

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2022 INSPECTION**



Site Number	Location	Name	Hwy	km
PH2a	East Hill	32+800 to 33+800	2:60	33.5
Legal Description		UTM Co-ordinates		
SW27-083-21 W5M		11V E 485640	N 6230750	

	Date	PF	CF	Total
Previous Inspection:	9-Jun-2020	8	3	24
Current Inspection:	25-May-2022	8	3	24
Road WAADT:	3990		Year:	2021
Inspected By:	Ed Szmata, TRANS Roger Skirrow, TRANS Max Shannon, TRANS		Don Proudfoot, TEL Tyler Clay, TEL	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	Widespread slumping on the cutslope is occurring in this segment. Much of this slumping is shallow. A large deep-seated upslope failure at 33+550 appears intermittently active.	
Dimensions:	Landslide at 33+550 is about 200 m wide and extends 100 m to 120 m upslope of roadway. Smaller shallow slumps extend the height of the cutslope and on average measure 15 m wide.	
Maintenance:	Minor erosion is occurring locally in ditches on both sides of roadway which should be regraded.	
Observations:	Description	Worsened?
<input type="checkbox"/> Pavement Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	<p>The toe of the shallow slumps between 32+800 to 33+200 were in the northeast ditch with minor additional movement (Photo 2-01). The active scarp is offset 1.5 m from the gravel road north of the highway. No major change from 2020.</p> <p>No significant expansion since 2016 of the landslide at 33+450 that was first observed during the 2013 inspection (Photo 2-02). Landslide at 33+550 is active and toe is locally encroaching into ditch. Ditch partially blocked, no significant changes since 2017 (Photo 2-03).</p>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Minor local ditch erosion (Photo 2-01). Active erosion was noted on the south side of the highway between 33+300 to 33+700 (Photo 2-04) that was worse than the 2020 condition.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>

<input checked="" type="checkbox"/> Bridge/Culvert Distress	Near km 33+000 the culvert inlet is partially buried, and the outlet is damaged. Flow into the dual elephant trunk drains is blocked at one inlet.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation: No instrumentation installed in this area.		
Assessment: There has been recent slide activity and retrogression at the cut slopes near km 33+100 and it is retrogressing towards the gravel road above the Highway (Grouard Trail / Township Road 834A). Ditch has become blocked in some areas and water has been observed to pool in some sections. Potential exists that the landslide at 33+550 could flow onto roadway. Movements of this landslide to date have been slow but could accelerate after a heavy precipitation event. Ditch erosion on the south side of the highway is creating gullied areas with potential for future sidewall instability that could affect the south highway shoulder between 33+300 to 33+700. Backslope and ditch repairs (including ditch armoring) were completed at this site in Summer 2022 as part of the pavement overlay project being administered by McIntosh Perry. These are expected to address most of the primary slide and erosion issues affecting the site and reduce overall risk.		
Recommendations:		Cost
Continue to visually monitor as part of annual inspection of PH002 to assess how well the repair work in 2021 has been at remediating the backslope and ditch issues		-
Surface drainage should be maintained in north ditch and culvert / trunk drain as sediment buildup occurs.		- Maintenance

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
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2022 INSPECTION**



Site Number	Location	Name	Hwy	km
PH2b/2c	East Hill	Retaining Wall 33+850 to 34+050	2:60	33.85- 34.0
Legal Description		UTM Co-ordinates		
SW27-083-21 W5M		11V E 485345	N 6230685	

