

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



Site Number	Location	Name	Hwy	km
NC103-2	Approximately 7.9 km north of Hwy 29 (North of Elk Point)	KEHIWIN LAKE	41:23	7.9
Legal Description		UTM Co-ordinates (NAD 83)		
9-25-58-07 W4		12 N 5988463.22	E	506745.73

	Date	PF	CF	Total
Previous Inspection:	May 18, 2023	11	4	44
Current Inspection:	June 5, 2024	5	4	20
Road WAADT:	1,300	Year:		2023
Inspected By:	José Pineda, Tarek Abdelaziz (Thurber) Rocky Wang (TEC)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue	<p>A slump on the west side of the highway downslope of the NC103-1 pile wall location. The slump occurred above an existing 600 mm CSP centre line culvert.</p> <p>A sinkhole developed on the east side of the highway above the 600 mm CSP centre line culvert inlet.</p>
Dimensions:	<p>The slump on the west side of the highway was approximately 5.5 m wide, 20 m long, and about 1.6 m deep below the original ground surface.</p> <p>The sinkhole on the east side of the highway was about 3.3 m wide 2 m deep.</p>
Site History/Maintenance:	<p>The slump occurred in a section of the highway that is known for multiple landslides that have been repaired by TEC using various configurations of pile walls on the west side of the highway. At the location of the west slump failure, a tied-back concrete pile wall was constructed in 2011 under TEC contract No. 11165. The pile wall consisted of 15 m deep, 1.8 m diameter concrete piles, connected at the top using a 1.8 m deep concrete waler. Two rows of 200 mm diameter grouted anchors, 22 m long, were installed within the waler to further restrain the wall movement.</p> <p>At the location of the side slope failure, a centre line culvert was present prior to the construction of the pie wall. Hydrovac excavation was completed prior to the installation of the pile wall to expose the 600 mm CSP culvert. The top of the culvert was at an approximate elevation of 547.3 m (~6 m below the top of waler). The pile spacing at the culvert location was 3 m (i.e., 1.2 m clear space between concrete piles).</p>

TEC noted that the slope failure occurred in 2019. The maintenance contractor attempted to expose the centre line culvert downslope of the pile wall locations in 2020. However, the hydrovac excavation was not advanced deep enough to expose the culvert.

In May 2022 a hydrovac excavation and a CCTV inspection were conducted from the outlet of the centre line culvert under Thurber's supervision. The CCTV inspection revealed that the top of the culvert had collapsed and separated approximately 16 m from the outlet side. However, the condition and actual orientation of the culvert under the highway, between the identified break point and the inlet was unable to be inspected. Attempts were made to perform the CCTV inspection from the inlet side, but it was not possible due to a blockage in the culvert near the inlet.

In May 2023, after the inlet was made accessible by TEC, CAM-TRAC completed a second CCTV inspection. This later CCTV inspection revealed that an obstruction was present at about 24.8 m from the culvert separation near the inlet which corresponds with the general location of the obstruction measured in 2022 from the outlet (i.e., the rupture is located on the west side of pile wall).

In the spring of 2024, TEC retained In-Line Contracting to undertake the repairs proposed by Thurber. The repair work encompassed several tasks, including excavating the failed mass on both sides of the highway; lining the damaged 600 mm CSP culvert with a 500 mm diameter Smooth Wall Steel Pipe (SWSP) between the pile wall and the inlet location; extending the new 500 mm diameter culvert to the original outlet location; and performing backfilling, grading, topsoil placement and seeding of disturbed areas, and riprap installation around the inlet and outlet locations of the new pipe. Additional details about the repairs are presented in Thurber's report dated May 7, 2024.

Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	Damage of edge of pavement at two locations. Refer to Photo No. 2 and 2 a	<input checked="" type="checkbox"/>
<input type="checkbox"/> Slope Movement		<input type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	New culvert appears to be slightly sagging	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	Sink hole about 500 mm wide, 200 mm long, and 300 mm deep on the east side slope (hydrovac hole completed by In-line to expose the Telus line)	<input checked="" type="checkbox"/>

Instrumentation Readings (1 Slope Inclinator in pile wall, 2 Piezometers near the slump, 2 Load cells in pile wall):

S111-4 installed in Pile 60 above the original slump on the west side of the highway showed a creep movement of 0.3 mm in the spring of 2024.

The groundwater level recorded at PB10-1 and PB10-3 was 3.6 m and 0.5 m, respectively.

Load Cells VC1706 and VC1712 installed at Anchors G60L and G35L in Pile 60 had readings of 210 and 260 kN, respectively. Current loading on these cells is less than the design lock off load of 290 kN.

