

SITE NUMBER AND NAME: C012 Hwy 841 Ditch Erosion		HIGHWAY & KM: 841:02, 6.495	PREVIOUS INSPECTION DATE: June 25, 2020 (Call-Out Inspection)	INSPECTION DATE: June 24, 2021
LEGAL DESCRIPTION: 33-27-20-W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5689847 377129		RISK ASSESSMENT: PF: 9 CF: 3 TOTAL: 27	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 100 (north) & 240 (south) (Ref No. 109220 & 108240)			CONTRACT MAINTENANCE AREA (CMA): 517	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the C012 site. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Roger Skirrow (AT) Tony Penney (AT)
PRIMARY SITE ISSUE: Erosion in the ditch on the west side (southbound lane) of Hwy 841 near and either end of the geocell armoring and gabion drop structure; and erosion of the toe of the tall slope on the west side (southbound lane) of Hwy 841.	
APPROXIMATE DIMENSIONS: The site is approximately 650 m long, and the highway embankment above the ditch is approximately 2 m to 3 m high sloped at approximately 4H:1V. Approximately 50 m to 100 m of the ditch is reinforced with geocell armoring and the height of the slope west of the highway is estimated to be approximately 25 m.	
DATE OF ANY REMEDIAL ACTION: 2003 – A repair consisting of the installation of geotextile, geocell reinforcement, and two gabion basket drop structures was completed in two locations in the ditch bottom west of Hwy 841.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement settlement and cracking in southbound lane		X
Slope Movement	X		Ditch erosion has triggered a slope failure that has not reached the highway embankment in two locations.		X
Erosion	X		Erosion of ditch and toe of slope Continued erosion ditch bottom and toe of slope.	X	
Seepage		X	None observed		X
Culvert Distress		X	Culvert inlet open		X

COMMENTS
Erosion is occurring in the ditch bottom on the west side of Hwy 841 at the north and south extents of the site, where geotextile, geocell armoring, and two gabion basket drop structures were installed in 2003. Near the middle of the site, an erosion gully extends outside AT's Right-of-Way (ROW) onto private land.
A CSP culvert at the south extent of the site was extended before our June 25, 2020 inspection. The culvert was extended by sleeving the existing culvert with a larger diameter CSP culvert, backfilling around the joint, and constructing a riprap apron at the culvert outlet (Photo 1). There was one sinkhole (0.3 m deep) observed in June 2020 and minor rill erosion above the culvert outlet was observed in June 2021. If seepage into the culvert joint continues, the material loss could form voids and eventually impact the highway.

There is minor ditch erosion in the east (northbound) ditch, approximately 0.5 m to 1.0 m deep and 1 m to 2 m wide. The east ditch erosion is much less severe than the west ditch erosion.

There is a well-vegetated area near the CSP culvert outlet and downstream of the west (southbound) ditch. The well-vegetated area appears to act as a sediment trap for the surface water flows out of the CSP culvert and west ditch, before discharging into an erosion gully (approx. 3 m wide and 3 m deep) at the southwest extent of the site.

Portions of the west ditch have been previously repaired with geotextile and geocell armoring. Approximately 50 m to 100 m of the geocell reinforcement has failed (i.e., exposed and undermined) at the north and south extents of the site, respectively.

Near the south extent of the ditch erosion in the west ditch, there are erosion gullies upwards of 3 m to 4 m deep. The erosion gully has triggered a slope failure that hasn't impacted the southbound lane of Hwy 841 (Photo 3). However, eventually the erosion gully will impact a nearby power pole located on the west side of the ditch (Photo 2).

Near the north extent of the site, the ditch erosion is 2 m to 3 m deep (south extent of the gabion baskets). The erosion gully extends off of the Hwy 841:02 right of way and into the upper portion of the well-vegetated area upslope of the lower erosion site.

Ditch erosion at the north extent of the site is impacting the toe of the highway embankment along a 25-m-long section (Photo 6). Where the erosion is impacting the toe of the highway embankment, it has retrogressed to within 1 m to 2 m of edge of pavement. If not repaired the erosion will eventually impact the southbound lane of Hwy 841:02.

Ditch erosion of the steep and high (estimated to be 25 m high) natural slope has either caused or exacerbated a natural slope failure approximately 70 m wide that extends to just below the crest of the slope. The erosion scarp above ditch bottom appears to be about 3 to 4 m high above eroded ditch base. The ditch base appears to be eroded by 1.0 m to 1.5 m below original ditch grade.

