

SITE NUMBER AND NAME: NC036 – Lazy “S” Slide	HIGHWAY AND KM: 22:32, km 30.338	PREVIOUS INSPECTION: June 16, 2022	CURRENT INSPECTION: June 13, 2024
LEGAL DESCRIPTION: SW-28-56-08-W5M (NC036-1) NW 21-56-08-W5M (NC036-2)	NAD83 COORDINATES: UTM11U 5969791N, 622172E		RISK ASSESSMENT: PF: 9 CF: 6 Total: 54
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 1,340 (2023)		CONTRACTOR MAINTENANCE AREA (CMA): 509	

SUMMARY OF INSTRUMENTATION: One slope inclinometer and one standpipe piezometer.	INSPECTED BY: Stantec: Leslie Cho, Sonja Pharand TEC: Kristen Tappenden, Tim Germyn
LAST READING DATE: May 15, 2024	
PRIMARY SITE ISSUE: NC036-1: High groundwater table leading to slope instability. NC036-2: Landslide with semi-circular cracks on highway affecting the northbound lane (NBL).	
APPROXIMATE DIMENSIONS: NC036-1: 40 m along the highway by 30 m wide. NC036-2: 25 m along the highway by 15 m wide and 3 m high.	
DATE OF ANY REMEDIAL ACTION: In 2016, the twin culverts were replaced with 2120 mm diameter culvert at the outlet and a riprap lined drainage channel was constructed to replace the previous twin culvert. Asphalt patching in 2010, 2013, and Fall 2018.	

ITEM	CONDITIONS EXIST		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement cracks reflecting through the 2018 patch at NC036-1. Semi-circular crack on NBL of NC036-2.		X
Slope Movement	X		NC036-1: Pavement cracks reflecting through patches. Retrogressing scarp and cracking on east side of highway. Scarp east of riprap channel. NC036-2: Semi-circular pavement cracking with vertical difference. Toe bulging along east embankment slope.	X	
Erosion	X		NC036-1: Erosion along northeast and south edge of riprap drainage channel. Erosion gully in west ditch leading to creek. Erosion gully from private property east of site leading into riprap channel.		X
Seepage		X			X
Bridge/Culvert Distress	X		Standing water at culvert outlet.		X

COMMENTS
<u>NC036-1</u>
<ul style="list-style-type: none"> Previously observed pavement cracks continue to resurface through the 2018 patch. Cracking has progressed near the south end of the site compared to the 2022 site inspection (Photos 1 to 3).

- A pothole has formed in the western wheel path in the south bound lane (SBL) at the south end of the site.
- The riprap lined channel appeared to be in working condition (Photo 4).
- Ponded water continues to be observed at the outlet of the 2120 mm diameter culvert as shown in Photo 5.
- A ground crack about 300 mm wide by 150 mm deep by 1.1 m long was observed north of the 2120 mm diameter culvert outlet. The crack appeared relatively unchanged since the previous inspection in 2022.
- On-going erosion of the natural swale southeast of the riprap channel was observed as shown in Photo 6. The erosion channel was up to 1.8 m wide and 0.8 m deep, similar as measured in 2022. The erosion channel extends past the fence line (i.e. TEC's right-of-way). Vegetation is growing within the channel.
- A depression and ground crack was observed downslope from SI20-1 as shown on Photo 7.
- The scarp on the east side of the riprap lined channel was observed to be approximately 300 mm tall and 2.5 m from the fence, similar to 2022 (Photo 8). Tension cracks were observed behind the scarp.
- SI20-01 shows the failure plane to be about 5 m deep and within the high plastic clay layer. The SI has a current rate of movement of 5 mm/year.
- Piezometric levels in BH20-01 have been decreasing since 2020, with the water level dropping by approximately 1.4 m. The last reading taken in Spring 2024 was the first increase seen since installation. The water level increased by 0.1 m corresponding to 2.3 m below ground surface.

