

<b>SITE NUMBER AND NAME:</b> NC098 – Hwy 658 Embankment Slide	<b>HIGHWAY AND KM:</b> 658:02, km 29.900	<b>PREVIOUS INSPECTION:</b> June 14, 2022	<b>CURRENT INSPECTION:</b> June 13, 2024
<b>LEGAL DESCRIPTION:</b> SW 12-61-9-W5M	<b>NAD83 COORDINATES:</b> UTM11U 6013255N, 615954E		<b>RISK ASSESSMENT:</b> PF: 7 CF: 3 Total: 21
<b>AVERAGE ANNUAL DAILY TRAFFIC (AADT):</b> 370 (2023)		<b>CONTRACTOR MAINTENANCE AREA (CMA):</b> 508	

<b>SUMMARY OF INSTRUMENTATION:</b> No instrumentation installed at this site. <b>LAST READING DATE:</b> N/A	<b>INSPECTED BY:</b> Stantec: Leslie Cho, Sonja Pharand TEC: Kristen Tappenden, Tim Gernyn
<b>PRIMARY SITE ISSUE:</b> Embankment creep movements towards south of highway causing pavement distress.	
<b>APPROXIMATE DIMENSIONS:</b> Approximately 125 m long (pavement section)	
<b>DATE OF ANY REMEDIAL ACTION:</b> Pavement milled and filled in 2020.	

ITEM	CONDITIONS EXIST		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Transverse cracking within patch limits, Semi-circular cracking near east and west patch limits.	X	
Slope Movement	X		Dip in the westbound lane (WBL) near east patch extent. Semi-circular cracking near east and west patch limits.		X
Erosion	X		Minor erosion in the north ditch.	X	
Seepage		X			
Culvert Distress		X			

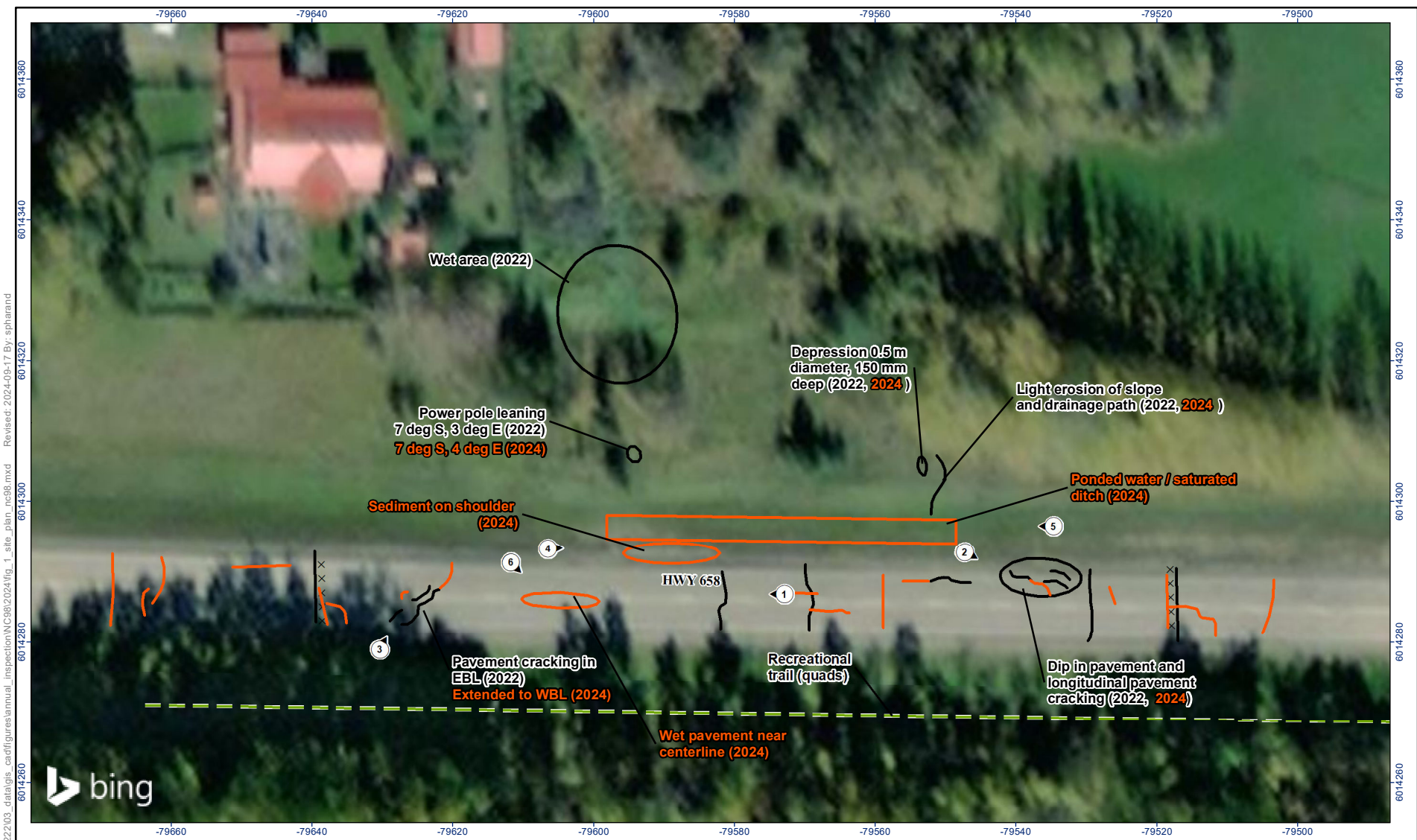
<b>COMMENTS</b>
<ul style="list-style-type: none"> <li>A pavement patch was placed in 2020 within the landslide zone. Pavement cracks have reflected through the patch with semi-circular cracking near the east and west extents. No vertical difference was observed at the crack locations, however the semi-circular cracks have spread, and additional cracking was present compared to the 2022 inspection (Photos 1 to 3).</li> <li>A slight dip on the WBL was observed near the east patch limits (Photo 2).</li> <li>The second power pole east of the private driveway on the north embankment is leaning approximately 7° south and 4° east, similar to the 2022 inspection.</li> <li>A wet area with differing vegetation (grasses) is located northeast of the power pole, at the top of the embankment.</li> <li>A depression approximately 0.5 m in diameter and 0.15 m deep was observed on the embankment slope northwest from where the pavement dips. Light erosion and a drainage path exist to the east of this depression. These elements appear unchanged from the 2022 inspection.</li> <li>Ponded water was observed in a section of the north ditch. Minor erosion and sedimentation was observed closer to the shoulder of the highway (Photo 4 and 5).</li> <li>No rain occurred while on site for the inspection, however a wet spot was observed along the centerline of the highway across from the power pole (Photo 6), suggesting potential high groundwater table.</li> </ul>

