ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP NORTH CENTRAL (ATHABASCA AND FORT MCMURRAY DISTRICTS) 2025 SITE INSPECTION

Site #	Location	Name	Hwy	km
NC008	15.6 Km North of Hwy 63 & 55 Intersection	La Biche River (0.8 to 0.9 km North of Bridge)	63:02	15.6
Legal Description		**UTM Co-ordinates (NAD 83)**		
3-69-17 W4		12 N 6089536 E 403480		

	Date	PF	CF	Total
Previous Inspection:	June 4, 2024	11	4	44 (New Landslide)
Current Inspection:	May 14, 2025	11	4	44 (New Landslide)
Road WAADT:	4,270		**Year:**	2024
Inspected By:	José Pineda, Bruce Nestor (Thurber) Arthur Kavulok, Rishi Adhikari (TEC)			
Report Attachments:	☒ Photographs ☒ Plans ☐ Maintenance Items			

Primary Site Issue	An active landslide within the western side slope of the highway southbound lanes, causing a severe drop and deterioration to western half of the highway southbound lanes.
Dimensions:	About 90 m wide (parallel to the highway alignment) and 40 m long (perpendicular to the highway alignment).
Site History:	The current landslide area (NC008-2) is to the south of the NC08-1 landslide site, which was repaired in the fall of 1997. Available information suggests that this stretch of the highway (along previous Highway 63 lanes prior to the implementation of the twinning project) has been showing slide movements since 1987. Initial attempts in the year 1990 to improve the highway condition consisted of the installation of a cut-off drain along the east side of the highway with the intention of intercepting the seepage from the swampy area to the east. However, after some time this drain was covered with silt and became non-functional. A subsequent attempt to repair the slide consisted of the installation of a centre line culvert in 1996 to allow runoff water from the east swampy area to drain out toward the oxbow lake. During the fall of 1997, additional repairs were conducted at the NC008-1 site. The repair consisted of (a) excavating and replacing a 100 m long section of the roadway with compacted clay and granular backfill, (b) placing a 600 mm thick granular drainage layer below replacement zone to reduce pore pressure build up, (c) constructing a 230 m long toe berm along the toe of the slope to the south of the ALPAC road, (d) regarding the east ditch and installing a 900 mm diameter culvert across ALPAC road to the north of the site, and (e) abandoning centre line culverts below original highway 63. The highway was twinned between 2014 and 2015 and the old highway, where previous and current instabilities took place, became the new southbound lanes of the current highway. There is a new centerline culvert (Culvert C2) below the southbound lanes that may

	have been installed during the highway twinning projects. It also appears that the OH powerlines may have been relocated to the west side of the southbound lanes during the implementation of the highway twinning project. A geotechnical investigation, consisting of drilling three test holes along with the installation of a slope inclinometer and four piezometers, was completed in 2020. The test holes indicated that the stratigraphy within the slope consists of 3 to 4 m of high plastic clay fill underlain by a high plastic firm clay foundation to 21 m depth. The native clay was noted to be stiffer 14 to 16 m below existing ground surface.
Maintenance/Repairs:	Cracks were spray patched by TEC in 2020; the beaver dam to the north of the culvert C1 outlet location and beaver dam 1 to the east of the culvert inlet location were cleared by the County in 2020. ACP patch was placed in 2022 along the section of the highway being impacted by landslide movement. The southbound lanes at the project site were overlaid with ACP in the fall of 2024 as part of a wider overlay project in the area. The debris in front of the inlet to Culvert C1 was removed shortly before the 2025 inspection.

