López-Luna, J., Angeles González-Chávez, M. del C., & Rodríguez, M. D. (2024). Cyanide biodegradation: A scoping review. International Journal of Environmental Science and Technology. https://doi.org/10.1007/s13762-024-05885-1 [link.springer.com]
- William A. Stubblefield, W.A, E. Van Genderen, A.S. Cardwell, D.G. Heijerick, C. R. Janssen, and K.A.C. De Schamphelaerec. 2020. Acute and Chronic Toxicity of Cobalt to Freshwater Organisms: Using a Species Sensitivity Distribution Approach to Establish International Water Quality Standards. Environmental Toxicology and Chemistry—Volume 39, Number 4—pp. 799–811.
- WSP Canada Inc. (WSP). 2022. Memo, Kinross Gold Corporation - Great Bear Project - Preliminary Hydrology Design Basis Memo (Rev0), October 19, 2022
- WSP. 2023. Great Bear Project - Dixie Creek Floodline Mapping Study. Kinross Gold Corporation. April 2023. OMGS21045.
- WSP. 2024. Great Bear Project – Tailings and Mine Waste Engineering - Pre-feasibility Study – Geotechnical Design of the Tailings, Mine Waste and Water Management Facilities. Kinross Gold Corporation. June 2024. OMGM2313.
- WSP. 2025a. Great Bear Project – Detailed Climate Change Dataset. Great Bear Resources. February 2025. CA0017226.8574-R-REV0.
- WSP. 2025b. Great Bear Tailings Rheology Measurements. Lab Report. Great Bear Resources. DRAFT. 31 July 2025. GTEX-FGT027-520-C-RPT-0001_RevB.
- WSP. 2025c. Great Bear Project – Mine Site Water Balance. Great Bear Resources. April 2025. OMEMA2303.
- WSP. 2025d. Great Bear Project – Hydrology Baseline Study. Great Bear Resources. DRAFT.
- WSP. 2025e. Great Bear Project – Mine Site Water Quality Modelling Report. November 2024.
- WSP. 2026. Great Bear Project – Tailings and Mine Waste Engineering – Failure Mode & Effects Analysis (FMEA) Report. Kinross Gold Corporation. January 2026. GTEX-FGT027-520-C-RPT-0003.
- Zengeni, B.T. 2016. Bingham Yield Stress and Bingham Plastic Viscosity of Homogeneous Non-Newtonian Slurries. Dissertation – Cape Peninsula University of Technology. October 2016.

Appendix A
Dam Breach Results Figures



LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPES
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LiDAR
- MAXIMUM INUNDATION EXTENT
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 11 m)
BREACH WIDTH = 250 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 150 300 600
1:15,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
NORTH DAM FAIR-WEATHER FAILURE: INUNDATION BOUNDARY

