GEOHAZARD RISK MANAGEMENT PROGRAM
North Central Region – Edson / Stony Plain Area

2019 Inspection Report

Site Number	Site Name		Hwy	km
NC37	South of Whitecourt		32:10	34.6
Legal Land Description	NW 27-59-12-W5M			
UTM Coordinates (NAD 83)	Zone 11U	N5999427	E583507	
Operational Site Instrumentation	**Slope Inclinometers**		9	
	Pneumatic Piezometers		4	
	Vibrating Wire Piezometers		5	
	Standpipe Piezometers		4	
Date of Last Instrumentation Readings	May 8, 2019			

Risk Assessment	Date	PF	CF	Risk Ranking
Current Inspection	May 15, 2019	7	4	28 (Powerline Site)
Previous Inspection	May 31, 2018	7	4	28 (Powerline Site)
Report Attachments	☒ Photographs (18 photos)	☒ Site Plans (1 page)		

	Stantec	Alberta Transportation
Inspected By	Leslie Cho, Junwen Yang, and Xiteng Liu	Kristen Tappenden, Kathleen Davis, Paul Macaraeg, and Tim Germyn

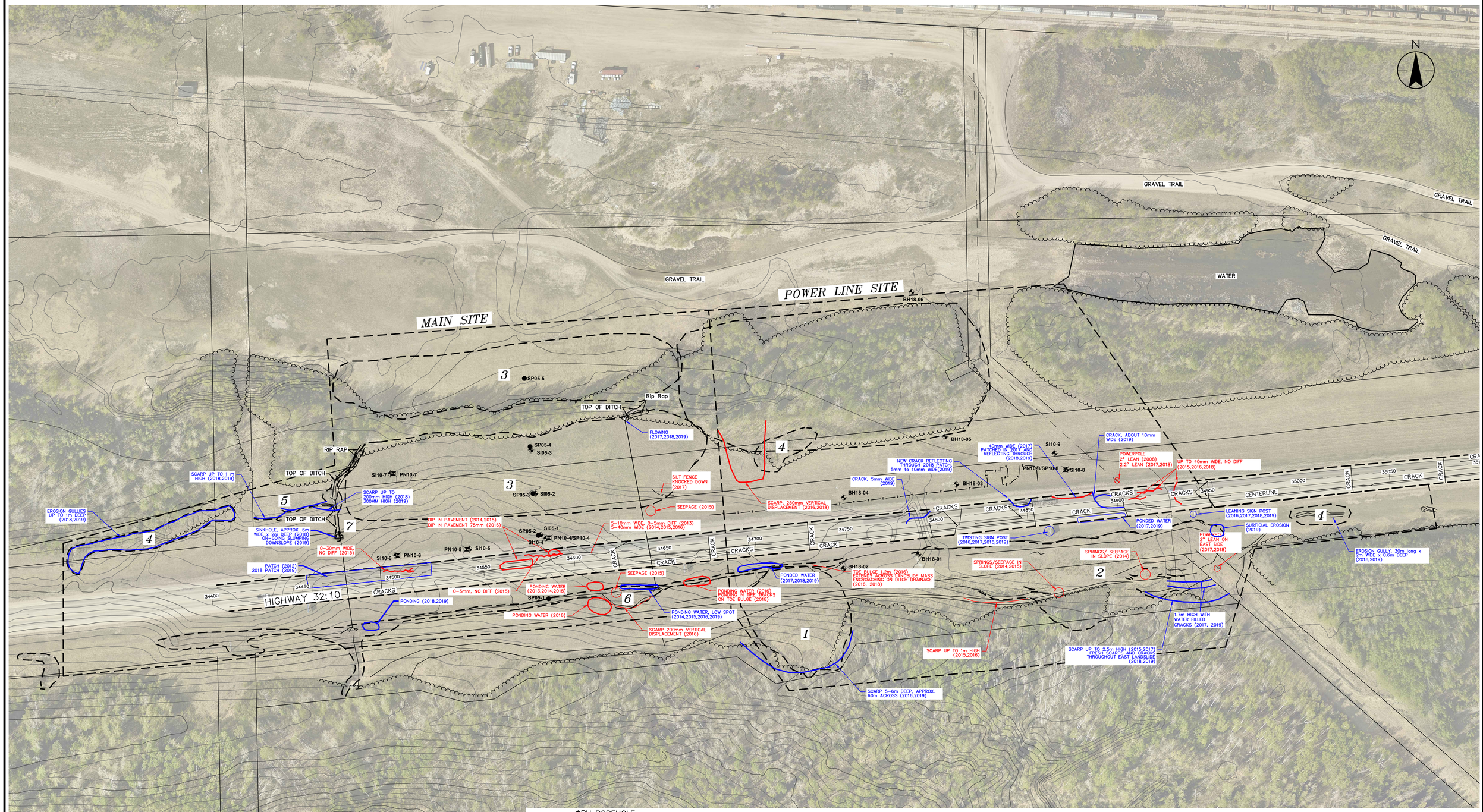
	Stantec	**Alberta Transportation**	
Date of Remediation	2011 – two berms constructed at Main Slide Site		
Recent Maintenance	Patching of westbound lane in 2012. Westbound lane patched in 2017 and 2018		
Primary Site Issue	Slope instability due to raised groundwater level caused by embankment construction together with weak foundation soils.		
Observations	**Description and Location**	**Change from Previous Inspection**	
☒ Pavement Distress	- Pavement cracks reflecting through 2018 patch. - New circular cracks at Station 34+850 and 34+900.	☒ Yes	☐ No
☒ Culvert Distress	- Sinkhole along culvert alignment at station 34+450. Possibly related to culvert.	☐ Yes	☒ No
☐ Bridge Distress		☐ Yes	☐ No
☒ Slope Movement	- Back scarp at approximately Sta 34+700 on south side of highway - Scarp south of highway at Main Slide Site at approximately Sta 34+625 - Toe bulge extends across drainage ditch - New cracks observed at Power Line Site - Power poles have 2˚ lean.	☐ Yes	☒ No
☒ Erosion	- Erosion gullies at the toe of slope at about station 34+400 - Erosion gully in south ditch at about station 35+000	☐ Yes	☒ No
☐ Seepage		☐ Yes	☐ No
☒ Other	- Ponded water at toe of slide / highway embankment ditch at Main Slide Site	☐ Yes	☒ No