Observations:	**Description**	**Worse?**
☒ Pavement Distress	New landslide (NC008-2): reflective landslide cracks through the ACP overlay up to 40 mm wide in the middle portion of the highway southbound lane. No drop noticeable in the slide area after the placement of the 2024 ACP overlay.	☐
☒ Slope Movement	New landslide (NC008-2): Multiple reflective head scarp cracks reappeared shortly after the 2022 ACP patch; toe bulge in the oxbow lake continues to narrow the oxbow lake at the landslide location. A new crack or settlement area 100 mm wide, 150 mm deep and approximately 20 m long was noted within the northern portion of the slide mass during the current inspection.	☐
☐ Erosion		☐
☒ Seepage	Oxbow lake downslope of the highway; water levels appear similar to 2024 inspection.	☐
☐ Bridge/Culvert Distress		☐
☒ Other	Three beaver dams were previously noted within the Oxbow Lake. Beaver Dam 1 was cleared in 2020; Beaver rebuilt NE corner of Dam 2 after 2023 inspection. Beaver Dam 3 has been exposed since 2022. A new beaver dam (Dam 1A) was noted near the start of the east-west running drainage channel at the north end of the oxbow lake.	☐

Instrumentation Readings (1 SI, 1 SPs, Spring 2025):

SI1B showed a rate of movement of 2.4 mm/yr over 4.8 m to 8.4 m depth since the fall of 2024 readings. SI20-2 was found to be damaged during the fall of 2024 readings and no data could be obtained.

Standpipe piezometer SP20-1 showed a groundwater depth of 1.65 m, corresponding to a decrease in groundwater level of 0.22 m since the fall of 2024 readings.

Assessment and Observations (Refer to attached Figures and Photos)**:**

The site condition has not changed significantly since the 2024 site inspection visit, except for the ACP overlay placed in the fall of 2024, extending throughout and beyond the site limits, which has covered much of the previously noted pavement cracking and distress.

Fill placement on the top of the weak high plastic clay foundation and high groundwater levels within the clay fill and native clay are the main triggers for the landslide movement. It is likely that the presence of beaver dams within the oxbow lake resulted in high ground water levels within the landslide mass and aggravated the situation in the past.

The observed water levels in the oxbow lake between 2022 and 2025 were much lower than in the past, and this appears to have reduced the rate of movement of the landslide over the past few years.

The ACP overlay placed in the fall of 2024 has improved the highway driving condition within the NC008-2 landslide area. However, landslide cracks are beginning to reflect on the highway surface and these cracks are expected to get worse and will contribute to faster deterioration of the highway surface condition until long-term repairs take place.

Although the new landslide is currently creeping, accelerated landslide movement may occur in the future resulting in a lane closure. Power and phone services may also get impacted by additional landslide movements.

Recommendations:

This site should be visited again in the spring of 2026.

In the short term, the local MCI should:

(a) Monitor the highway surface periodically for signs of distress and watch closely for the development of additional cracks and highway dip (particularly after prolonged rainfall events). The highway surface cracks at NC008-2 location should be sealed to prevent surface water infiltration into the landslide mass.

(b) Consider removing all beaver dams within the oxbow lake to further reduce water levels within the highway embankment.

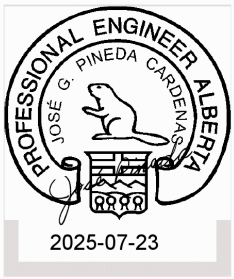
Based on a preliminary engineering assessment prepared by Thurber in 2024, TEC has selected a long-term repair option consisting of two rows of driven steel pile walls parallel to the highway alignment. The estimated cost to construct the pile walls is in the range of $3,500,000.

Closure

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement for Use and Interpretation of Report.

Yours very truly,
Thurber Engineering Ltd.
José Pineda, M.Eng., P.Eng.
Associate | Senior Geotechnical Engineer

July 22 2025



2025-07-23

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.

RM SIGNATURE: _____

RM APEGA ID #: 91085

DATE: July 23, 2025

PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Bruce Nestor, M.Eng., P.Eng.
Geotechnical Engineer

THURBER

STATEMENT FOR USE AND INTERPRETATION OF REPORT

1. STANDARD OF CARE

This Report has been prepared in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality and in compliance with all applicable laws.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment, including this Statement For Use and Interpretation of Report, are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT, AS DESCRIBED ABOVE. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TOTHE WHOLE OF THE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives, and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client for the development, design objectives, and/or purposes described to Thurber by the Client. **NO OTHER PARTY MAY USE OR RELY ON THE REPORT OR ANY PORTION THEREOF FOR OTHER THAN THE CLIENT'S BENEFIT IN CONNECTION WITH THE PURPOSES DESCRIBED IN THE REPORT**. Any use which a third party makes of the Report is the sole responsibility of such third party and is always subject to this Statement for Use and Interpretation of Report. Thurber accepts no liability or responsibility for damages suffered by any third party resulting from use of the Report for purposes outside the reasonable contemplation of Thurber at the time it was prepared or in any manner unintended by Thurber.

