

**ALBERTA TRANSPORTATION AND  
ECONOMIC CORRIDORS GRMP  
NORTH CENTRAL (ATHABASCA AND FORT  
MCMURRAY DISTRICTS)  
2024 SITE INSPECTION**



<b>Site Number</b>	<b>Location</b>	<b>Name</b>		<b>Hwy</b>	<b>km</b>
NC006	11 Km East of Slave Lake	Mitsue Recreation Area		2:46	47.33
<b>Legal Description</b>		<b>UTM Co-ordinates (NAD 83)</b>			
NW-7-72-4-W5M		11	N 6122200	E	651552
	<b>Date</b>	<b>PF</b>	<b>CF</b>	<b>Total</b>	
<b>Previous Inspection:</b>	May 16, 2023	14	5	70	
<b>Current Inspection:</b>	June 3, 2024	14	5	70	
<b>Road WAADT:</b>	2,480	<b>Year:</b>		2023	
<b>Inspected By:</b>	José Pineda, Tarek Abdelaziz (Thurber) Arthur Kavulok, Gordon Wolters, Rocky Wang (TEC)				
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items				
<b>Primary Site Issue</b>	Active landslide causing severe deterioration to highway conditions.				
<b>Dimensions:</b>	About 80 m wide (parallel to the highway alignment) and 60 m long (perpendicular to the highway alignment)				
<b>Site History:</b>	<p>In the Spring of 2019 Mr. Gordon Wolters, local MCI of TEC, noticed a sudden severe depression on the highway surface. TEC requested Thurber to conduct a call out.</p> <p>During Thurber's inspection on June 10, 2019, it became clear that the current landslide area is adjacent to a previously repaired landslide in 2007 (previously known as NC06-1).</p> <p>The repairs at the NC06-1 site included the installation of surface and sub-surface drainage improvement measures and the construction of a toe berm to stabilize the landslide movement. The drainage improvement measures consisted of installing sub-drains, constructing a riprap lined swale, flushing, and tying older sub-horizontal drains to a drainage collection manhole at the bottom of the slope. The site NC06-1 was inspected by Thurber as part of the GRMP until 2012 when it was determined that the 2007 remedial measures appeared to have mitigated the slope movement. The instruments installed at the old landslide site are not read under the current GRMP.</p> <p>In 2020, Thurber installed geotechnical instruments, consisting of slope inclinometers and vibrating wire piezometers, within the active landslide area to assess depth of movement and soil and groundwater conditions. These instruments are currently read under the GRMP.</p> <p>In 2024, existing underground fiber optic communication lines on both sides of the highway were relocated to avoid conflict with designed remedial measures at this site.</p>				
<b>Maintenance</b>	ACP patch placed in 2021 on the west bound lane covering most of the landslide impacted section of the highway.				

Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	25 mm dip noted on the middle portion of the 2021 ACP patch.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Reflective landslide cracks within the 2021 ACP patch area continue widening; diagonal cracks within the landslide area are up to 100 mm wide with up to 25 mm drop across the crack surfaces; multiple tension cracks on the north side slope; guardrail displaced laterally by approximately 300 mm to the north (middle section of the landslide); titling and bent trees in the bush; distinct toe roll near the bush line within the middle section of the landslide	<input checked="" type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Ponding water observed at 800 mm CSP culvert outlet	<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	800 mm CSP culvert outlet was damaged; restricted water flow from culvert outlet due to sediment accumulation	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	Settlement of drill benches, constructed in the winter of 2020 to install geotechnical instruments, created severe open cracks in the highway side slope; the upper settlement crack is about 900 mm from the highway guardrail	<input type="checkbox"/>
<b>Instrumentation Readings (4 SIs and 7 VWs):</b>		
SI20-1, installed in the south ditch of the highway, and SI20-4, installed further downslope of the potential toe of the active landslide, continued to show no discernable movement.		
SI20-2 and SI20-3 installed within the extent of the active landslide have shown movements within the upper 3 m. SI20-2, installed near the crest of the highway north embankment, showed a rate of movement of 24 mm/yr in the spring of 2024. SI20-3, installed immediately to the east of the bush line downslope of SI20-2, showed a rate of movement of 3.1 mm/yr in the spring of 2024.		
The vibrating wire piezometers showed groundwater depths ranging from 1.9 m in VW20-4A to 7.9 m in VW20-1 in the spring of 2024.		
<b>Observations and Assessment (Refer to attached Figures and Photos):</b>		
The site condition has slightly deteriorated since the 2023 inspection.		
The embankment fill at this location was built on a landslide terrain. The deterioration of the highway condition is due to the retrogression of the ancient landslide towards the highway surface. The active movement at this site is relatively shallow based on the SI readings. However, there is still a potential for a future deep-seated movement of the ancient landslide mass. In addition, there is a dormant landslide to the west of the existing culvert, but it is not currently impacting the highway.		
The landslide is still active as evidenced from the further widening/reopening of reflective cracks on the highway surface. The landslide has three distinct moving blocks, and the middle section is the most active one. Within the middle landslide block, there is a distinct dip on the highway surface, more noticeable on the shoulder, and a significant distress in the highway side slope. The dip on the highway surface creates a rough ride to motorists and the side slope's head scarp will continue to retrogress to take out the guardrail and the highway shoulder.		
Furthermore, the existing culvert to the west of the active landslide area is in a poor condition.		