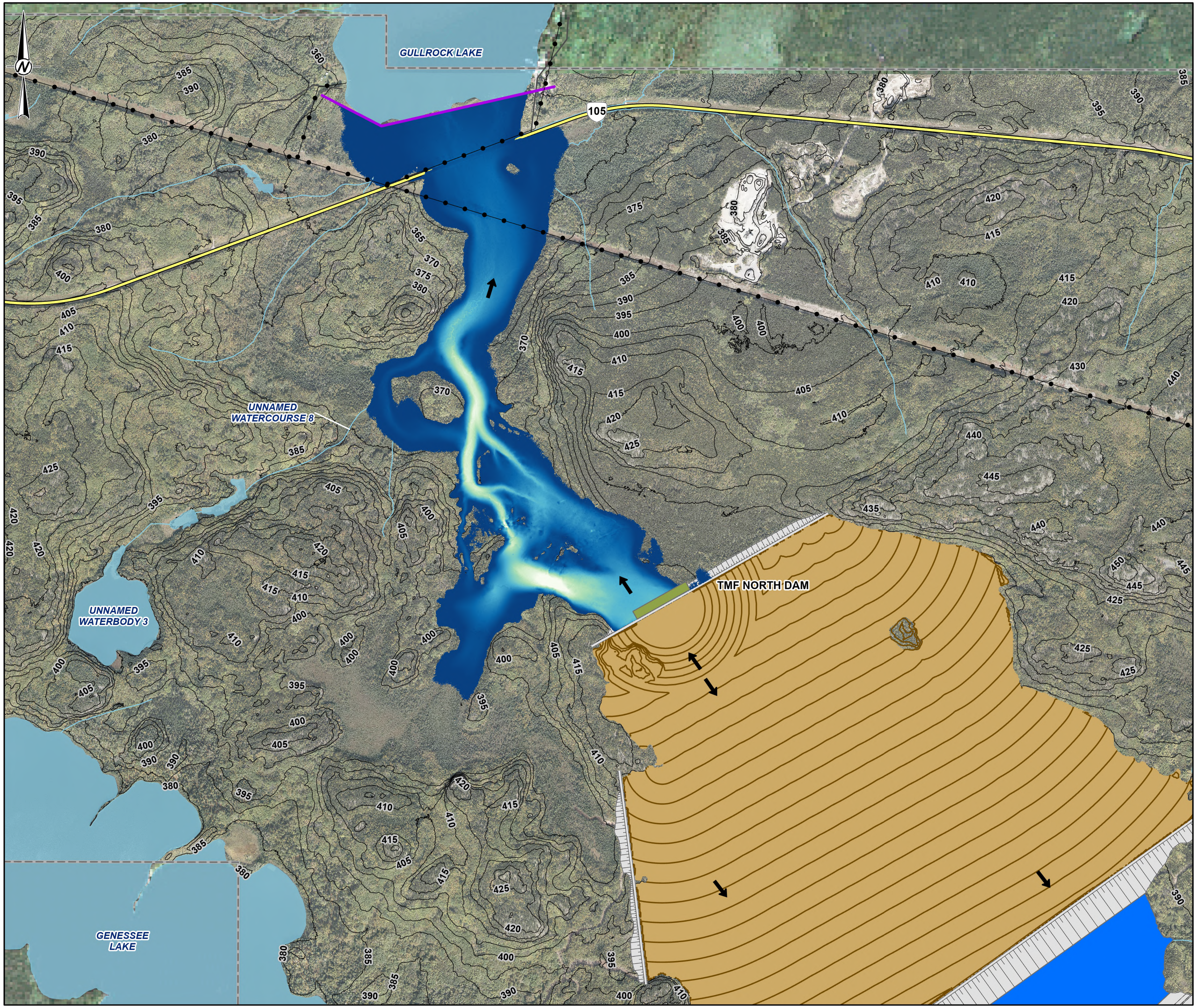
CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-1

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



LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPES
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LiDAR
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

DEPTH VELOCITY PRODUCT (m^2/s)

41.10

0

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 11 m)
BREACH WIDTH = 250 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 150 300 600

