

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION - SWAN HILLS
2024 INSPECTION**



Site Number	Location	Name	Hwy	km
SH037-1	Southwest of High Prairie	Nicholls Creek Slide	747:02	35.2
Legal Description		UTM Co-ordinates		
SW09-74-19-W5		11U N 6,138,622	E 508,118	

	Date	PF	CF	Total
Previous Inspection:	5-Jun-2023	12	4	48 (Call-out)
Current Inspection:	3-Jun-2024	12	4	48
Road AADT:	600		Year:	2023
Inspected By:	Rishi Adhikari, TEC Robert Senior, TEC		Ken Froese, Thurber Roger Skirrow, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items

Primary Site Issue:	A landslide affects the 3.5 m high west embankment fill immediately to the north of a 1.8 m diameter culvert (BF71661) carrying Nicholls Creek. The landslide is causing severe distress to the pavement within the highway SBL. The culvert does not appear to be impacted by the slide mass at this time.		
Dimensions:	The landslide is about 18 m wide (on highway) and has about 110 mm drop in the asphalt along the backscarp.		
Date of Remediation:	None. Tender is being prepared to address the issue at this site which consists of sub-excavating the failed slide mass down to intact foundation soil, rebuilding the slope with a compacted clay fill toe berm to a slightly flatter 4.5H:1V inclination, and extension of the culvert outlet to accommodate the toe berm.		
Maintenance:	2021: Highway Patching 2023: Subgrade replacement which included new guardrails on both sides of the highway and pavement overlay.		
Observations:	Description	Worsened?	
<input checked="" type="checkbox"/> Pavement Distress	The main scarp has resurfaced after the subgrade replacement and overlay. The scarp crack has extended into the highway west of the fogline. Tension cracks reappeared where main scarp was previously present on the SBL.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Slope Movement	The landslide occurred within the west embankment fill adjacent to BF71661 (Nicholls Creek). On the west side of the highway a deep scour hole is present at the culvert outlet and the creek bank has eroded and sloughed into the river. Loss of support at the toe of the fill has contributed to the instability. Based on SI23-1 the base of the slide is about 3.5 m BGS. The flank of the slide continues into the tree line; no toe roll was observed.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Erosion	There is some bank erosion on the south side of the highway along Nicholls Creek and on either side of the culvert outlet.	<input type="checkbox"/>	
<input type="checkbox"/> Seepage		<input type="checkbox"/>	

<input checked="" type="checkbox"/> Bridge/Culvert	The culvert outlet had about 800 mm of scour below it. The concrete apron at the outlet also has extensive cracks and perforations. This was not visible during the 2024 inspection due to a higher water level in the creek. Walk through of culvert was completed and there was no obvious sidewall distortion of the culvert.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>

Instrumentation: (Fall 2023)		
Active:	Standpipe TH23-2 - Short term monitoring indicated that the groundwater table is about 6.9 m below the existing ground surface. This is about the same elevation as Nicholls Creek.	
Destroyed (During 2023 Subgrade Replacement and Pavement Overlay:	<p>Readings prior to damage: Slope Inclinator TH23-1 -The readings indicated a movement zone at a depth between 3.0 m and 4.8 m below ground surface with a rate of 32.6 mm/year on June 11, 2023.</p> <p>Vibrating Wire Piezometer TH23-1 - Short term monitoring indicated that the groundwater table varied between 4.9 m and 5.5 m below the existing ground surface.</p>	
Assessment:		
<p>In June 2022, the MCI reported the slide and in early August it had dropped significantly requiring closing of the southbound lane. The slide was approximately 27 m wide by 20 m long and the landslide scarp had retrogressed into the southbound lane requiring it to be closed off with barricades at the ends of the slide. The north flank of the scarp extending into the tree line appeared to be somewhat grown over and no exposed soil was visible during the inspection. The south flank of the slide is bounded by BF71661 and the north bank of Nicholls Creek. The banks of Nicholls Creek were eroded and slumping into the creek on both sides of the creek. A deep scour hole is present at the outlet of BF71661.</p> <p>The pavement in the southbound lane had dropped approximately 100 mm over an 18 m length at the time of the 2022 call-out. At the time of the 2023 inspection, the pavement had dropped up to 200 mm at the north end of the scarp. The road had been patched several times over the years as approximately 300 mm of ACP was observed near the middle of the slide.</p> <p>Thurber prepared a detailed design and special provisions package and submitted to TEC in June 2023 to repair the landslide through upcoming the paving contract. It is understood that TEC, due to cost and contract issues, decided to do a deep subgrade repair at this site instead of the proposed landslide repairs during the paving overlay project. Shortly after the pavement was placed, cracks reappeared in the asphalt surface.</p> <p>During the 2024 GRMP inspection, the main scarp has retrogressed into the highway between the west guardrail and the SBL fogline. Tension cracks were also present on the southbound lane. The tension and scarp crack generally follows the same outline as the previous backscarp in 2023.</p> <p>It is anticipated that the landslide was triggered by creek erosion and continues with moderate but increasing rate of movement. Weak embankment materials and a steep embankment slope (approximately 20 degrees) have likely contributed to causing the slide. The main scarp extends into the highway and could eventually retrogress further and affect both lanes of the highway. A toe roll has not been observed but it may be obscured by river erosion. The slide, once fully mobilized, could push displaced slide material into the creek and squeeze the culvert.</p>		
Recommendations:		
Short Term:		
<p>In the short term, the slide should be regularly monitored for regression of the slide scarp, which could require jersey barriers and widening of the highway on the east side for a detour, if it retrogresses.</p>		