5. INTERPRETATION OF THE REPORT

a) **Nature and Exactness of Soil and Contaminant Description:** Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors is inherently judgement-based. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other parties making use of such documents or records with or without our express written consent need to be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other parties. Some conditions are subject to change over time and those making use of the Report need to be aware of this possibility and understand that the Report only presents the interpreted conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client must disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

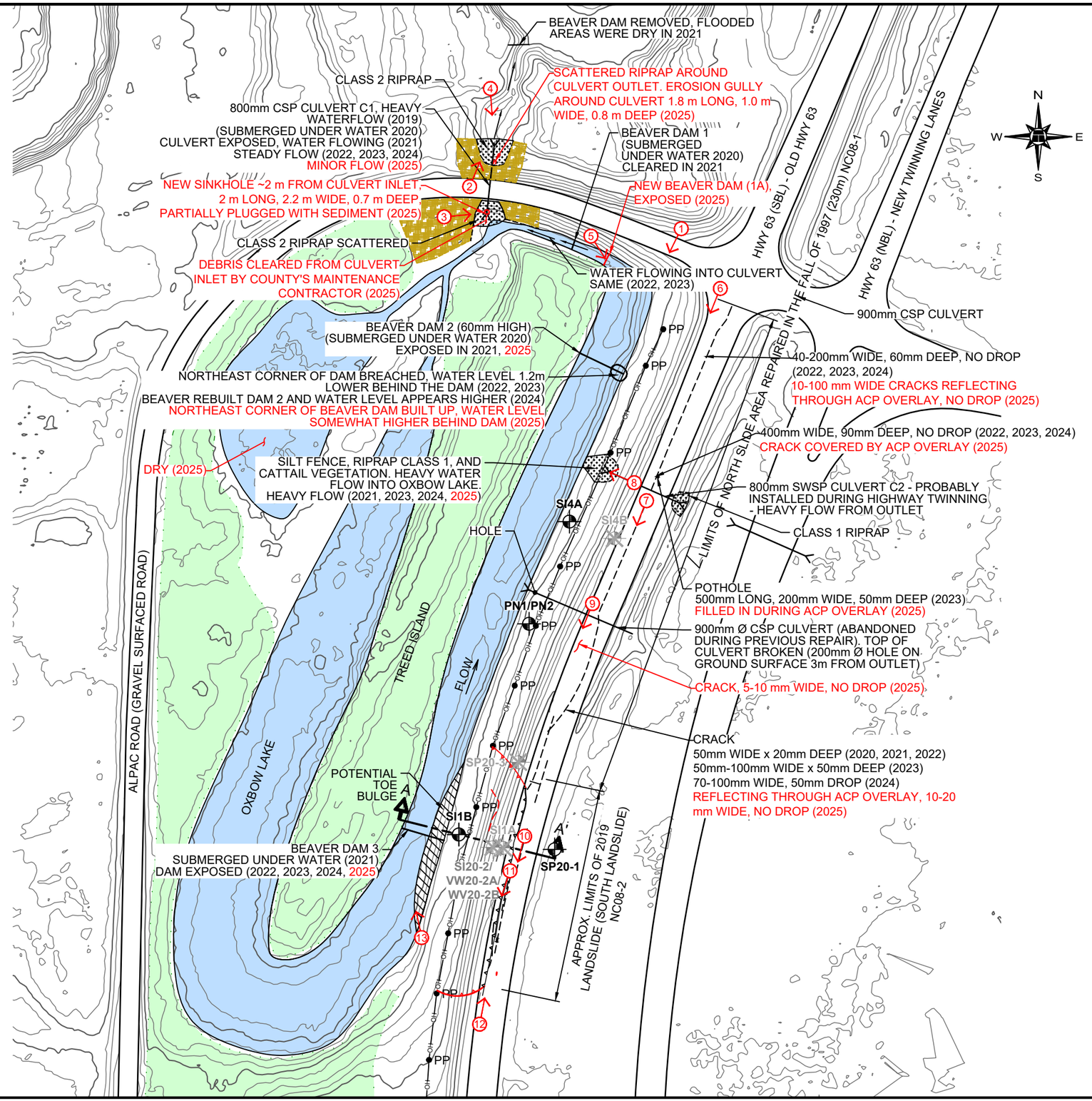
b) **Reliance on Provided Information:** The evaluation and conclusions contained in the Report have been prepared based on conditions in evidence at the time of site inspections and based on information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report resulting from misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other parties providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) **Design Services:** The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber is recommended to be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design need to be reported to Thurber immediately so that Thurber can address potential conflicts.