NC36-2

- The semi-circular crack on the NBL remains approximately 25 m long, and the vertical difference has increased since the 2022 call-out inspection to between 20 and 50 mm. The crack is between 5 and 20 mm wide. An apparent dip towards the east of approximately 60 to 80 mm was observed along the crack (Photos 10 to 12).
- The asphalt thickness within the landslide area is about 400 mm thick. Outside of the landslide limits, the pavement thickness is approximately 150 mm thick, suggesting pavement patches have been historically placed. Google Earth imagery suggests historical pavement patching dates to at least 2012.
- Tire marks were observed in the NBL, north of (after) the semi-circular crack. The longitudinal cracking north of the semi-circular cracking has also progressed, and is up to 20 mm wide (Photo 13).
- Some longitudinal cracking and potholes were observed along the SBL and appeared unchanged since the 2022 call out inspection. These features do not appear to be related to landslide activity.
- The possible toe bulge observed at the base of the east embankment, at the fence line, appears similar to the previous observation (Photo 14).
- A 'bumpy road' warning sign was installed on the east side of the highway, near the south extent of the semi-circular cracking.
- A watercourse exits about 20 m east of TEC's ROW. Ponded water was observed near the culvert outlet.

RECOMMENDATIONS

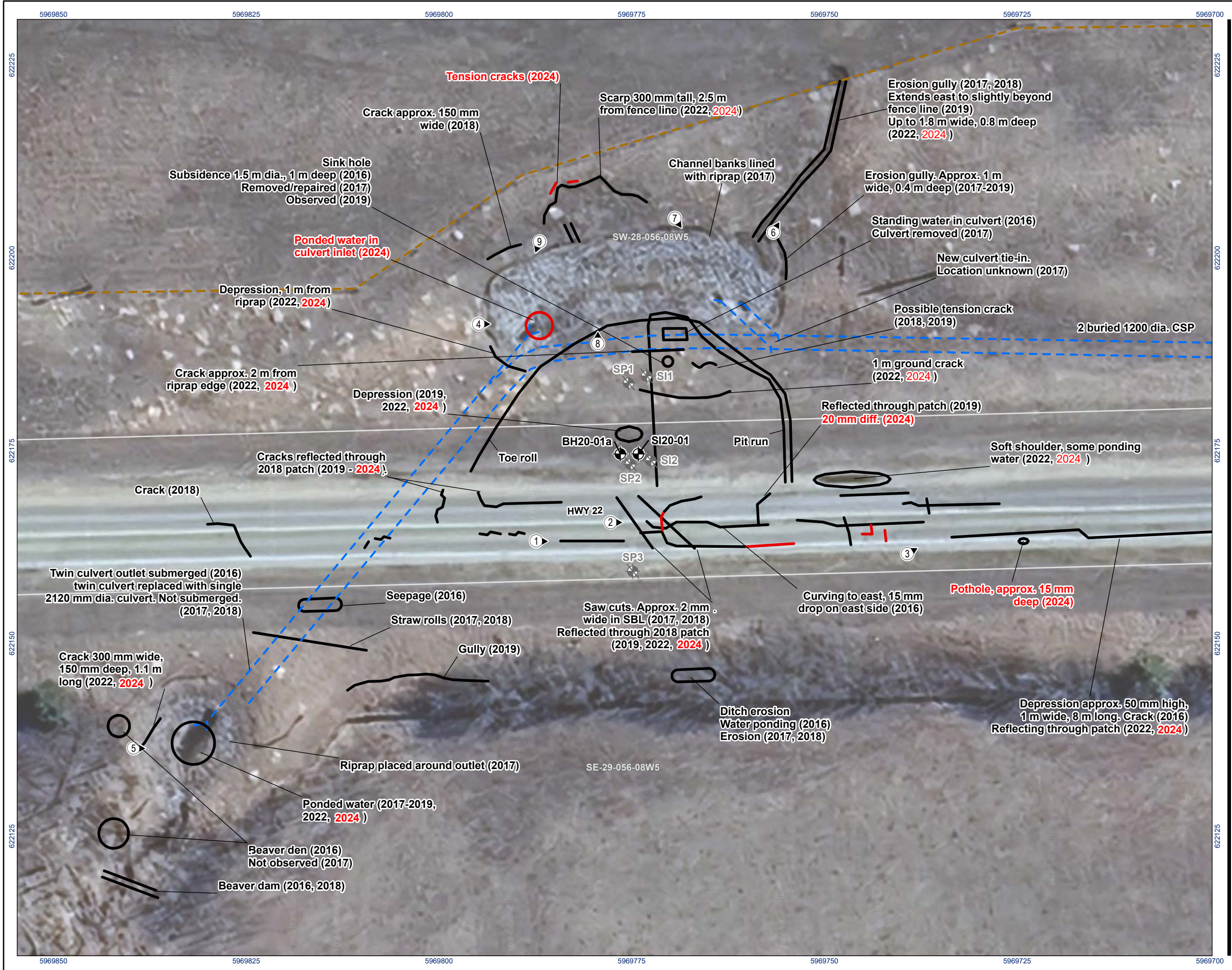
- It is recommended that short term remediation measures should be taken. This may include:
 - Sealing pavement cracks to reduce surface water infiltration into the slope and pavement structure.
 - Milling and filling the highway to avoid adding more surcharge weight on the slope.
 - Re-grading the slopes around the riprap channel at NC036-1 to seal any pavement cracks.
- The 'bumpy road' warning sign should be moved further south of the semi-circular cracking to provide advance warning of the dipping pavement.
- Long term remediation measures at NC036-1 may include:
 - Installation of a driven steel pile wall at NC36-1. The estimated cost for a driven steel pile wall 40 m long is approximately \$400,000 to \$600,000 excluding engineering.
 - Excavating the embankment / landslide mass and replacing with granular fill. Geogrid may also be considered to enhance slope stability but will require additional analysis to determine if it is required. The high-level cost for removal and replacement is \$200,000 to \$400,000 excluding engineering.
- The design for NC036-2 has been completed. The selected remediation option includes removal of the landslide mass and replacement with granular backfill and geogrid. The granular backfill will be underlain by a gravel drainage blanket daylighting at the toe of the slope.
- Site inspections should continue every two years.
- Instrumentation readings should continue annually in the spring.



