

SITE NUMBER AND NAME: NC050 – Gregg River Slide	HIGHWAY AND KM: 40:28, km 11.752	PREVIOUS INSPECTION: July 15, 2021	CURRENT INSPECTION: May 30, 2023
LEGAL DESCRIPTION: NW-33-47-24-W5	NAD83 COORDINATES: UTM11U 5883282N, 469320E		RISK ASSESSMENT: PF: 3 CF: 4 Total: 12
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 1120 (2022)		CONTRACTOR MAINTENANCE AREA (CMA): 508	

SUMMARY OF INSTRUMENTATION: Four slope inclinometers and three pneumatic piezometers functional	INSPECTED BY: Stantec: Leslie Cho and Sonja Pharand TEC: Rocky Wang, Amy Driessen, Dave Farr
LAST READING DATE: May 10, 2023	
PRIMARY SITE ISSUE: Rotational slide with backscarp in westbound lane (WBL) at pile wall site. Retrogressive surficial skin slides at culvert site.	
APPROXIMATE DIMENSIONS: 80 m wide by 6 m deep. Unclear where toe of slide is located.	
DATE OF ANY REMEDIAL ACTION: Pile wall (1800 mm dia.) installed in 2010. Repaired separation of half-round culvert at culvert site in 2015. Cleaned backslope slump material in south ditch in summer 2016.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X			
Slope Movement	X		Several skin slides on highway backslope. Retrogressive skin slides on both sides of the half-round culverts.		X
Erosion	X		Concrete piles more exposed along pile wall. Erosion at skin slides near half-round culverts. Erosion and gully along highway shoulder from pile wall site to culvert site.	X	
Seepage	X		Seepage along north ditch between pile wall site and culvert site. Seepage previously observed east of half-round culvert within skin slides.		X
Bridge/Culvert Distress	X		Twisting of braces/supports at the two half-round culverts at culvert site. Sag in both 1000 mm diameter (dia.) corrugated steel pipe (CSP) culverts at culvert site. Separation noted between 1 st and 2 nd segment of the west culvert inlet at the culvert site.	X	

COMMENTS
<ul style="list-style-type: none"> • The <u>pile wall site</u> had little change from the previous site visit in 2021 (Figure 1). Observations include: <ul style="list-style-type: none"> – An old retrogressive scarp downslope from the pile wall, about 1.5 m high (Photo 1). – An erosion gully approximately 300 mm wide has formed within the area of surface erosion previously noted along the south ditch shoulder to the west of the C/L culvert (Photo 2). – The concrete piles are slightly exposed at ground surface. Increased erosion was observed as evidenced by more concrete piles being exposed along the downslope side since the visit in 2021 (Photo 3).