	Date	PF	CF	Total
East Wall				
Previous Inspection:	9-Jun-2020	3	6	18
Current Inspection:	25-May-2022	3	5	15
West Wall				
Previous Inspection:	9-Jun-2020	3	6	18
Current Inspection:	25-May-2022	5	6	30
Slide West of Pile Wall (KM 34+050)				
Previous Inspection:	9-Jun-2020	n/a	n/a	n/a
Current Inspection:	25-May-2022	11	3	33
Road WAADT:	3990		Year:	2021
Inspected By:	Ed Szmata, TRANS Roger Skirrow, TRANS Max Shannon, TRANS		Don Proudfoot, TEL Tyler Clay, TEL	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	<p>Large deep-seated landslide was occurring below roadway at 34+050 with potential to adversely affect highway if retrogression or reactivation were to occur. Active landslide caused roadway settlement on the eastbound lane at 33+910 since January 2013. Further east at 33+875 an instability of fill within an infilled ravine was previously mitigated with a cantilevered, cast-in-place concrete pile wall reinforced with steel wide-flange with a concrete header beam. Fill slope below wall had ongoing downslope movement and piles were becoming exposed.</p> <p>A concrete, tied-back tangent retaining wall to mitigate the slide movement between (33+925 to 34+000) and support the roadway was installed from August 2016 to October 2017. At the same time, a new concrete cantilever wall was also constructed immediately upslope of the old wall to replace it and stabilize the old ravine area.</p>
Dimensions:	<p>Landslide at 34+050 laterally continuous below roadway extending approximately 200 m south to North Heart River. About 40 m of roadway experiences settlement due to slide activity on the eastbound lane at 33+910.</p> <p>Unstable ravine width at 33+875: 65 m Previous cantilevered wall length: 40 m New anchored tangent pile retaining wall length: 175 m</p>
Maintenance:	No maintenance since construction of the new wall.

Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	ACP above the pile wall has minor dips and minor increased settlement from 2020 condition (Photo 2-08).	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	<p>The fill slope below the wall and area of previously observed movement has been regraded as part of the pile wall installation work. No newly developed scarps or tension cracks were observed downslope of the pile wall since construction completed (Photos 2-05 and 2-06).</p> <p>Active slide area developing west and downslope of the pile wall at 34+050 has expanded with significant more dropdown at the scarp (up to 0.8 m) and extended tension cracks (Photos 2-07 and 2-14). Width of slide area is approximately 75 m and is offset approximately 26 m from the highway.</p>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Erosion at the end of the armored drainage outlet area at the west end of the pile wall. Minor ditch erosion.	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation: Reported under PH070 instrumentation report		
<p>Four (4) Slope Inclinometers within the new pile walls:</p> <ul style="list-style-type: none"> • SI-P40: showed a rate of movement of 2.2 mm/yr in the downslope direction over the length of the pile and a rate of movement of 2.9 mm/yr in the downslope direction over the combined length of the pile and waler since the spring of 2021 readings. Total cumulative pile head movement of 0.9 mm in the downslope direction and a total cumulative movement of 3.0 mm in the upslope direction over the combined length of the pile and waler. • SI-P58: no discernible downslope movement over either the length of the pile or over the combined length of the pile and waler since the spring of 2021 readings. The cumulative pile head movement was 7.5 mm in the uphill direction and the cumulative movement at the top of the water was 9.2 mm in the uphill direction. • SI-P90: no discernible movement in the downslope direction over the length of the pile and a rate of movement of 0.1 mm/yr in the downslope direction over the combined length of the pile and waler since the spring of 2021 readings. Pile 90 has shown a total cumulative pile head movement of 12.3 mm in the upslope direction and a total cumulative movement of 15.4 mm in the upslope direction over the combined length of the pile and waler. • SI-P116: 0.9 mm/yr over the length of the pile and a rate of movement of 1.2 mm/yr over the combined length of the pile and waler since the spring of 2021 readings. Total cumulative pile head movement of 6.4 mm in the downslope direction and a total cumulative movement of 7.2 mm in the downslope direction over the combined length of the pile and waler. <p>Pile number 74 contains one (1) SAA (SAA-P74) and thirty (30) vibrating wire strain gauges.</p> <ul style="list-style-type: none"> • SAA-P74: 1.1 mm/yr in the downslope direction over the length of the pile and an average rate of movement of 0.6 mm/yr over the combined length of the pile and waler in the downslope direction since the spring of 2021 readings. Total cumulative pile head movement of 2.9 mm in the upslope direction and a total cumulative movement of 7.5 mm in the upslope direction over the combined length of the pile and waler <p>The strain gauges showed small increases in negative (compressive) strain on the upslope pile face, while the strain gauges on the downslope pile face showed small increases in positive (tension)</p>		

stress. The maximum change in microstrain since the previous readings was $-13.0 \mu\epsilon$. The changes in strain have been more noticeable in the upper 20 m of the pile.