Discussion	Power Line Site: The westbound lane was overlaid in 2017 and patched again in 2018. The pavement crack observed in 2017 at about Station 34+875 has reflected through the new patch as shown in Photo 1. Currently, the crack is up to 10 mm wide with no vertical differential. Two new circular pavement cracks up to 10 mm wide were observed reflecting through the new patch at about Station 34+900 and 34+850 as shown in Photos 2 and 3, respectively. The scarp at approximately Station 34+700 appeared to have a larger toe bulge than in previous years as shown in Photo 4. Slope movement in the backscarp from approximately Station 34+750 to 34+950 is ongoing. Previously observed ground cracks appeared larger than the previous inspection with evidence of fresh cracks as shown in Photo 5. This may be contributing to further leaning of the "photo radar" sign in the south ditch as shown in Photo 6. The toe bulge at the base of the slide was about 1.2 m high and encroached further into the drainage ditch to the point of contact with the sign as shown in Photo 7. No change was observed to the leaning power pole north of the highway. Both power poles were measured to have a 2˚ lean towards the east. A new erosion gully east of the power line near Station 35+000 was observed as shown in Photo 8. The erosion gully was measured to be about 30 m long, 2 m wide, and 0.6 m deep. Toe bulging continues to be progressing into the south ditch as shown in Photo 9. Wet/saturated ground was observed in the ditch. Main Slide (Berm) Site: The upper and lower toe berms appear unchanged since the previous inspection. The overall views of the upper and lower toe berms are shown in Photos 10 and 11, respectively. The culvert outlet at approximately Station 34+475 was observed to be flowing as shown in Photo 12. Immediately upslope and southwest of the culvert outlet, a vegetated gully about 200 mm high was observed as shown in Photo 13. Approximately midway upslope from the culvert a sinkhole feature was observed along the culvert alignment as shown in Photos 14 and 15. The sinkhole was measured to be about 6 m wide and 2 m deep with a gully-like feature leading downslope. The sinkhole appeared to have increased in size towards the south compared to the 2018 inspection. A series of erosion gullies were observed west of about Station 34+400. The deepest gullies were approximately 1 m deep as shown in Photo 16.