- SI10-11 to SI10-13 were installed in the concrete piles and monitoring results suggests the pile wall is performing well with little to no deflection in the piles. Total cumulative movement ranges from 0 mm to 8 mm since 2010.
- The C/L culvert at the pile wall site had a slight bulge along the west side wall near the outlet approximately in line with the pile wall location (Photo 4). The first and second segment at the inlet was previously thought to be separated, but it was confirmed by TEC that this is a collar for an extension. It is possible from previous site observations that water is ponding or infiltrating the ground at the collar. The culvert had approximately 25 mm of water in the bottom during the site visit.
- Transverse pavement cracking was observed several meters west of the C/L culvert at pile wall site. The cracks appeared to have been sealed and relatively unchanged from the last inspection (Photo 5).
- Several seepage locations with oxide staining in the north ditch between the culvert site and the pile wall site were observed. The north ditch was also wet (Photo 6).
- The north ditch shoulder had numerous erosion rills and gullies between the culvert site and the pile wall site. Several rills have progressed to gullies and have begun to undermine the asphalt (Photo 6).
- The old scarp to the east of the culvert site appears unchanged (Photo 7).
- The skin slides on the highway backslope were well vegetated.
- The culvert site had little change since the previous inspection (Figure 2).
 - There was no apparent change to pavement cracking upslope from the skin slides.
 - The skin slides appeared unchanged (Photo 8).
 - The west culvert had heavier flow down to the creek while the east culvert was trickling (Photo 10).
 - The bracings along the half-round culverts appeared twisted and distressed (Photo 10).
 - Leaning mature coniferous trees and slumping ground were observed within the treed area to the east of the skin slides.
- No flow was observed from the two old (non-functional) culverts near the toe of the slope adjacent to the river. The location of the inlet of these two culverts are unknown.
- A sag was observed in both 1000 mm dia. Culverts approximately at the highway location. Culvert flow is also undermining both culverts at the transition from full-round to half-round culvert. At the west culvert transition area, water is flowing out of the full-round and largely missing the half-round culvert (Photo 9). At the east culvert transition, water is trickling out and completely missing the half-round culvert, though some water does make it into the half-round culvert after trickling over rocks.
- At the culvert inlets on the south side of the highway, it was observed that the east culvert inlet was dry with vegetation growing thickly around the inlet, and the west culvert inlet was being undermined by water, which appeared to be entering the culvert from a separation between the 1st and 2nd culvert segments (Photos 11 and 12).
- Ponded water was observed at the toe of the south slope, in the highway ditch. Water was also ponding behind multiple ditch blocks.


RECOMMENDATIONS

- All culverts should be inspected to reduce the risk of water seeping into the slope.
- The extension collar at the C/L culvert on the pile wall side should be inspected for any leaks and repaired as required.
- The culvert inlets and outlets at the culvert site should be re-seated to reduce the amount of water currently undermining the culverts at these locations.
- The ditch blocks in the south ditch should be removed and replaced with rock check dams or similar to allow continued flow.
- Repeat LiDAR data sets or InSAR satellite monitoring can be used to estimate the rate of slope movement or slide retrogression towards the highway.
- Should the landslide movement retrogress further towards the highway, or increased distress to the highway be observed, a concrete pile wall could be used to remediate the culvert site. The high-level cost estimate for a 140 m long x 20 m deep concrete pile wall is \$3.5 million, excluding engineering.
- No long-term remediation is required at the pile wall site.
- The site should continue to be inspected every two years with the next visit in 2025. Future inspections should place more focus on the culvert site and less on the pile wall site.
- Instrumentation monitoring should continue annually in the spring.



NORTH CENTRAL REGION GRMP
EDSON / STONY PLAIN
SITE INSPECTION FORM



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

2023 Site Inspection Photos at NC050



Photo 1: Retrogressive scarp on the north side of the pile wall, looking west.



Photo 2: Gully on north side of the highway, to the west of the C/L culvert. Looking south.