d) **Construction Services:** During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or other parties who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes, but is not limited to, decisions made to develop, purchase, or sell land, unless such decisions expressly form part of the stated purpose of the Report as described in Paragraph 3.



LEGEND

- APPROXIMATE TEST HOLE LOCATION
- SI — SLOPE INCLINOMETER
- VW — VIBRATING WIRE PIEZOMETER
- SP — STANDPIPE PIEZOMETER
- DESTROYED INSTRUMENT
- ACTIVE LANDSLIDE SCARP CRACK
- CRACK
- 540 — GROUND SURFACE CONTOUR
- OH — OVERHEAD POWERLINE
- PP — POWER POLE
- CULVERT
- EROSION CONTROL BLANKET
- APPROXIMATE DIRECTION AND NUMBER OF PHOTO

NOTES:

1. SITE FEATURES ARE APPROXIMATE
2. TOPOGRAPHY IS BASED ON 2008 LIDAR DATA
3. MAY 14, 2025 OBSERVATIONS SHOWN IN RED
4. OVERHEAD POWERLINES WERE RELOCATED TO THE WEST SIDE OF THE OLD HIGHWAY 63 DURING HIGHWAY TWINNING PROJECT
5. HIGHWAY SOUTHBOUND LANES WERE OVERLAID WITH ACP IN FALL 2024

0 20 40 60 80 100 120m

SCALE 1:2000

Alberta

NORTH CENTRAL REGEON
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2025 GEOHAZARD ASSESSMENT

NC008: HWY 63:02 LA BICHE RIVER (km 15.6)
SITE PLAN SHOWING EXISTING FEATURES

FIGURE NC008-A

DRAWN BY	ML
DESIGNED BY	JGP / BWN
APPROVED BY	TSA
SCALE	1:2000
DATE	JUNE 2025
FILE No.	32122

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G:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\2025 GEO HAZARD\32122 NC008-A~C.dwg - 2 - Jul. 22, 2025

TREED ISLAND

FLOW

OXBOW LAKE

SOLID WHITE LINE

POTENTIAL EXTENT OF 2019 LANDSLIDE

HWY 63

EDGE OF HWY

LIMITS OF NORTH SLIDE REPAIRED IN THE FALL OF NC08-1

SP20-3

CRACK 10-20mm WIDE, NO DROP UP TO 100mm WIDE (2022, 2024)

CRACK 300mm WIDE x 30mm DROP (2020) SAME IN 2021

POTENTIAL TOE BULGE

CRACK OR POSSIBLE SETTLEMENT, 100 mm WIDE, UP TO 150 mm DEEP, WELL VEGETATED (2025)

500mm WIDE x 60mm DROP(2020)
500mm WIDE x 30mmDROP (2021, 2022)
30mm-50mm WIDE, 10mm DROP (2023, 2024)
REFLECTING THROUGH OVERLAY, 10-20 mm WIDE, NO DROP (2025)

BEAVER DAM 3
SUBMERGED UNDER WATER (2021)
DAM EXPOSED (2022, 2023, 2024, 2025)

CRACK 22m LONG,
25mm WIDE, NO DROP (2020)
40mm WIDE, NO DROP (2021, 2022)
20mm-40mm WIDE, <10mm DROP (2023)
REFLECTING THROUGH OVERLAY, 5-10 mm WIDE, NO DROP (2025)