Assessment:

The repairs carried out by Inline in the spring of 2024 are performing satisfactorily. Although, the centre line culvert exhibits slight sagging under the highway, this is likely caused by a minor variation in the culvert grade between the inlet and the pile wall section and the portion between the pile wall and the outlet. This change in grade within the culvert is unlikely to affect the stability of the highway embankment at this location.

The sink hole noted on the east side slope was likely caused from the lack of proper backfilling at the hydrovac excavation conducted during repairs to expose Telus line on the east side slope. Unless the sinkhole is properly backfilled, it is anticipated that the hole will keep getting bigger in size with time and may cause future distress/cracking of the highway side slope.

Recommendations:

It is recommended to visit the site again in 2025 to confirm the effectiveness of the repairs, and then removed from the annual site inspection tour.

The damaged edge of pavement sections should be repaired to reduce the likelihood of the retrogression of the asphalt cracking into the driving lanes.

The sink hole on the east side of the highway should be backfilled with compacted fill.

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.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph.D., P.Eng.
Partner | Senior Geotechnical Engineer

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



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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.

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- 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

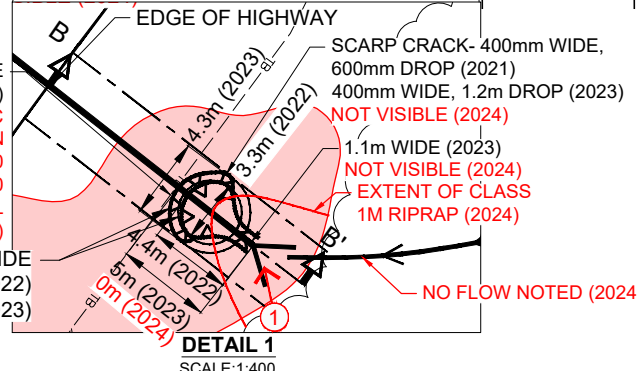
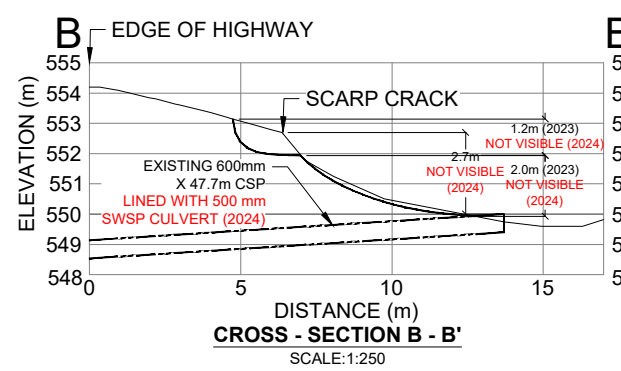
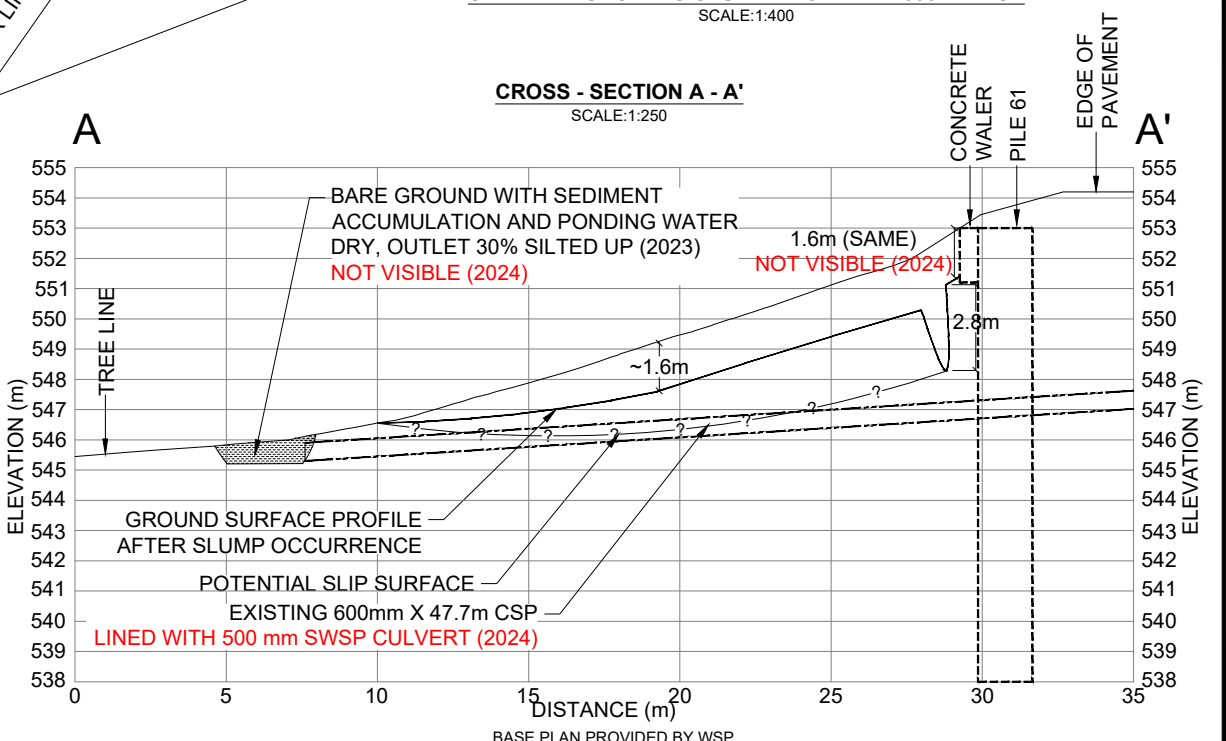
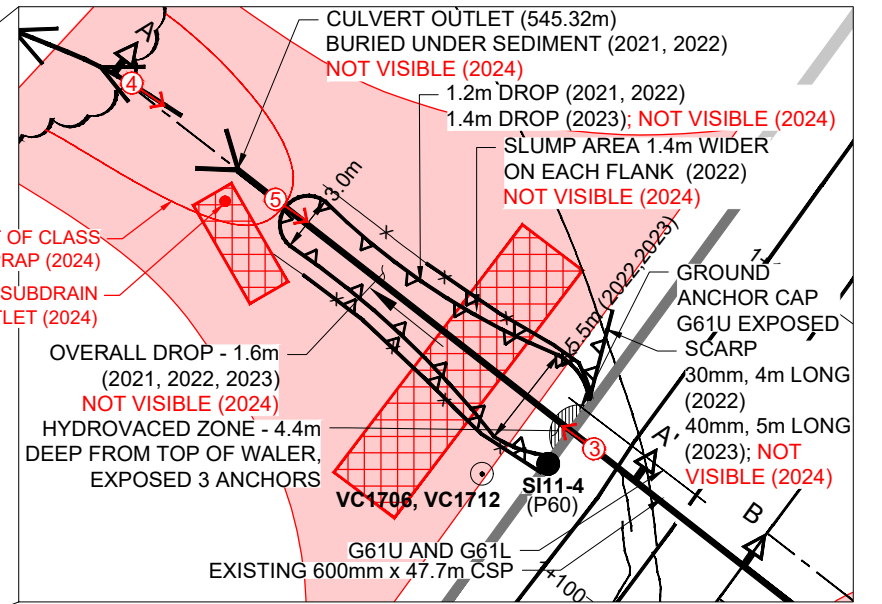
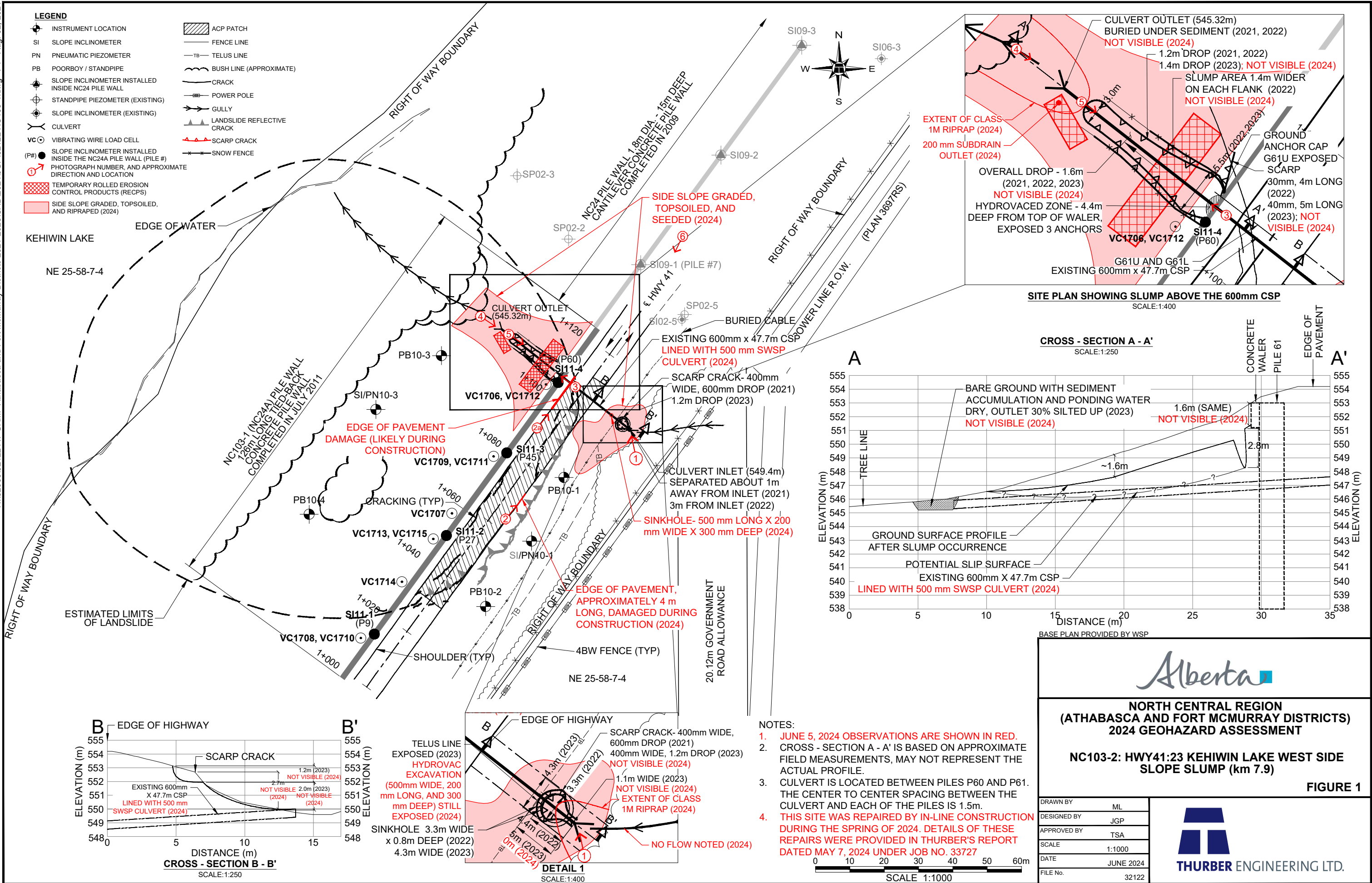
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, 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.