2023 Site Inspection Photos at NC050

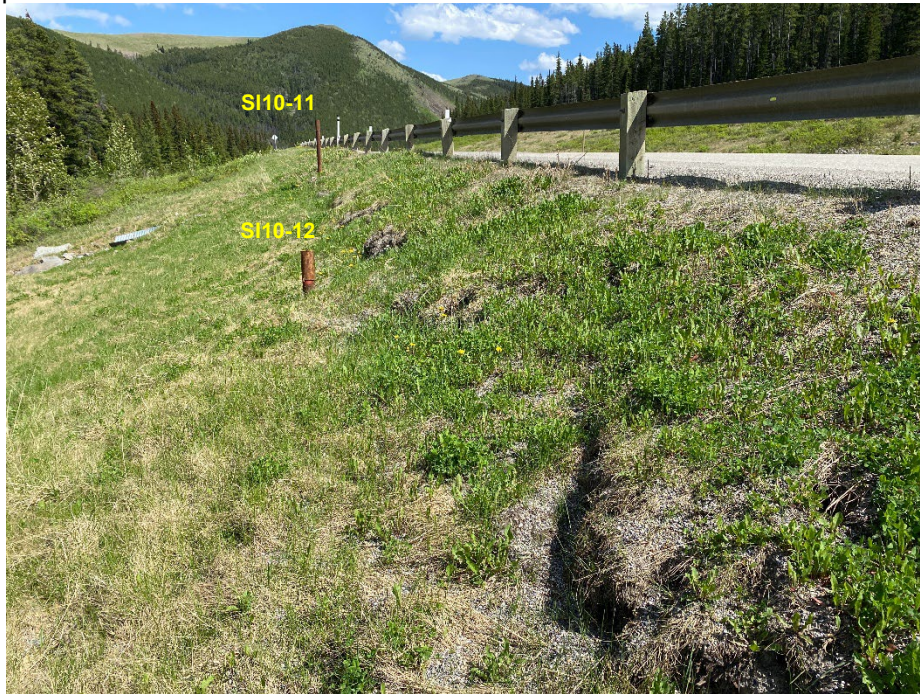


Photo 3: Exposed tops of concrete piles. Looking southeast.



Photo 4: Bulge in west sidewall of C/L culvert. Looking south.

2023 Site Inspection Photos at NC050



Photo 5: Pavement crack west of C/L culvert at pile wall site. Looking northeast.



Photo 6: Seepage along north ditch between pile wall site and culvert site with erosion rills and gully on the north ditch highway shoulder. Looking northwest.

2023 Site Inspection Photos at NC050



Photo 7: Old scarp east of culvert site, looking west.



Photo 8: View of culvert site and slope, looking northwest.

2023 Site Inspection Photos at NC050



Photo 9: Water undermining culvert. Looking east.



Photo 10: Twisted bracing along half-round culverts. Looking southwest.