SI1B

SI20-2/ VW20-2A/ WV20-2B

SI1A

SP20-1

100mm WIDE x 60mm DROP (2020)
100mm WIDE x 30mm DROP (2021, 2022)
20mm - 30mm WIDE, <10mm DROP (2023)
30-40mm WIDE, NO DROP (2024)
REFLECTING THROUGH OVERLAY 10-50 mm WIDE, NO DROP (2025)

APPROX. LIMITS OF 2019 LANDSLIDE (SOUTH LANDSLIDE) NC08-2

300mm WIDE x 50mm DROP (2020)
500mm WIDE x 50mm DROP (2021, 2022)
20mm - 30mm WIDE, NO DROP (2023, 2024)
REFLECTING THROUGH ACP OVERLAY, 10-40 mm WIDE, NO DROP (2025)

30mm WIDE (2020)
30 - 60mm WIDE (2021, 2022)
NOT VISIBLE (2023)
40-60mm WIDE, 10mm DROP (2024)
REFLECTING THROUGH ACP OVERLAY, 10-20 mm WIDE, NO DROP (2025)

POT HOLE (2.2m LONG x 400mm WIDE x 120mm DEEP)
SAME IN 2022
NOT VISIBLE (2023)
COVERED BY ACP OVERLAY (2025)

30 - 50mm WIDE,
NO DROP (2020, 2021)
30 - 70mm WIDE, NO DROP (2022)
30 - 70mm WIDE, UP TO 10mm DROP (2023, 2024)
REFLECTING THROUGH ACP OVERLAY, LESS THAN 15 mm WIDE (2025)

NEW POTHOLE (POSSIBLY DUE TO POOR QUALITY OVERLAY), 100 mm WIDE, 50 mm DEEP AND 0.8 m LONG (2025)

POTENTIAL EXTENT OF 2019 LANDSLIDE

PP

A

A'

N
W
E
S

LEGEND

- APPROXIMATE TEST HOLE LOCATION
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0 5 10 15 20 25 30m
SCALE 1:500

Alberta

NORTH CENTRAL REGEON
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2025 GEOHAZARD ASSESSMENT

NC008: HWY 63:02 LA BICHE RIVER (km 15.6)
SITE PLAN SHOWING THE SOUTH SLIDE AREA

FIGURE NC008-B

DRAWN BY	ML
DESIGNED BY	JGP / BWN
APPROVED BY	TSA
SCALE	1:500
DATE	JUNE 2025
FILE No.	32122

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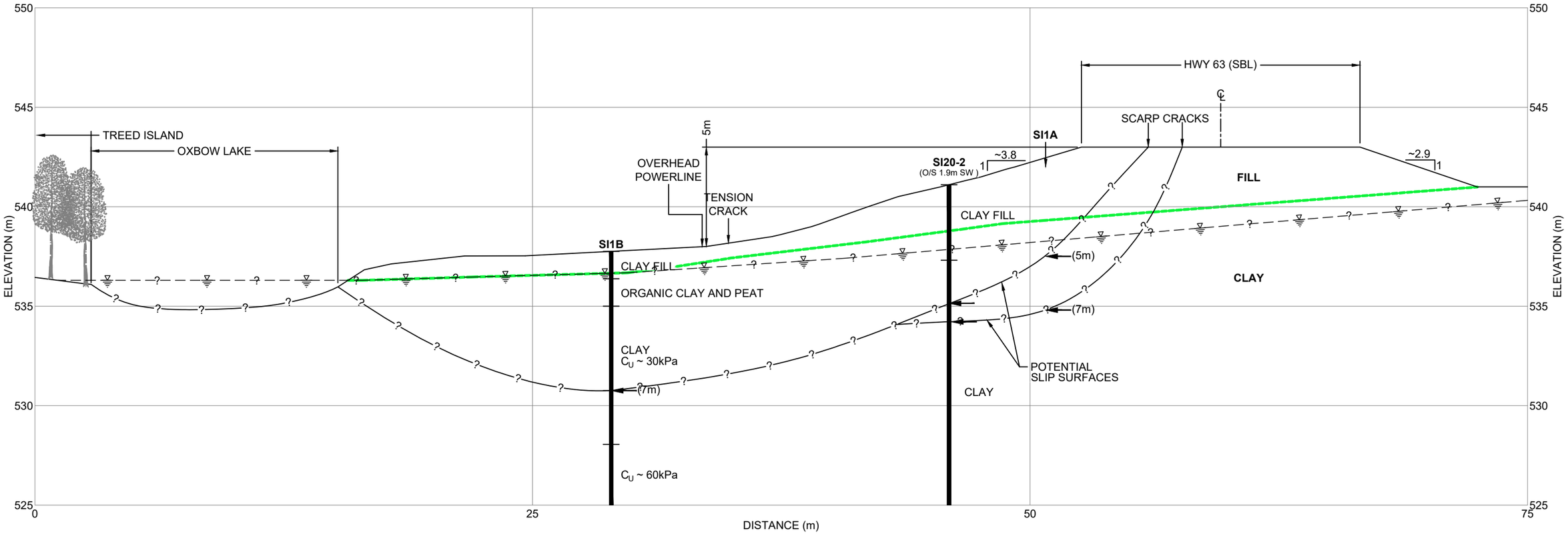
WEST

