

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA &
FORT MCMURRAY DISTRICTS)
2022 SITE INSPECTION**



| Site Number | Location | Name | Hwy | km |
|------------------------|------------------------|----------------------------------|----------|-----|
| NC017A | North of Fort McMurray | Hwy 63 Backslope Failures | 63:12 | 2.7 |
| Legal Description | | UTM Co-ordinates (NAD 83) | | |
| NW7 and SW18-90-09-W4M | | 12 N 6295275 | E 473365 | |

| | Date | PF | CF | Total |
|----------------------------|--|--------------|------|-------|
| Previous Inspection | May 18, 2017 | 13 | 3 | 39 |
| Current Inspection: | June 07, 2022 | 13 | 3 | 39 |
| Road AADT: | 18,070 | Year: | 2021 | |
| Inspected By: | Tarek Abdelaziz and José Pineda (Thurber) Arthur Kavulok, Rishi Adhikari, Amy Driessen (TRANS) | | | |
| Report Attachments: | <input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items | | | |

| | |
|---------------------------------|---|
| Primary Site Issue: | Active landslides are present in the back slope west of the SBL at Borrow Pits A (NC017A-2, km 2.7) and B (NC017A-1, km 2.4). The toe of a lower back slope lump at Borrow Pit A location is pushing into the highway ditch and side slopes. |
| Dimensions: | At Borrow Pit A, the highway lower back slope slide is about 100 m in width and extends into the offloaded area behind the crest of the back slope and toes into the highway ditch. There have been also two slumps in the backslope of the upper offloaded area that are now merging. The combined width of the north and south slumps is about 100 m. The head scarps cracks have been retrogressing and currently extend about 300 m back from the highway. At Borrow Pit B the slump in the highway back slope is about 100 m wide and extends to the top of the highway backslope. |
| Date of any remediation: | N/A |
| Maintenance / History: | <p>Km 2.4: Pavement patching to smooth out the highway combined with some minor re-grading to remove humps in the highway west ditch (2007); in fall 2009, ditch was cleaned up, dirt pushed back into the west side of the ditch, and ACP overlay was placed on the highway surface; in fall 2011, ditch was cleaned up, dirt pushed back into the west side of the ditch, lower slump mass re-graded; Wavy highway surface was milled by 40 to 150 mm in 2013.</p> <p>In 2015, the highway south bound lanes were shifted to the east of the original location during the construction of the Parsons Creek Interchange. The new lanes were located to the east of the toe of the landslide, which heaved up the former southbound lanes. In addition, it is understood that a small toe berm (approximately 2 m in height above the ditch grade) was placed at the original highway location to buttress the lower back slope area in an attempt to stabilize the landslide.</p> <p>Km 2.7: Minor re-grading of lower backslope landslide mass to seal up cracks and smooth out dips, slight contouring of the toe by pushing dirt back towards the west side to enhance drainage in the ditch (2011).</p> <p>In 2015, a 600 mm CSP culvert was constructed by others in the former highway ditch below the toe of the lower back slope landslide to allow</p> |

| | | |
|---|---|--------------------------|
| | <p>the drainage of the ditch water which had been blocked by the landslide activity at this location. Sediment noted in the 2016 inspection at this culvert was cleaned in the summer/fall of 2016.</p> <p>Existing culvert between the two landslide areas appeared to have been abandoned during the construction of the highway new lanes.</p> | |
| Observations: | Description | Worse? |
| <input type="checkbox"/> Pavement Distress | | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Slope Movement | <p>Km 2.7: The toe roll of the lower backslope landslide is blocking the highway ditch and is pushing against the new highway southbound lanes shoulder; retrogression of the upper head scarp cracks of the upper slumps; 3 m high distinct toe roll of the upper slumps; toe roll moved east by about 5 m and buried TH99-12</p> <p>Km 2.4: Not addressed in 2017</p> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Erosion | Km 2.7: Minor erosion previously noted at the outlet of the of the existing 600 mm diameter CSP culvert in the ditch was not visible during the 2022 inspection as this area was covered with vegetation | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Seepage | Km 2.7: Water ponding within the sag ponds in the lower backslope landslide mass near PB09-2; seepage noted within the toe rolls of the upper backslope slumps | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> Bridge/Culvert Distress | Km 2.7: Water slowly flowing from the culvert outlet; ponding water inside the culvert | <input type="checkbox"/> |
| <input type="checkbox"/> Other | More vegetation within the lower backslope landslide | <input type="checkbox"/> |
| Instrumentation: (Non-Operational) | | |
| Previously installed instruments as shown on the attached Figure NC017A-1 are either sheared off or damaged and unreparable. | | |
| Assessment (Refer to attached Figure): | | |
| <p>The existing lower landslide and upper backslope slumps occurred due to the progressive failure of the steep back slope cuts in the weak colluvium deposits.</p> <p>The ditch does not appear to have enough gradient to the north and the south of the culvert location to handle surface runoff.</p> <p>Km 2.4: The highway was shifted away from the toe of the landslide and hence it is not currently impacted by the landslide movement.</p> <p>Km 2.7: The upper back slope slumps and lower landslide are still active and will continue to move over time. However, the upper back slope slumps appear to have moved more than the lower landslide. It is likely that the lower landslide debris will keep pushing against the culvert and the highway shoulder. Although the landslide is not currently affecting the highway condition, the landslide debris are within the highway clear zone, which constitutes a safety hazard to motorists. In addition, the landslide debris may encroach into the highway surface in response to future accelerated movements.</p> <p>The ditch culvert appears to be sagging as it is not draining properly, and the water continues ponding inside and beyond the ends of the culvert. Impedance of surface drainage in the ditch could result in accelerated landslide movement and instability of the highway embankment side slopes. In addition, the culvert may get damaged/distorted in response to future accelerated movements.</p> | | |

