ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2021 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH033-2	Judah Hill	Judah Trunk	744:04	58.761
Legal Description		**UTM Co-ordinates**		
SE¼ 29-083-21 W5M		11V E 482906	N 6230669	

	Date	PF	CF	Total
Previous Inspection:	10-June-2020	11	4	44
Current Inspection:	6-July-2021	11	4	44
Road WAADT:	600		**Year:**	2020
Inspected By:	Tyler Clay, TEL Ed Szmata, TRANS Max Shannon, TRANS		Don Proudfoot, TEL Kristen Tappenden, TRANS Erwin Kurz, TRANS	
Report Attachments:	☑ Photographs ☑ Plans		☑ Maintenance Items	

Primary Site Issue:	Failure of joints on band-coupled 450 mm diameter corrugated plastic pipe down-drain installed at km 58.9. Erosion on slope due to water discharging from failed couplings. Cracking and pavement distress on downslope shoulder of road.	
Dimensions:	Cracking and pavement distress extend from shoulder to the middle of the south-bound lane, along approximately 120 m length of road north of the down drain.	
Maintenance:	The highway was closed from May 2013 until December 2013 due to the occurrence of the Sunshine Landslide. The connection between the culvert under the road and the down-drain was reconnected and wrapped with polyethylene in 2010 and other failed couplings were wrapped with a polyethylene sleeve.	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	Longitudinal cracking, settlement, and occasional transverse cracks along 120 m length of road north of the trunk drain. Longitudinal cracks extend from the downslope shoulder into the middle of the south-bound lane. At km 58.95 the SBL dip has not visibly changed, cracks are open between 50 mm to 170 mm in width. Stone columns are showing the ACP and there is cracking in the shoulder near SI10-11, no change from 2020. (Photos 6 and 8)	☑
☑ Slope Movement	Vegetated backslope slide scarp near km 58.9 had no visible changes. (Photo 5) No change noted in the slope below the vicinity of slope inclinometer SI10-10. (Photo 7)	☐
☑ Erosion	There is extensive ditch erosion in the east ditch between this site and the Sunshine Slide site that is undermining the road shoulder in several areas creating a hazard to motorists. (Photo 1) Ditch erosion is occurring within the ditch upslope from the trunk inlet up to 2.5 m wide and	☑

	1.2 m deep. Erosion is ongoing beneath the trunk culvert on the west side of the highway but there has not been major expansion the last few years. (Photos 2 to 4). Gully south of the trunk drain was well vegetated and appeared unchanged. (Photo 4). Erosion rills from runoff were noted on the west side of the road near km 58.85 and were slightly worse from last year (Photo 9).	
☐ Seepage		☐
☑ Bridge/Culvert Distress	The inlet to the drain remains open. Trunk condition appeared unchanged. (Photos 3 and 4)	☐
☐ Other		☐

Instrumentation:

SI98-6i	Inclinometer installed at the toe of the slope, north of the drain. Showed a rate of movement of 6.6 mm/yr over 0.4 m to 3.4 m depth and a rate of movement of 6.9 mm/yr over 0.4 m to 9.5 m depth since the fall of 2020 readings. The last three datasets have shown a trend of steady to increasing movement rates within these two zones. Prior to this cyclic or seasonal displacement trends were observed.
SI98-7i	Inclinometer installed at the toe of the slope, north of the drain. Showed a rate of movement of 0.5 mm/yr over 3.3 m to 4.5 m since the fall of 2020 readings. Historically, only very small creep movements have been noted in this instrument.
SI10-10 and SI10-11	Installed at road shoulder in area of cracking either side of km 59. SI10-10 showed a rate of movement of 2.4 mm/yr over 1.0 m to 8.3 m depth since the fall of 2020 readings for a total cumulative movement of 39 mm. SI10-11 showed a rate of movement of 5.0 mm/yr over 2.0 m to 5.0 m depth since the fall of 2020 readings for a total cumulative movement of 63 mm. Last year the instrument had the highest recorded movement rate since installation (11.9 mm/yr).
PN98-6 PN10-10 PN10-11	Pneumatic piezometers PN98-6 and PN10-11 showed decreases in ground water level of 0.02 m and 0.01 m, respectively, since the fall of 2020 readings. PN10-10 showed an increase in groundwater level of 0.03 m since the fall of 2020 readings. Groundwater depth at PN98-6 has historically been between 7 m to 8 m depth and around 18 m depth at PN10-10 / PN10-11 with only minor variation since installation.
PN98-7a	Instrument is damaged and requires repairs.