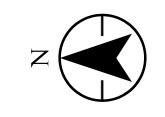
**NORTH CENTRAL REGION GRMP
EDSON / STONY PLAIN
SITE INSPECTION FORM**



PREPARED BY: Sonja Pharand, P.Eng.	REVIEWED BY: Xiteng Liu, M.Sc., P.Eng., PMP	PERMIT TO PRACTICE:

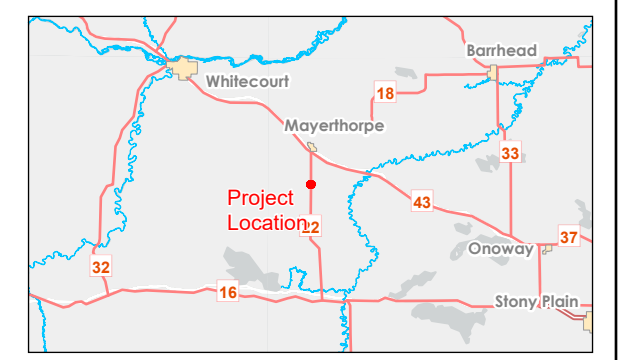


- Photo and Direction
- 2024 Observation
- Previous Observation
- Fence
- Culvert
- Quarter Section



0 5 10 metres
 (At original document size of 11x17)
 1:500

- Notes**
1. Coordinate System: NAD 1983 CSRS UTM Zone 11N
 2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
 3. Background: Light Gray Base: Esri Canada, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada
 4. Reference: Thurber Project No. 15-16-258, August 2011 (original Scale 1:2000).



