ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
2025 INSPECTION

Site Number	**Location**	**Name** (Old Site 5)	**Hwy**	**km**
PH023	12 km W. Cleardale	Clear River East Hill-Twin Pipes	64:02	23.4-24.1
Legal Description		**UTM Co-ordinates (NAD 83)**		
NE28/NW27-84-11-W6		11 N 6244273 E 335460		

	Date	**PF**	**CF**	**Total**
Previous Inspection:	May 8, 2024	10	8	80 Slide Risk Rating
		20	4	80 Erosion Risk Rating
Current Inspection:	May 7, 2025	10	8	80 Slide Risk Rating
		20	4	80 Erosion Risk Rating
Road AADT:	300		**Year:**	2024
Inspected By:	Don Proudfoot, Barry Meays (Thurber). Robert Senior, Chris Newman, April Holt, Mike Rosendahl, Ken Szmata (TEC).			
Report Attachments:	☒ Photographs ☒ Plans ☐ Maintenance Items			

Primary Site Issue:	Active erosion and slumping along the creek has re-activated a large ancient landslide. There are also active slides in the highway sideslopes.		
Dimensions:	Large ancient landslide blocks have linked together and affected a length of 750 m along the highway. Active slumping and erosion are occurring along the creek, located approximately 40 m below the highway level.		
Date of any remediation:	1986-Road realignment uphill; 1988-Drainage measures; 1996-Toe Buttress/berm fill covering twin SWSP culverts; 1997-Armoured Channel; winter 1998-Non perf. CSP culvert at north channel bank; 2023-Removed guardrail, milled/removed existing ACP, graded existing GBC, drained water/repaired existing north ditch, replaced ACP millings on road surface, & installed High Tension Cable Barriers (HTCB).		
Maintenance:	Asphalt overlay in August 2008. Chip seal in 2017. Frequent milling/patching (extensive since 2020 hwy closure) the last several years. Grading ACP millings since 2023. HTCB's currently need attention.	**Worsened?**	
	Description	**Yes**	**No**
☒ Pavement	No remaining pavement surface, only ACP millings, except at west extent of the landslide where scarp crack and pavement distortion are still evident.	☒	☐
☒ Slope Movement	Re-activation of a large ancient slide movement has cut completely across the highway at both ends, with numerous movement-induced intermediate cracks, settlements, and slumps in between. Continued and enlarged slumping downslope of highway adjacent to creek channel edges. Continued regression in 1 of the 3 south highway embankment slumps.	☐	☐
☒ Erosion	Very severe along the creek and former toe berm	☒	☐
☒Seepage	Significant/steady seepage from base of enlarged piping slump (north side of creek channel).	☐	☒
☒ Bridge/Culvert	The twin culverts installed in the creek below the toe berm are ineffective due to silt build-up and channel erosion. The trash rack is toppling due to loss of support.	☒	☐

Instrumentation: Last read June 15, 2025 - The inclinometer movement zones, and piezometer tip depth measurements are shown on the cross-sections attached (Drawings PH023-4 to -6).

INCLINOMETERS.
88-09: Sheared at 5.5m. **20-1:** 6mm/yr @ 4 to 5.5m; & 4mm/yr @ 50 to 54m. **20-2:** Sheared off at 33.2m (but former movement zones @ 32 to 34m & 42 to 43m). **20-3:** Sheared off at 21.0m (former movement zone @ 19.5 to 21m). **20-4:** Sheared off at 7.6m (but former movement zones @ 6 to 8m & 60 to 62m). **20-5:** Sheared off at 11.6m (but former movement zones @ 9 to 12m & 31 to 36m). **20-6:** Sheared off at 20.1m, (but former movement zones @ 18 to 20m & 28 to 31m). **20-7:** 2mm/yr @ 18 to 20m; & 3mm/yr @ 32 to 34m. **20-8:** Sheared off at 36.2m (former movement zone @ 34 to 37m).

PIEZOMETERS - 2 Pneumatic Tips were installed in each of the eight 2020 test holes, taped to the outside of the inclinometer casing (A=Upper Tip; B=Lower Tip). PN20-2B, 20-4B, 20-5B & 20-6A are inoperable and will not be read any more. Since TH 20-5 and 20-6 require bear scare personnel and the SI's have sheared, these two remaining piezometers (20-5A and 20-6B) will not be read any more. Groundwater Elevations (m): 20-1A=506.2; 20-1B=485.7; 20-2A=505.5; 20-3A=491.7; 20-3B=491.0; 20-4A=510.8; 20-5A=485.6; 20-6B=460.6; 20-7A=484.4; 20-7B=439.9; 20-8A=474.9; 20-8B=463.4. The piezometers showed fluctuations (decreases up to 1.1 m and increases up to 1.6 m) in groundwater levels since last fall.

Assessment (Refer to Drawings PH023-1 to -6)**:**

During the July 2020 Call Out, the slide spanned an approximate 750 m length of highway, with the scarp crack areas at both ends extending completely across the highway, with frequent intermittent cracking, scarp cracks, and numerous dipped pavement and shoulder embankment areas existing in-between. This indicated that the slide had moved along ancient landslide paths. Many of the observed cracked and dipped areas were reflecting through older patched areas, which indicated there had been past movements at localized areas, but not to the degree and extent of this more sudden movement. Information provided during the Call Out indicated that the majority of movement and highway damage occurred over an approximate 4 to 10 hour time frame on July 8/9, 2020, which resulted in closure of the highway by TEC. Heavy rainfall accumulations (it was indicated that in the order of 240 mm of rainfall had fallen in this area between June 28 and July 9, 2020), likely contributed to both creek runoff/erosion, subsoil saturation, and landslide formation/transgression.

Sliding has also been aggravated by severe creek erosion at the toe of the valley slope over the years. There appears to be a recent large slide block that has moved towards the creek on the north side, centered about 300 m west of the drainage trench erosion area at the east end of the site. The large slump below the east end of the site is a result of the toe buttress fill blocking off the drainage trenches, causing erosion and earth flows that are retrogressing back towards the highway. The original twin culverts in the creek were not big enough to pass storm flows and to handle large amounts of silt and debris coming into the channel. As a result, channel lining/gabions below the east end of the site have eroded away and are ineffective. Recent creek erosion has completely eroded the gabion weirs and exposed the twin pipe outlets, rendering them ineffective. This creek erosion has also displaced the large riprap laid in the channel and has caused the trash rack piles to lean and bend.