Sixteen (16) vibrating wire load cells were installed on select anchors. The majority of the load cells showed an increase in measured load compared to the spring of 2021 readings, ranging from 0.05 kN in VC1973 (anchor G59WL) to 8.52 kN in VC1875 (anchor G40WU). Load cells VC1980 (anchor G118PU) and VC2023 (G182PL) showed decreases in measured load of 0.09 kN and 0.03 kN, respectively, since the spring of 2021 readings.

Load cells VC1977 (anchor G39WL), VC1975 (anchor G40WU) VC1972 (anchor G58WU) and VC1973 (anchor G59WL) registered all-time high loads during a period between June 2-10, 2022.

Overall, the load cells show a trend of relatively stable loads. Anchors G39WL and G40WU in Wall Section 2 currently show a trend of gradually increasing load, although these loads are still below the SLS design loads. Anchor G190PL, in the bottom (fifth) row of anchors in Wall Section 4, also shows a trend of slowly increasing load, however the design of the wall assumes that the anchors installed through the piles in this wall section will pick up load over time. Some of the load cells have also shown somewhat higher load values during the winter months, similar to what has been observed in other tied-back pile walls of similar configuration.

Nine (9) pneumatic piezometers and one (1) standpipe were installed prior to construction:

- Pneumatic piezometers PN13-2A, PN13-3B and PN14-2B showed increases in groundwater level of 0.36 m, 0.33 m, and 0.41 m, respectively, since the spring of 2021 readings. PN13-3A, PN14 2A, PN14-3A and PN14-4A showed decreases in groundwater level of 0.10 m, 0.02 m, 0.21 m, and 0.01 m, respectively. The current groundwater readings in PN13-3A, PN13-3A and PN14-4A were the lowest levels measured in the respective instruments since initialization. PN14 3B showed no change in groundwater level compared to the spring of 2021 readings.

Existing pre-construction slope instrumentation that is operational includes:

- SI13-3: No discernible movement measured (instrument may not be deep enough to intercept the active slip surface).
- SI14-2: A new zone of movement, which was not previously recorded, was observed over 17.4 m to 21.0 m during the 2020 readings. This is of significance since this zone is below the tips of the piles in Wall Section 2. Spring 2022 readings measured no discernible movement over 2.8 m to 5.8 m depth, a rate of movement of 1.8 mm/yr over 17.4 m to 21.0 m depth, and a rate of movement of 1.4 mm/yr over 24.7 m to 27.1 m depth since the spring of 2021 readings.
- SI14-3: Historically, has had creep-like movement. 0.9 mm/yr over 3.3 m to 9.4 m depth since the spring of 2021 readings. Movement rates have greatly diminished since the September 2016 readings.
- SI14-4: 4.2 mm/yr over 17.3 m to 19.7 m depth since the spring of 2021 readings. Creep-like movement has been measured between Fall 2016 to Spring 2019 but there has been an increasing movement rate trend within the last three readings.

Assessment:

Large deep-seated landslides are widespread below roadway in this area and have potential to affect highway if they retrogress. The new retaining wall is performing as expected to mitigate settlement issues related to the landslide movement at 33+900. The pile wall is designed to accommodate ongoing downslope movement of the slide mass downslope of the wall. Based on instrument data and site observations there is ongoing creep downslope of the wall and movement rates upslope of the wall have diminished significantly.

Close review of the surface conditions around SI14-2 and future readings is recommended as current trends show potential movement of a failure surface occurring below the pile tips. The risk level for the west wall has been increased this inspection to account for this.

The slide developing west of the wall has developed a very apparent scarp and is expected to considerably worsen over the next 5 years. Due to its current offset from the highway (approximately 26 m) it is not expected to have an immediate impact to the NBL however future retrogression could cause instability that reaches the road shoulder or further if left unmitigated. The progression of this

slide area relative to any changes in the rate of creep movements below the west portion of the wall should be made following each annual inspection to determine if the two are related to a single larger slide movement. Drainage into a slide area below this area is expected to be a factor as the slope loses toe support.