Project Location
 SW-28- and SE-29-056-08W5,
 Alberta

Prepared by SP on 2024-10-01
 TR by LC on 2024-10-01
 IR by XL on 2024-10-01

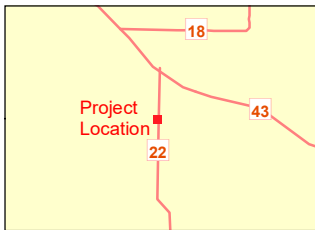
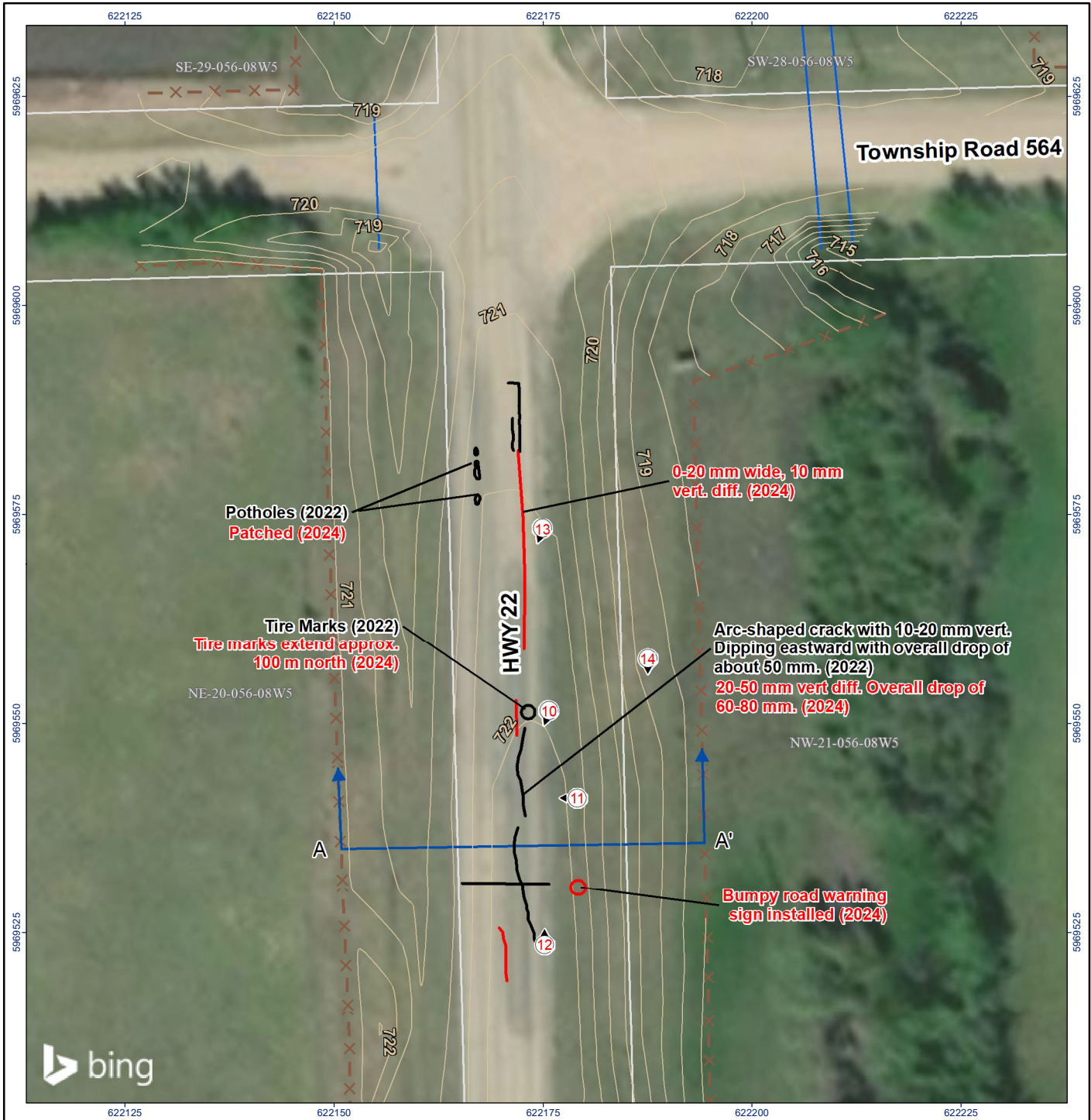
Client/Project
 Transportation and Economic Corridors
 Geohazard Monitoring Program
 NC36-1 Lazy "S" Slide

