

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA &
FORT MCMURRAY DISTRICTS
2023 SITE INSPECTION**



| Site Number | Location | Name | Hwy | km |
|-------------------|-------------------------------------------------|----------------------------|-------|-----------|
| NC087 | 20.75 km north of the junction of Hwy 55 and 63 | FISCHER TRAIL SLIDE | 63:02 | 20.75 |
| Legal Description | | UTM Co-ordinates (NAD 83) | | |
| SE-22-69-17-W4M | | 12 N 6094104.70 | E | 404166.89 |

| | Date | PF | CF | Total |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------|------|-----------------|
| Previous Inspection: | June 7, 2022 | 14 | 4 | 56 (Highway 63) |
| Current Inspection: | May 17, 2023 | 14 | 4 | 56 (Highway 63) |
| Road WAADT: | 3,960 | Year: | 2022 | |
| Inspected By: | José Pineda, Tarek Abdelaziz (Thurber) Arthur Kavulok, Kristen Tappenden (TEC) | | | |
| Report Attachments: | <input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items | | | |

| | |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Site Issue | <p>Upper landslide block: Active slide movement causing severe distress for about 140 m along the Fischer trail surface and affecting Hwy 63 southbound lanes west side slope.</p> <p>Lower landslide block: Active slide movement causing severe distress for about 85 m along Fischer trail surface.</p> |
| Dimensions: | <p>Upper landslide block: About 140 m wide along the trail alignment and 120 m long perpendicular to the trail alignment.</p> <p>Lower landslide block: About 90 m wide along the trail alignment and 95 m long perpendicular to the trail alignment.</p> |
| Site History/Maintenance: | <p>Fischer trail is a gravel surfaced road located on the west side of the HWY 63:02 southbound lane embankment. Based on discussions with TEC and WSP, it is understood that Fischer Trail is a private road that was upgraded in 2014 during the construction of the highway twinning project at this location as part of land negotiations. Prior to construction, the subject area was low-lying and covered with shrubs and trees. During construction, about 1 m to 1.5 m of peat was removed from below the trail alignment to expose the firm clay foundation. As per the information provided by WSP, it is understood that up to 3 m of clay fill was placed on the exposed native clay to establish the design profile of the trail. However, shortly after the fill was placed, tension cracks were noticed along the trail surface and near the toe of the highway embankment side slope. The movement has also resulted in the tilting of one of the power poles. Survey monitoring was conducted after the cracking was observed and a vertical drop of 50 to 70 cm was noted shortly after monitoring began. During construction, an attempt to stabilize the slope was made by flattening the side slope of Fischer trail and re-grading the road. Thurber was called out to the site during construction in September 2014 and May 2015 and preliminary assessment letters were submitted to WSP. In 2015, the survey</p> |

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| | <p>monitoring program conducted by WSP indicated a reduction in the movement rates and hence a decision was made to seal up open cracks on the highway side slope and to get the Fortis Alberta to straighten the affected power pole.</p> <p>TEC resurfaced the trail with gravel in late 2016. Since 2022 it is understood that TEC has no obligation to maintain Fischer Trail.</p> | |
| Observations: | Description | Worse? |
| <input checked="" type="checkbox"/> Pavement Distress | Longitudinal and transverse cracks on the HWY (SBL) 40 to 50 mm wide no drop; no noticeable dips on HWY 63:02 paved surface | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Slope Movement | Tension crack within 6.5 m from the edge of the highway; open head scarp cracks within the upper and lower landslide blocks (100 to 700 mm wide, and 100 mm to 1.5 m drop); leaning/tilting trees between the west edge of the trail and the pronounced toe roll area | <input checked="" type="checkbox"/> |
| Based on 2021 Inspection on the Trail | | |
| <input checked="" type="checkbox"/> Erosion | Observations during and prior 2022 indicated that the erosion gully within the trail east ditch (10 m long x 2 to 3 m wide x 0.8 m deep) and at the 800 mm diameter culvert inlet (4.5 m long x 3.5 m wide x 1.5 m deep). Fisher Trail not inspected since 2023. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Seepage | Observations during and prior 2022 indicated that Fisher trail surface was wet and standing water was noted in the trail surface and the east ditch; previously noted water ponding in the highway east ditch between culverts C2 and C3 located to the south of the landslide area was dry. Water is partially flowing under culvert C3 inlet. Fisher Trail was not inspected in 2023. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Bridge/Culvert Distress | Observations during and prior 2022 indicated severe sinkholes and subsidence along Fischer trail; The existing 800 mm CSP culvert, installed during construction below the trail had been separated resulting in the formation of multiple sinkholes that have converged into a large sinkhole (6 m in diameter and 1.5 m deep). Fisher Trail was not inspected in 2023. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Other | <p>La Biche River outside bend of the meander is located 90 m and 125 m to the west of the western edge of the trail and highway, respectively.</p> <p>Fence posts have moved approximately 1.5 – 2.0 m toward the river.</p> <p>Power poles are tilting within the slide area by 2 degrees.</p> | <input checked="" type="checkbox"/> |
| Instrumentation Readings (2 PN and 2 SP piezometers; Spring 2023): | | |
| <p>Between the spring and the fall of 2018: SI17-1, SI17-2 and SI17-3, installed near the edge of the trail, were sheared off at depths varying between 5.6 m and 8.1 m below the trail surface; SI17-5, installed between the fence and the highway was damaged at 1.3 m below ground surface. SI17-1, SI17-2, SI17-3 and SI17-4 moved at maximum rates ranging between 55 and 160 mm per year.</p> | | |