At the time of the 2020 Call Out, the main scarp crack that crossed into the highway at the east end of the site exposed a pavement structure consisting of between 0.4 m to 0.5 m of ACP (likely that thick due to several previous patches), overlying between 0.15 m to 0.2 m of saturated GBC. The exposed scarp on the north side of the highway at a location near the west end of the site exposed a wet, medium plastic, silty clay that contained some sand.

A geotechnical investigation, consisting of drilling eight test holes between 32 to 66 m in depth with instrumentation installed (locations shown on Drawings PH023-1 to -3), was completed in 2020. The soil conditions were predominantly medium to highly plastic clay, with some near surface sand, and possible clay shale bedrock at depth. The inclinometers installed in 2020 were registering movements below the present tributary level, and all except for SI20-3 and SI20-8 were registering two movement zones (with the upper zone generally indicating faster rates than the lower zone). Six of these eight inclinometers have now sheared off, leaving SI's 20-1 and 20-7. In general, the rates of movement in both SI20-1 and SI20-7 have shown increases between 1 to 2 mm/yr since last spring's readings in both the upper and lower zones.

The landslide movements are expected to have cycles of subsidence and re-initiation as new equilibrium modes are reached due to the upper part of the landslide body settling and separating from the intact ground at the backscarp as the lower part of the slide body pushes into and constricts the creek. However, over time the creek will continue to erode and undermine the support at the toe of the landslide mass and keep the slide in motion until some permanent stabilization and creek erosion protection measures are constructed.

Recommendations:

Maintenance:

Prior to the 2020 slide, the slide movements had been mitigated by the maintenance contractor by milling and patching the road. To reopen the road following the big slide movement in 2020, the east flank of the slide was cut down along the highway and patched with a thin asphalt layer, but this area continued to distort, and the asphalt was breaking up. These maintenance repairs were temporary measures until the short-term repairs in 2023 listed below were designed and implemented.

The speed through the landslide area has been posted at a slower speed of 30 km/hr to improve traffic safety through this slide area.

Cold mix was placed in a few spots on the repaired area listed below, and the ACP millings surface is being graded as required (50 tonnes of millings in 2025). The WB section of road contains a dip and a washboard area and needs to be graded/smoothed out. The top two cables on the north High Tension Cable Barrier (HTCB) came loose and need to be re-attached, and all four cables near the west end of the south HTCB need to be tightened. The MCI indicated the Maintenance Contractor will undertake this later this year using a tension meter.

Short-term Measures Completed in 2023:

Due to the size and complexity of the landslide the cost to permanently repair this site is substantially higher than first anticipated; therefore, TEC gave approval to remove the asphalt and turn the affected portion of the highway back to gravel so that it can be maintained by grading the gravel surface to smoothen distortions caused by landslide movements until a more permanent repair can be implemented. This was performed as extra work under Contract #21542 by N.P.A. using Northern Road Builders as their earthworks sub-contractor, and consisted of:

- Removed and salvaged the existing W-Beam guardrail, and installed a new High Tension Cable Barrier further from the edge of the road, as directed/agreed by TEC.
- Removed the road sand that had accumulated from underneath the guardrail.
- Stripped and salvaged topsoil
- Removed the road asphaltic concrete pavement (ACP) between Sta. 23+615 and 24+215 and an existing stockpile of ACP that existed north of the highway, to an approved disposal site.
- Drained the existing pond in north ditch and removed the approach on the north side of the highway.
- Regraded and compacted the existing GBC surface and added new GBC material where required to provide uniform grades.
- Placed and compacted 100 mm of the ACP millings over the compacted GBC surface.
- Graded, shaped, and compacted the north highway ditches from approximately 24+135 to 23+980 and 23+700 to 23+625.
- Placed topsoil and broadcast seeded all disturbed areas.
- Installed Permanent Erosion Control Soil Covering (TRM) with synthetic ditch barriers on all regraded ditch sections.

Medium to Longer Term:
A geotechnical investigation and preliminary engineering assessment was completed by Thurber for this site dated April 8, 2022. The following recommendations were provided:

- Carry out a large-scale grading scheme to raise the tributary creek bed over a 1.15 km length to create a buttress to the toe of the landslide mass. This infill will begin about 180 m upstream of the tributary split location in both the north and south branches, then increase in height at a 0.5% downward surface gradient to a location about 100 m west of Section A, where it reaches the full infill height of 18 m. Downstream of this point, the top of the 18 m high fill will extend at a 4% downward gradient to a point about 200 m west of Section C, where it will transition down to the natural creek bed through a 4H:1V stepped gabion dissipation structure. [This remediated tributary length may be extended an additional 200 m to the west, to incorporate the PH022 geohazard site.]
- Install a sub-drainage system to maintain the groundwater table at a position as was assumed under pre-construction conditions. This will consist of a 500 mm diameter subdrain pipe enveloped in clean filter gravel and non-woven geotextile, that extends along the entire length of the tributary bottom (having 4 maintenance manholes), that outlets downstream of the fill in the gabion dissipation structure. This subdrain will be continuously joined to 0.3 m thick filter gravel/sand blankets overlying non-woven geotextile placed in intimate contact with the stripped tributary channel walls and at strategic fill areas further upslope.
- Fill to raise the tributary creek bed will be obtained from cutting back the valley slope north of the highway, while flattening critical areas to improve the overall stability factor of safety.
- Construct an armoured channel indented into the completed buttress fill that can pass the creek flows. The upper 0.5% gradient channel can be armoured with a 0.3 m thick, clean filter gravel, while the steeper 4% gradient channel will need to be armoured with 0.8 m thick Class 2 riprap. The grouted gabion dissipation structure will consist of 19 steps (each step 1m high x 4m long x 10m wide), flanked by steel sheet piles driven along the outside edges, and a 12 m long Class 1 riprap apron at the downstream toe where it meets grade.
- At Section A (near the east end), two additional measures include: a) Lowering the water table by 2 to 3 m over a 100 m wide x 250 area long area by installing a series of closely spaced trench (slot) drains that drain into the base of the tributary fill; and b) Reconstructing a 200 m length of slide compromised highway with lightweight fill by excavating a 5 m thickness of ACP, GBC, and clay fill.