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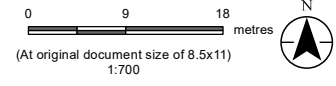
Figure No.
1

Title
Site Plan

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- Previous Observations
- 2024 Observations
- Culverts
- X — Fence Line
- Ground Elevation Contours (m)
- Quarter Section
- ↔ Cross-section



Project Location
 SE-29-056-08W5M, SW-28-056-08W5M, NE-20-056-08W5M and NW-21-056-08W5M Areas

Prepared by SP on 2024-10-01
 QR by LC on 2024-10-01
 IR by XL on 2024-10-01

Client/Project
 Transportation and Economic Corridors
 Geohazard Monitoring Program
 NC036-2 Highway 22 Lazy "S" Slide

Figure No.
 2

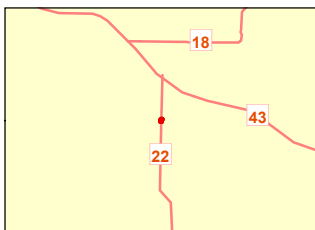
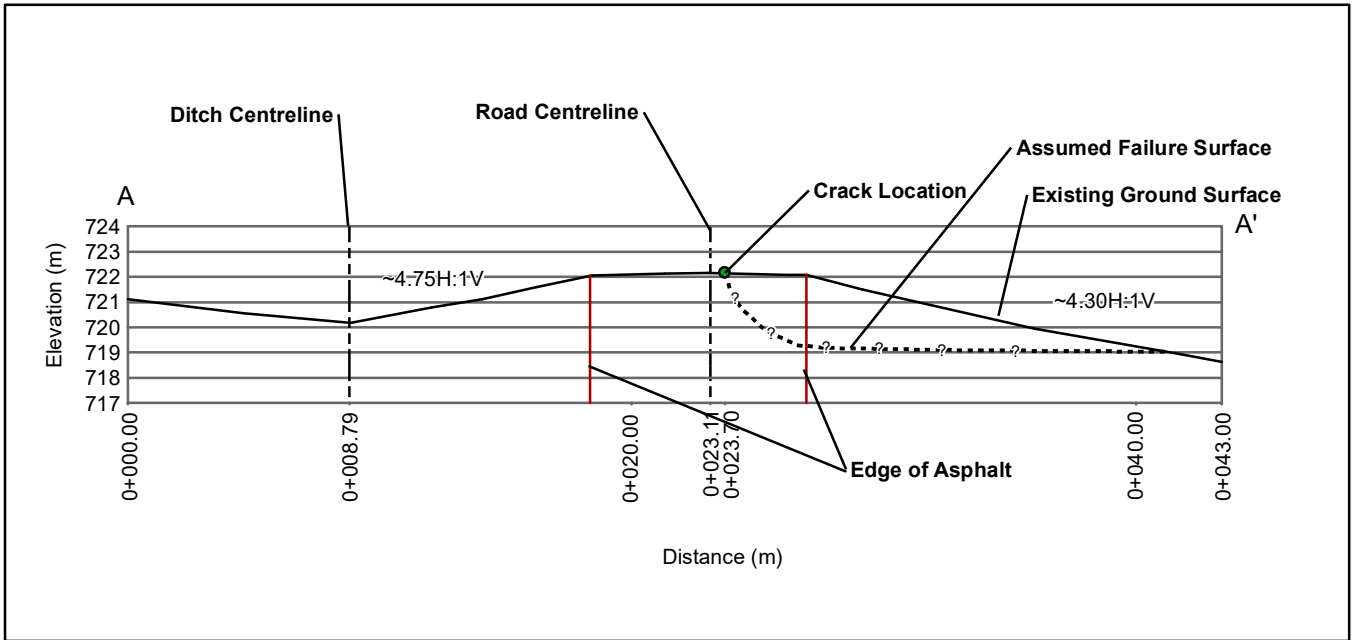
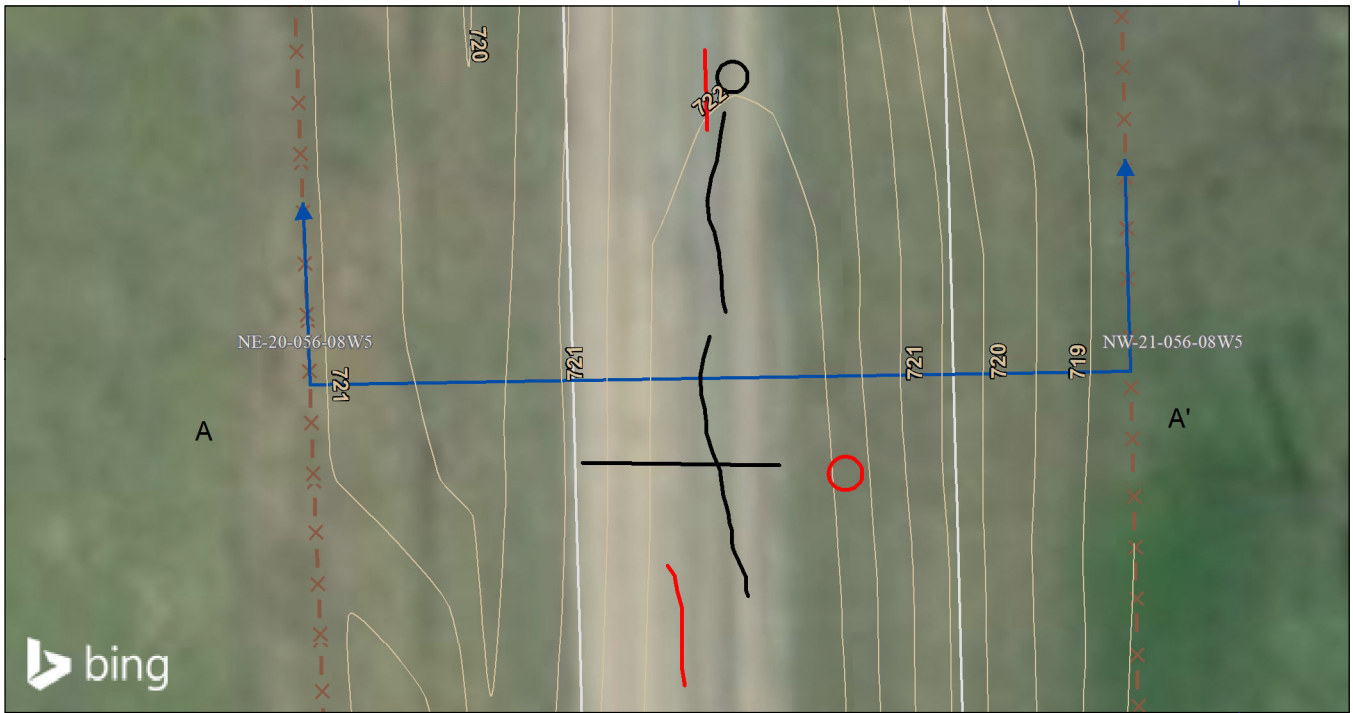
Title
 Site Plan

Notes

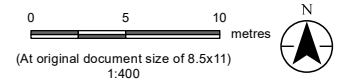
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: © 2024 Microsoft Corporation © 2024 Maxar ©CNES (2024) Distribution Airbus DS.

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- Previous Observations
- Ground Elevation Contours (m)
- Culverts
- Fence Line



Project Location
 SE-26-056-08-W5M,
 SW-26-056-08-W5M,
 NE-20-056-08-W5M and
 NW-21-056-08-W5M Alberta

Prepared by SP on 2024-10-01
 QR by LC on 2024-10-01
 IR by XL on 2024-10-01

Client/Project
 Alberta Transportation
 Geohazard Monitoring Program
 NC036-2 Highway 22 Lazy "S" Slide

123315222

Figure No.
 3

Title
 Ground Profile of Section A - A'

- Notes**
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 2. Base features: Geogritis, ©Department of Natural Resources Canada, All rights reserved.
 3. Background: © 2024 Microsoft Corporation © 2024 Maxar ©CNES (2024) Distribution Airbus DS.

