

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



| Site Number | Location | Name | Hwy | km |
|-------------------|--------------------------------|---------------------------------|----------|----|
| NC 069-1 | 14 km south of Wandering River | S. of Wandering River- BF 76427 | 63:02 | 32 |
| Legal Description | | UTM Co-ordinates (NAD 83) | | |
| SW-27-70-17-W4M | | 12 N 6105290 | E 403588 | |

| | Date | PF | CF | Total |
|-----------------------------|--|----|--------------|-------|
| Previous Inspection: | June 07, 2022 | 8 | 4 | 32 |
| Current Inspection: | June 04, 2024 | 8 | 4 | 32 |
| Road WAADT: | 3970 | | Year: | 2023 |
| Inspected By: | Tarek Abdelaziz, José Pineda (Thurber) Rocky Wang (TEC) | | | |
| Report Attachments: | <input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items | | | |

| | |
|---------------------------------|--|
| Primary Site Issue: | Creep movements of east and west side slopes of Hwy 63 SBL causing pavement distress |
| Dimensions: | Highway 63 Southbound Lanes Landslides: East Landslide affecting about 90 m of the highway and West Landslide affecting about 50 m of the highway. |
| Date of any remediation: | <p>West side slope embankment failed in 2009 causing damage to the existing 1910 mm dia. SPCSP culvert and development of slide cracks along the highway. Emergency repairs were completed in May 2010 and consisted of building a toe berm along the bottom of the slope and extending the culvert outlet by about 28 m (using a 2000 mm CSP). The existing culvert failed during construction (approximately 28 m from the original culvert outlet location), and was strutted over a distance of about 12 m. An 1800 diameter SWSP was auger bored below the highway to temporarily replace the existing pipe.</p> <p>In 2013, the following was carried out during the construction of highway twinning project at this location: Grouting of old culverts, pipe jacking a 3630 mm diameter SWSP culvert below highway, diversion of stream channels at the inlet and outlet of the new pipe, increasing the size of the berm downslope of the highway SBL, and grading of future highway northbound lanes. The highway was patched in the vicinity of the southern flank of the east landslide near the pipe jacking pit.</p> |
| History/Maintenance: | <p>The original highway was a two-lane undivided highway. The east and west landslides developed on the east and west side slopes of the original highway. The highway was upgraded between 2014 and 2016 to a four-lane divided highway. The two lanes of the former highway are currently the southbound lanes of the new highway.</p> <p>West Landslide: ACP overlay on the SBL of the former highway in</p> |

| | <p>June 2010; ACP overlay on the former highway SBL in 2014 and 2015</p> <p>East Landslide: ACP overlay on the southern limits of the NBL of former highway in 2014</p> <p>Erosion issues identified in 2014 were addressed by others: The erosion within the diversion channel at the inlet of the new pipe and along the south facing drainage channel to the north of the pipe were repaired; South facing drainage Channel: erosion control included extension of existing soil covering mat further north, armouring the southern segment of the channel using Class 1M riprap, inclusion of spring berms along the channel within the segment covered with the erosion mat; North facing Draining channel: erosion control included placement of a Class 1M riprap over existing soil covering mat, and installation of geo-ridge berms within the northern portion covered with the erosion blanket; fibre rolls installed along the crest of the east slope of the NBL above the inlet of the pipe.</p> <p>One of the erosion issues identified in 2015 was addressed by others under the contract for the highway twinning project. The erosion gully developed within the north facing drainage channel above the culvert inlet location was repaired through the extension of the riprap channel to the bottom of the slope towards the diversion channel.</p> | |
|---|--|-------------------------------------|
| Observations: | Description | Worse? |
| <input checked="" type="checkbox"/> Pavement Distress | <p>West Landslide (western lane of highway SBLs): 25 to 30 mm dip for about 50 m</p> <p>East Landslide (eastern lane of highway SBLs): 15 to 20 mm dip for about 90 m</p> <p>Western Lane of highway SBLs: The existing patch on the western lane is 40 to 50 mm higher than surrounding pavement surfaces.</p> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Slope Movement | <p>West Landslide (western lane of highway SBLs): 40 to 200 mm wide reflective landslide cracks with up to 25 mm drop across crack surfaces</p> <p>East Landslide (eastern lane of highway SBLs): 30 to 70 mm wide landslide cracks with up to 15 mm drop across crack surfaces</p> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Erosion | <p>Diversion channel at the inlet of the pipe: erosion/slump on the north facing slope exposed fabric and shifted riprap.</p> <p>South facing drainage Channel to the east of the highway NBLs: Spring berms and synthetic ditch barrier failed shortly after construction completion; severe erosion gullies (previously observed) to the north of the outlet of the NBL centerline culvert were mostly covered by grass; localized erosion within the ditch to the south of the culvert outlet (4 m long, 1.2 m wide, and 500 mm deep); severe erosion gully near the mouth of the channel within the western edge riprap (18 m long x 1.2 m wide x 1.3 m deep) was partially filled by adjacent riprap and water was flowing under this area</p> <p>Slump in the east back slope of the highway NBLs healed and was covered with vegetation. Furthermore, vegetation continued to grow within the highway median, side slopes of the highway NBLs, and within south facing drainage channel to the east of the NBLs.</p> | <input type="checkbox"/> |

