

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



Site Number	Location	Name	Hwy	km
PH032	Judah Hill	Makeout Landslide	744:04	57.924
Legal Description		UTM Co-ordinates (NAD 83)		
SE¼ 20-083-21 W5M		11U E 483171	N 6229947	

	Date	PF	CF	Total
Previous Inspection:	May 17, 2023	5	6	30 (Highway)
		13	2	26 (Downslope)
Current Inspection:	May 15, 2025	5	6	30 (Highway)
		13	2	26 (Downslope)
Road WAADT:	630	Year:		2024
Inspected By:	Don Proudfoot, Tyler Clay (Thurber) Rocky Wang (TEC)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input checked="" type="checkbox"/> Maintenance			

Primary Site Issue:	<p>In 1997, this section of the highway was partially realigned into the backslope and other repairs completed including a pile wall.</p> <p>In 2001, a 40 m wide landslide occurred affecting both highway lanes. Repair work was conducted in the form of a toe berm and drainage improvements in the upslope ditch. In 2005, the road was re-aligned to the east into the backslope and re-grading/off-loading of the sideslope was conducted below the highway.</p> <p>Between 2006 and 2013, slides developed to the south of the re-graded area and erosion occurred along the lined channel for the subdrains at the toe of the sideslope. Subsequently, cracking and slope movement occurred below the drains and below the 1997 pile wall.</p> <p>In October 2013, several crack features were observed in the ACP observed above the 1997 pile wall and the 2005 repair with a landslide bowl feature developed about 20 m downslope of the highway at km 58.12 below the outlet of a subdrain pipe.</p>
Dimensions:	Refer to attached Figure.
Date of any remediation:	<p>1997 – Partial highway realignment into the backslope and slope flattening, reconstruction of embankment with lightweight shredded tire fill, and buried tied-back pile wall.</p> <p>2005 – Highway realignment into backslope, regrading/off-loading below the highway.</p> <p>2014/15 – As part of Contract CON0015153, two cast-in-place concrete pile walls (Makeout and km 58) supported with tieback soil anchors were installed below the cracks in the ACP and the landslide bowl feature was excavated and rebuilt with uniaxial geogrid reinforced clay fill.</p>
Maintenance:	The concrete drain trough/gutters for the KM 58 and Makeout pile walls were cleaned in 2018.

	The pavement of the PH032 site was overlaid, and strong post W-beam guardrail replaced (rails only, previous posts reused) in summer 2025 (after the current inspection) as part a larger paving project (CON0023098) of Hwy 744:04 between Peace River and the intersection with Hwy 683.		
Observations:	Description:	Worsened?	
		Yes	No
<input checked="" type="checkbox"/> Pavement	<p>A crack and minor dip in the SBL (km 58.04) behind the km 58 pile wall was slightly worse; 75 mm wide tension crack with up to 50 mm drop (Photo 3).</p> <p>At the Makeout pile wall the pavement condition appeared largely similar to the 2023 condition (Photo 8).</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	<p>The old landslide scarps below the km 58 pile wall that were regraded in 2015 have ongoing movement at intermittent rates. A tension crack along the downslope edge of the old pile wall with up to 0.3 m of drop was first observed in 2023 (Photo 4).</p> <p>The tieback and waler of the old downslope wall are exposed near the middle of the wall with a 1.2 m drop. Most of the piles from the old wall are now exposed with the highest drop at 2.0 m from the top of the exposed piles (unchanged from 2023). Overall drop of 2.5 m at backscarp at north end of old pile wall. (Photo 5).</p> <p>The bench and graded area below the Makeout pile wall was in good condition with no observable changes from 2023 (Photo 9).</p> <p>Lower slope area between the walls appears the most active; exacerbated by seepage and erosion processes from disconnected drains (Photo 6).</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	<p>Both ends of the km 58 pile wall have become eroded by runoff water and water overtopping the outlet of the pile wall due to blockage of the drain trough with sediment buildup. Scour at the north end of the wall has become worse (up to 1.5 m deep and 1.2 m wide) exposing the gutter and subdrain outlet pipes. Multi-flow subdrain has become disconnected from drainpipe (Photo 7).</p> <p>The solid HDPE outlet drainpipe for the clay backfilled area became disconnected from the perforated CSP drainpipe at the base in 2018 and erosion damage is ongoing.</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	No major changes observed at previous seepage area in the lower slope area between the pile walls near the active erosion gully (Photo 6).	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	No change observed in the ACP shoulder protective cover at either pile walls (Photos 2, 8 and 10).	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Instrumentation:

The operational instruments were read on June 10, 2025.

Makeout Pile Wall*Slope Inclinometers PM12 and PM24*

Two slope inclinometers were installed in the pile retaining wall piles during construction. PM12 showed a rate of movement of 3.0 mm/yr over the length of the pile and a rate of movement of 4.5 mm/yr over the combined length of the pile and waler during the current readings. PM24 showed no discernible movement during the current readings. The SIs have shown 3.6 mm or less of overall pile head deflection.