Erosion at the drainage outlets should be monitored by regular visual inspection and if the condition significantly worsens, consideration should be given to extending the armoring or installing a drainpipe to prevent gully retrogression towards the road and disturbance of existing riprap.

Recommendations:	Cost
Continue to visually monitor as part of annual inspection of PH002 and monitor wall instrumentation to ensure the mitigation is performing as designed.	
Due to the increased movements of the landslide block west of the wall and the creep zone under the wall at S114-2, it is recommended that the visual monitoring of this site be changed from once every 2 years to annually.	-
Should confirm whether the camera monitoring posts need replacement (i.e., damaged Styrofoam balls) and how long the camera monitoring system (installed by Queens University) will be kept in place.	-
Ongoing pavement repairs as required until movement upslope from the wall is reduced.	Maintenance

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PEACE REGION (PEACE RIVER DISTRICT)
2022 INSPECTION**



Site Number	Location	Name	Hwy	km
PH2d	East Hill	34+100 to 34+780 Site 1	2:60	34.5
Legal Description		UTM Co-ordinates		
SW27 & SE 28-083-21 W5M		11V E 484800	N 6230710	

	Date	PF	CF	Total
Previous Inspection:	9-Jun-2020	11	5	55
Current Inspection:	25-May-2022	11	5	55
Road WAADT:	3990	Year:		2021
Inspected By:	Ed Szmata, TRANS Roger Skirrow, TRANS Max Shannon, TRANS	Don Proudfoot, TEL Tyler Clay, TEL		
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input checked="" type="checkbox"/> Maintenance Items			

Primary Site Issue:	Site of large landslide that crossed Highway 2 in 1980s. Mitigated on upslope side of roadway by crest unloading. Mitigated on downslope side of highway by toe berm. North Heart River was channelled through large diameter steel culverts which were breached many years ago. Area below road embankment at 34+550 km is unstable: with shallow and deep-seated instabilities as well as widespread gully erosion. Potential exists for retrogressive movement downslope of roadway to adversely affect road embankment.	
Dimensions:	Site 1 landslide is 750 m wide extending 200 m to 500 m downslope of roadway to North Heart River and 300 m upslope of roadway to crest of valley slope. Embankment width in area of concern at 34+550 is 120 m.	
Maintenance:	Minor erosion is occurring in ditches on both sides of roadway which should be regraded. No maintenance activity since 2011.	
Observations:	Description	Worsened?
<input type="checkbox"/> Pavement Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Road fill embankment between 34+450 to 34+600 (old Site 1) had no visible signs of new slope movement/instability (Photo 2-09). Shallow slumping is occurring on upslope side of the roadway within Site 1 landslide. Shallow and deep-seated movements are active just below the large road embankment at 34+550 with minor main scarp and flank retrogression (Photo 2-10). Visually, top of scarps below and just west of the embankment appears similar to 2020 condition (Photo 2-11). Shallow earth slide in backslope at 34+400 partially blocking	<input type="checkbox"/>