Recommendations:

It is recommended to remove this site from the GRMP.

Km 2.7: In the short-term, the local MCI should visually monitor the lower landslide, particularly after heavy rainfall events, to check if the landslide debris encroaches into the highway lanes in response to an accelerated movement. The ditch to the north and the south of the culvert should be slightly contoured to enhance surface drainage. The area located between the highway and the toe of the lower backslope landslide should also be touched, without significantly changing grades, to drain ponded water into the existing ditch.

In addition, the local MCI should periodically inspect the culvert to ensure it is not damaged or separated. Consideration should be given to lining the existing culvert with a more robust pipe (e.g., a smooth wall steel pipe) to sustain ongoing landslide movements. If the culvert is damaged or separated in response to the landslide movement, a new SWSP pipe will have to be auger bored below the toll roll debris to enhance surface water drainage in the highway ditch.

The long-term remedial measure may include the installation of a gravity wall in the highway ditch to retain the toe of the landslide.

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 | Senior Geotechnical Engineer

José Pineda, M.Eng., P.Eng.
Associate | 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

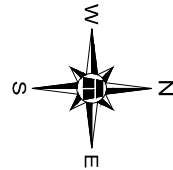
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification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

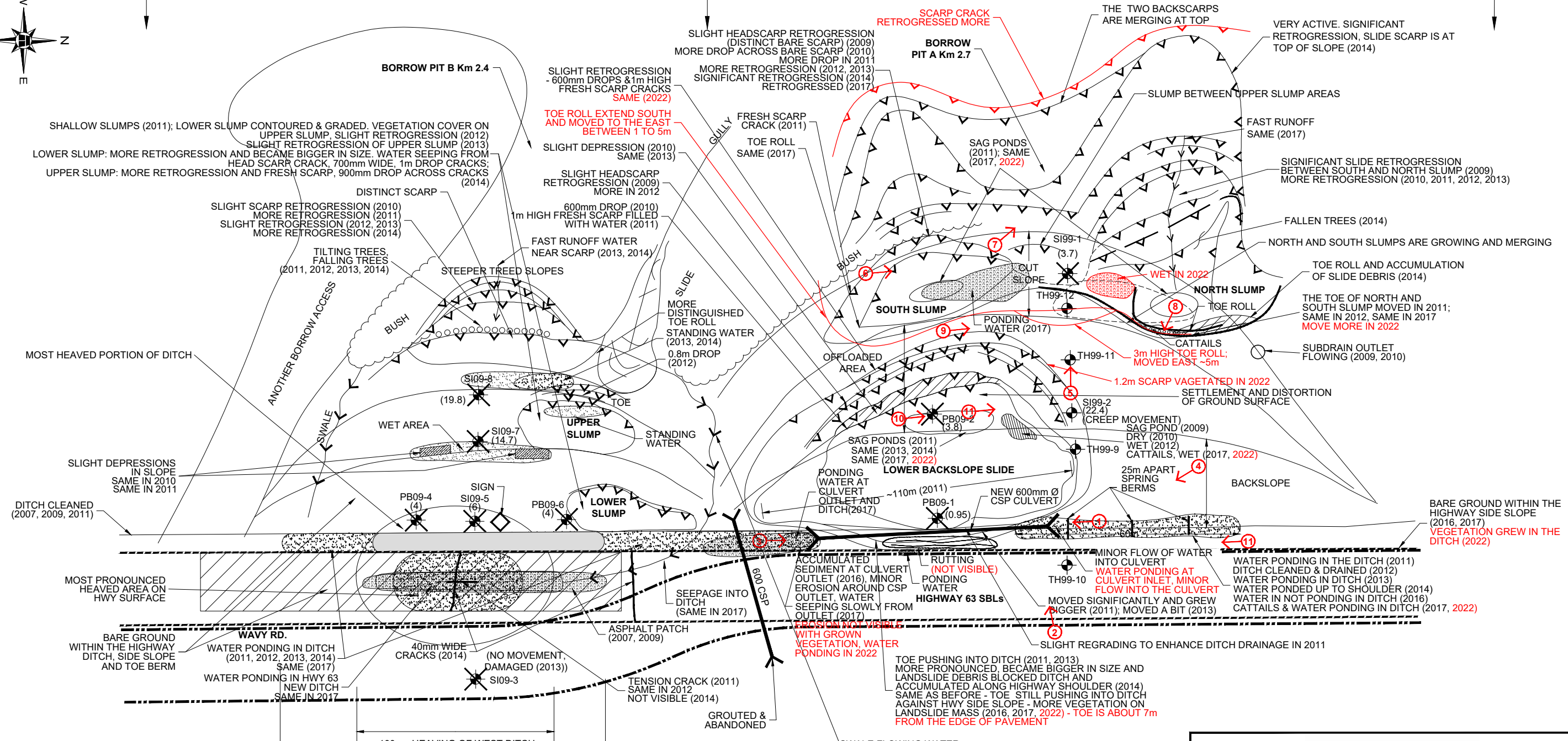
7. INDEPENDENT JUDGEMENTS OF CLIENT

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.



NC017A-1 (km 2.4)

NC017A-2 (km 2.7)



NOTES

1. PREVIOUS OBSERVATIONS ARE SHOWN IN BLACK.
2. HWY 63 SOUTH BOUND LANE WAS RELOCATED TO THE EAST OF ITS ORIGINAL LOCATION (km 2.4) DURING THE CONSTRUCTION OF THE PARSONS CREEK INTERCHANGE IN 2015 - A SMALL TOE BERM WAS PLACED BY OTHERS AGAINST THE HILL AT km 2.4 SLIDE LOCATION. A SLUMP WAS NOTED IN THE BERM SIDE SLOPE IN 2016.