SECTION A-A'

EAST



LEGEND

C_U UNDRAINED SHEAR STRENGTH BASED ON POCKET PENETROMETER

←(7m) ZONE OF MOVEMENT IN SLOPE INCLINOMETER (DEPTH)

POTENTIAL PIEZOMETRIC SURFACE

NOTES:

1. CROSS-SECTION IS APPROXIMATE, BASED ON 2008 LIDAR DATA AND JULY 3, 2019 OBSERVATIONS
2. SI1A STRATIGRAPHY IS NOT AVAILABLE

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NORTH CENTRAL REGEON (ATHABASCA AND FORT MCMURRAY DISTRICTS) 2025 GEOHAZARD ASSESSMENT

NC008: HWY 63:02 LA BICHE RIVER (km 15.6) CROSS-SECTION A-A'

FIGURE NC008-C

DRAWN BY	ML
DESIGNED BY	JGP / BWN
APPROVED BY	TSA
SCALE	1:200
DATE	JUNE 2025
FILE No.	32122

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Photo 1. Looking south at Oxbow Lake. Beaver Dam 2 visible towards center of photo. Water levels behind and in front of the dam appear similar to levels noted in the 2024 inspection.

Photo 2. Looking north at Culvert C1 outlet. Water is freely flowing through the culvert and along the channel.

Photo 3. Looking northeast towards the inlet of CSP Culvert C1. Debris has been removed from the culvert inlet since the 2024 inspection.

Photo 4. Steady water flow from Culvert C1 outlet (though noticeably less than during 2024 inspection). Bottom of culvert barrel is severely corroded at outlet.

Photo 5. New beaver dam 1A at north end of Oxbow Lake

Photo 6. Looking south at highway within the limits of the area repaired in 1997 (previously known as NC08-1). Highway was overlaid in September 2024, but reflective cracks (10-100 mm wide, no drop) are visible through the new ACP.

Photo 7. Looking south at highway within the limits of the NC08-1 repaired area. Reflective cracks are visible through the ACP overlay area.

Photo 8. Looking at the outlet of the 900 mm SWSP C2 Culvert outlet. Lighter flow than noted in the 2024 inspection.

Photo 9. Looking south at the southern flank cracks of the NC08-1 repaired landslide.

Photo 10. Looking at the northern flank of the new landslide (NC08-2). Previous ACP patch is no longer visible (new ACP overlay completed September 2024). Reflective cracks 10-20 mm wide are visible in the ACP overlay.

Photo 11. Looking south at middle section of the NC08-2 landslide. Reflective cracks 5-10 mm wide are visible in the recent ACP overlay.

Photo 12. Looking north at southern flank of NC08-2 landslide. Hairline cracks are visible through the recent ACP overlay.

Photo 13. Looking north at landslide toe bulge. Beaver Dam 3 is visible at the left of the photo.