| | | |
|---|--|-------------------------------------|
| | Three sinkholes filled with water within the highway median ditch. | |
| <input type="checkbox"/> Seepage | | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Bridge/Culvert Distress | The 600 mm diameter culvert below the highway NBLs has sagged and water is ponding inside the pipe | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Other | Beaver Dam approximately 1.5 m high noted at eastern edge of the Class 1 rock riprap upstream of 3630 mm diameter SWSP culvert | <input checked="" type="checkbox"/> |

Instrumentation: (3SIs, 3 PNs, 2 VWs)

West Landslide: SI13-14 showed a rate of movement of 0.5 mm/yr. SI09-4 showed a rate of movement of 1.4 mm/yr. PN09-3: Ground water levels increase by about 0.2 m.

East Landslide: SI09-1 was sheared off/blocked at a depth of 3 m below ground surface; this instrument was creeping prior to the fall of 2021 at 0.8 mm/yr; and SI10-1 showed no discernable movement; PN09-1 was malfunctioning and PN10-1 was damaged. VW 13-11 and 13-12: Groundwater levels increased by 0.15 m and 0.1, respectively, since the spring of 2023.

Assessment (Refer to attached Figure):

In general, the remedial measures have been effective in stabilizing the east and west landslides of the highway SBLs.

The highway surface conditions appear to have deteriorated due to the ongoing creep movements of the landslides, as evidenced by further opening of cracks and the more distinct dips on the southbound lanes. The existing dips on the SBLs continue to create a rough ride to travellers.

The top surface elevation of the patch placed in 2015 along the most western lane of the old highway is about 40 to 50 mm higher than the top surface elevation of the pavement surface outside the boundaries of the patched area. This has resulted in an uncomfortable ride on the highway surface and constitutes a major safety hazard to the motorists. The existing dip on the highway lanes has also aggravated the situation.

The sink holes developed near the bottom of the new lanes west side slope are near the inlets of the old culverts and channels. It is likely that the sinkholes reflect poor subgrade preparation and backfill construction practice at these locations.

The existing erosion along south facing ditch to the east of the highway NBLs does not appear to be as active as observed in the past as vegetation continues to grow in this area.

The highway east back slope slump is completely covered with vegetation and does not seem to be as active as observed in 2017.

The beaver dam located upstream of the 3630 mm diameter SWSP culvert inlet is creating a significant rise in this water course. In addition, if a sudden breach of the dam occurs, the beaver dam may trigger erosion beyond the extent of the riprap.

Recommendations:

It is recommended that the site continues to be inspected every second year.