As a minimum, AEP and DFO will need to be contacted prior to these measures being undertaken.

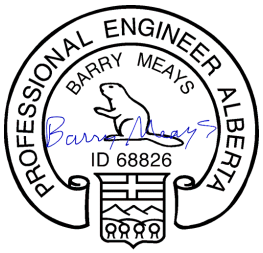
Ballpark cost ~$28 million.

Long Term:
Also, a large highway re-alignment is also being evaluated by TEC as part of an on-going functional planning study headed up by CIMA Canada Inc., that bypasses all the slide sites through the Clear River valley over a new crossing. To date, it was understood that the study results indicated the cost of a new valley crossing alignment was less favorable/desired than the cumulative cost of repairing/maintaining each geohazard site individually and adding climbing lanes where needed to the existing highway.

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.
Partner | Senior Geotechnical Engineer



August 28, 2025

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: August 28, 2025
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Barry Meays, P.Eng.
Senior Geotechnical Engineer

THURBER

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 TOTHE 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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SW33 84-11-6

SE33 84-11-6

SW34 84-11-6

SE34 84-11-6

NE28 84-11-6

NW28 84-11-6

NW27 84-11-6

NE27 84-11-6

SW28 84-11-6

SE28 84-11-6

SW27 84-11-6

SE27 84-11-6

POTENTIAL BORROW AREA

SEE DWG No. 32123-3

SEE DWG No. 32123-2

4143 PLATEAU ROAD

CLEAR RIVER

PH022 SCARP CRACKS

96-61 (BLUE SI)

TH20-1

TH20-2

TH20-3

TH20-4

TH20-5

TH20-6

TH20-7

TH20-8

88-9

88-15

N

W E

S

LEGEND

APPROXIMATE TEST HOLE LOCATION

APPROXIMATE TRIBUTARY CENTERLINE

0 100 200 300 400 500 600m

SCALE 1:10000

BASE PLAN PROVIDED BY WSP (LIDAR UAV FLOWN SEPT 29/30, 2020)

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

SITE PLAN

DWG No. 32123-PH023-1

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:10000
DATE	MAY 7, 2025
FILE No.	32123

THURBER

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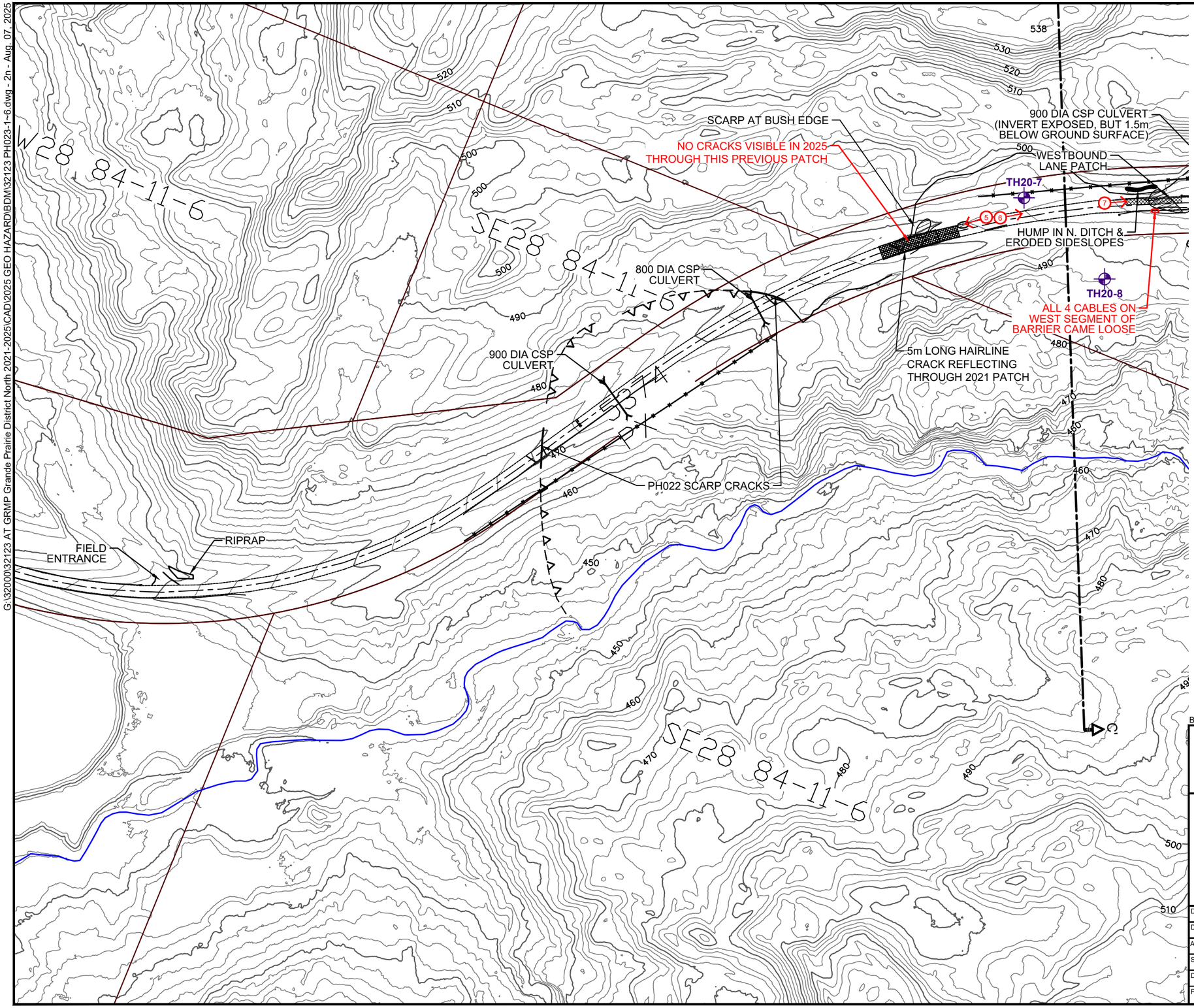