1:15,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

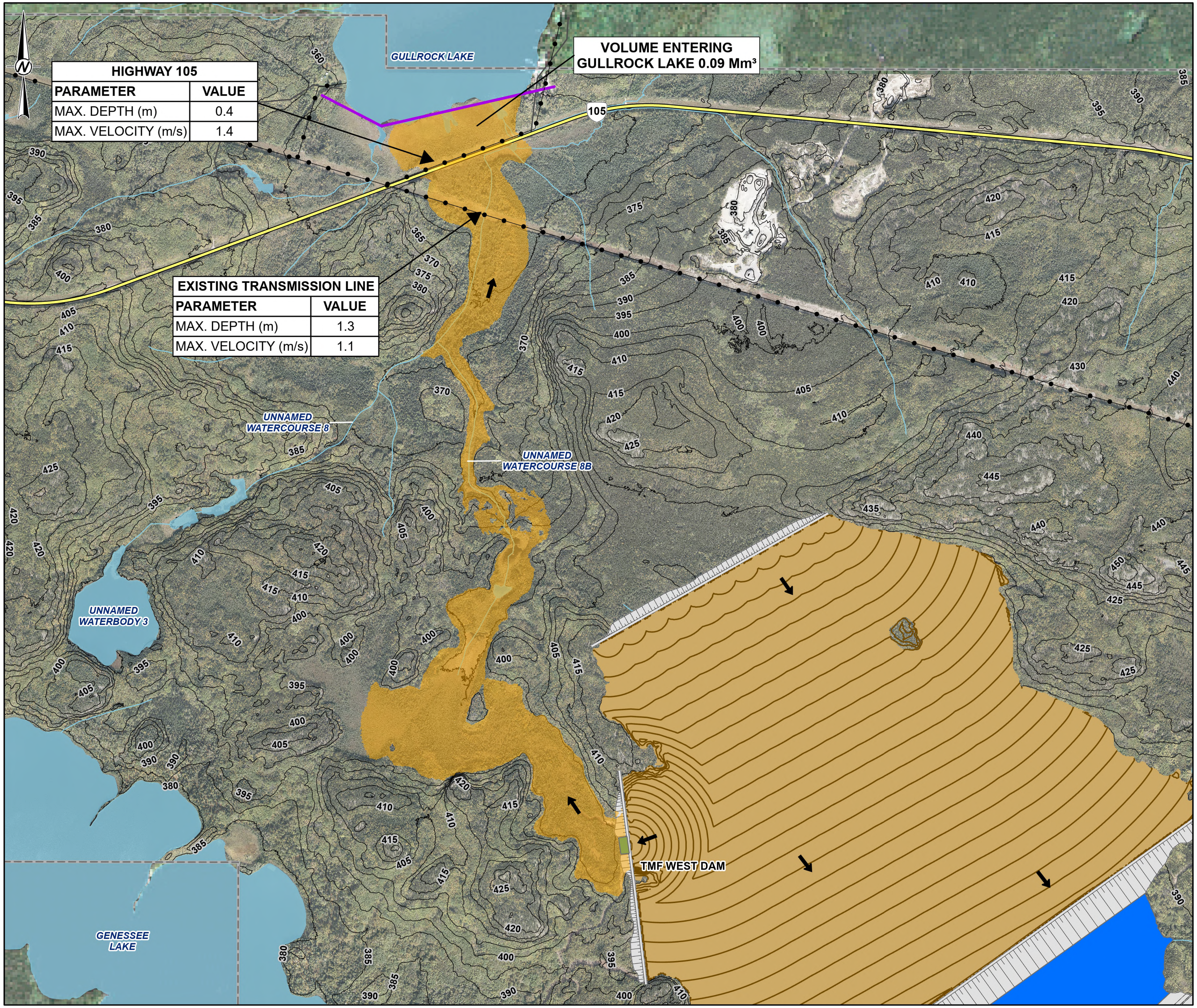
PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
NORTH DAM FAIR-WEATHER FAILURE: DEPTH VELOCITY PRODUCT

CONSULTANT

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-2



LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPES
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LiDAR
- MAXIMUM INUNDATION EXTENT
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH HEIGHT = VARIES (~11 m)
BREACH WIDTH = 30 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 150 300 600
1:15,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