	south ditch with no major change from the 2019 condition.	
<input checked="" type="checkbox"/> Erosion	Widespread erosion and gulying occurring on steep slopes of upper berm below road embankment. Minor erosion of ditches both sides of roadway.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	North Heart River diversion culverts breached.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	Elephant Trunk Drain breached further upslope in ravine downslope of roadway. Significant gully erosion and slides have developed along the gully sidewalls at 34+650 (Photos 2-12).	<input checked="" type="checkbox"/>
Instrumentation:		
<p>Downslope:</p> <p><u>Outside of Embankment Area:</u> SI 63 – No discernible movement. SI 64 – No discernible movement.</p> <p><u>Below Road Embankment:</u> SI 10-3 - Near toe of road embankment - No discernible movement. SI 10-4 - 50 m from toe of embankment - Sheared since June 2012 at 6.7 m depth SI 10-5 - 100 m from toe of embankment - Sheared since Fall 2011 at 12.2 m depth</p> <p>Upslope: No operational instrumentation on the upslope side of roadway.</p>		
Assessment:		
<p>Deep-seated movements within the old berms on downslope side of roadway continue to be of concern to the stability of the road embankment at 34+550. Mitigation would be required if SI 10-3 began to register ground movements. The upslope portion of the Site 1 landslide is affected by numerous local shallow instabilities in the form of slumps. These slumps typically do not affect the roadway and toe out above the ditch. The possibility of deep-seated creep movement of the old rupture surface cannot be ruled out, although there is no surviving instrumentation to confirm or disprove.</p> <p>Erosion at the breach in the elephant trunk drain has become significantly worse and will continue to retrogress further upslope and destabilize upper portions of the slope closer to the road. The drain itself has become compromised further upslope and has created a new leak origin area. As gulying continues it is expected the trunk drain will undergo further stress and these new leak points will continue to move upslope along the joints if left unmitigated. Diversion of the current trunk drain to a new alignment to the east is required to slow the erosion (Photo 2-13).</p>		
Recommendations:		Cost
Continue to visually monitor as part of annual inspection of PH2. Slope inclinometers should continue to be monitored twice annually.		-
South ditch should be cleared before it eventually becomes blocked at 34+400. North ditch should be cleared of silt buildup between 34+500 to 34+600.		Maintenance
A new trunk drain alignment should be constructed.		\$300k

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.

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

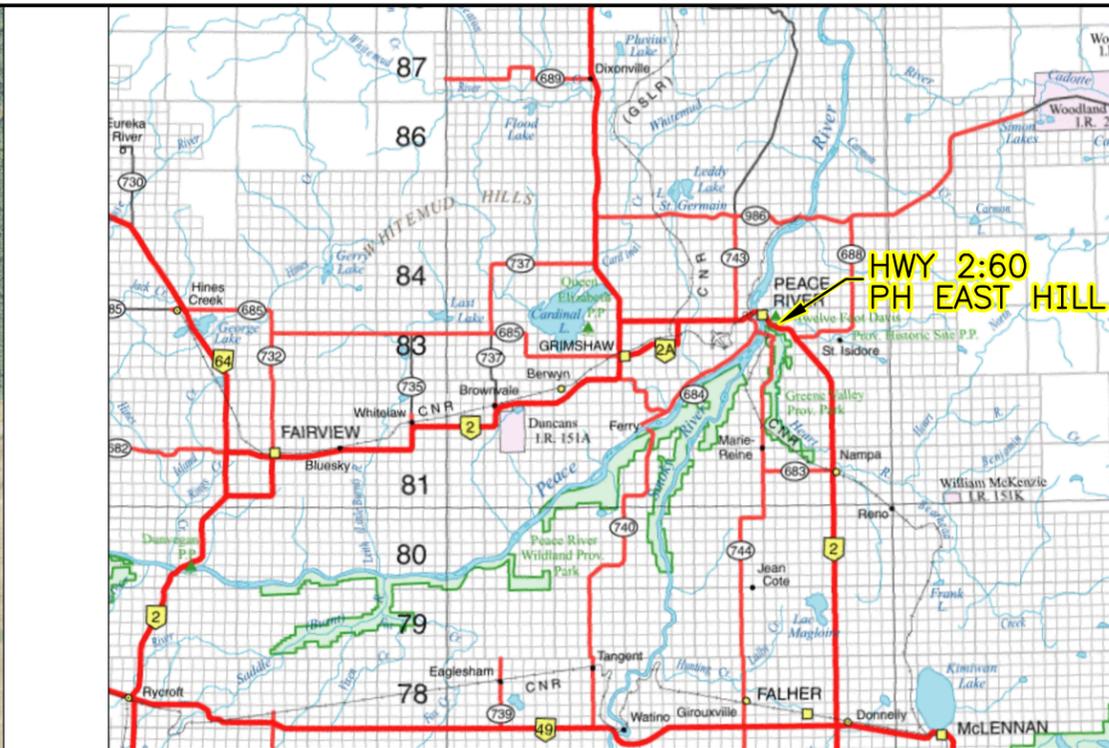
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification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



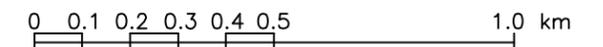
KEY MAP
SCALE 1:1 000 000

LEGEND:
PH002 EXTENT



NOTES:

- 1 DRAWING MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED OCTOBER 2022 AND IS SUBJECT TO THE STATEMENT OF LIMITATIONS AND CONDITIONS INCLUDED IN THE REPORT.
- 2 AIR PHOTO BASE FROM TARIN RESOURCE SERVICES LTD. 0.4 m/PIXEL (2012).
- 3 CHAINAGE SHOWN ARE APPROXIMATE ONLY.