2024 Site Inspection Photos at NC036



Photo 1: Longitudinal pavement cracks at north end of south bound lane at NC36-1. Looking south.



Photo 2: Cracks reflecting through 2018 pavement patch at NC36-1. Looking south.

2024 Site Inspection Photos at NC036



Photo 3: Pavement condition at south end of NC36-1. Looking southeast.



Photo 4: Riprap lined channel. Looking south.

2024 Site Inspection Photos at NC036



Photo 5: 2120 mm diameter culvert outlet with riprap lining on west side of highway. Looking south.



Photo 6: Erosion channel leading from riprap to fence line on east side of highway. Looking southeast.

2024 Site Inspection Photos at NC036

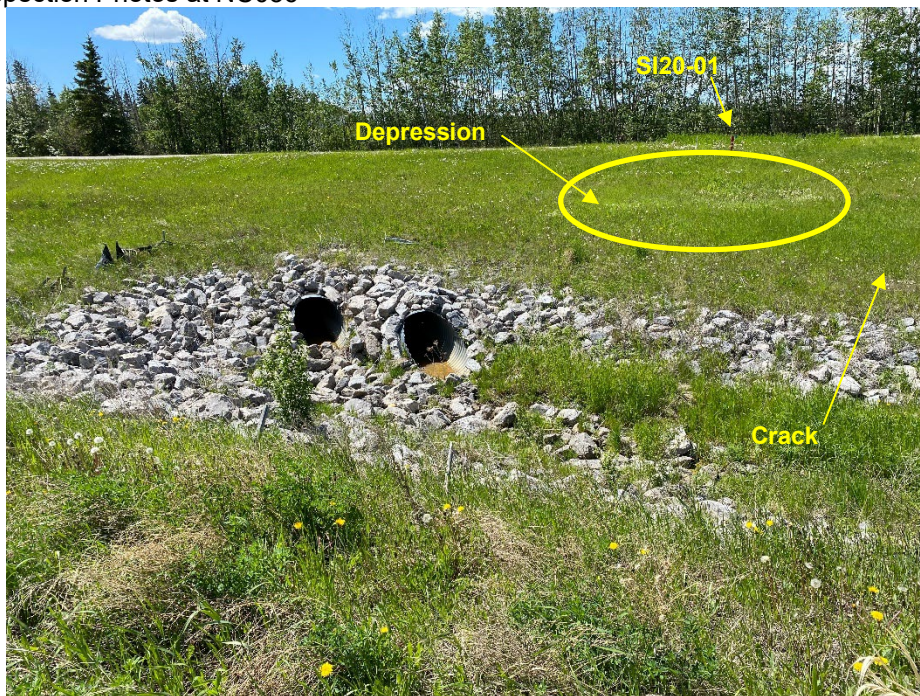


Photo 7: East side of highway embankment at south end of riprap lined channel. Looking southwest.



Photo 8: Scarp on east side of riprap lined channel. Looking east.

2024 Site Inspection Photos at NC036



Photo 9: Depression and crack above 2120 mm diameter culvert and riprap, looking northwest.



Photo 10: Pavement cracking at approximately north extent of NC36-2. Looking southwest.

2024 Site Inspection Photos at NC036



Photo 11: Northbound lane dipping to the east. Looking west.



Photo 12: Pavement cracking approximately at south extent of NC36-2. Looking north.

2024 Site Inspection Photos at NC036



Photo 13: Cracking and tire marks visible north of (after) semi-circular cracking. Looking southwest.



Photo 14: Slight toe bulging at base of embankment. Looking south.

2024 Site Inspection Photos at NC036



Photo 15: Site overview of NC036-1, taken by drone. Looking southeast.



Photo 16: Site overview of NC36-2, taken by drone. Looking northwest.