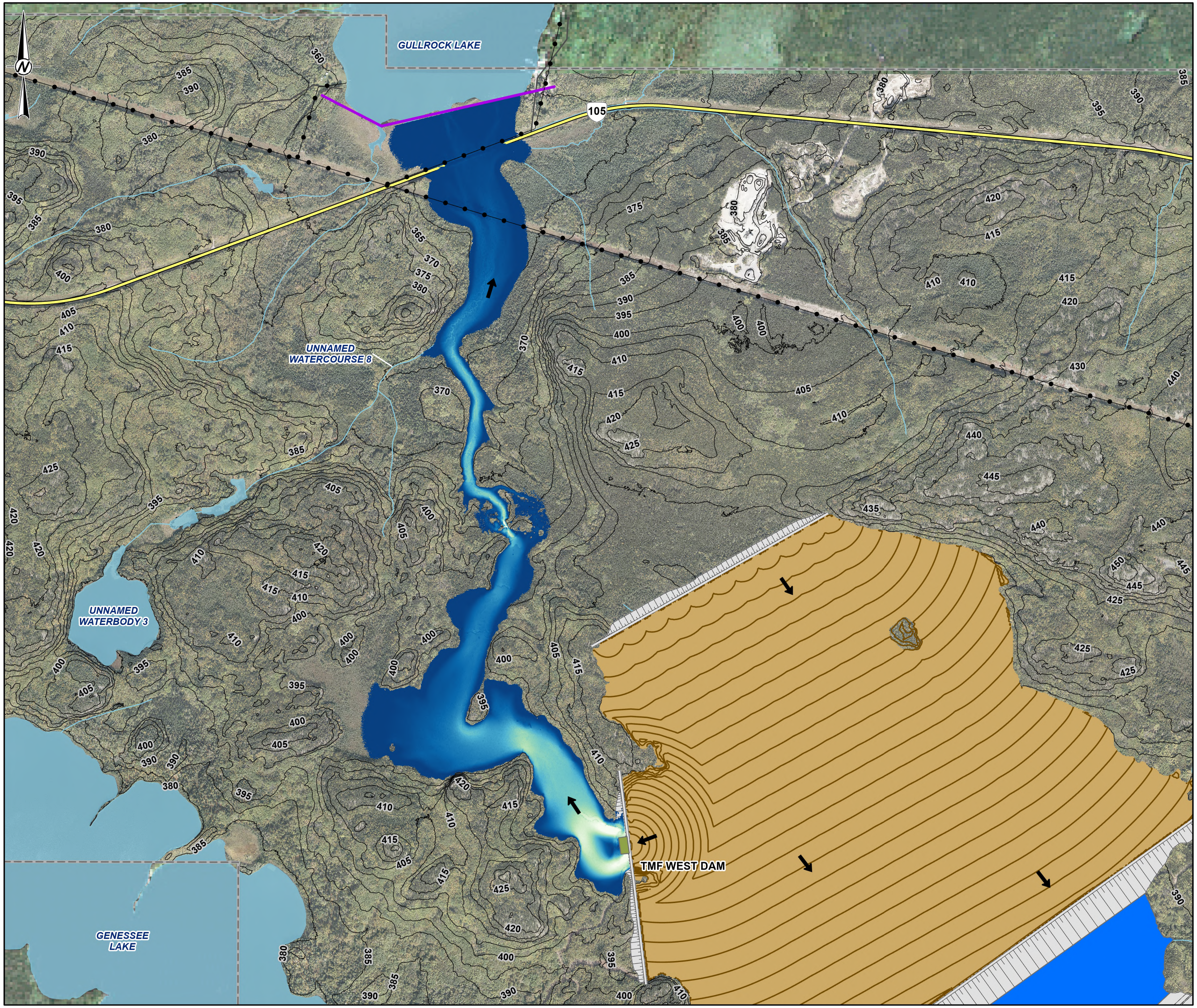
TITLE
WEST DAM FAIR-WEATHER FAILURE: INUNDATION BOUNDARY

CONSULTANT

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-3

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



LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPES
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

DEPTH VELOCITY PRODUCT (m^2/s)

15.55

0

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH HEIGHT = VARIES (~11 m)
BREACH WIDTH = 30 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 150 300 600