LEGEND

- APPROXIMATE 2020 TEST HOLE LOCATION
- FENCE LINE
- HIGH TENSION CABLE BARRIER
- SETTLEMENTS (JULY 9, 2020)
- CRACKS (JULY 9, 2020)
- SLIDE SCARP
- APPROXIMATE TRIBUTARY CENTERLINE
- DIRECTION AND NUMBER OF PHOTO
- ACP PATCH

NOTE:
1. MAY 7, 2025 OBSERVATIONS SHOWN IN RED

0 25 50 75 100 150 200 m
SCALE 1:3000

BASE PLAN PROVIDED BY WSP (LIDAR UAV FLOWN SEPT 29/30, 2020)

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

DETAILED SITE PLAN - WEST

DWG No. 32123-PH023-2

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:3000
DATE	MAY 7, 2025
FILE No.	32123

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DISTANCE OF SCARP TO HTCB 2.1m (B)(SAME) & 2.3m (A)(SAME)

RIPRAP

900 DIA CSP CULVERT (INVERT EXPOSED, BUT 1.5m BELOW GROUND SURFACE)

TOP 2 CABLES ON BARRIER CAME LOOSE

CSPS

WESTBOUND LANE PATCH

HUMP IN N. DITCH & ERODED SIDESLOPES

SAME

SEEPAGE AREA

ALL 4 CABLES ON WEST SEGMENT OF BARRIER CAME LOOSE

ACP PILE

NORTH DITCH RESHAPED AND POND DRAINED

PATCHES OVER EXCAVATED & CRACKED PAVEMENT - 25m ALLIGATOR CRACKING IN WB LANE

SOME RETROGRESSION OF SIDESLOPE SLUMP, (TOE ROLL PUSHED FENCE DOWNSLOPE)

1000 DIA SWP CULVERT OUTLET
N 6244304.8, E 335753.7
INVERT ELEV = 495.537m

2020 SLIDE / EROSION PERIMETER
2025 SLIDE / EROSION PERIMETER

SCARP 5.5m HIGH (BIT OF RETROGRESSION)

TWIN PIPE INLETS
N 6244087.8, E 335537.7
INVERT ELEV = 490.4 m

SAME

SLIDE RETROGRESSION

MORE EROSION AND SLUMPING

TRIBUTARY SPLIT LOCATION

NORTH BRANCH (MAINSTEM)

SOUTH BRANCH (EXTENSION)

3.0m HIGH SCARP

TRASH RACK (EROSION AROUND LEGS CAUSED SIDE TO TIP OVER)

1100 DIA TWIN PIPES OUTLETS
(20mm WALL THICKNESS)
N 6244054.8, E 335432.3
INVERT ELEV = 473.7m

TH20-1 TH20-2 TH20-3 TH20-4 TH20-5 TH20-6 TH20-7 TH20-8 88-9 88-15 96-61 (BLUE SI)

NW27 84-1-6 NW28 84-1-6 052 3888 052 3888

LEGEND

- APPROXIMATE 2020 TEST HOLE LOCATION
- APPROXIMATE OLDER TEST HOLE LOCATION
- FENCE LINE
- HIGH TENSION CABLE BARRIER
- SETTLEMENTS (JULY 9, 2020)
- CRACKS (JULY 9, 2020)
- SLIDE SCARP
- POND
- APPROXIMATE TRIBUTARY CENTERLINE
- DIRECTION AND NUMBER OF PHOTO
- ACP PATCH
- SEEPAGE

NOTES:
1. MAY 7, 2025 OBSERVATIONS SHOWN IN RED

0 25 50 75 100 150 200 m
SCALE 1:3000

BASE PLAN PROVIDED BY WSP (LIDAR UAV FLOWN SEPT 29/30, 2020)

Alberta Transportation

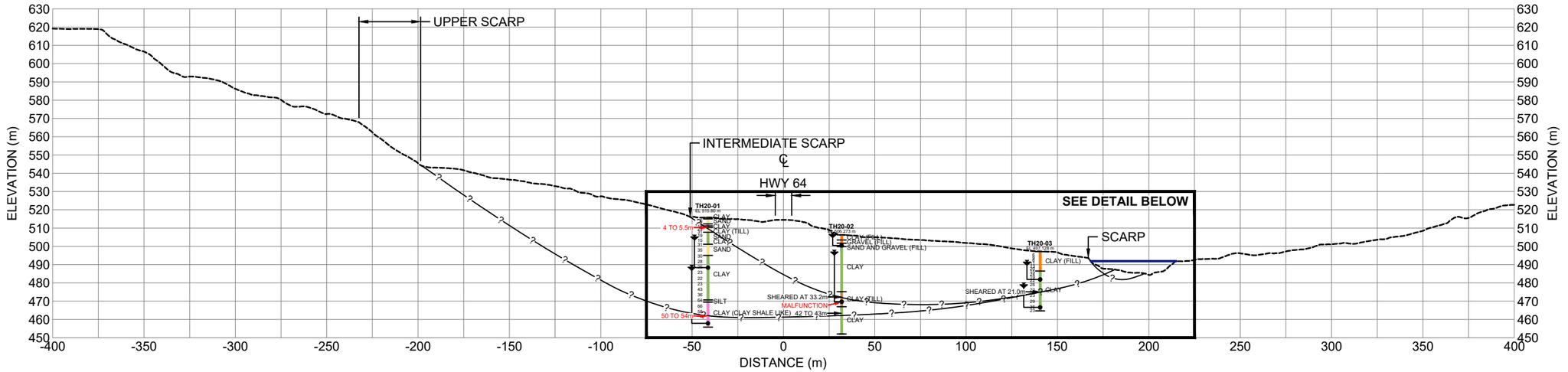
PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