Assessment:

Further skin failures should be expected in the steep cut slopes above the road – the maintenance burden does not appear very great at this stage.

Shallow slumps have also begun to appear downslope of the road just below the guardrail in the embankment.

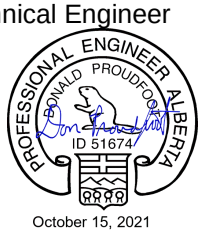
The joints on the trunk down-drain should be monitored and repaired when required to prevent erosion on the slope. Given that it includes drainage all along the road from up to the Lookout slide, a larger pipe with welded joints may be required.

Cracking, settlement and pavement distress on the downslope shoulder and southbound lane indicate the onset of future slope stability problems that could affect the use of the southbound lane of the highway. The slip surface of the slides varies from 8.3 m to 5 m at SI10-10 and SI10-11, respectively. If the trend of increasing measured movement rate at SI10-10 and/or pavement damage worsens the risk level should be increased and a temporary detour construction towards the upslope will likely be required.	
Recommendations:	**Cost**
The ditch erosion damage between this site and the Sunshine slide site should be backfilled with coarse granular fill to restore support to the shoulder and prevent further damage to the ACP. In some locations the drop-off to the ditch gully from the road shoulder is large enough to be a hazard to motorists who may drive close to the shoulder or enter the ditch. Consideration should be given to installing georidge or equivalent check dams at regular intervals and geocell or equivalent erosion control matting.	Maintenance
Continue to monitor pavement condition and seal cracks and patch when required for traffic safety	Monitoring/ Maintenance
Flatten/re-grade upslope sideslope around drain inlet, remove debris and re-armour with Class 1M rip rap.	Maintenance
As a short-term fix, repair remaining damaged band couplings on down-drain.	Maintenance
Replace corrugated plastic down drain with welded HDPE pipe with appropriate flow capacity as a longer-term fix. Repair connection to culvert under road.	$ 250,000
LONG TERM: A highway re-alignment into the backslope could be considered to deal with the slide movements that are affecting the shoulder of the highway. This could buy some time before the slides affect the highway again in the future. A more permanent, but more expensive, solution would be a pile wall.	$300,000 $3,000,000

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.

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



PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 15, 2021
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Tyler Clay, P.Eng.
Geological Engineer

THURBER

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.