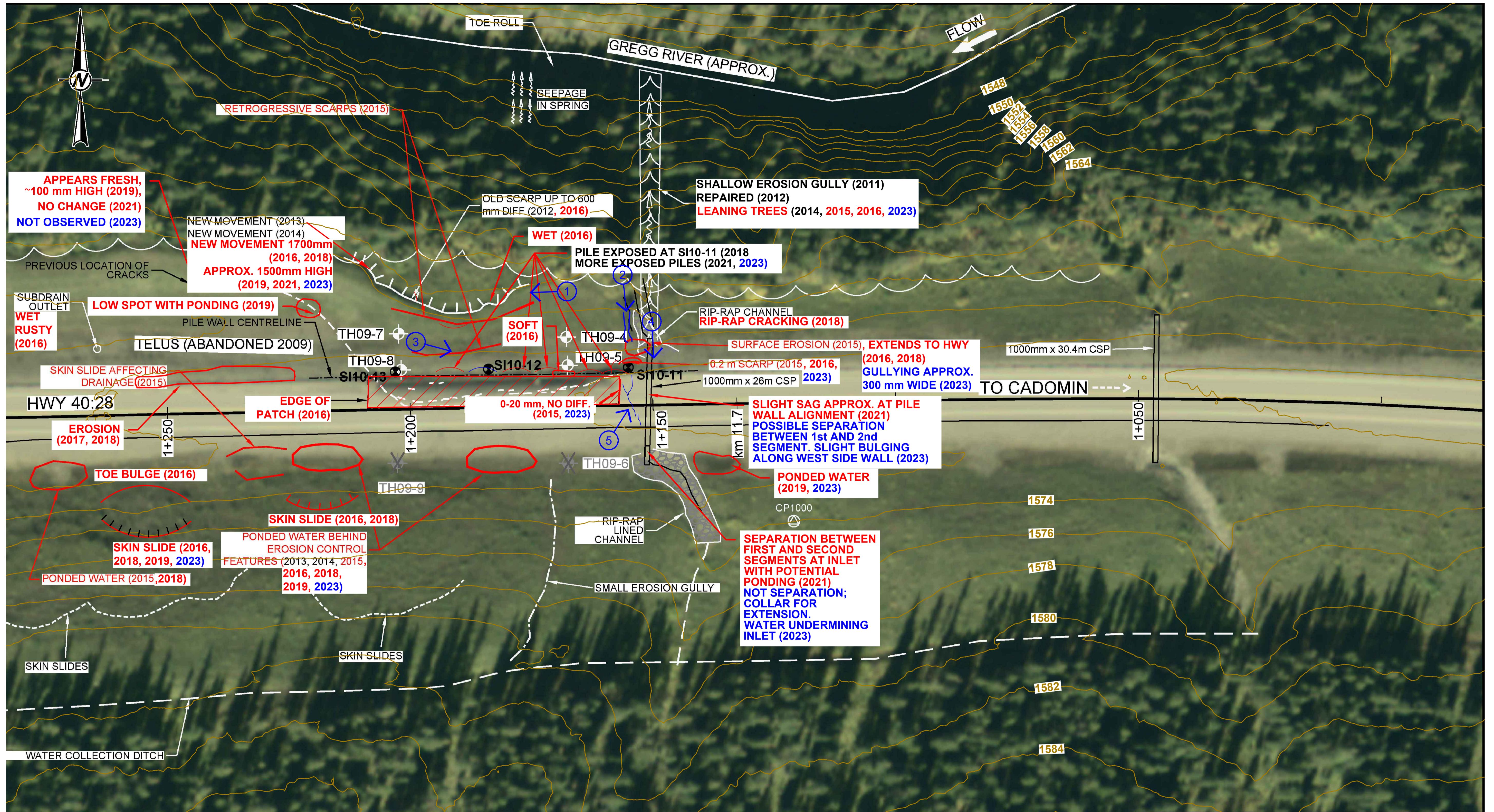
2023 Site Inspection Photos at NC050



Photo 11: Culvert inlets on south side of highway at culvert site, looking southeast.



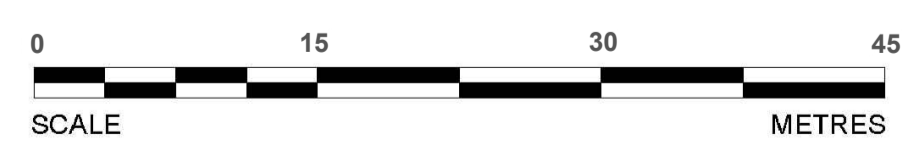
Photo 12: Water undermining the west culvert inlet at the culvert site. Looking west.



- LEGEND**
- APPROXIMATE LOCATION OF 2010 SLOPE INCLINOMETER
 - APPROXIMATE LOCATION OF PREVIOUS TEST HOLES
 - DESTROYED SLOPE INCLINOMETER OR STANDPIPE PIEZOMETER
 - SURFACE CONTOURS (m AMSL)**
 - PHOTO NUMBER AND DIRECTION**

- NOTES**
1. FEATURE LOCATIONS ARE APPROXIMATE
 2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
 3. 2015-21 OBSERVATIONS SHOWN IN RED
 4. 2023 OBSERVATIONS SHOWN IN BLUE
 5. m AMSL - METRES ABOVE MEAN SEA LEVEL

REFERENCE
 THURBER ENGINEERING LTD, PROJECT #15-16-258,
 ORIGINAL SCALE 1:1,000, DATE AUGUST 2011.