Load Cells VC1848, VC1849, VC1851, VC1852 and VC1854

The load cells showed increases in measured load ranging from 1.96 kN to 6.56 kN. The load cells have shown a trend of slowly increasing loads since the end of construction, with seasonably higher loads during the winter months.

KM 58 Pile Wall*Slope Inclinometers PK15, PK36, PK54 and PK80*

Four slope inclinometers were installed in the retaining wall piles during construction. The rates of movement over the length of the piles ranged from no discernible movement in PK15 and PK36 to a rate of movement of 1.6 mm/yr in PK80. Total cumulative downslope pile deflection has been up to 12 mm since the end of construction and there is a current overall trend of slow downslope movement.

Load Cells VC1853 and VC1855 to 1862

The load cells showed minor changes in measured load ranging from a decrease in VC1859 to an increase of 6.64 kN in VC1862. The anchors at the KM 58 wall show an overall trend of slowly increasing load, with seasonably higher loads during the winter months. Load cells VC1862 (K15M) and VC1858 (K15L) are currently showing loads above their SLS design loads.

Assessment (Refer to Drawing PH032-1):

The newly reconstructed slide bowl repair and pile walls appear to be performing well. Recent movement observed in the passive soil bench below the km 58 wall was anticipated and accounted for in the design.

The progressing of the scour below the disconnected drainpipe at the base of the clay backfilled slide bowl will need to be monitored. This slide could grow rapidly in size and retrogress toward the highway if the water leakage is not remediated.

Recommendations:**Monitoring:**

The slope inclinometers will continue to be read manually twice per year and the datalogger installed at the site will continue to take readings of the load cells twice daily as part of the Geohazard Assessment Program.

Maintenance:

- The pile wall surface drainage gutters will require to be regularly cleaned to continue to provide erosion protection for the partially buried pile wall and avoid clogging of its solid down drain pipes. The void at the north end of the km 58 pile wall should be backfilled with granular fill and topped with Class 1 riprap to prevent further expansion of the erosion damage. The multi-flow subdrain will also need to be reconnected to the down drain pipe at the km 58 pile wall.
- Some further drainage efforts might be required at the wet area near the south end of the km 58 wall as a future maintenance item as history has shown that persistent seepage can lead to slide movements. The disconnected drainpipe below the north end of the km 58 pile wall should be reconnected to help prevent further retrogression of the landslide scarp that has formed below it.

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
Site 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.