1:15,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

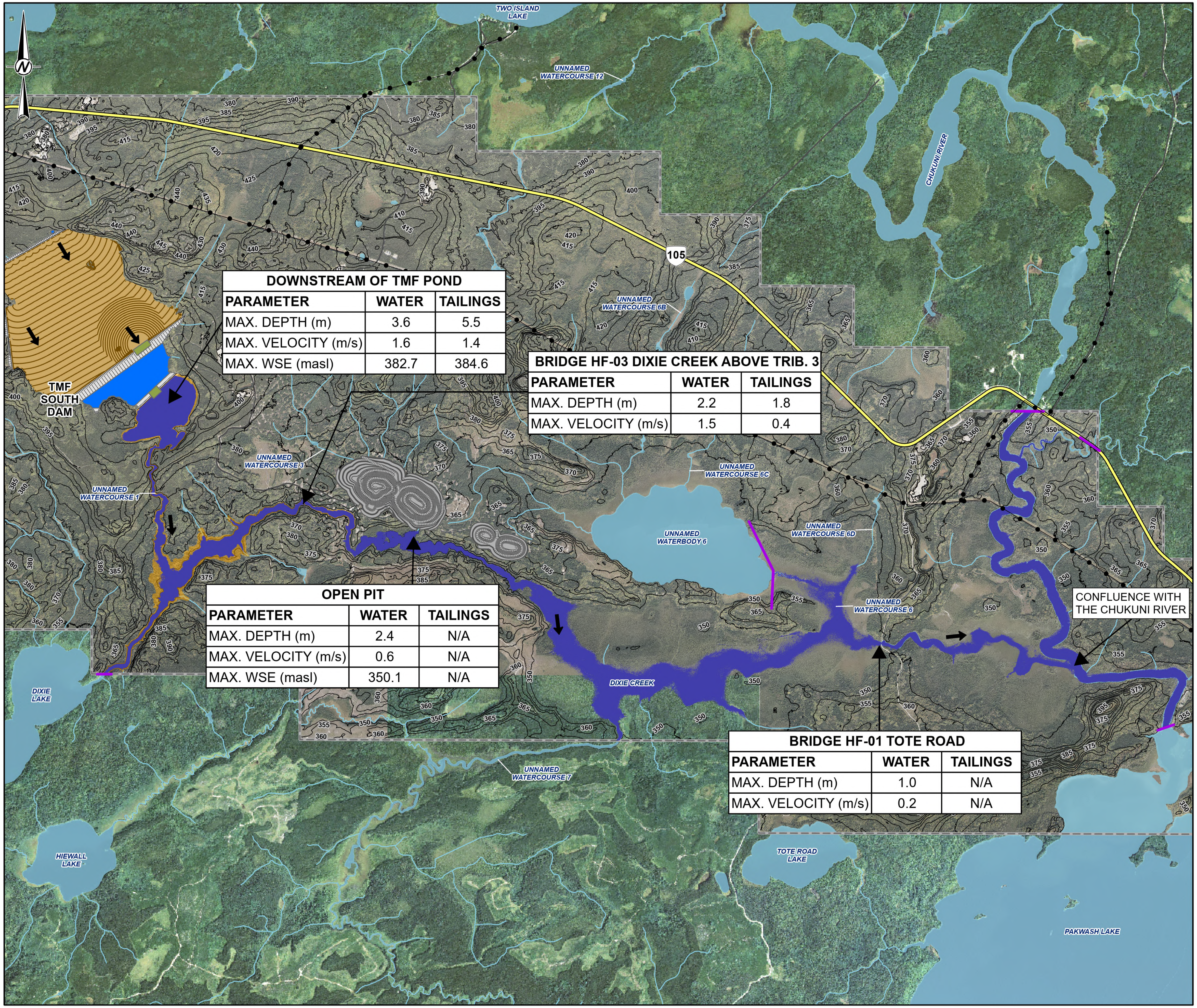
TITLE
WEST DAM FAIR-WEATHER FAILURE: DEPTH VELOCITY PRODUCT

CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-4



DOWNSTREAM OF TMF POND

PARAMETER	WATER	TAILINGS
MAX. DEPTH (m)	3.6	5.5
MAX. VELOCITY (m/s)	1.6	1.4
MAX. WSE (masl)	382.7	384.6

BRIDGE HF-03 DIXIE CREEK ABOVE TRIB. 3

PARAMETER	WATER	TAILINGS
MAX. DEPTH (m)	2.2	1.8
MAX. VELOCITY (m/s)	1.5	0.4

OPEN PIT

PARAMETER	WATER	TAILINGS
MAX. DEPTH (m)	2.4	N/A
MAX. VELOCITY (m/s)	0.6	N/A
MAX. WSE (masl)	350.1	N/A

BRIDGE HF-01 TOTE ROAD

PARAMETER	WATER	TAILINGS
MAX. DEPTH (m)	1.0	N/A
MAX. VELOCITY (m/s)	0.2	N/A

LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPE
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- MAXIMUM INUNDATION EXTENT (TAILINGS, NON-NEWTONIAN)
- MAXIMUM INUNDATION EXTENT (WATER, NEWTONIAN)
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- OPEN PIT
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 12 m)
BREACH WIDTH = 250 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 500 1,000 2,000
1:50,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
SOUTH DAM FAIR-WEATHER FAILURE: INUNDATION BOUNDARY

CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-5

LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPE
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- OPEN PIT
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

DEPTH VELOCITY PRODUCT (m²/s)

20.50

0

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 12 m)
BREACH WIDTH = 250 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

0 500 1,000 2,000

1:50,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
SOUTH DAM FAIR-WEATHER FAILURE: DEPTH VELOCITY PRODUCT (TAILINGS, NON-NEWTONIAN)

CONSULTANT

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-6

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

25mm

LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPE
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- OPEN PIT
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

DEPTH VELOCITY PRODUCT (m^2/s)

14.5

0

SCENARIO DESCRIPTION:
FAIR-WEATHER
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 12 m)
BREACH WIDTH = 250 m
YIELD STRESS = 103 Pa
VISCOSITY = 0.45 Pa.s

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

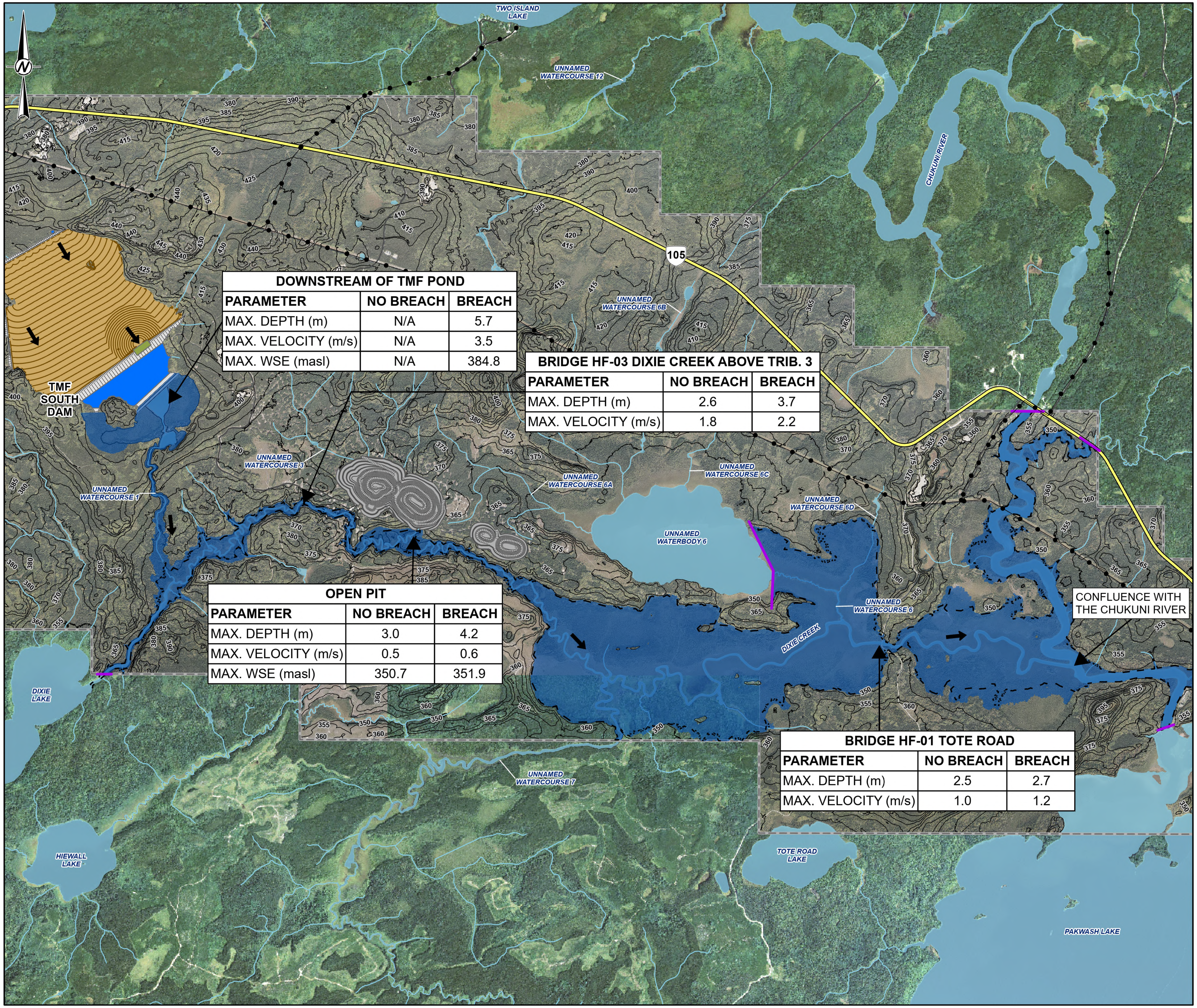
TITLE
SOUTH DAM FAIR-WEATHER FAILURE: DEPTH VELOCITY PRODUCT (WATER, NEWTONIAN)

CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-7



DOWNSTREAM OF TMF POND		
PARAMETER	NO BREACH	BREACH
MAX. DEPTH (m)	N/A	5.7
MAX. VELOCITY (m/s)	N/A	3.5
MAX. WSE (masl)	N/A	384.8

BRIDGE HF-03 DIXIE CREEK ABOVE TRIB. 3		
PARAMETER	NO BREACH	BREACH
MAX. DEPTH (m)	2.6	3.7
MAX. VELOCITY (m/s)	1.8	2.2

OPEN PIT		
PARAMETER	NO BREACH	BREACH
MAX. DEPTH (m)	3.0	4.2
MAX. VELOCITY (m/s)	0.5	0.6
MAX. WSE (masl)	350.7	351.9

BRIDGE HF-01 TOTE ROAD		
PARAMETER	NO BREACH	BREACH
MAX. DEPTH (m)	2.5	2.7
MAX. VELOCITY (m/s)	1.0	1.2

LEGEND
- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPE
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- MAXIMUM INUNDATION EXTENT (NO BREACH)
- MAXIMUM INUNDATION EXTENT (BREACH)
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- OPEN PIT
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

SCENARIO DESCRIPTION:
FLOOD-INDUCED
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 12 m)
BREACH WIDTH = 100 m

0 500 1,000 2,000
1:50,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
SOUTH DAM FLOOD-INDUCED FAILURE: INUNDATION BOUNDARY

CONSULTANT

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-8

LEGEND

- HIGHWAY
- LOCAL ROAD
- TAILINGS FAILURE SLOPE
- CONTOUR (5 M INTERVAL)
- STUDY LIMIT
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXTENT OF 2022 LIDAR
- TAILINGS MANAGEMENT FACILITY (TMF)
- TMF DAM
- TMF POND
- OPEN PIT
- BREACH LOCATION
- FLOW / SLOPE DIRECTION

DEPTH VELOCITY PRODUCT (m^2/s)

28.9

0

SCENARIO DESCRIPTION:
FLOOD-INDUCED
BREACH TO TOP OF STARTER DAM (BREACH HEIGHT = 12 m)
BREACH WIDTH = 100 m

0 500 1,000 2,000
1:50,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. CONTOURS ACQUIRED FROM 2022 LIDAR SURVEY.
3. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
5. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
6. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT
TAILINGS DAM BREACH ASSESSMENT

TITLE
SOUTH DAM FLOOD-INDUCED FAILURE: DEPTH VELOCITY PRODUCT

CONSULTANT

wsp

YYYY-MM-DD	2026-02-23
DESIGNED	----
PREPARED	MD
REVIEWED	RS
APPROVED	DM

PROJECT NO.	CONTROL	REV.	FIGURE
CA0031271.9255	0001	0	A-9

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