

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2025 INSPECTION**



Site Number	Location	Name	Hwy	km
PH034	Judah Hill	Fence Slide	744:04	59.177
Legal Description		UTM Co-ordinates (NAD 83)		
SE¼ 29-083-21 W5M		11V E 482792	N 6230946	

	Date	PF	CF	Total
Previous Inspection:	May 28, 2024	14	5	70 (Slide Risk Rating)
Current Inspection:	May 15, 2025	14	5	70 (Slide Risk Rating)
Road WAADT:	630		Year:	2024
Inspected By:	Tyler Clay, Don Proudfoot (Thurber). Rocky Wang (TEC)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance

Primary Site Issue:	<p>An approximately 50 m wide slide, with its backscarp within the road, was repaired in 2005 by excavating the slide mass (including some old stone columns) and rebuilding the highway with geogrid reinforced fill. Since repairs, settlement and cracking of the pavement have occurred and cracks have extended further south and north of the original slide.</p> <p>New landslide formed in highway embankment in August 2023 near km 58.975. A callout inspection and report were completed on August 14, 2023.</p>
Dimensions:	<p>Main slide is about 60 m wide at the road shoulder. Additional areas of pavement distress and cracking extend 80 m to 100 m north and south of the main slide.</p> <p>New landslide at km 58.975 is approximately 15 m wide at the road shoulder and 30 m long.</p>
Date of any remediation:	<p>2022 - The Judah Hill gravel pavement conversion and ditch erosion repair project was administered by LaPrairie under TEC's maintenance contract. The ACP was removed, and the road was converted to a gravel surface between km 58.943 to km 59.625 and ditch erosion repairs were completed between km 58.479 to km 59.539 in fall of 2022. Ditch erosion repair designs consisted of adding Class 1M riprap to ditch areas already filled with rock, regrading and adding Class 1M over geotextile, TRM with synthetic ditch barriers, and adding riprap bowls.</p> <p>2025 – The strong post W-beam guardrail and posts were replaced as part of a larger paving project (CON0023098) of Hwy 744:04 between Peace River and the intersection with Hwy 683.</p>
Maintenance:	Ongoing grading of the gravel surface when required.

Observations:	Description:	Worsened?	
		Yes	No
<input checked="" type="checkbox"/> Pavement	ACP removed and converted to gravel surface as part of fall 2022 construction work. Gravel road surface was in a good condition with no visible disturbance in areas with previously observed pavement damage. (Photo 1, 5 and 6)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	At the new landslide near km 59.975 there has been slightly more retrogression and erosion of the main head scarp since the 2024 inspection. There is also ongoing erosion of the flanks. Two of the guardrail posts were undermined by the slide at the time of the inspection. (Photos 2 and 3) At main slide repair area: the previously observed shallow slump and skin failure in the clay cap that was constructed over the sideslope during the 2005 repairs had no visible changes except for surficial erosion and appears similar to the 2024 condition.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Slightly worse rill erosion is present in the upper sideslope at the main slide repair area (km 59.03). (Photo 4)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	The synthetic ditch barriers installed as part of the erosion repairs have become broken at several locations, likely from impact with the grader blade or winter plowing due to the high ditch elevation. Limited grass growth was noted in the ditch south of km 58.9 towards the Judah Trunk Site (PH090). Geogrid installed as part of the 2005 repair has been previously observed becoming exposed on the embankment downslope resulting in a further reduction of its anchoring capacity.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Instrumentation:

Instruments were read on June 10, 2025 and the results are summarized below:

- SI05-15 (installed in 2005 at the top of the hill in the ATCO gas utility right of way above the Fence Slide, 30 m elevation above the road) – no consistent trend of movement since installation.
- SI10-12 – sheared off at 4.9 m depth in Fall 2019.
- SI10-15 – showed a rate of movement of 1.7 mm/yr over 2.4 m to 5.5 m depth since the fall of 2024 readings. The rate of movement has shown a generally steady trend since initialization and has typically been between 2 to 7 mm/yr (average 4 mm/yr) and there is total cumulative downslope movement of approximately 59 mm.
- SI10-13 and SI10-14 – sheared at depths of 6.4 m and 5.7 m (2015), which correspond to the approximate elevation of the base of the upper clay fill of the 2005 repair.
- PN10-12 and PN10-15 – Pneumatic piezometers showed decreases in groundwater level of 0.02 m and 0.03 m since the fall of 2024 readings. The groundwater depths (equivalent piezometric elevations) have shown generally steady trends since initialization in 2010 at approximately 18 mbgs and 3.5 mbgs respectively.

- PN10-13 and PN10-14 – Pneumatic piezometers are non-operational likely due to being pinched or blocked (PN10-13 has been malfunctioning since Spring 2014 while PN10-14 since Spring 2012).

Assessment (Refer to Drawings PH034-1 to PH034-2):

A smooth driving surface should be easier to maintain through areas with previously observed landslide damage because of the ACP to gravel surface conversion. Any ongoing settlement or slide movements that distort the road surface can be graded out until a more permanent solution is implemented.

