

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2024 INSPECTION**



Site Number	Location	Name	Hwy	km
PH061	East Hill	36+180 to 37+130 Site 4	2:60	36.7
Legal Description		UTM Co-ordinates (NAD 83)		
NW & E29-083-21 W5M		11V E 482790	N 6231755	

	Date	PF	CF	Total
Previous Inspection:	May 25, 2022 Site 4 Upslope	2	5	10 (Slide Risk Rating)
		8	4	32 (Slide Risk Rating)
	Shallow Slides (37+050) Shallow Slide at Trunk (36+500)	7	3	21 (Slide Risk Rating)
Current Inspection:	May 28, 2024 Site 4 Upslope	2	5	10 (Slide Risk Rating)
		8	4	32 (Slide Risk Rating)
	Shallow Slides (37+050, 37+300) Shallow Slide at Trunk (36+500)	7	3	21 (Slide Risk Rating)
Road WAADT:	3760	Year:	2023	
Inspected By:	Don Proudfoot, Tyler Clay, Cole Szakacs (Thurber). Rocky Wang, Robert Senior (TEC)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance			

Primary Site Issue:	Large landslide (Site 4) on south side of Grouard bridge previously encompassed highway in 1980s. Mitigated upslope area by major crest unloading. Local gullying and erosion mainly on the north side of east approach embankment of Grouard bridge. Shallow instabilities of fill slope of roadway/cutslope to adjacent CN railway. Previous major gully erosion issues from elephant drain discharging midslope at 36+450; mitigated in 2007 with construction of new elephant trunk drain. Earth flow occurred in Spring 2016 at base of gully at 36+230 that encroached into the Heart River.
Dimensions:	Site 4 landslide is 200 m wide; extends 150 m upslope of roadway. CN rail line runs parallel (30 m horizontal) from roadway on downslope side. Earth flow at 36+230 is located 85 m downslope of highway and is approximately 30 m wide (widest point at the main gully head) and 100 m long.
Date of any remediation:	Slope grading and concrete drainage swales were constructed at the Grouard bridge and within the ditch in 2017/2018. Concrete curb added at Grouard bridge to direct runoff into the concrete swale during Fall 2022 repairs.
Maintenance:	Minor maintenance on the east approach embankment of Grouard bridge in 2014.

	Highway repaved and multiple ditch and culvert repairs completed in 2022.		
Observations:	Description:	Worsened?	
		Yes	No
<input type="checkbox"/> Pavement		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	<p>Earth flow first noted in 2016 below the erosion gully at 36+230 has ongoing movement but no major retrogression towards upslope erosion gully. (Photo 61-02).</p> <p>Shallow slide 10 m downslope of road embankment at 36+350 had no visible expansion of main scarp since 2022 and was vegetated (Photo 61-01). A new shallow slide has formed immediately northeast of the previous shallow slide (36+365). Slide area was approximately 15 m wide with 0.15 m of vertical drop and was similar to the two other shallow failures observed within this embankment section downslope of the highway. (Photo 61-04 and 61-05)</p> <p>Shallow slide first observed in 2022 in lower highway embankment near 36+400 has ongoing movement but no major retrogression. The slide area was offset approximately 35 m from the highway.</p> <p>Upslope of Site 4 landslide continues to appear inactive. (Photo 61-12).</p> <p>Overgrown scarp between southwest side of highway and CN rail tracks near km 37+300 has ongoing slow movement but no fresh scarps or visible retrogression towards the highway (Photo 61-12). Shallow slump on CN cutslope just below roadway at 37+300 appears to have recent slide activity with fresh scarps since 2022. (Photo 61-13)</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	<p>Erosion directly below culvert outlet at 36+225 was slightly deeper as this culvert has been re-established as part of the Fall 2022 repairs (Photo 61-01). Headwall of erosion gully further downstream from culvert outlet is overgrown and does not appear to have expanded significantly (Photo 61-02).</p> <p>Gullying at 36+470 and drop at the edge of the ACP was repaired in Fall 2022.</p> <p>Erosion within southeast side of Grouard Bridge abutment slope was repaired in Fall 2022 (37+050). Previous road runoff in this area has been mitigated by construction of a concrete curb. Curb and swale system were functioning as intended with minor sand buildup along the curb. (Photos 61-06 and 61-07).</p> <p>Ditch erosion forming a gully at the base of northeast side of Grouard bridge embankment below and</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	upstream of concrete swale outlet. Erosion gully was up to 0.8 m wide and 0.6 m deep. (Photo 61-08)		
	Ditch erosion repaired at northwest side of the Grouard Bridge (37+125) (Photo 61-09). Erosion and vegetation disturbance was slightly worse relative to the 2022 condition at the lower section of the trunk drain near km 36+475. (Photo 61-10)		
<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	Trunk drain outlet structure was intact and functioning as intended. (Photo 61-11)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Instrumentation:

Instruments were read on May 20, 2024 and the results are summarized below:

- SI-06 – No discernible movement.
- SI-99 – No discernible movement.
- SI-105 – No discernible movement.

Assessment (Refer to Drawings PH061-1 and PH061-2):

Small deep-seated movements are occurring along the roadway in vicinity of Site 4. These rates of movement are small and/or intermittently active and do not appear to pose any immediate threat unless they begin accelerating.

Shallow slides between km 36+300 and 36+400 are likely due to a progress loss of cohesion in the clay fill due to weathering processes. The two upper slides offset approximately 10 m from the road are shallow but could eventually impact the edge of road as the main scarp retrogresses and erodes. The lower shallow slide at 36+400 (offset approximately 35 m from highway) suggests that a wider portion of the embankment fill has lost its cohesion, and more widespread sliding is starting to occur.

Active slide/earth flow area at the base of the slope below the gully does not pose immediate hazard to the highway but could cause retrogressive instability further upslope in the future.

Grading and the addition of concrete curb and swale structures are expected to reduce the rate of erosion at the Grouard bridge abutments from surface runoff. The sand and gravel buildup at the edge of the highway and along the curb will need to be regularly cleaned to ensure water runoff is not blocked from entering the swale inlets.

The slumps in the sideslope at 37+300, above and below the CN tracks, still appear to be active. CN did some minor grading to remove material from the toe of the upper slide that was encroaching along the tracks but did not substantially unload or stabilize the slides. These slides are also considered to be a result of progressive failure as the clay material gradually lost its cohesion.

Recommendations:

Monitoring:

Biennial inspections should continue with the next inspection occurring in the Spring of 2026. Recommend changing to biennial instrument reading frequency as all three slope inclinometers have shown little to no movement since initialization in 1996.

Maintenance:

- Remove buildup of sand and gravel at the pavement edges, along the concrete curb and within the drain trough around Grouard Bridge embankments.

- Regrade and rock armor ditch or add ECB and synthetic check dams at base of the northeast Grouard bridge embankment (km 37+100)

Short-term Measures:

- Could consider installing anchored (e.g. Duckbill earth anchors or similar) TRM along the upper embankment between km 36+300 and 36+400 where shallow slides are occurring to reduce rates of retrogression and erosion towards the highway. (\$50k - \$100k)

Long-term Measures:

- Mitigation measures (such as excavation of slide material and replacement with gravel backfill or reconditioned geogrid reinforced clay) should be developed and implemented for the shallow slides in the downslope sideslope of the highway embankment fill at 36+350 to 36+400 to avoid potential retrogression into the highway. (\$500k)
- At Sta. 37+300, some grading involving removal of material from site is recommended to flatten the sideslope between the highway and CN tracks. A toe berm could be constructed at the toe of the slope to stabilize the section of slope below the tracks, or a pile wall could be installed to support the south/downhill side of the tracks. (\$500k)

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

Tyler Clay, P.Eng.
Geological 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.

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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.

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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.

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5. INTERPRETATION OF THE REPORT