The highway condition is expected to continue deteriorating until an effective remedial measure is implemented. If an accelerated landslide movement occurs at this site, a partial or full road closure may be required.

**Recommendations:**

The selected remedial measure by TEC involves installing a shallow pile wall to address the shallow movement at the site. The tender closed in June 2024, and the repair is scheduled to be completed by May 31, 2025.

In the short term, and until the pile wall is constructed, the local MCI should monitor the highway periodically for signs of distress and watch closely for the development of new cracks, further opening/widening of existing cracks or drop in highway surface/shoulder (particularly after prolonged rainfall events). Any open surface cracks should be sealed to prevent surface water infiltration into the landslide mass, which would result in further landslide movement and retrogression. Speed reduction signs should also be used, if the highway condition deteriorates significantly, to warn motorists of the existing hazard. Patching of the highway surface should be considered, if needed, to provide a smooth ride to motorists.

**Closure**

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

Tarek Abdelaziz, Ph.D., P.Eng.  
Partner | Senior Geotechnical Engineer

José Pineda, M.Eng., P.Eng.  
Associate | Senior Geotechnical Engineer



## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment 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. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE 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. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 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 are judgmental in nature. 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 persons making use of such documents or records with our express written consent should 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 persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should 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 on the basis of conditions in evidence at the time of site inspections and on the basis of 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 as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons 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 should 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 detailed in the contract documents should 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 in order to confirm and document that the site conditions do not materially differ from those interpreted 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.

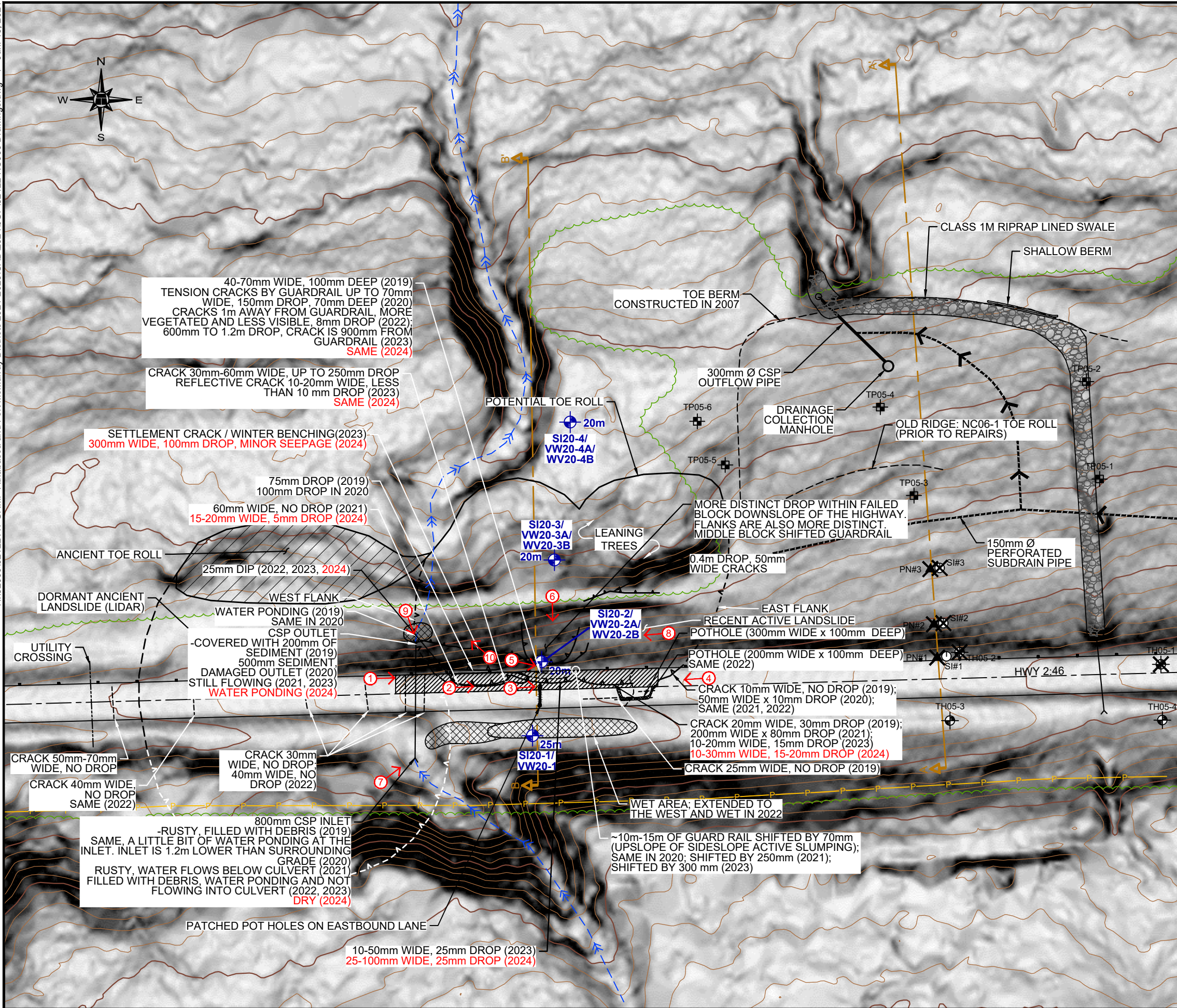
### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