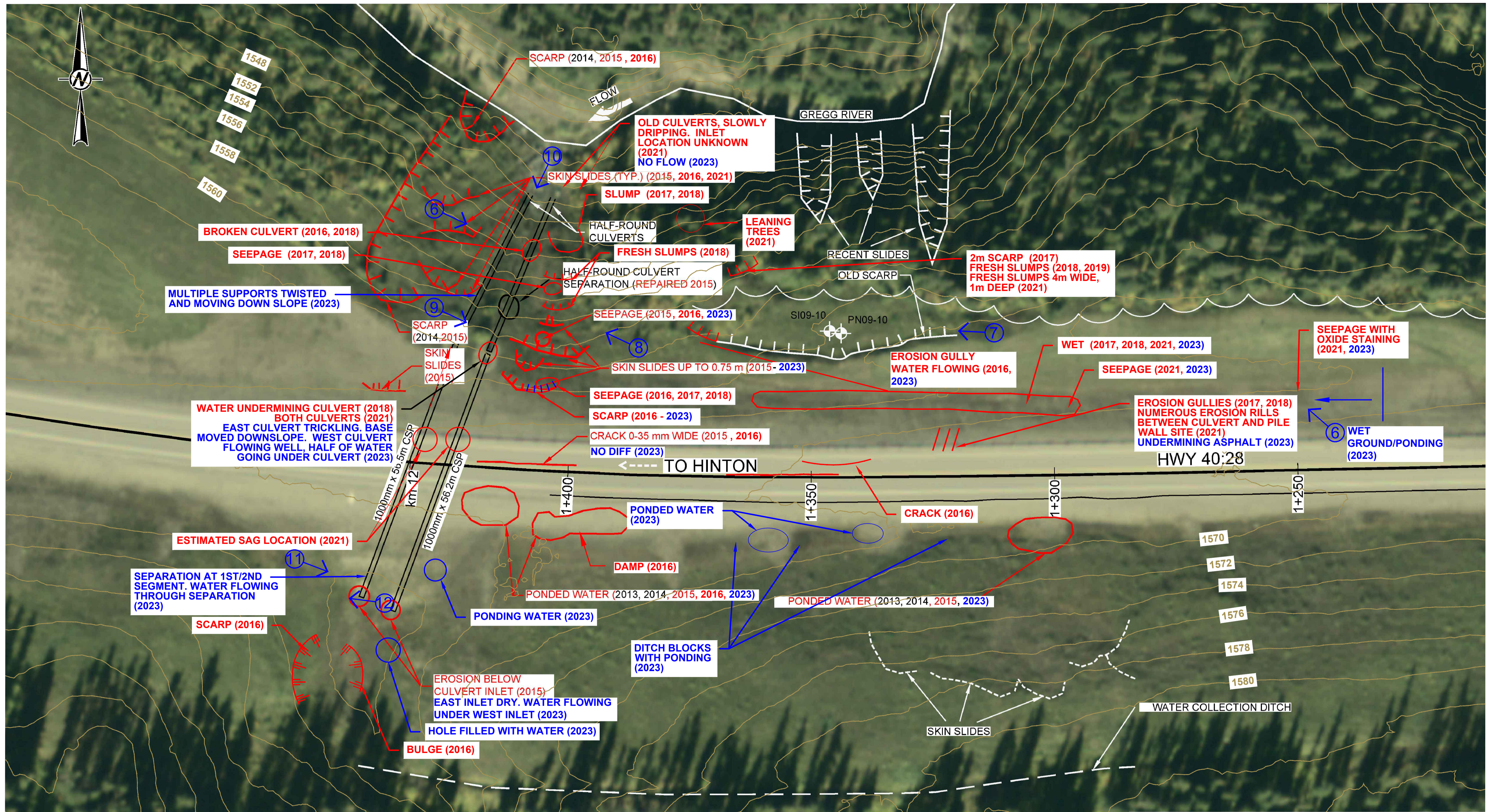
Stantec

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TRANSPORTATION AND ECONOMIC CORRIDORS
 GEOHAZARD MONITORING PROGRAM
 NC50 GREGG RIVER SLIDE
 PILE WALL SITE PLAN

DRAWN WW/MK/KE	CHECK CM	APPROVE LC	
DATE 18 JULY 2023	SCALE AS SHOWN	PROJECT # 123315222	

FIGURE 1



- LEGEND**
- APPROXIMATE LOCATION OF 2010 SLOPE INCLINOMETER
 - APPROXIMATE LOCATION OF PREVIOUS TEST HOLES
 - SURFACE CONTOURS (m AMSL)
 - PHOTO NUMBER AND DIRECTION

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FIGURE - 2