DETAILED SITE PLAN - EAST

DWG No. 32123-PH023-3

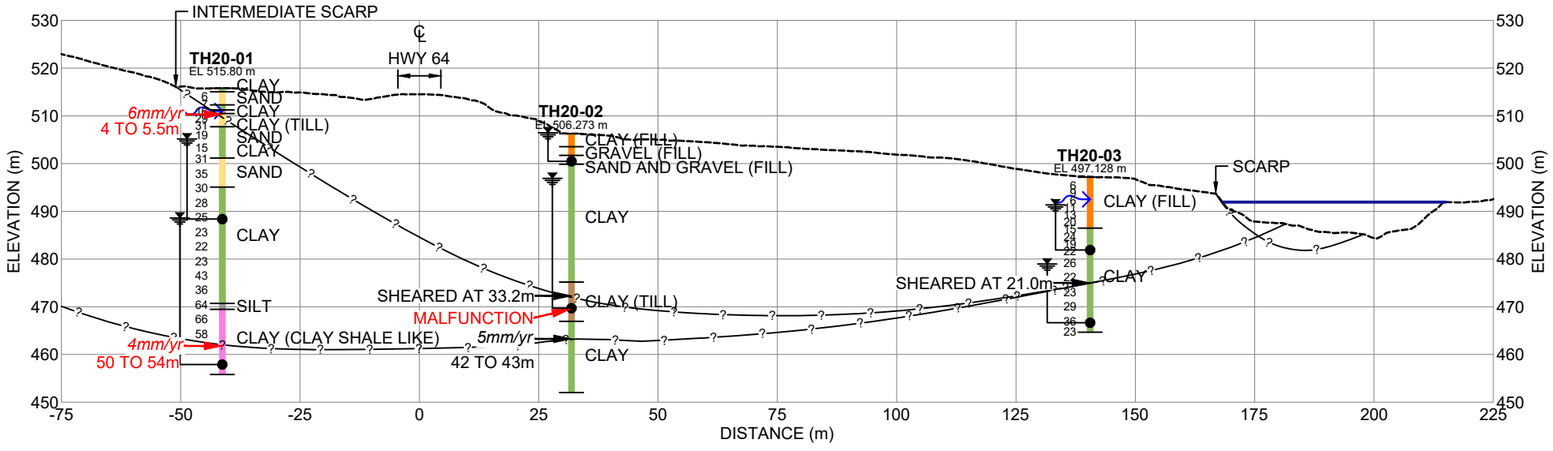
DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:3000
DATE	MAY 7, 2025
FILE No.	32123

THURBER



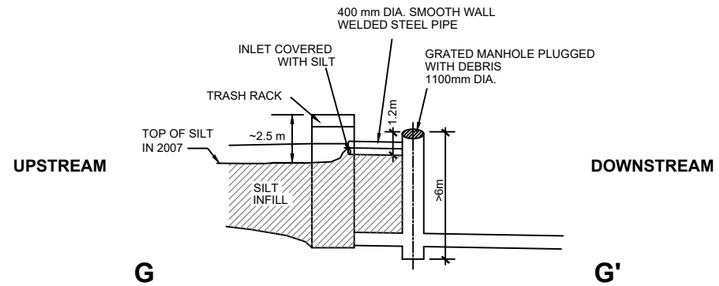
CROSS-SECTION A-A'

SCALE 1:2500



DETAIL

SCALE 1:1250



TYPICAL DETAIL OF ONE OF TWO TRASH PIPES AND MANHOLES

N.T.S.

LEGEND

- 15 — SPT N VALUE
- WATER LEVEL IN PIEZOMETER (JUNE 20, 2022)
- PNEUMATIC PIEZOMETER TIP LOCATION
- 4mm/yr 42 TO 43m — BASE OF MOVEMENT ZONES AND MOVEMENT RATE FROM Xm TO Xm (JUNE 15, 2025)
- SEEPAGE
- ASSUMED SLIP SURFACE
- 8 m FILL HEIGHT (FOR POTENTIAL TOE BERM)

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

CROSS-SECTION A-A'

DWG No. 32123-PH023-4

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	MAY 7, 2025
FILE No.	32123

THURBER

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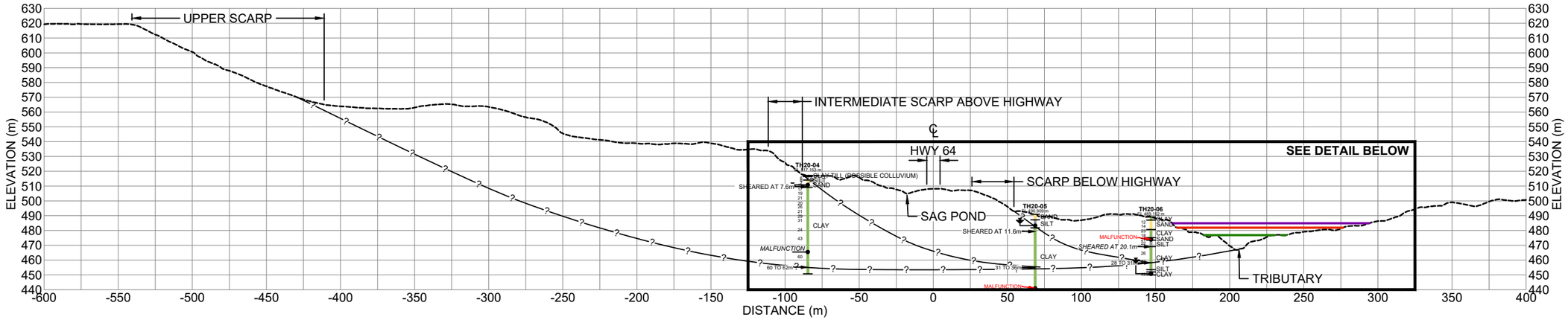
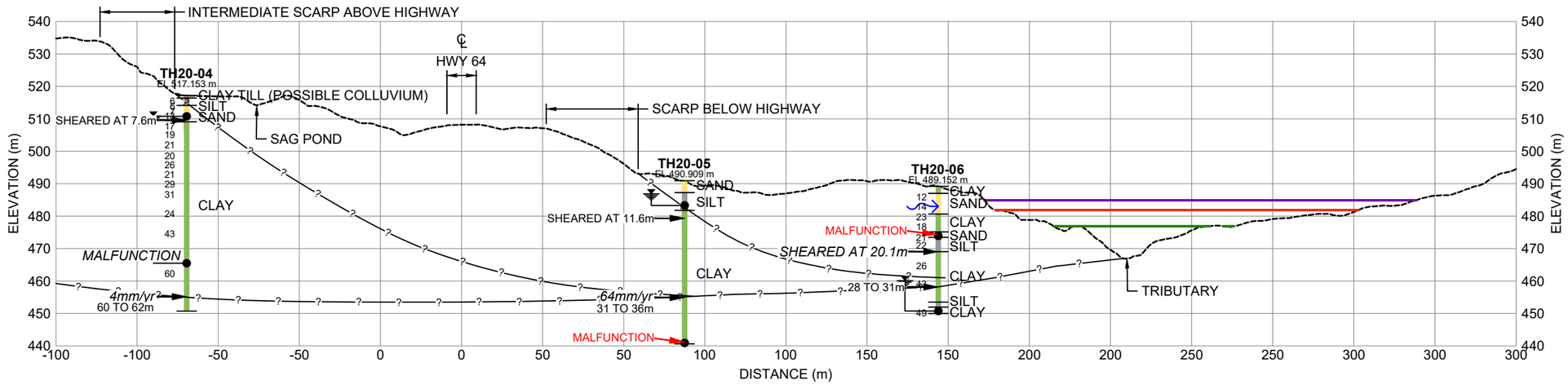