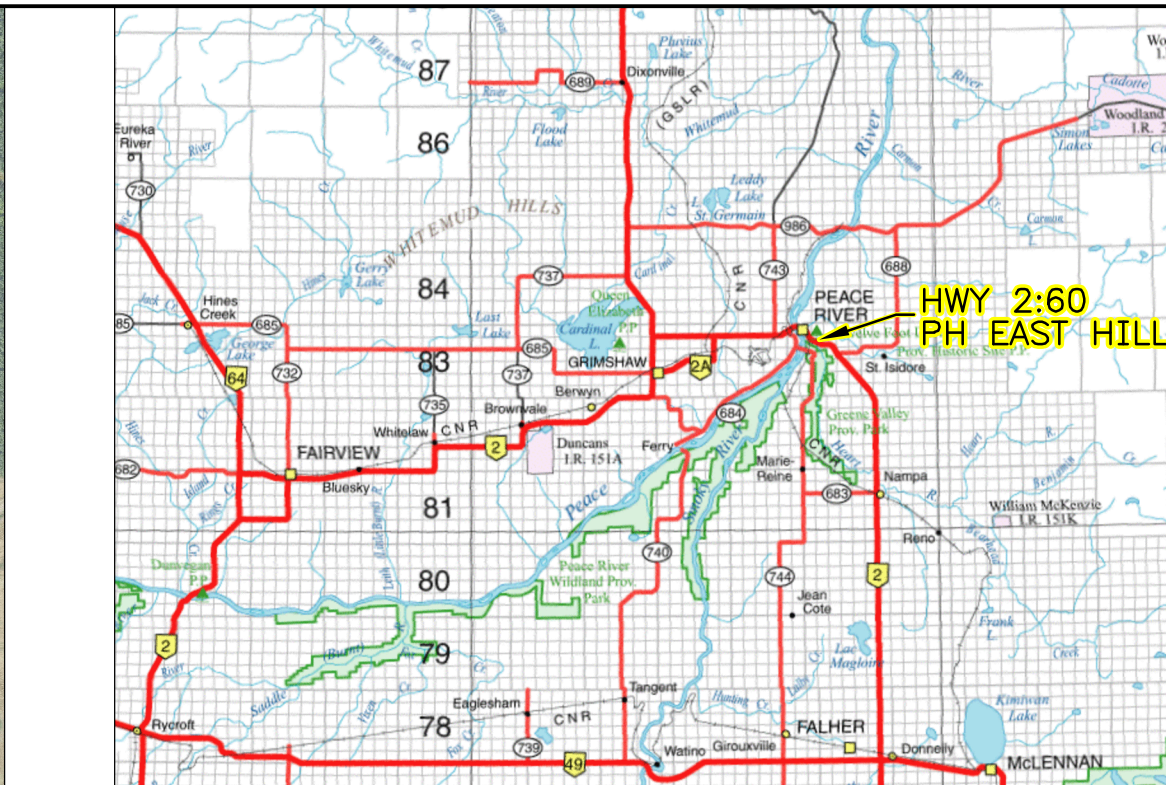
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification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



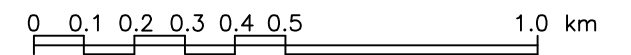
KEY MAP
SCALE 1:1 000 000

LEGEND:
PH061 EXTENT



NOTES:

- FIGURE MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED MAY 2024 AND IS SUBJECT TO ANY LIMITATIONS DESCRIBED THEREIN.
- PHOTO BASE IMAGE COMBINED FROM 2012 AIR PHOTO (TARIN RESOURCES SERVICES LTD.), THURBER DRONE IMAGERY (2022), MACINTOSH PERRY DRONE SURVEY (2022).
- CHAINAGE SHOWN ARE APPROXIMATE ONLY.