Consideration should be given to milling the 2015 ACP patch and placing a new patch on the highway SBLs. The new patch should provide a smooth ride to motorists and eliminate the safety hazard, associated with uneven pavement surfaces within the site.

The sinkholes should be backfilled with compacted gravel or clay. Prior to backfilling the sinkholes, it is recommended that the bottom and the sides of the sink holes be cleaned of loose materials

and debris.

A CCTV inspection should be undertaken for the existing 600 mm diameter culvert below the highway NBL. Based on the inspection results, it may be required to either replace or line the pipe to enhance surface drainage in the highway median.

Consideration should be given to placing riprap within the erosion gullies developed within the south facing channel, located to the east of the highway NBLs.

The beaver dam noted upstream of the 3630 mm diameter SWSP culvert inlet should be removed.

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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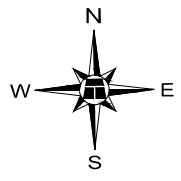
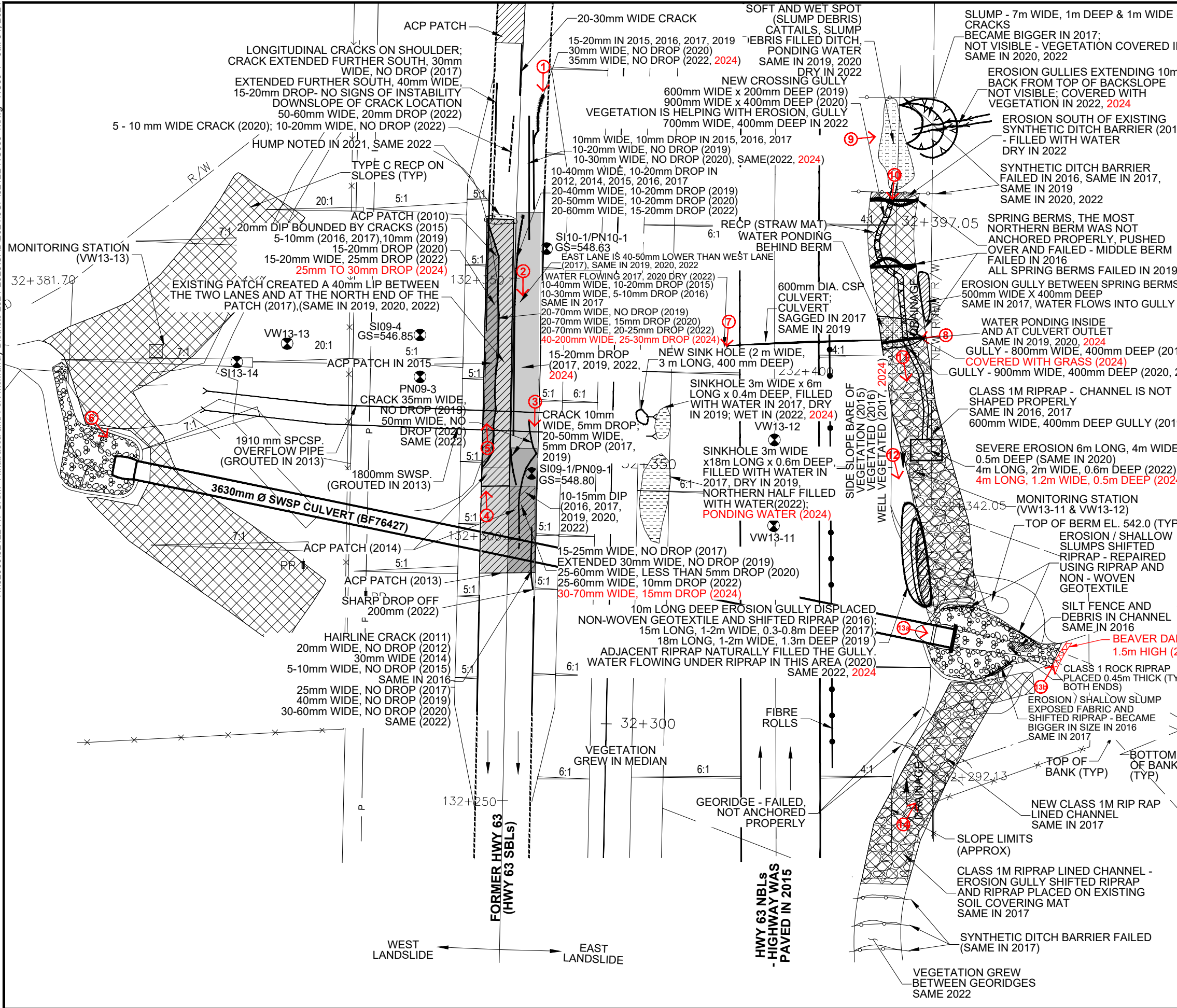
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification 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.