CROSS-SECTION B-B'

SCALE 1:3000



DETAIL

SCALE 1:1500

LEGEND

- 15 — SPT N VALUE
- WATER LEVEL IN PIEZOMETER (JUNE 20, 2022)
- PNEUMATIC PIEZOMETER TIP LOCATION
- 4mm/yr, 42 TO 43m — BASE OF MOVEMENT ZONES AND MOVEMENT RATE FROM Xm TO Xm (JUNE 15, 2025)
- SEEPAGE
- ASSUMED SLIP SURFACE
- 10 m FILL HEIGHT (FOR POTENTIAL TOE BERM)
- 15 m FILL HEIGHT (FOR POTENTIAL TOE BERM)
- 18 m FILL HEIGHT (FOR POTENTIAL TOE BERM)

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

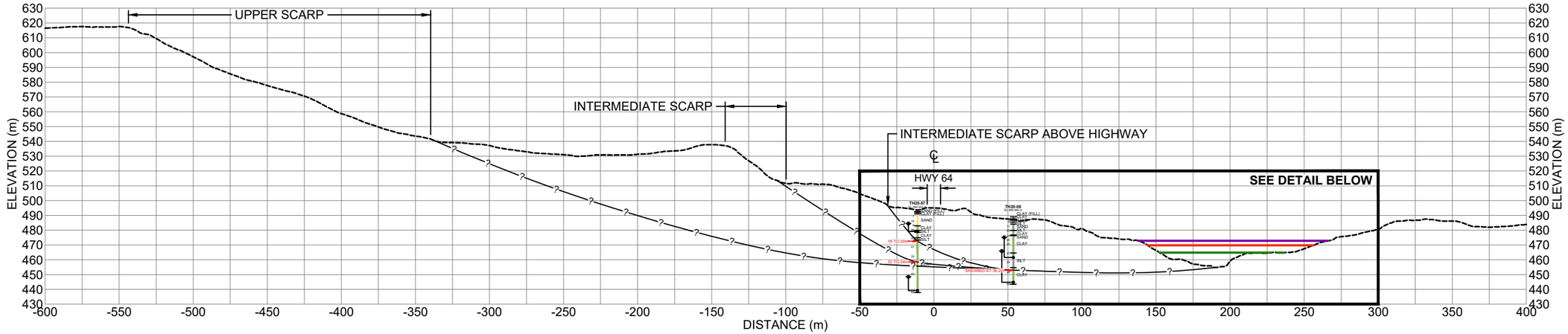
CROSS-SECTION B-B'

DWG No. 32123-PH023-5

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	MAY 7, 2025
FILE No.	32123

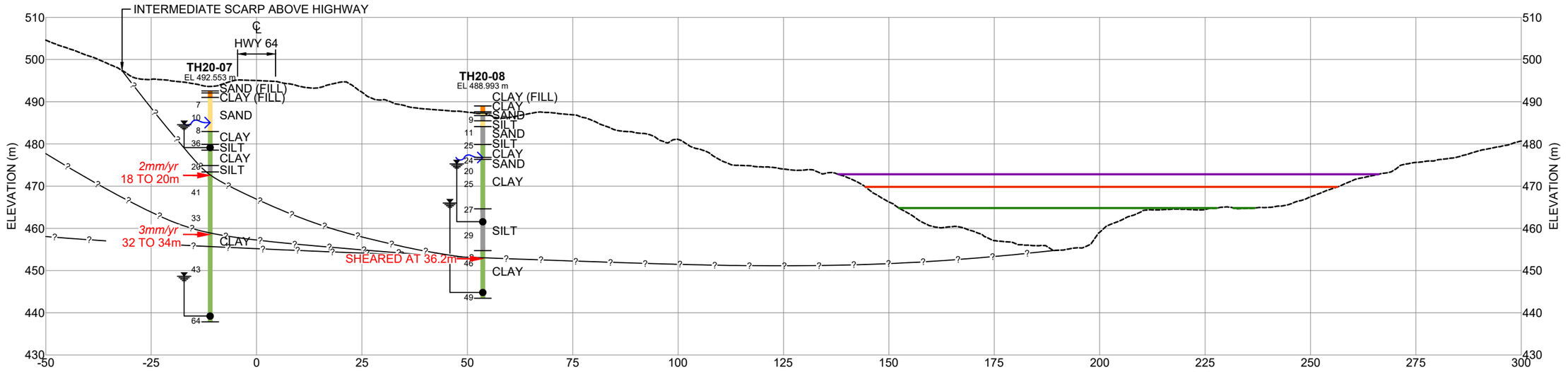
THURBER

G:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2025 GEO HAZARD\BDM\32123 PH023-1~6.dwg - 6n - Aug. 07, 2025



CROSS-SECTION C-C'