Groundwater levels in the pneumatic piezometers ranged between 1.0 m below ground surface to 0.02 m above ground surface (artesian). The groundwater level in standpipe piezometers below the ground surface is 1.3 m and 1.0 m in SP17-4 and SP17-6, respectively.

Assessment (Refer to attached Figures):

The site condition did not change significantly since the 2022 site inspection.

Based on the above site observations, and LiDAR information, the distress observed along Fischer trail and the side slope of the highway SBLs reflects an actively moving deep-seated landslide. The depth of movement ranges from 5.6 to 8.1 m below the trail surface. The landslide continues to cause severe distress of the trail surface and is retrogressing to the highway surface.

It is suspected that the low-lying area of the original trail alignment was located within the crest of an ancient landslide, toeing into the outside bend of the La Biche River. Placement of grading fill to construct the trail could have resulted in (a) re-activation of the ancient landslide, and (b) obstruction of natural drainage pattern, resulting in elevated ground water levels in the slope area.

The surface water in the trail ditch flows below the separated 800 mm diameter culvert, resulting in the saturation and washout of trail fill and subgrade and recharging of the landslide mass. It is likely that the uncontrolled discharge of surface water below the trail will result in the formation of additional sinkholes and potentially complete failure of the trail.

The landslide continues to be active, and this will eventually result in further failure of the trail surface, the retrogression of the landslide into the highway lanes due to continued loss of support at the toe of the slope, and potential damages to the fence line, Telus cable and the overhead power lines.

Recommendations:

This site should be visited again in the spring of 2025.

In the short term, we recommended the following:

- TEC should contact the County, the trail owner, and utility companies to let them know about existing hazard(s).
- The local MCI should periodically monitor the head scarp crack for further opening or drop and measure the distance between the head scarp crack and the edge of the highway.
- Clear sedimentation and regrade the ground surface near culvert C1 outlet; inspect and maintain culverts C2 and C3 as needed to prevent further ponding of water in the highway west ditch and water flow under C3.