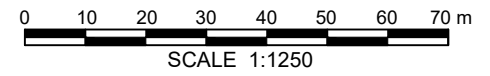
The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others 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.

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- LEGEND**
- APPROXIMATE 2020 INSTRUMENT LOCATION (DEPTH (m))
  - APPROXIMATE TEST HOLE (TH) LOCATION
  - APPROXIMATE TEST PIT (TP) LOCATION
  - APPROXIMATE PNEUMATIC PIEZOMETER (PN) LOCATION
  - APPROXIMATE SLOPE INCLINOMETER (SI) LOCATION
  - INSTRUMENT NON-OPERATIONAL
  - ACTIVE HEADSCARP
  - DORMANT SCARP CRACK
  - CRACK
  - GUARD RAIL
  - OVERHEAD POWERLINE
  - TREE LINE
  - GULLY
  - GROUND CONTOUR
  - 2021 ACP PATCH
  - APPROXIMATE DIRECTION AND NUMBER OF PHOTO

- NOTES:**
1. SITE FEATURES ARE APPROXIMATE
  2. LIDAR PROVIDED BY ALBERTA TRANSPORTATION
  3. JUNE 3, 2024 OBSERVATIONS SHOWN IN RED



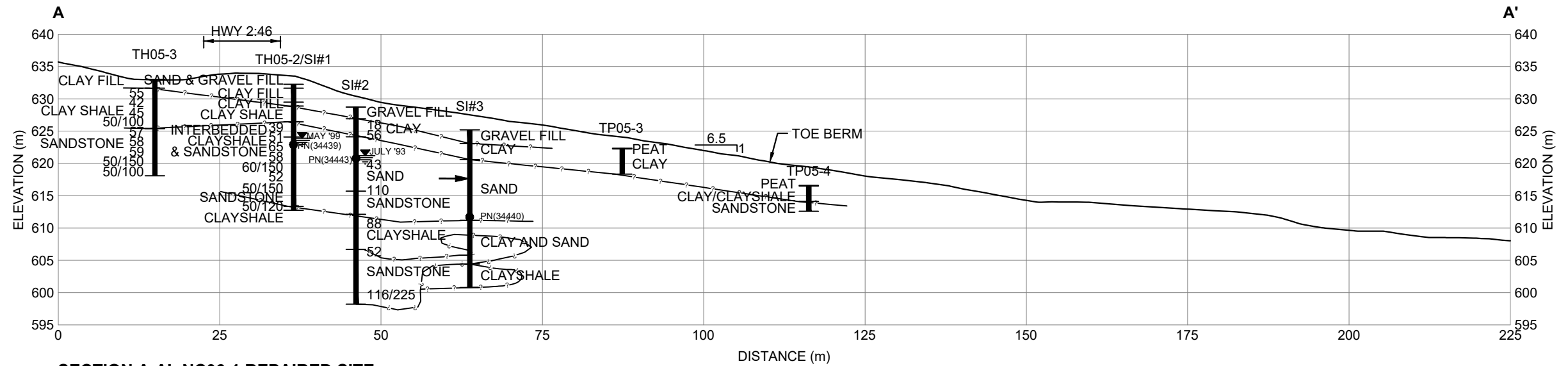
**NORTH CENTRAL  
(ATHABASCA AND FORT McMURRAY DISTRICTS)  
2024 GEOHAZARD ASSESSMENT**