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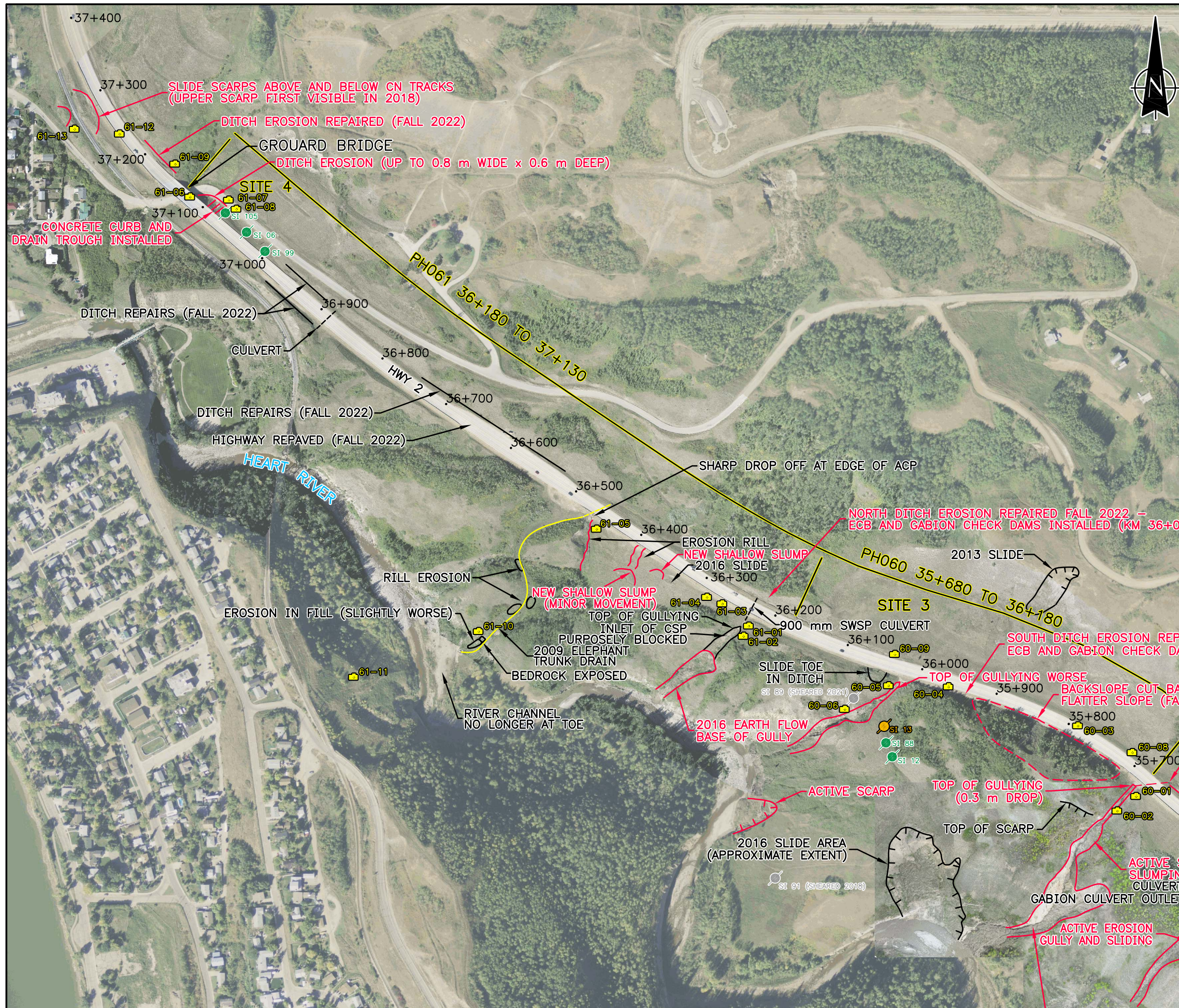
PEACE REGION (PEACE RIVER DISTRICT)

**PEACE RIVER EAST HILL
HWY 2:60 (PH061)
KEY MAP**

FIGURE PH061-1

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:15 000
DATE	OCTOBER 10, 2024
FILE No.	32121-A6D





LEGEND:

- HORIZONTAL CHAINAGE (37+130 GROUARD BRIDGE) ● 36+900
- PHOTOGRAPH LOCATION 📷 41-01
- SLOPE INCLINOMETER
- NO MOVEMENT ● SI 64
- CREEP 📏 SI 82
- MEASURABLE MOVEMENT (OR RECENTLY SHEARED) 📏 SI 82
- PIEZOMETER ▲ PN 004
- PH061 EXTENT —

- NOTES:**
- FIGURE MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED MAY 2024 AND IS SUBJECT TO ANY LIMITATIONS DESCRIBED THEREIN.
 - PHOTO BASE IMAGE COMBINED FROM 2012 AIR PHOTO (TARIN RESOURCES SERVICES LTD.), THURBER DRONE IMAGERY (2022), MACINTOSH PERRY DRONE SURVEY (2022).
 - SLIDE FEATURES, PHOTOGRAPHS AND CHAINANGE ARE SHOWN APPROXIMATE ONLY.

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PEACE REGION (PEACE RIVER DISTRICT)

**PEACE RIVER EAST HILL
HWY 2:60 (PH061) STA. 36+180 TO 37+130
LOCATION PLAN**

FIGURE PH061-2

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:5000
DATE	OCTOBER 10, 2024
FILE No.	32121-A7E





Photo 61-01.
Looking north at culvert outlet with increased gully erosion depth near km 36+225.



Photo 61-02.
Looking south at erosion gully downslope of culvert outlet km 36+225. Erosion is ongoing along the gully flanks but there was not significant expansion since 2022.