	Scarps up to about 1 m high were observed about 40 m west of the culvert outlet at Station 34 475 as shown in Photo 17. This scarp appears unchanged from previous inspection. The westbound lane was recently patched near SI10-6 with no pavement cracks observed as shown in Photo 18.

Assessment	Power Line Site: Existing SI's (SI10-8 and 10-9) indicated slip surface between 3 and 6 m in the upper clay/silt. However, the rate of movement was slow, at 1 to 2 mm/yr. Likely for this reason, the SI's installed in 2018 (SI18-03 to 18-05) have not picked up any noticeable movement since installation, other than surficial disturbance. The pavement cracks reflecting through the new overlay at Station 34+875 also suggests that slope movements are on-going. It is believed that the slope movement is the result of groundwater level rise in the foundation soil as well as embankment fill. Furthermore, toe bulges appear to be blocking surface water drainage along the south ditch and may be allowing water to infiltrate into the slope. Typical of embankment construction on hill side or natural slope, the embankment fill will block the surface water run off and therefore raised the groundwater level in the foundation soil, the upslope, and also the embankment fill unless a proper drainage blanket (grids) is placed underneath the embankment. Even with the use of drainage ditches and culvert, some surface water will seep into the ground and raise the groundwater level. The situation will get worse with time when the culvert becomes non-functioning. This eventually leads to slope movement/creep in the long run. Seepage previously observed at the Power Line Site suggests a high ground water table south of Highway 32. These seepage areas seem to correspond to locations of on-going slope movement. Main Slide Site: An initial failure plane based in the high plastic clay layer at a depth from 4.5 m to 9.5 m was described by Thurber in the 2006 Thurber Geotechnical Report. The movement zones were clearly identified from the slope inclinometers installed at the Main Slide Site. At that time, a perched water table above the high plastic clay layer was considered to be a contributing factor to the failure mechanism. Two berms (upper and lower berms) were designed by Thurber and constructed in 2011 to remediate the slope. Slope movements (at a slower rate) have been identified from the slope inclinometer readings at the Main Slide Site after the two berms were built in 2011. The rate of slope movements appeared to have slowed down after the toe berm construction with about 5 mm of movement at a depth of about 7 m in SI10-6 measured between 2011 and 2016. From 2016 onwards, SI10-6 showed an additional 5 mm of lateral movement at the same depth. Moreover, pavement cracking upslope from the berms started to be observed again in 2015. It appears that the two existing berms may have slowed down the slope movements along the original slip plane. It is possible a new slip surface has developed above the upper berm between the crest of the highway embankment and the top of the upper berm. A high groundwater table likely being recharged from the south side of the highway may also be a contributing factor to the on-going slope movements at the Main Slide Site. It is inferred that there is a break within the west culvert at Station 34+475 leading to the sinkhole feature observed. *(continued next page)*