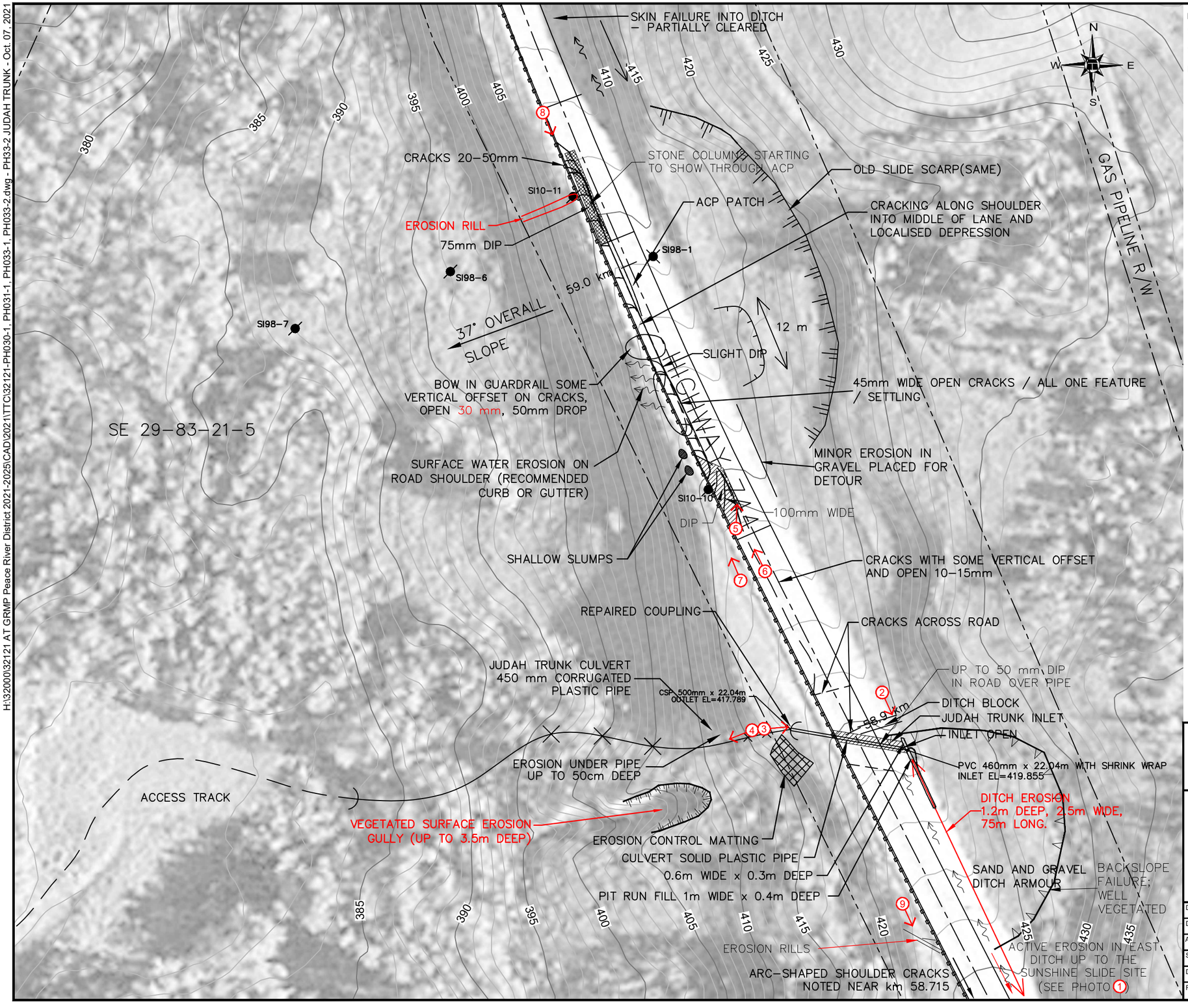
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

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.

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2021\TTC\32121-PH030-1, PH031-1, PH033-1, PH033-2.dwg - PH33-2 JUDAH TRUNK - Oct. 07, 2021



LEGEND:

- SLOPE INDICATOR (ACTIVE)
- SLOPE INDICATOR (INACTIVE)
- DIRECTIONS AND NUMBER OF PHOTO

NOTES:

1 LOCATION DATA RECORDED USING HANDHELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.

2 JULY 6, 2021 OBSERVATIONS SHOWN IN RED

0 10 20 30 40 50m

SCALE 1:750

Alberta

PEACE REGION (PEACE RIVER DISTRICT)

PH033-2 JUDAH HILL - JUDAH TRUNK
2021 SITE INSPECTION PLAN

DWG No. 32121-PH033-2-1

DRAWN BY	ML
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:750
DATE	OCTOBER 2021
FILE No.	32121

THURBER ENGINEERING LTD.

THURBER

	**Photo 1.** Looking south at the ditch erosion upslope from the Judah Truck Inlet towards the Sunshine Slide site. Erosion is worse and cutting towards the road and has begun to undermine the ACP shoulder in select areas creating a hazard for vehicles.
	**Photo 2.** Looking southeast at the ditch erosion upslope from the Judah Truck Inlet. No significant change from 2020 condition.

THURBER

	**Photo 3.** Looking west at km 58.9 at the corrugated plastic down-drain at connection to the centerline culvert. No change from 2020.
	**Photo 4.** Looking southwest at km 58.9 at CPP drain and erosion gully further downslope. Gully is well vegetated and has not visibly changed from 2020.

	**Photo 5.** Looking east from km 58.9 at vegetated backslope slide scarp No change from 2020.
	**Photo 6.** Looking northwest from km 58.95. Dip in the SBL has not visibly changed. Crack apertures are open from 50 mm to 170 mm in width.

	**Photo 7.** Looking northwest from km 58.93 at slope below the highway near SI10-10. No change from 2020.
	**Photo 8.** Looking northwest from km 59.01 at cracking within the shoulder and southbound lane near SI10-11. Stone columns showing through the ACP in the SBL. No major change since 2020.

Photo 9.
Looking south at erosion rills on the west side of the highway near km 58.85. Slightly worse from 2020 condition.