**NC006: HWY 2:46 MITSUE RECREATION AREA (km 47.6)  
SITE PLAN SHOWING LANDSLIDE FEATURES**

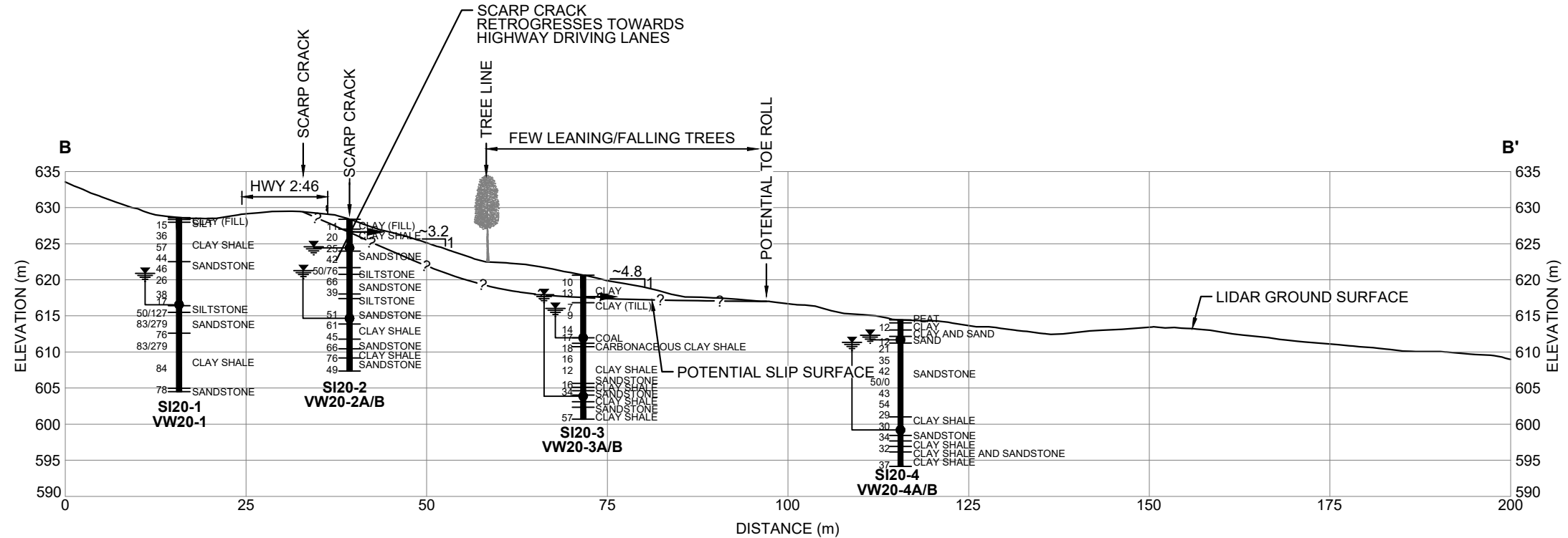
**FIGURE 1**

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:1250
DATE	JUNE 2024
FILE No.	32122





**SECTION A-A': NC06-1 REPAIRED SITE**



**SECTION B-B': NC06-2 NEW SITE**

- LEGEND**
- 15 I SPT N VALUE
  - WATER LEVEL IN PIEZOMETER
  - PNEUMATIC PIEZOMETER TIP LOCATION
  - DEPTH OF MOVEMENT IN SLOPE INCLINOMETER

**NOTE**  
 DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

**NORTH CENTRAL REGION  
 (ATHABASCA AND FORT MCMURRAY DISTRICTS)  
 2024 GEOHAZARD ASSESSMENT**

**NC006: HWY 2:46 MITSUE RECREATION AREA (km 47.6)  
 CROSS-SECTIONS**

**FIGURE 2**

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:750
DATE	JUNE 2024
FILE No.	32122

**THURBER ENGINEERING LTD.**



**Photo No. 1 – Looking east towards the landslide and the extent of 2021 ACP patch**



**Photo No. 2 – Looking east at reflective cracks near the western limit of the landslide**



**Photo No. 3 – Most active landslide block impacting the highway (middle section of landslide mass); note the presence of multiple retrogressive cracks impacting the highway WBL**



**Photo No. 4 – Looking west at reflective cracks from the eastern limit of the landslide**





**Photo No. 5 – Middle landslide block: Head scarp crack retrogressing into the highway; 600 to 1.2 m drop from original ground ( no change from 2023)**



**Photo No. 6 – Looking south at active landslide scarp cracks on the highway side slope**



**Photo No. 7 – 800 mm diameter culvert inlet. Culvert was rusty, partially blocked with vegetation and filled with garbage**



**Photo No. 8 – Looking west at the TELUS box installed as part of the line relocation in 2024**



**Photo No. 9 – Looking at 800 mm CSP culvert outlet**



**Photo No. 10 – Looking at Settlement Crack / Winter Benching. Note seepage at the bottom right of the photo**