Alberta Transportation

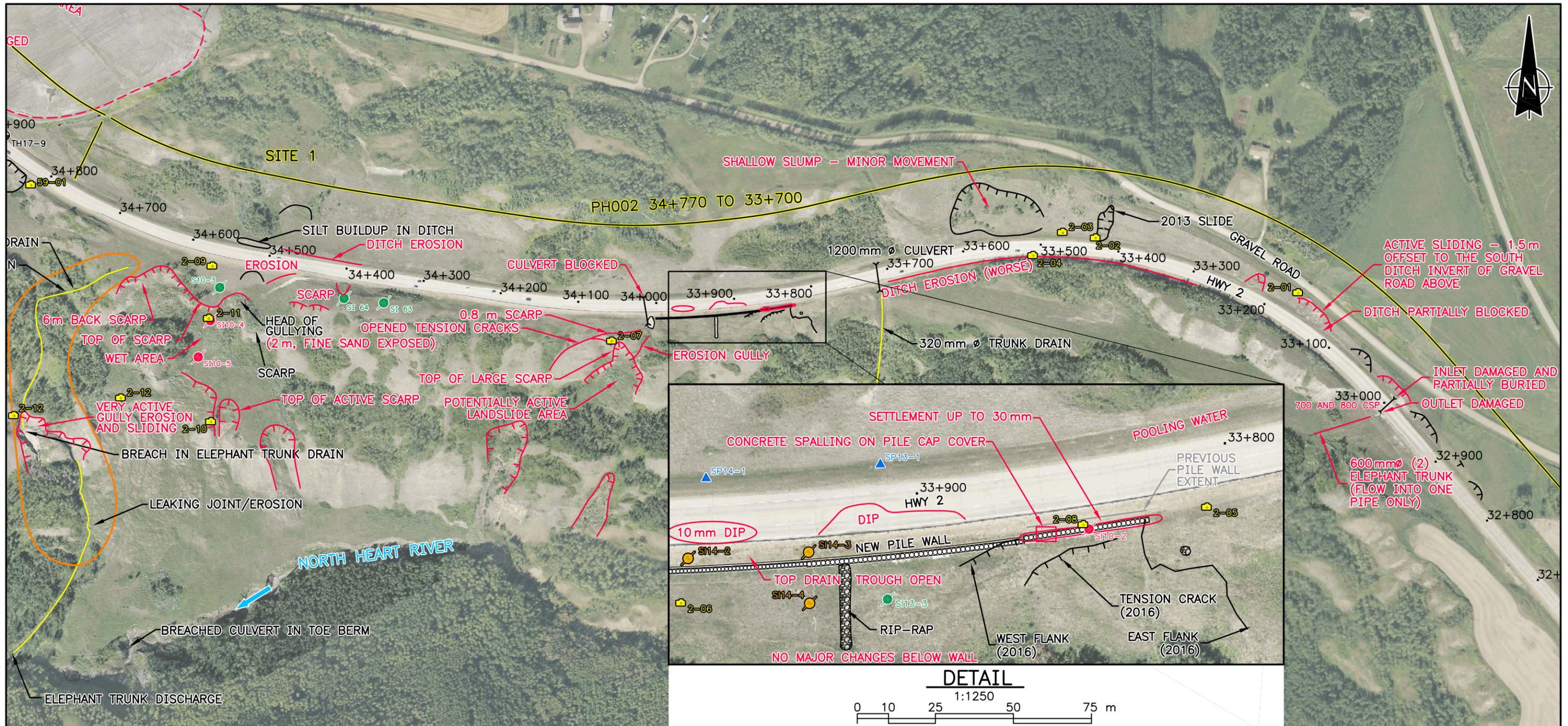
PEACE REGION (PEACE RIVER DISTRICT)