The shearing or buckling of SI10-13 and SI10-14 indicate that slide movement or settlement is occurring at a steady rate in the clay backfill from the 2005 repair. SI10-12, located to the south outside the former landslide repair limits, showed a steady annual rate of movement of about 8 mm/yr up until it sheared off in Fall 2019. The movement measured at SI10-15, located north of the slide repair area, is at a rate of about 2 mm/yr (highest movement rate of 11 mm/yr was recorded in the fall of 2020).

The previously observed dipping in the highway pavement surface is the result of the clay fill settling and spreading over time. The shallow sloughing of the clay cap is due to weathering (wetting and desiccation cycles), resulting in loss of cohesion. The repaired sideslope is steep and lateral spreading of the clay fill is expected to continue. The shear depth of the SIs correlates well with this assessment.

The previously observed cracks in the highway shoulder south and north of the Fence Slide (in the vicinity of SI10-12 and SI10-15) within the last few years were getting worse which was indicative of potential slope failures at these locations in the southbound lanes. The new landslide that occurred in 2023 was south of the 2005 repair near SI10-12 and corresponds to this area. As discussed in Thurber's August 14, 2023 callout report, this slide was assessed to be the result of possible water seepage and weathering that led to a loss of cohesion of the plastic clays in the steep embankment fill slope. Future movement of disturbed slide materials at the toe and ongoing erosion is expected to result in further retrogression into the SBL that would also undermine the NBL requiring a significant upslope detour into the hillside. A large increment of retrogression and/or saturation of existing disturbed slide materials could also result in further runout that could potentially impact the CN ROW.

Rill erosion and scouring below the highway SBL resulting from the concentrated water runoff in the lower dipped sections also needs to be addressed as it can lead to progressively larger erosion gullies, skin failures and landslide features, which could eventually retrogress into the roadway. Care will need to be taken when grading the gravel road surface to avoid a buildup of a windrow beneath the guardrail as breaches in a windrow could concentrate runoff and create erosion in the embankment sideslope.

Recommendations:**Monitoring:**

Annual inspections should continue with the next inspection occurring in the Spring of 2026.

Maintenance:

- Repair erosion rill areas on the upper sideslope with granular fill to reduce rates of undermining and loss of support for the guardrail posts. Consider establishing an armoured swale at known locations of concentrated runoff to reduce rates of erosion within the upper sideslope. The outlet areas would need to be directed as far down the sideslope (i.e. towards the west) as practical to avoid saturating the embankment fill and initiating new slides. Clear any ridges of gravel under the guardrail to encourage sheet flow runoff rather than concentrated runoff from the road over the side slope.
- High elevated areas of the ditch profile may need to be adjusted (lowered) to prevent damage to the synthetic ditch barriers during road maintenance activities and to reduce risk of ditch overflow onto the road and causing erosion damage.

Short-term Measures:

- The new slide near km 58.975 should be regularly monitored for retrogression of the main scarp into the SBL. Further retrogression would require partial closure of the SBL and signage / barricades would need to be placed for one-way alternative traffic. It is recommended that if this

occurs a culvert should be placed in the upslope ditch to locally widen the gravel road in this section until a more permanent solution can be constructed.

- A short-term solution for the shallow skin failures in the clay cap over the sideslope is to seed and cover the sideslope with Macmat and anchor it into the slope with Duckbill anchors. (\$75K - \$100k)

Mid term to Long-term Measures:

- A medium to long term option consists of sub-excavating the failed slide mass down to intact sand and gravel foundation soil and rebuilding the slope with imported granular material reinforced with uniaxial geogrid up to road surface elevation. The excavation for the gravel wedge would likely need to extend at least to the centreline of the highway. The new fill material should be placed and compacted in uniform lifts, benched into the intact slope surface, utilizing a gravel shear key (if required) to stabilize the slide area. The outer sideslope surface of the repair would need to be completed as a geogrid reinforced vegetated slope. A subdrain should be installed along the base of the excavation to drain any subsurface water that may enter the new fill zone. (\$750k - \$1.5M)
- Alternate medium to long term options would be the installation of driven steel H piles or soil nails. These options would also require some regrading of the highway side slopes. The advantages of the driven steel pile wall or soil nails would be that they can be implemented during winter months and construction is expected to take less time than excavating and replacing the landslide mass. A hybrid option could also be considered using steel piles and localized gravel replacement as described above. (\$750k - \$2M)
- Realignment of the highway into the backslope (now that the natural gas pipeline is decommissioned) and/or CIP pile wall(s), could also be long term options but are likely much more expensive relative to the options suggested above. The realignment is likely the cheapest option but would be limited towards the north end of the site due to the extensive cut required into the upslope hillside. (\$2M - \$10M)