3. **JUNE 7, 2022 OBSERVATIONS ARE SHOWN IN RED**

LEGEND

- EXISTING TEST HOLE
- SHEARED INSTRUMENT (FALL 2009)
- PHOTOGRAPH NUMBER AND APPROXIMATE LOCATION AND DIRECTION
- () DEPTH OF MOVEMENT IN METERS
- SI = SLOPE INCLINOMETER / PNEUMATIC PIEZOMETER
- PB = POORBOY / STANDPIPE PIEZOMETER
- APPROXIMATE ALIGNMENT OF NEW HWY 63 SOUTHBOUND LANES
- APPROXIMATE ALIGNMENT OF OLD HWY 63 SOUTHBOUND LANES



**NORTH CENTRAL REGION
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2022 GEOHAZARD ASSESSMENT
NC017A: HWY 63:12 BACKSLOPE FAILURES
(km 2.4 AND km 2.7)
SITE PLAN**

FIGURE NC017A-1

| | |
|-------------|----------------|
| DRAWN BY | ML |
| DESIGNED BY | JGP |
| APPROVED BY | TSA |
| SCALE | N. T. S. |
| DATE | SEPTEMBER 2022 |
| FILE No. | 32122 |





Photo No. 1 – Looking at the inlet of the culvert installed in the highway ditch below the lower landslide toe roll; water is slightly ponding at the culvert inlet location



Photo No. 2 – Looking west at NC017A-2 landslide area



Photo No. 3 – Looking north at culvert outlet; more vegetation grew in ditch and water ponding at outlet in 2022



Photo No. 4 – Looking southeast at a scarp cack of the lower backslope slide



Photo No. 5 – Looking at the upper backslope slump areas and toe rolls



Photo No. 6 – Looking at the southern flank of the upper backslope slump



Photo No. 7 – Looking northwest at the head scarp cracks of the upper backslope slump



Photo No. 8 – Looking at a tension crack within the toe of the upper north slump; the tension crack is 1 m wide x 1 m deep; note seepage at depth of 0.5 m



Photo No. 9 – Looking north at a 3 m high toe roll; the toe roll moved about 5 m to the east and buried TH99-12



Photo No. 10 – Looking north at head scarp crack of the lower backslope landslide; more vegetation grew within the landslide mass



Photo No. 11 – Looking north at sag pond with cattails and noted wet in 2022