Photo 61-03.
Looking west towards the shallow slide scarp approximately 10 m below the highway (36+350). Some minor movement within the slide mass but scarp is vegetated and there were no major visible changes since 2022.



Photo 61-04.
Looking west towards a new surficial skin failure that developed approximately 10 m below the highway and immediately northeast of the previous shallow slide (36+365). Slide area was approximately 15 m wide with 0.15 m of vertical drop and is similar to the two other shallow failures observed within this embankment section downslope of the highway.



Photo 61-05.
View towards the southeast from km 36+450 where three shallow slumps are located on the embankment downslope from the highway. Erosion rill is visible within the bottom of the photo which appeared similar to the 2022 condition.

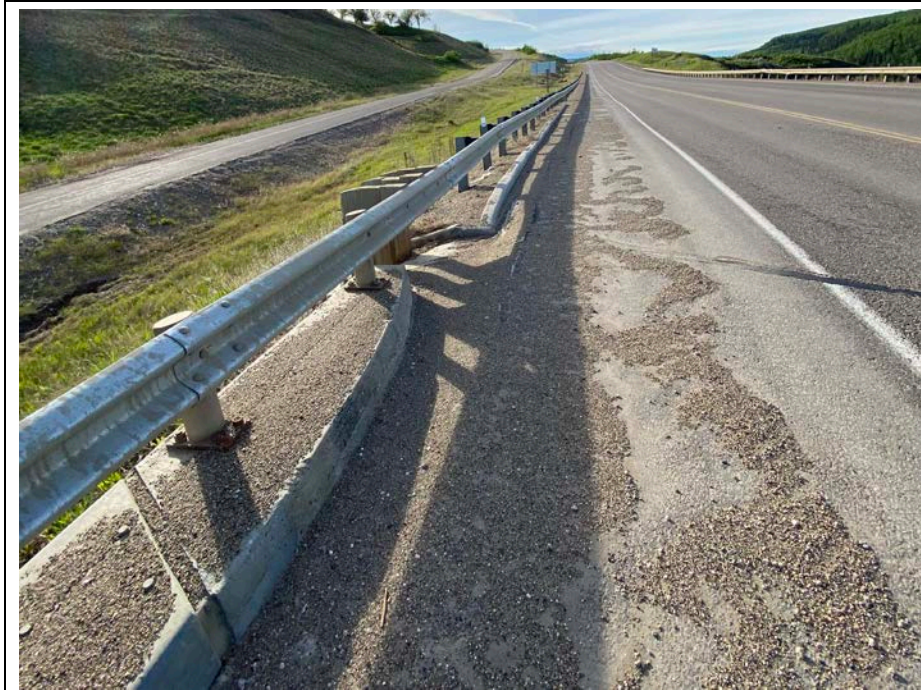


Photo 61-06.
View southeast near km 37+100 at the concrete curb constructed in Fall 2022 and swale at Grouard Bridge constructed in 2017/2018. There was some minor sand buildup but overall, the drain structure was performing as intended.



Photo 61-07.
View southwest of the east Grouard bridge embankment (km 37+100) where there was previous gully erosion damage that was repaired in Fall 2022. There were minor rills and vegetation disturbance (likely from winter salt) but overall repairs were in good condition and the curb/swale drainage system was functioning as intended.



Photo 61-08.
Looking northwest at increased ditch erosion at the base of the eastern Grouard bridge embankment (km 37+100). Erosion gully has formed up to 0.8 m wide and 0.6 m deep.



Photo 61-09.
Concrete swale and cobble armor outlet at the northeast side of the Grouard Bridge (37+125). Previous ditch erosion further downstream from the outlet area was repaired in Fall 2022.



Photo 61-10.
View looking southeast at ongoing erosion of fill area around the lower segment of the elephant trunk drain (km 36+475). Erosion and vegetation disturbance was slightly worse relative to the 2022 condition.



Photo 61-11.
Overall site view from the south side of the valley looking north. Lower section of the elephant trunk drain is visible with no major visible changes since 2022.



Photo 61-12.
Overgrown scarp between southwest side of highway and CN rail tracks. First visible on satellite imagery in 2018. Ongoing slow movement but no fresh scarps. More recently active shallow sliding was occurring downslope of the tracks in this area (KM 37+300).



Photo 61-13.
Intermittently active shallow sliding occurring downslope of the CN tracks near KM 37+300. Main scarp was offset approximately 35 m from southwest pavement edge.