SCALE 1:3000



DETAIL

SCALE 1:1000

LEGEND

- 15 — SPT N VALUE
- WATER LEVEL IN PIEZOMETER (JUNE 20, 2022)
- PNEUMATIC PIEZOMETER TIP LOCATION
- 4mm/yr 42 TO 43m — BASE OF MOVEMENT ZONES AND MOVEMENT RATE FROM Xm TO Xm (JUNE 15, 2025)
- SEEPAGE
- ASSUMED SLIP SURFACE
- 10 m FILL HEIGHT (FOR POTENTIAL TOE BERM)
- 15 m FILL HEIGHT (FOR POTENTIAL TOE BERM)
- 18 m FILL HEIGHT (FOR POTENTIAL TOE BERM)

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

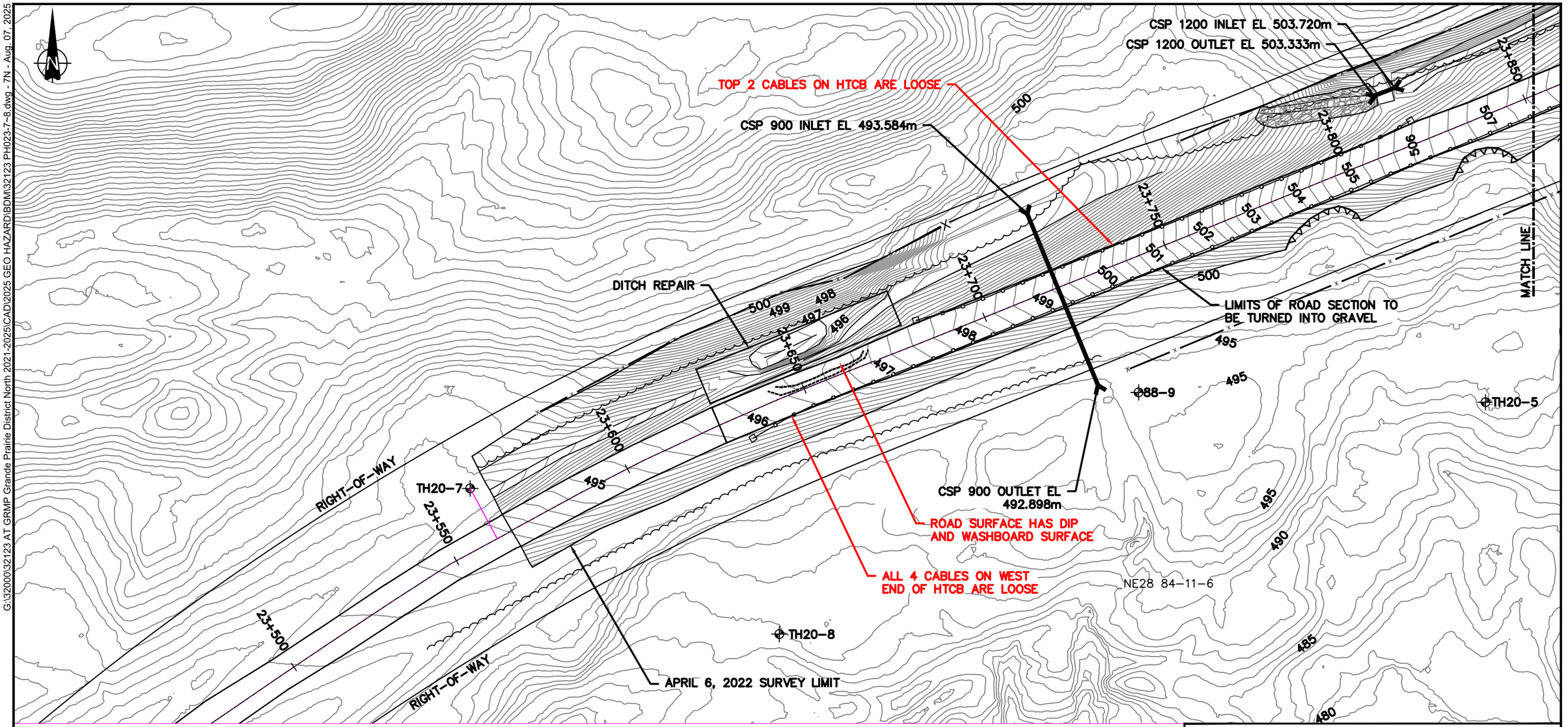
CROSS-SECTION C-C'

DWG No. 32123-PH023-6

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	MAY 7, 2025
FILE No.	32123

THURBER

G:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2025 GEO HAZARD\BDM\32123 PH023-7~8.dwg - 7N - Aug. 07, 2025



LEGEND

- HIGHWAY 64:02
- APPROXIMATE LANDSLIDE OUTLINES OBSERVED ON SITE
- GROUND SURFACE CONTOUR IN METRES
- APPROXIMATE TEST HOLE LOCATION
- DIP
- TREE LINE
- FENCE LINE
- HIGH TENSION CABLE BARRIER
- RIPRAP
- POND

NOTES:

1. GROUND SURFACE CONTOUR INTERVAL IS 0.5m
2. CONTOUR OUTSIDE SURVEY LIMIT OBTAINED FROM WSP UAV W. LIDAR EQUIPPED CAMERA FLOWN SEPTEMBER 30, 2020
3. MAY 7, 2025 OBSERVATIONS SHOWN IN RED