CLOSURE

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

Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer

Tyler Clay, P. Eng.
Geological Engineer
Field Inspection

Bruce Nestor, P.Eng.
Geotechnical Engineer
Report Preparation

STATEMENT FOR USE AND INTERPRETATION OF REPORT

1. STANDARD OF CARE

This Report has been prepared in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality and in compliance with all applicable laws.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment, including this Statement For Use and Interpretation of Report, 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, AS DESCRIBED ABOVE. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE OF THE 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 for the development, design objectives, and/or purposes described to Thurber by the Client. **NO OTHER PARTY MAY USE OR RELY ON THE REPORT OR ANY PORTION THEREOF FOR OTHER THAN THE CLIENT'S BENEFIT IN CONNECTION WITH THE PURPOSES DESCRIBED IN THE REPORT.** Any use which a third party makes of the Report is the sole responsibility of such third party and is always subject to this Statement for Use and Interpretation of Report. Thurber accepts no liability or responsibility for damages suffered by any third party resulting from use of the Report for purposes outside the reasonable contemplation of Thurber at the time it was prepared or in any manner unintended by Thurber.

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 is inherently judgement-based. 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 parties making use of such documents or records with or without our express written consent need to 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 parties. Some conditions are subject to change over time and those making use of the Report need to be aware of this possibility and understand that the Report only presents the interpreted conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client must 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 based on conditions in evidence at the time of site inspections and based on 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 resulting from misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other parties 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 is recommended to 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 need to 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 to confirm and document that the site conditions do not materially differ from those 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. 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 other parties 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, unless such decisions expressly form part of the stated purpose of the Report as described in Paragraph 3.





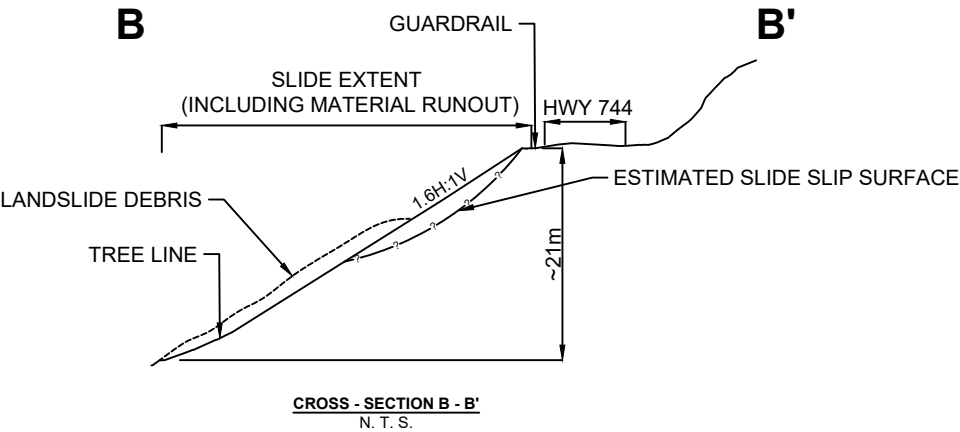
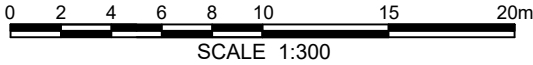
ORTHOMOSAIC IMAGE IS ON AUGUST 3, 2023

LEGEND

- APPROXIMATE INSTRUMENT LOCATION
- LANDSLIDE BACKSCARP
- TREE LINE

NOTES:

- MAY 15, 2025 OBSERVATION SHOWN IN RED**
- AERIAL PHOTO TAKEN ON AUGUST 3, 2023
- MEASUREMENTS BASED ON APPROXIMATE FIELD MEASUREMENTS, HAND HELD GPS, AND LIMITED PHOTOGRAMMETRY
- REFER TO 2023 INSPECTION PLAN FOR HISTORIC INFORMATION



PEACE REGION (PEACE RIVER DISTRICT)

PH034 JUDAH HILL FENCE SLIDE
2025 SITE INSPECTION PLAN

DWG No. 32121-PH034-2

DRAWN BY	DLA
DESIGNED BY	BWN / TTC
APPROVED BY	DWP
SCALE	1:300
DATE	SEPTEMBER 2025
FILE No.	32121




Photo 1.

Looking north from km 58.87 at the converted ACP to gravel road surface within the southern site extents. Gravel road surface was in a good condition with no visible dips or cracking.


Photo 2.

Looking west from km 58.975 at south end of the new landslide that occurred in 2023 with main scarp that is below the guardrail of the SBL. No cracks were observed upslope of the slide area in the road.


Photo 3.

Looking south from the north flank of the 2023 landslide near km 58.99. Ongoing erosion and retrogression of the main scarp since 2024 inspection. Two of the guardrail posts have been undermined.


Photo 4.

Looking south near km 59.03 along the road segment where the downslope embankment had landslide repairs in 2005 and previous pavement damage had been observed prior to the ACP to gravel conversion in 2022. An erosion rill has opened up from concentrated runoff.


Photo 5.

Looking south near north end of chain link fence at km 59.12. Gravel conversion road surface appeared to be in good condition. Vegetation is growing well in the section ditch erosion repaired with Type C TRM and ditch barriers.


Photo 6.

Looking north near the south end of the chain link fence at km 59.05.