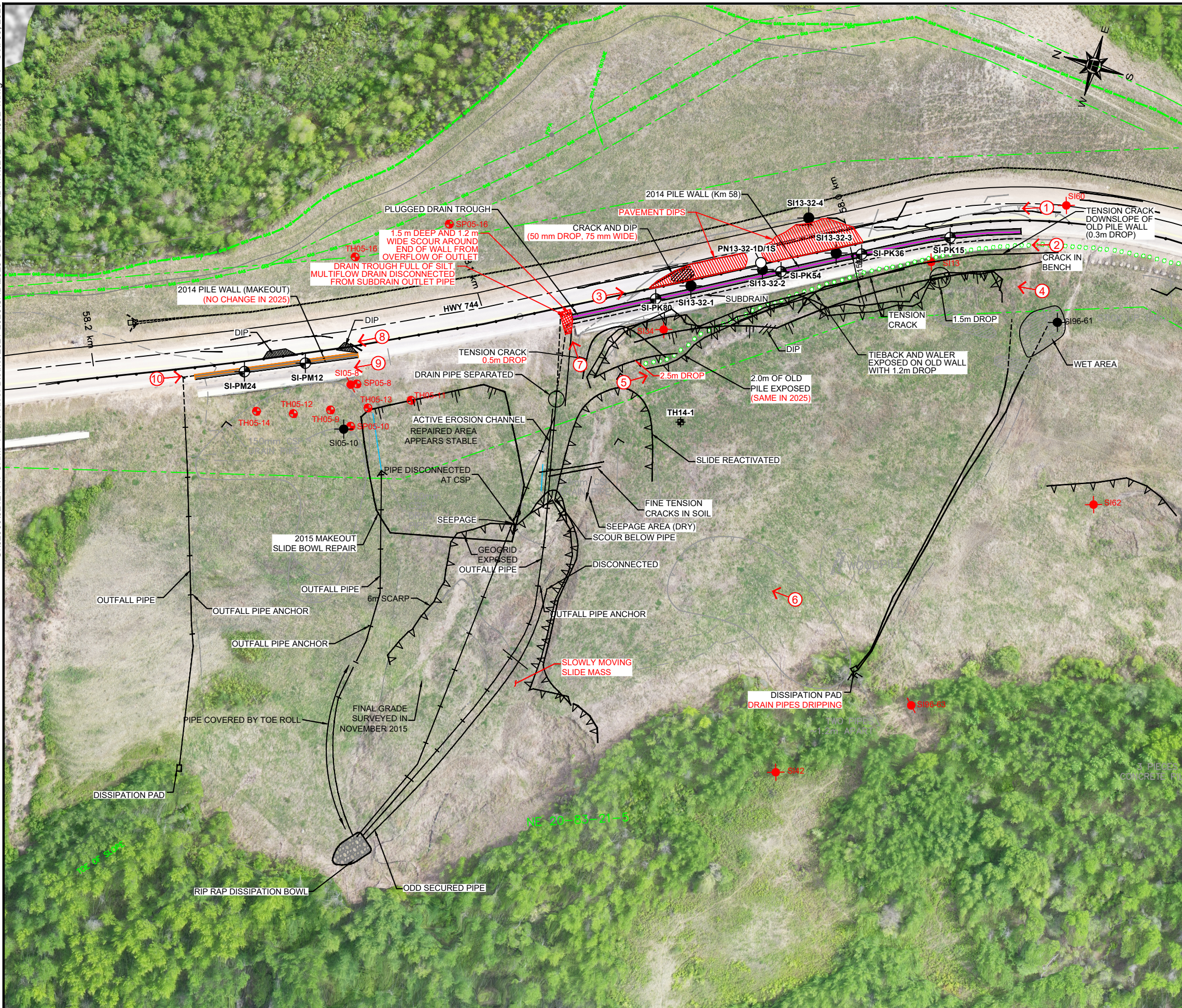
5. INTERPRETATION OF THE REPORT

- 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.

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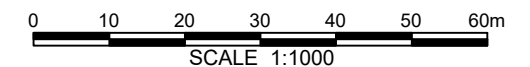


LEGEND

- 2014 SLOPE INCLINOMETER LOCATION
- 2014 TEST PIT LOCATION
- PREVIOUS SLOPE INCLINOMETER (PRESENT)
- PREVIOUS SLOPE INCLINOMETER APPROXIMATE LOCATION (MISSING)
- 2014 PNEUMATIC PIEZOMETER (PRESENT)
- PREVIOUS TEST HOLE LOCATION
- 2014 PILE WALLS
- 1997 H-PILE REINFORCED CONCRETE PILE WALL
- GASLINE ABANDONED IN 2018
- GASLINE ABANDONED IN 2005
- LEGAL RIGHT OF WAY
- GUARD RAIL
- DRAINAGE PIPE OUTLET
- SOLID DRAIN PIPE
- BURIED DRAIN PIPE
- CONTROL POINT
- DIRECTION AND PHOTO NUMBER

NOTES:

1. LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
2. MAY 15, 2025 OBSERVATIONS SHOWN IN RED.
3. ORTHOMOSAIC DERIVED FROM UAV IMAGERY FLOWN BY THURBER IN MAY 2024



ORTHOMOSAIC IMAGE TAKEN ON MAY 28, 2024



PEACE REGION (PEACE RIVER DISTRICT)

PH032-1 HWY 744:04 JUDAH HILL - MAKEOUT SLIDE
2025 SITE INSPECTION PLAN

DWG No. 32121-PH032-1

DRAWN BY	DLA
DESIGNED BY	BWN / TTC
APPROVED BY	TSA
SCALE	1:1000
DATE	SEPTEMBER 2025
FILE No.	32121



**Photo 1.**

Looking northwest from the SBL shoulder of Hwy 744:04 at km 57.98 along the guardrail above the km 58 pile wall. There have been no major changes in the cracks in the ACP within the southern half of the wall since 2023.

**Photo 2.**

Looking northwest from the south end of the km 58 pile wall. The ACP shoulder protective cover was in good condition. No significant changes were noted downslope of the wall at this site relative to the 2023 condition.

**Photo 3.**

Looking south from the north end of the km 58 pile wall. Overall road condition appeared similar to 2023 condition; tension crack in center of photo had a 50 mm drop with a width of 75 mm.

**Photo 4.**

Looking northeast from below the south end of the km 58 pile wall. The old landslide scarps below the pile wall that were regraded in 2015 have ongoing movement with a drop of up to 1.5 m at the south end of the wall.

**Photo 5.**

Looking southeast at the landslide scarps downslope from the km 58 pile wall (km 58.07). A tension crack in this area first observed in 2023 had a 0.5 m drop. The old piles are exposed up to 2.0 m in height. Overall drop of 2.5 m at backscarp at south end of old pile wall.

**Photo 6.**

Looking at the north flank of the slowly moving lower slide area between the pile walls. Seepage from a disconnected drainage pipe is causing erosion and exacerbating slide movement. No major changes from the 2023 condition.

**Photo 7.**

Looking at the north end of the km 58 pile wall where the drain outlet has become blocked and caused water overflow and scour exposing the subdrain and gutter pipes. Multiflow subdrain has become disconnected from the outlet pipe.

**Photo 8.**

Looking northwest at the highway above the "Makeout" pile wall. Overall condition appeared similar to 2023 inspection.

**Photo 9.**

Looking north at the bench and graded area below the “Makeout” pile wall. Area appeared in good condition and had no observable changes from 2023.

**Photo 10.**

Looking at the north end of the top of the “Makeout” pile wall. Drainage trough inlet was relatively clear and functioning.