**PEACE RIVER EAST HILL
HWY 2:60 (PH002)
KEY MAP**

FIGURE PH002-1

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:15 000
DATE	OCTOBER 13, 2022
FILE No.	32121-A6C





LEGEND:

HORIZONTAL CHAINAGE (37+130 GROUND BRIDGE)	● 33+900
PHOTOGRAPH LOCATION	📷 44-01
SLOPE INCLINOMETER	📐 SI 64
- NO MOVEMENT	📐 SI 82
- CREEP	📐 SI 82
- MEASURABLE MOVEMENT (OR RECENTLY SHEARED)	📐 SI 82
PIEZOMETER	▲ PN 004
PH002 EXTENT	—
DRAIN BOUNDARY	—

- NOTES:**
- DRAWING MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED OCTOBER 2022 AND IS SUBJECT TO THE STATEMENT OF LIMITATIONS AND CONDITIONS INCLUDED IN THE REPORT.
 - 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.

Alberta Transportation

PEACE REGION (PEACE RIVER DISTRICT)

**PEACE RIVER EAST HILL
HWY 2:60 (PH002) STA. 34+770 TO 33+700
LOCATION PLAN**

FIGURE PH002-2

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:5000
DATE	OCTOBER 13, 2022
FILE No.	32121-A7C

THURBER ENGINEERING LTD.

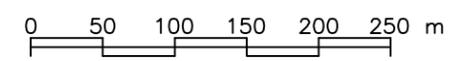




Photo 2-01.
Looking northeast at the shallow cut slope slumps on the northeast side of the road (33+100). Backslope regrading and excavation of the slide areas is to be completed this year. No other new slide areas were noted since the 2021 inspection.



Photo 2-02.
Looking north towards a shallow slide in the cut slope first observed in 2013. No significant expansion or movement since 2016 (33+450).



Photo 2-03.
Looking west towards the toe roll of a larger surficial slump (130 m wide) within the cutslope. There has been minor ongoing encroachment into the ditch since the 2017 inspection (33+550). No major changes relative to the 2020 condition.



Photo 2-04.
Looking southwest towards the south road ditch with active erosion damage between 33+300 to 33+700. Erosion damage has worsened since the 2020 condition.



Photo 2-05.
Looking west at
concrete pile
retaining wall at
33+850.



Photo 2-06.
Looking east at the
retaining wall located
at 33+900.



Photo 2-07.
Looking downslope at the large, active landslide below roadway (34+050). There was a more visible scarp with dropdown up to 1.3 m and tension cracks have extended and opened up further relative to the 2020 condition.



Photo 2-08.
Looking west towards the highway surface above the pile wall at 33+900. Minor dips and cracking is present along previously observed extents. No major changes from the 2020 condition.



Photo 2-09.
Looking east towards the road fill embankment between 34+450 to 34+600 (old Site 1).



Photo 2-10.
Looking upslope towards the northwest at the active slide area below the highway at 34+550. Minor main scarp and flank retrogression were observed since the 2020 inspection.



Photo 2-11.
Looking west at the top of the main scarp below the highway at (34+600). No major changes observed from 2019.



Photo 2-12.
Looking east at the trunk drain breach. Significant gully erosion and landsliding has developed upslope from the initial breach. Terrain is actively eroding and sliding that is expected to continue to retrogress upslope. Diversion of the current trunk drain to a new alignment is required to slow the erosion.



Photo 2-13.
View of historic slide terrain east of the trunk drain breach that is proposed as possible re-alignment option for a new trunk drain. Note existing drain visible near bottom of the slope.



Drone Photo 2-14 –

Photogrammetric 3D model produced from drone imagery of the slide developing west of the pile wall (KM 34+050) and visible scarp and tension cracks (highlighted red). Slide is approximately 75 m wide and has a minimum offset of 26 m from the highway. View is towards the northeast.