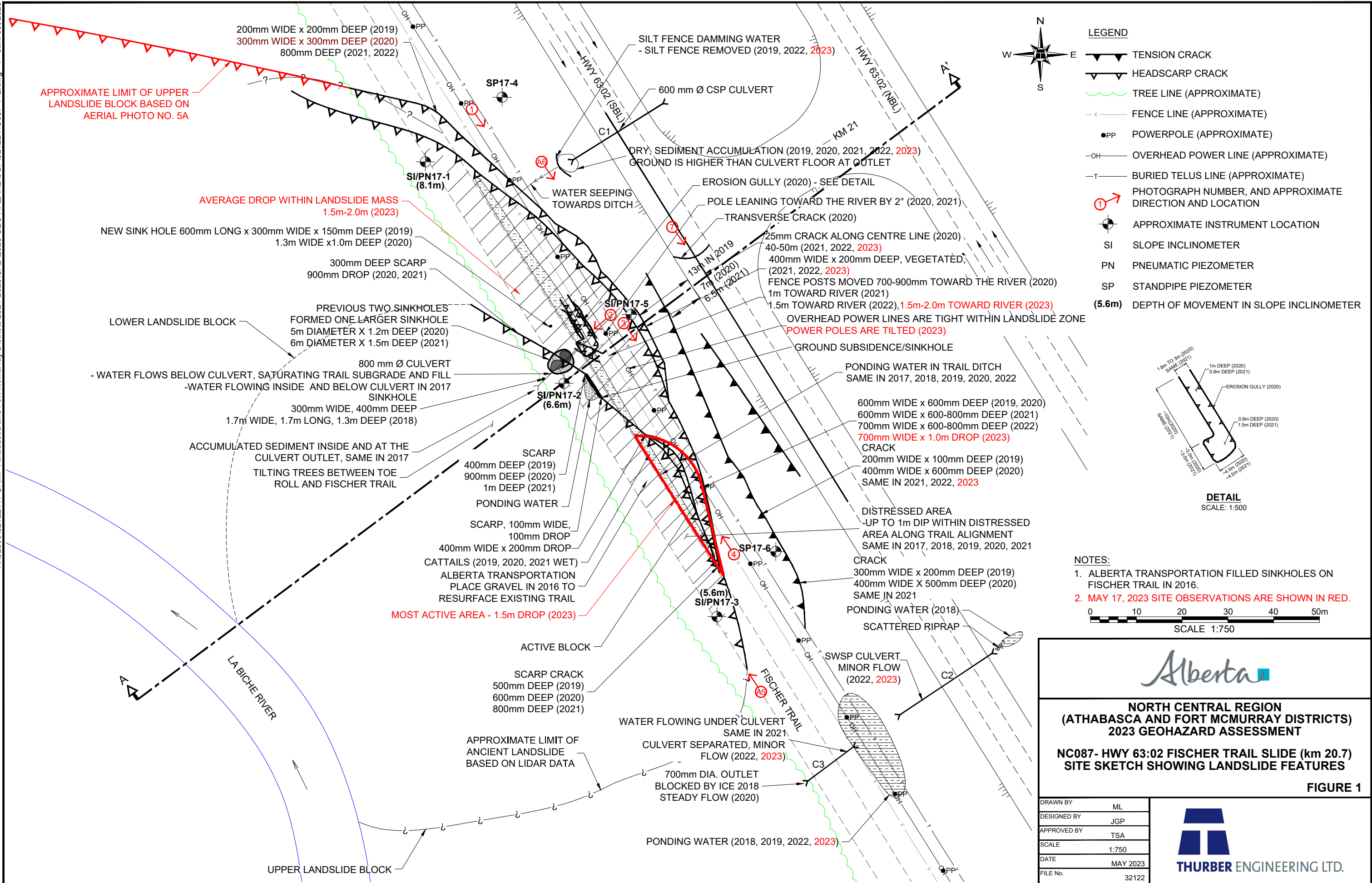
It is understood that TEC has no obligation to maintain the trail. Hence, the long-term measure may include the construction of a pile wall between the head scarp crack and the west edge of the highway to shelter the highway from potential retrogression of the head scarp crack into the highway surface. The ballpark cost of this option, excluding engineering, would be in the range of \$850,000 for a steel pile wall and \$2.0 Million for a tangent cast-in-place cantilever pile wall. It should be noted that this option will not address the impact of future movements downslope of the wall on existing trail and utility lines within the landslide mass.