Discussed remedial actions:

Short Term:

- AT should have a ditch armoring design prepared for where the ditch erosion is beginning to encroach upon the shoulder of the southbound lane of Hwy 841 and in the erosion gully that is forming at the downstream extent of the ditch reinforcements located at the north extent of the site.
- Signage (sharp shoulder) should be installed along the shoulder of the highway where the ditch erosion is starting to encroach upon the shoulder of the southbound lane of Hwy 841:02. If the ditch erosion begins to impact the highway embankment/road surface elsewhere, signage should also be installed there as well, and a speed reduction and/or temporary guard rail may be required.

Long Term:

- Repair, replace, or extend the geotextile and geocell reinforcement previously installed along the west ditch. (i) Where the geocell reinforcement is intact, the geocell should be backfilled with granular material or fine-grained material that will promote more rapid revegetation. Additional geocell should be installed to maintain a channel shape to prevent erosion occurring at the edges of the geocell reinforcement. (ii) Where the geocell reinforcement has been undermined and bypassed by gulying, existing geocell and geotextile should be removed, gulying should be backfilled, and new geotextile and geocell armoring should be installed and maintain a channel shape. The geocell should be backfilled with granular material and disturbed areas should be hydro-mulched with a seed mix suitable for badlands soil. (iii) Where the geocell has been displaced by slope failure, place fill to allow ditch flows to flow over the toe of the slide area without excavating slide material that may further destabilize the slope. Armour regraded ditch with sand-and-gravel backfilled geocell. (iv) where the ditch has eroded and no geocell is present, extend the fully backfilled, ditch regrading and geocell repair while maintaining a ditch channel with freeboard to contact the ditch flows without exposing unarmoured soils to ditch flows.

- A 3 m high, 70 m long gabion-basket retaining wall should be built at the north extent of the site along the portion of the backslope being impacted by the ditch erosion. The ditch bottom should be graded with well-compacted fill to replace eroded material (estimated to be about 1.5 m) and establish positive drainage away from the slope.

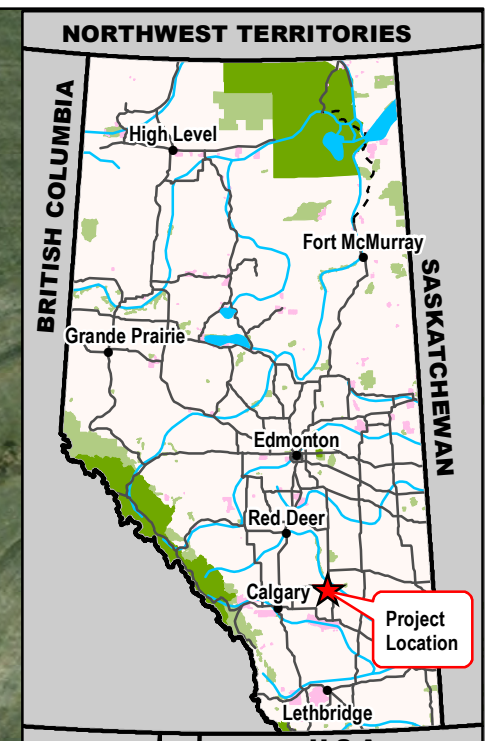
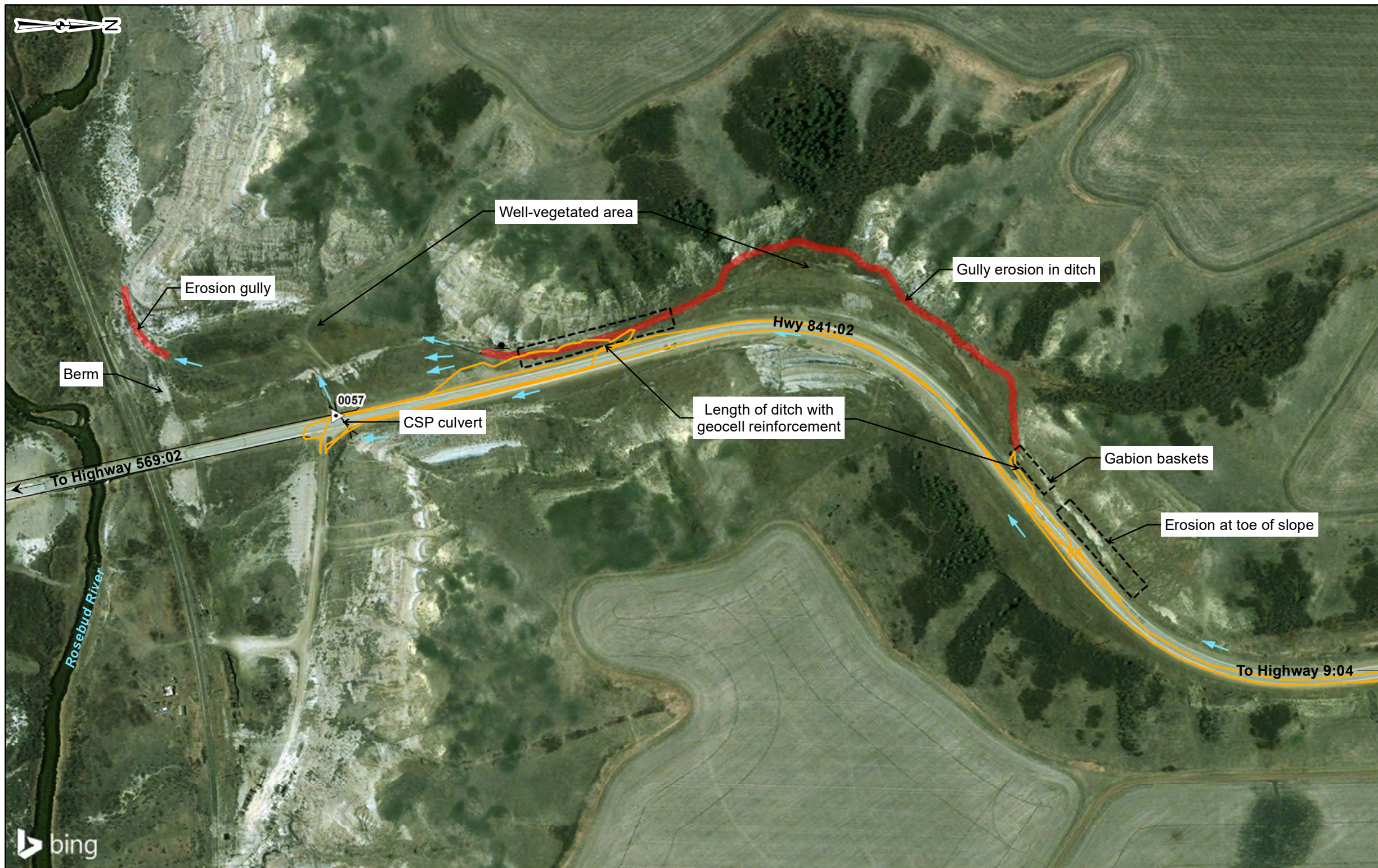
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- (ii) The observations, findings, and conclusions in this report are based on observed factual data and conditions that existed at the time of the work, and should not be relied upon to precisely represent conditions at any other time.
- (iii) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