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LEGEND

⊕	INSTRUMENT LOCATION	▨	ACP PATCH
SI	SLOPE INCLINOMETER	—	FENCE LINE
PN	PNEUMATIC PIEZOMETER	—	TELUS LINE
PB	POORBOY / STANDPIPE	~	BUSH LINE (APPROXIMATE)
⊕	SLOPE INCLINOMETER INSTALLED INSIDE NC24 PILE WALL	—	CRACK
⊕	STANDPIPE PIEZOMETER (EXISTING)	—	POWER POLE
⊕	SLOPE INCLINOMETER (EXISTING)	—	GULLY
⊕	CULVERT	—	LANDSLIDE REFLECTIVE CRACK
VC	VIBRATING WIRE LOAD CELL	—	SCARP CRACK
(P#)	SLOPE INCLINOMETER INSTALLED INSIDE THE NC24 PILE WALL (PILE #)	—	SNOW FENCE
Ⓟ	PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION		
▨	TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECPS)		
▨	SIDE SLOPE GRADED, TOPSOILED, AND RIPRAPED (2024)		



- NOTES:**
- JUNE 5, 2024 OBSERVATIONS ARE SHOWN IN RED.
 - CROSS - SECTION A - A' IS BASED ON APPROXIMATE FIELD MEASUREMENTS, MAY NOT REPRESENT THE ACTUAL PROFILE.
 - CULVERT IS LOCATED BETWEEN PILES P60 AND P61. THE CENTER TO CENTER SPACING BETWEEN THE CULVERT AND EACH OF THE PILES IS 1.5m.
 - THIS SITE WAS REPAIRED BY IN-LINE CONSTRUCTION DURING THE SPRING OF 2024. DETAILS OF THESE REPAIRS WERE PROVIDED IN THURBER'S REPORT DATED MAY 7, 2024 UNDER JOB NO. 33727

Alberta

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

NC103-2: HWY41:23 KEHIWIN LAKE WEST SIDE SLOPE SLUMP (km 7.9)

FIGURE 1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:1000
DATE	JUNE 2024
FILE No.	32122

THURBER ENGINEERING LTD.



Photo No. 1 – Old 600 mm CSP Centre-Line Culvert was lined with 500 mm SWSP Culvert in the Spring of 2024



Photo No. 2 – Looking at the highway southeast side slope upslope of the 600 mm CSP culvert inlet location. Note asphalt surface outside of the white line was damaged during construction



Photo No. 2a – Looking at the highway northwest side slope upslope of the 600 mm CSP culvert outlet location. Asphalt surface outside of the white line was likely damaged during construction



Photo No. 3 – Looking west at the area of the 2024 slump repairs downslope of the pile wall location. Note vegetation starting to grow between the pile wall and the riprap channel



Photo No. 4 – Looking east at the new SWSP culvert outlet downslope of the pile wall location



Photo No. 5 – Looking east at the area of the 2024 slump repairs downslope of the pile wall location.



Photo No. 6 – Aerial photo covering both sides slopes of the highway and the extent of the 2024 repairs completed by In-Line Construction