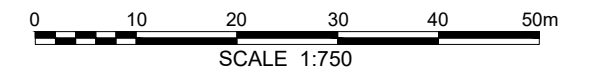
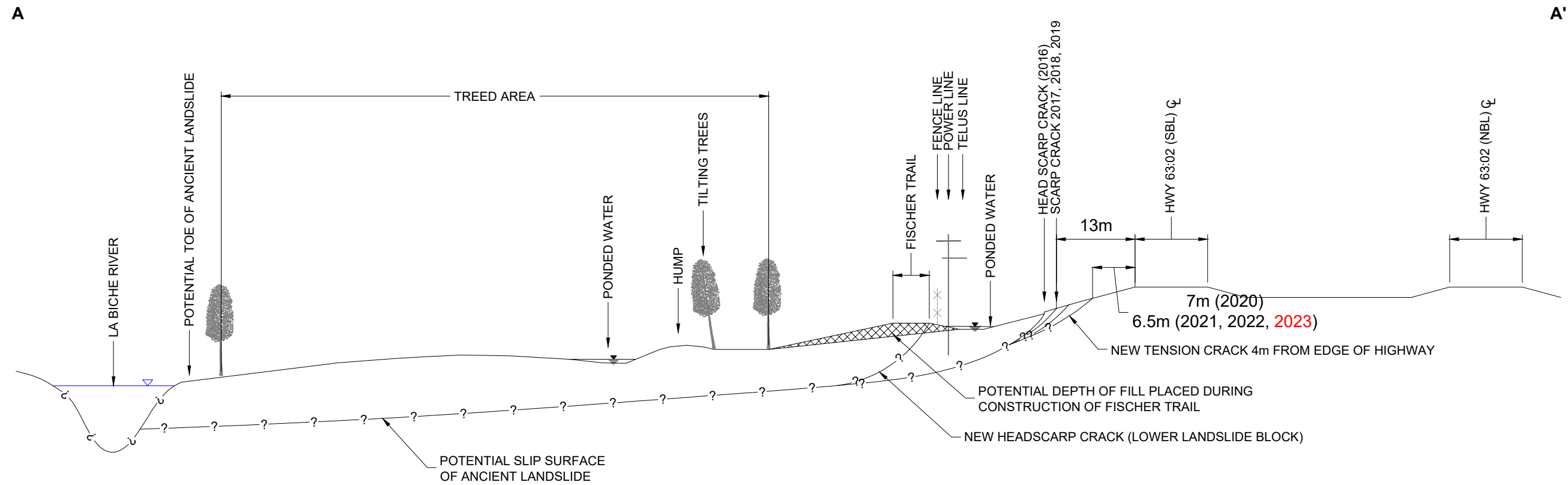
Closure:

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.
Principal | Geotechnical Review Engineer

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





NOTE
 CROSS-SECTION A-A' IS BASED ON APPROXIMATE SIMPLE
 FIELD MEASUREMENTS AND MAY NOT REPRESENT THE
 ACTUAL PROFILE THROUGHOUT THE SLIDE AREA.




**NORTH CENTRAL REGION
 (ATHABASCA AND FORT MCMURRAY DISTRICTS)
 2023 GEOHAZARD ASSESSMENT**

**NC087- HWY 63:02 FISCHER TRAIL SLIDE (km 20.7)
 CROSS-SECTION A-A'**

FIGURE 2

| | |
|-------------|---------------|
| DRAWN BY | ML |
| DESIGNED BY | JGP |
| APPROVED BY | TSA |
| SCALE | APPROX. 1:750 |
| DATE | MAY 2023 |
| FILE No. | 32122 |



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Photo No.1 – Head scarp crack of upper landslide block (Looking South)



Photo No.2 – Sinkhole above the 800 mm diameter culvert; looking at the culvert inlet



Photo No.3 – Looking south at the southern flank of the landslide (700 mm wide cracks, up to 1 m drop); water ponding along the ditch between the trail and the fence (note cattails in this area)



Photo No.4 –Looking north at the southern flank of upper and lower landslide blocks; note standing water within the flank and lateral shifting of existing fence; landslide is well vegetated.



Photo No. A5 (aerial photo) – Looking north at the active landslide mass to the west of Hwy 63. Note head-scarp crack between the edge of pavement and power lines, fresh quad tracks within Fischer trail, dead/tilting trees within landslide mass, and toe of the landslide narrowing of the river channel at the river bend.



Photo No. A6 (aerial Photo)– Looking south at landslide area. Note deadfall and sink holes within Fisher Trail on the northern portion of the landslide mass.



Photo No. 7 – Looking south at highway southbound lanes; landslide is not currently impacting the highway surface; head scarp crack is about 6.5 m away from the edge of pavement.