Chris Gräpel, M.Eng., P.Eng.
Civil Engineer, Associate



- Legend**
- GPS Waypoint (June 24, 2021)
 - Flow Direction
 - GPS Track (June 24, 2021)
 - Power Pole
 - Guardrail
 - Culvert
 - Erosion



NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM Zone 12N
 3. IMAGE SOURCE: World Imagery, ESRI ArcGIS Online
 4. The locations of features were estimated from site observations and were not surveyed.

CLIENT

PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan C012 - Hwy 841 Ditch Erosion Hwy 841:02, km 6.71		
SCALE 1:3,000	PROJECT No. A05116A02	FIG No. 1

Time: 14:21:26 PM
 Date: November 08, 2021
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Inspection Photographs

Photo 1 Riprap apron at the outlet of the culvert beneath Hwy 841:02. The vegetation coverage on the highway embankment improved since the 2020 call-out. Photo taken June 24, 2021 facing east.



Photo 2 A failed section of geocell armouring that was previously installed near the south extent of the site. Red arrow indicates power pole that will be impacted by erosion. Photo taken June 24, 2021 facing north.



Photo 3 Geocell armoung in the west (southbound) ditch of Hwy 841. Photo taken June 24, 2021 facing north.



Photo 4 An embankment slope failure observed on the west (southbound) portion of the highway embankment slope, upslope of the gully erosion and near the south extent of the site. Photo taken June 24, 2021 facing southwest.



Photo 5 Erosion gully downstream of a gabion basket drop structure/geocell armouring (downstream edge indicated with red arrow). Photo taken June 24, 2021 facing west.



Photo 6 Ongoing erosion of the toe of the slope west of Hwy 841. Photo taken June 24, 2021 facing southwest.



Photo 7 Gabion basket drop structure and ongoing erosion occurring at the toe of the slope, on the west side (southbound) of Hwy 841. Red circle indicates slope instability on private land influenced by oversteepening at toe of slope due to ditch erosion. Photo taken June 24, 2021 facing west.