Assessment (continued)	The toe bulges appear to be blocking surface water drainage along the south ditch and may be allowing water to infiltrate into the slope. The more significant slope movements appear to be occurring south of the highway along the back slope.
Recommendations	Short term recommendations include sealing any new cracks to reduce surface water infiltration into the slope and pavement structure. Regrading of the south ditch should be completed to improve positive drainage. Stantec has completing a draft remedial design for Site NC37. The proposed design consists of constructing finger drains and interceptor drains to improve slope drainage and possibly extending the existing toe berms, if warranted. The design is currently in the draft stage to be reviewed by AT. Given that the upper clay/silt was underlain by a continuous layer of sand and gravel, it might be possible to drain the upper clay/silt into the underlying sand and gravel via vertical drains. This includes forming a series of sand drains under the south ditch and connecting the top via a granular trench. The granular trench will help collect the surface runoff, and the sand drains will drain the surface water and the surrounding clay towards the underlying sand and gravel. It is recommended that a CCTV inspection be completed for the culvert at station 34+475 so that remedial measures can be developed for the culvert. This may require additional boreholes to support culvert remediation. Instrumentation readings at the site should continue to be collected semi-annually, with site inspections completed annually.



BH BOREHOLE
SP STANDPIPE PIEZOMETER
PN PNEUMATIC PIEZOMETER
CULVERT
OVERHEAD POWERLINES
BURIED TELEPHONE LINES
FENCE LINES
TREE LINES
PREVIOUS OBSERVATION
2019 OBSERVATION

1 WEST LANDSLIDE
2 EAST LANDSLIDE
3 BERMS
4 GULLY / EROSION AREA
5 TENSION CRACKS
6 SEEPAGE AREA
7 CULVERT / DITCH
PROJECT LIMIT

ALL DIMENSIONS AND ELEVATIONS ARE EXPRESSED IN METRES AND DECIMALS THEREOF

STATIONING DISTANCES ARE GRID DISTANCES.

1:1000 0 10 30 50m

Stantec

STANTEC CONSULTING
400-10220 103 AVENUE NW
EDMONTON, ALBERTA, CANADA
T5J 0K4

ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC37 SOUTH OF WHITECOURT
MAIN SITE PLAN

DRAWN WW / MK	CHECK XL	APPROVE LC	
DATE 17 JUL 2019	SCALE AS SHOWN	PROJECT # 123312435	

FIGURE -1 -

Reference: 2019 Annual Inspection Photographs at NC37 – South of Whitecourt
File Number: 123312435

Photo 1: Circular cracks reflecting through 2018 patch. Cracks about 10 mm wide. Looking east.

Photo 2: New circular crack up to 10 mm wide reflecting through 2018 patch at about Sta 34900. Looking southeast.

Photo 3: New circular crack up to 10 mm wide reflecting through 2018 patch. Looking west.

Photo 4: Scarp south of the highway at approximately Sta 34+700. Increased toe bulging. Looking south.

Photo 5: Fresh scarps with larger ground cracks west of the power pole south of the highway. Looking southeast.

Photo 6: Leaning "Photo Radar" sign at power line site. Appears to be leaning more than previous inspection. Looking north.

Photo 7: Toe bulge encroaching onto south ditch and sign post at Photo 6. Looking west.

Photo 8: Erosion gully east of sign in Photo 6. Looking east.

Photo 9: Toe bulging at "other businesses" sign. Looking east.

Photo 10: Overall view of upper toe berm. Looking west.

Photo 11: Overall view of lower toe berm. Looking west.

Photo 12: Culvert outlet adjacent to west extents of upper toe berm. Slumping immediately upslope of culvert. Looking south.

Photo 13: Vegetated gully immediately upslope of culvert in Photo 12. Looking north.

Photo 14: Slump/sinkhole along culvert alignment further upslope of culvert in Photo 12 and 13. Approximately 6 m wide by 2 m deep. Looking south.

Photo 15: Erosion gully leading from sinkhole in Photo 14. Looking north.

Photo 16: One of a series of about 10 slump/erosion features about 150 m west of Photo 12 at toe of slope. Looking north.

Photo 17: Tension crack/slump about 40 m west of Photo 12. Scarp about 1 m high. Looking south.

Photo 18: New patch on westbound lane at main slide site near SI10-6. No cracks observed. Looking west.