Medium to Long Term:

Since the main scarp has resurfaced after the subgrade repairs and pavement overlay, we recommend proceeding with the detailed design for this landslide repair which consists of sub-excavating the failed slide mass down to intact foundation soil, rebuilding the slope with a compacted clay fill toe berm to a slightly flatter 4.5H:1V inclination, and extension of the culvert outlet to accommodate the toe berm. The 2021 BIM inspection report for BF71661 noted it was constructed in 1961 and had an estimated replacement year of 2024. Although there may be some opportunity to combine work packages for both sites into a single tender the urgency of the slide repair likely negates this option.

Geohazard Inspections:

Due to the ongoing movements observed at this site, it is recommended that the Geohazard inspection continued to be undertaken annually.

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.

Roger Skirrow, M.Sc., P.Eng.
Senior Geotechnical Engineer

Mark Gallego, P.Eng.
Geotechnical 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.

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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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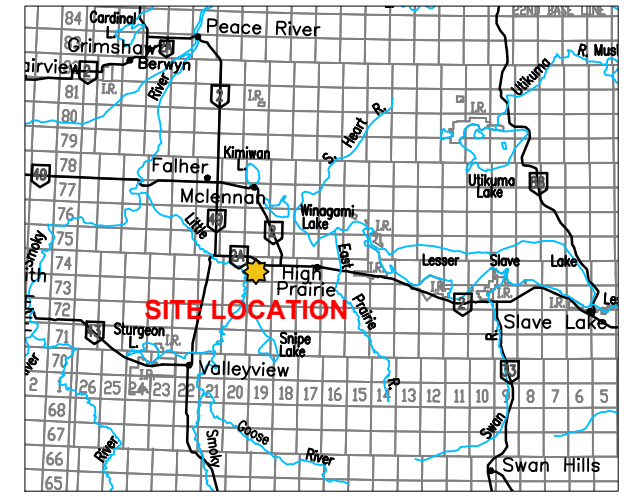
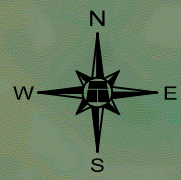
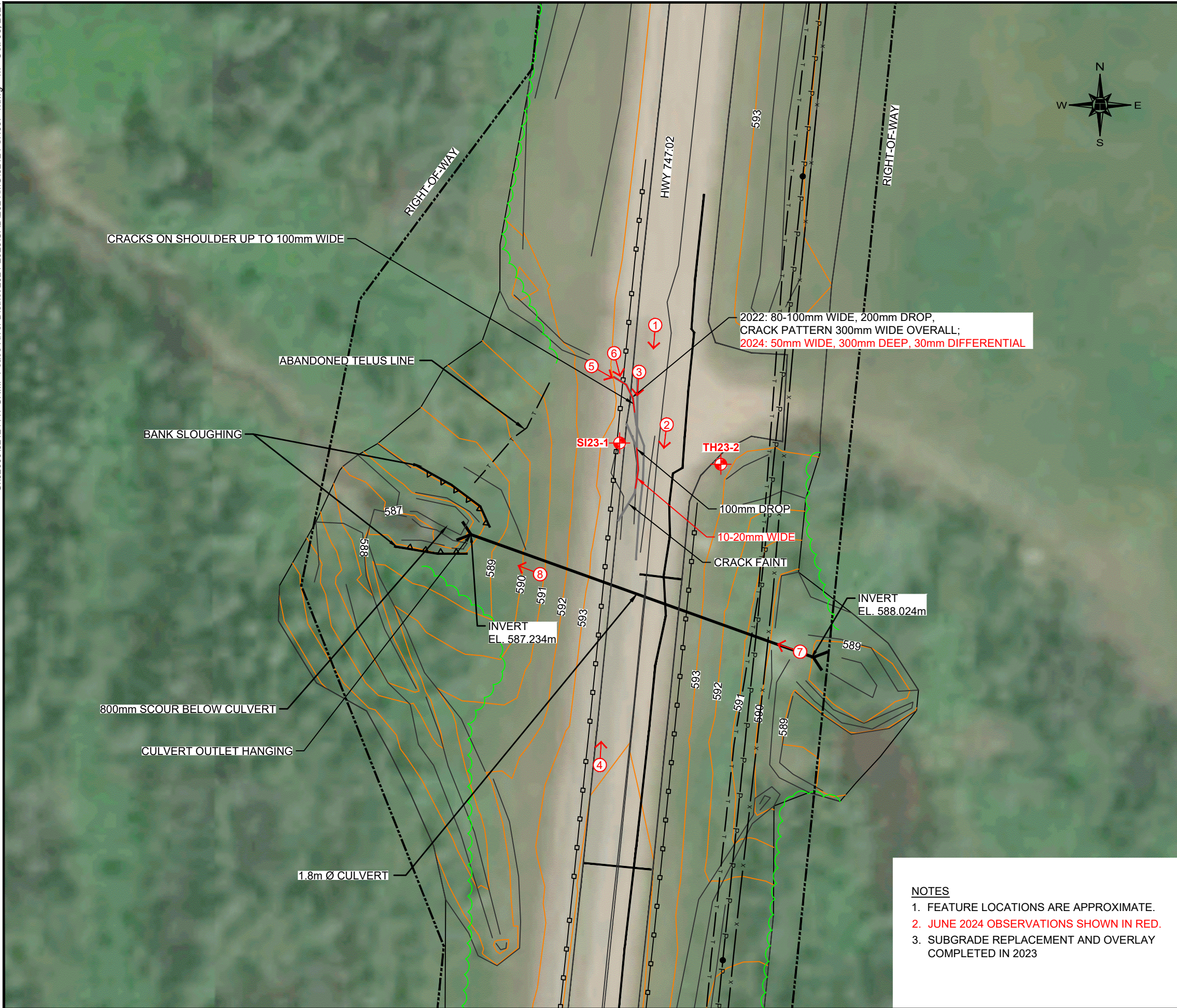
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- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has 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.