0 5 10 15 20 25m
SCALE: 1:1000

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

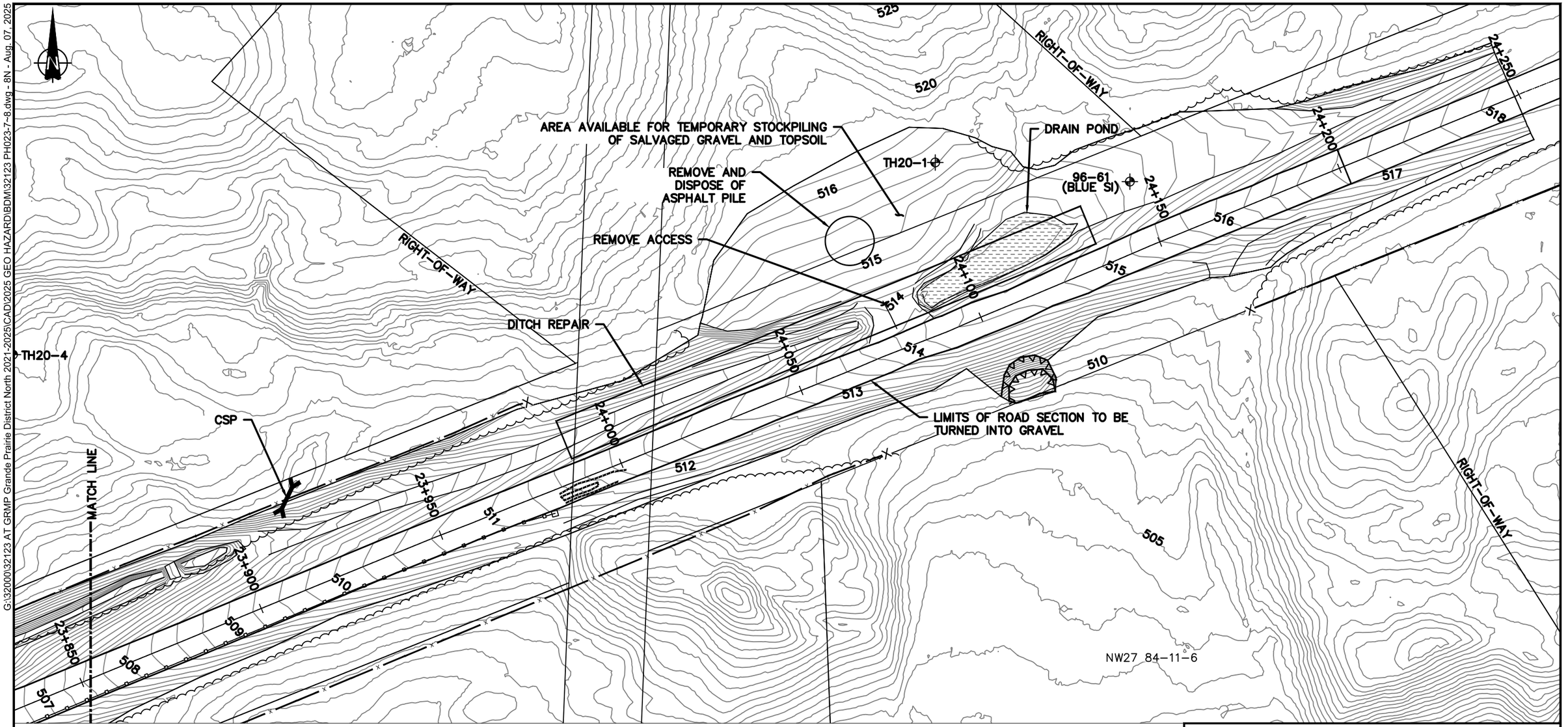
SITE PLAN SHOWING 2023 REPAIRS

DWG No. 32123-PH023-7

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:1000
DATE	MAY 7, 2025
FILE No.	32123

THURBER

G:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2025 GEO HAZARD\BDM\32123 PH023-7-8.dwg - 8N - Aug. 07, 2025



LEGEND

- HIGHWAY 64:02
- APPROXIMATE LANDSLIDE OUTLINES OBSERVED ON SITE
- GROUND SURFACE CONTOUR IN METRES
- APPROXIMATE TEST HOLE LOCATION
- DIP
- TREE LINE
- FENCE LINE
- HIGH TENSION CABLE BARRIER
- RIPRAP
- POND

NOTES:

1. GROUND SURFACE CONTOUR INTERVAL IS 0.5m
2. CONTOUR OUTSIDE SURVEY LIMIT OBTAINED FROM WSP UAV W. LIDAR EQUIPPED CAMERA FLOWN SEPTEMBER 30, 2020

0 5 10 15 20 25m
SCALE: 1:1000

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH023: HWY 64:02 CLEAR RIVER EAST HILL

SITE PLAN SHOWING 2023 REPAIRS

DWG No. 32123-PH023-8

DRAWN BY	DLA
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:1000
DATE	MAY 7, 2025
FILE No.	32123

THURBER

Photo 1 – UAV Looking east at the east end of the site where the tributary channels merge.

Photo 2 – UAV Looking east at the trash rack, twin culvert riser pipes, and remaining gabion remnants.

Photo 3 – UAV Looking north across the highway at the east end of the site.

Photo 4 – UAV Looking west along the highway and tributary.

Photo 5 - Looking west at the milled/patched area over the two slide cracks first observed in 2013 that mark the west boundary of the slide on the highway.

Photo 6 – Looking east at the same slide crack and scarp as Photo 5 that extends into the north ditch. Note the two settled areas along the north edge of the highway embankment.

Photo 7 – Looking east just east of where a landslide crack and large dip used to be visible in the road surface and north ditch before the road surfacing was converted to gravel in 2023.

Photo 8 – Looking east at Embankment Slump B on the south side of the hwy.

Photo 9 – Looking west along the south edge of the highway at Embankment Slump A.

Photo 10 – Looking west along the road. Note the damaged and loose north HTCB.

Photo 11 – Looking north at the slide scarp running along the hill above and to the west of the east end of the site.

Photo 12 – Looking east along the north ditch that was re-graded and lined with TRM, across the area where the east slide crack was affecting the highway.

Photo 13 – Looking west along the north highway ditch at the former sagged area that had ponded water. Water was drained, the former north approach was removed and the ditch was graded and lined with TRM as part of the 2023 road surface gravel conversion project.

Photo 14 – Looking west at the slump in the south highway embankment sideslope at the east end of the site. Note how the toe has pushed the fence downslope.

Photo 15 – Looking west along the eroded channel at the twin pipe riser inlets, eroded trash rack, and gabion remnants.

Photo 16 – Looking east at the upstream end of the eroded and silted in tributary channel.

Photo 17 – Looking north across the eroded tributary channel towards the highway, at the eroded piping area (LHS), twin pipe inlets and trash rack (Center), and eroded gabion weir (RHS).

Photo 18 – Looking west along the eroded creek channel at the twin pipe outlets.

Photo 19 – Looking east along the channel at the twin pipe outlets.

Photo 20 – Looking east along the eroded channel from the site center.