- Anecdotal evidence was provided by a motorist during the 2022 inspection. The motorist identified themselves as a former construction manager working in the area. They indicated that this section of highway was an old borrow pit and was a corduroy road before further development. There is potential that the corduroy structure still exists below the highway.
- The site was given a probability factor of 7 since there is a high probability of continued movement. The consequence factor was reduced to 3 as this highway has a fairly low average daily traffic volume and the site consists of a shallow to moderate fill.

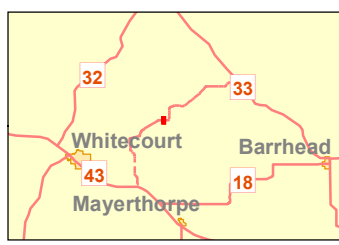
**RECOMMENDATIONS**

- All pavement cracks should be sealed to reduce surface water infiltration to the landslide mass.
- Additional pavement patches are not recommended since it would represent an additional load on the landslide. Instead, mill and fill should be completed to maintain the pavement cracks. Where mill and fill is planned, the pavement elevation should be equal to or lower than existing such that no net addition of loads is placed on the landslide.
- The Maintenance Contract Inspector should continue to monitor the pavement cracks and embankment for further movement in between site inspections.
- Given the lack of subsurface information, a geotechnical investigation program is recommended. The investigation should include installation of slope inclinometers and piezometers (minimum 2 each). Stantec can prepare a cost estimate for the geotechnical investigation upon request.
- Potential remediation options include:
  - During the site visit, it was discussed that this site could be a trial site for use of geosynthetic drainage/filtration mats. Assuming removal of the existing highway to a depth of about 1 m and reconstructing the highway, the high-level cost of construction is \$400,000 to \$600,000, excluding engineering. Regrading of the north ditch to promote flow of water away from site and reduce water infiltration into the fill under the highway could also be completed at the same time.
  - Construction of a driven steel pile wall on the south side of Highway 658. For a 140 m long driven steel pile wall, the estimated cost of construction is in the order of \$1.5 million to \$2 million. For concrete piles, the estimated cost of construction is in the order of \$3 million to \$4 million.
- Site inspections should continue to be completed every 2 years.

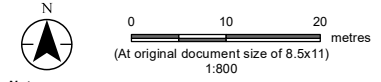
<b>PREPARED BY:</b> Sonja Pharand, P.Eng.	<b>REVIEWED BY:</b> Xiteng Liu, M.Sc., P.Eng., PMP	<b>PERMIT TO PRACTICE:</b>



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- Legend**
- Previous Observations
  - 2024 Observations
  - Extent of 2020 mill and fill
  - Recreational trail (quads)
  - Photo Number and Direction



- Notes**
1. Coordinate System: NAD 1983 3TM 114
  2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
  3. Imagery: © 2024 Microsoft Corporation © 2024 Maxar ©CNES (2024) Distribution Airbus DS

**Project Location** Woodlands County, Alberta  
**Prepared by SP on** 2024-09-17  
**Quality Review by LC on** 2024-09-17  
**Independent Review by XL on** 2024-09-17

**Client/Project** Transportation and Economic Corridors  
 Geohazard Monitoring Program  
 NC98 Hwy 658.02, km 29.9  
 12331 5222

**Figure No.**  
**1**

**Title**  
**Site Plan**



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2024 Site Inspection Photos at NC098



**Photo 1:** Highway 658, looking west.



**Photo 2:** Pavement cracking in west bound lane. Looking east.



2024 Site Inspection Photos at NC098



**Photo 3:** Angled pavement cracks across east bound lane. Looking northeast.



**Photo 4:** Minor erosion and sedimentation in north ditch. Looking east.



2024 Site Inspection Photos at NC098



**Photo 5:** Ditch and embankment on north side of highway. Facing west.



**Photo 6:** Possible seepage near centerline across from power pole. Looking southeast.



2024 Site Inspection Photos at NC098



**Photo 7:** Site overview, taken by drone. Looking northeast.



**Photo 8:** Site overview, taken by drone. Looking north.