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KEY MAP
SCALE 1:3 000 000

LEGEND

- CRACK (APPROXIMATE)
- SCARP CRACK (APPROXIMATE)
- APPROXIMATE TEST HOLE LOCATION
- SLOPE INCLINOMETER
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 1m)
- FIBRE LINE
- FENCE LINE
- POWER LINE
- POWER POST
- TREE LINE
- GUARDRAIL
- DIRECTION AND NUMBER OF PHOTO

0 5 10 15 20 25 30m
SCALE 1:500

2023-01-09 SURVEY FROM MCINTOSH PERRY
SATELLITE IMAGE FROM ESRI WORLD IMAGERY (DOWNLOADED 2022-08-22)



PEACE REGION (SWAN HILLS)

**SH037: HWY 747:02 km 35.2 NICHOLLS CREEK
2024 SITE INSPECTION PLAN**

DWG NO. 32121-SH037-1

- NOTES**
1. FEATURE LOCATIONS ARE APPROXIMATE.
 2. JUNE 2024 OBSERVATIONS SHOWN IN RED.
 3. SUBGRADE REPLACEMENT AND OVERLAY COMPLETED IN 2023

DRAWN BY	KLP
DESIGNED BY	MG
APPROVED BY	RKS
SCALE	1:500
DATE	OCTOBER 2024
FILE No.	32121





Photo 1 – Looking south along southbound lane from the north end of site. The scarp that has retrogressed into the highway is visible on the shoulder.



Photo 2 – Looking north along the centerline of highway. Tension cracks resurfacing on southbound lane. New guardrails installed on both sides of the highway.



Photo 3: Looking south at scarp crack that retrogressed into the highway. Tension cracks observed along the southbound lane.



Photo 4: Looking north along west sideslope from the south end of the site.



Photo 5: A close look at open cracks on the highway SBL shoulder.



Photo 6: Looking southeast at crack that has retrogressed towards the highway.



Photo 7: Walk through of culvert conducted and indicated no obvious sidewall distortion.



Photo 8: Looking west from above the culvert outlet location at creek and bank erosion.