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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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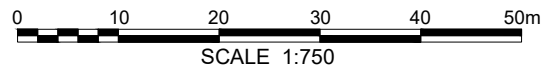
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LEGEND

- INSTRUMENT LOCATION
- MONITORING STATION
- 2013 & 2014 ACP PATCH
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
- VW VIBRATING WIRE PIEZOMETER
- P OVERHEAD POWERLINE
- FENCE LINE
- PP POWER POLE
- RECP ON SLOPES
- PHOTOGRAPH NUMBER, AND APPROXIMATE LOCATION AND DIRECTION

- NOTE:
1. OLD 1800 & 1910mm CULVERTS WERE GROUTED IN 2013.
 2. HIGHWAY NORTHBOUND LANES AND THE NEW 3630mm DIA. CULVERT(BF76427) WERE CONSTRUCTED IN 2013.
 3. JUNE 4, 2024 OBSERVATIONS SHOWN IN RED



BASE PLAN PROVIDED BY WSP.

**NORTH CENTRAL REGION
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2024 GEOHAZARD ASSESSMENT
NC069-1: HWY 63:02 (km 32) - BF76427
SITE PLAN SHOWING SITE FEATURES**

DWG No. NC069-1

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

THURBER ENGINEERING LTD.



Photo No. 1 – Looking south at open diagonal and longitudinal cracks on the former highway NBL surface from the north limit of the east landslide



Photo No. 2 – Looking south at an open longitudinal reflective crack within the middle section of the east landslide; note the presence of a 40 mm elevation difference between the two lanes



Photo No. 3 – Looking south from the southern limit of the east landslide at reflective diagonal crack on the existing patch



Photo No. 4 – West landslide (looking north from the southern limit of the landslide); note the dip developed on the highway surface within the limits of the landslide



Photo No. 5 – Looking north at the west landslide reflective cracks on the highway surface



Photo No. 6 – Looking at the outlet of the SWSP centerline culvert



Photo No. 7 – Looking south at highway median. Heavy flow into the 600 mm diameter CSP culvert



Photo No. 8 – Looking inside the outlet of the 600 mm diameter CSP culvert installed below the NBLs; water is still ponding inside the pipe



Photo No. 9 – Looking northeast at the backslope slump area observed in 2017; vegetation has grown within the slump area. Slump is not longer visible.



Photo No. 10 – South facing channel: Vegetation has grown within the upslope section of the channel and erosion is no longer visible



Photo No. 11 – South facing channel: Looking south at a gully approximately 900 mm wide x 400 mm deep; note vegetation is starting to cover the gully in this zone



Photo No. 12 – South facing channel: Erosion gully developed on the west edge of the channel has been filled with riprap



Photo No. 13a – Looking east at an existing beaver dam (approximately 1.5 m high), upstream of the SWSP inlet location



Photo No. 13b – A closer look at the beaver dam in Photo 13a



Photo No. 14 – Looking northeast along the riprap lined north facing drainage channel