



**PEACE REGION
(GRANDE PRAIRIE DISTRICT – SOUTH) GRMP**



SITE INSPECTION FORM

SITE NUMBER AND NAME: GP007 Wanyandie Road Slide		HIGHWAY & KM: 40:36, 29.339	PREVIOUS INSPECTION DATE: June 12, 2023	INSPECTION DATE: June 10, 2024
LEGAL DESCRIPTION: NW 02-59-07-W6M NE 02-59-07-W6M	NAD 83 COORDINATES: UTM Northing Easting 11 5993890 372875		RISK ASSESSMENT: PF: 9 CF: 8 TOTAL: 72	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 430 (north) & 437 (south) (Reference No. 60403650, 2023)			CONTRACT MAINTENANCE AREA (CMA): 504	

SUMMARY OF SITE INSTRUMENTATION: Operable: Nine slope inclinometer (SIs), ten pneumatic piezometers (PNs), nineteen vibrating wire piezometers (VWPs), and three standpipe piezometers (SPs) installed between 1998 and 2022. All VWPs and two SPs connected to data loggers. Inoperable: Nine SIs and two PNs installed between 1998 and 2024. LAST READING DATE: May 23, 2024	INSPECTED BY: Chris Gräpel (KCB) Courtney Mulhall (KCB) Robert Senior (TEC) Rishi Adhikari (TEC) Babatunde Awokunle (TEC)
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PRIMARY SITE ISSUE: Deep-seated landslide (or nested slides) along north valley slope of the Smoky River. Hwy 40:36 fill placed in a cut and side-hill arrangement across slide area. Slide movement affecting both lanes of highway.

APPROXIMATE DIMENSIONS: Entire site is approximately 600 m long. An approximate 200 m and 150 m length of highway primarily being affected at west and east ends of site, respectively.

DATE OF ANY REMEDIAL ACTION: 2018 and 2019 – asphalt overlay. Summer/Fall/Winter 2020 and 2021 – highway surface returned to gravel in summer/fall then paved for winter. Fall 2023 – north highway ditch regarded at west end of site. Ongoing pavement patching, and sub-excavation and backfilling of voids with granular fill. Site last patched in late 2022.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Cracking and settlement in pavement surface, including recent pavement patches, as described below.	X	
Slope Movement	X		Cracking and settlement in recent pavement patches and SI data indicates ongoing slide movements.	X	
Erosion		X	None observed at time of 2024 inspection.		X
Seepage	X		At west side of site: Area downslope/south of Hwy 40:36 not visited during 2024 inspection, but ponded water and seepage previously observed in 2022 as described below. At east side of site: none observed during 2024 inspection.		X
Culvert Distress		X	None observed at time of 2024 inspection (Photos 2 and 10).		X

COMMENTS
Slope upslope and downslope of highway is landslide terrain.
Highway crosses deep gully/ravine and bridge-sized culvert (BF80699) at east end of site (Photo 10).
High fills located at western (Photo 4) and eastern flanks of slide with lower side-hill fills in middle of slide area.
Cracking observed in pavement surface at west and east ends of site as follows: <ul style="list-style-type: none"> • At west end of site (Photo 1): cracking across both lanes through recent pavement patch to north shoulder, which was similar to previous inspection. Some skid marks observed in both lanes.. • At east end of site (Photos 6 to 8): cracking and settlement across both lanes through recent pavement patch, which was more noticeable than previous inspection. SI20-03 downslope of this sheared between the fall of 2023 and spring of 2024 readings. Some skid marks observed in westbound lane. <ul style="list-style-type: none"> ○ It is noted that while preparing this report a call-out inspection was completed in August 2024 due to increased pavement distress at the east end of the site, including a circular depression or sinkhole along highway centerline. Additional observations will be documented in the call-out inspection report to be issued in fall 2024. ○ Ongoing movement at east end of site could eventually impact bridge-size culvert (BF80699) (Photo 10).
Portions of landslide that appear most active coincide with areas of high fill (below/adjacent to Wanyandie Road intersection and deep gully at eastern site limit). Slide relatively inactive near middle of site (Photo 5) and above highway.
Less active portions of slide above/north of highway may not be as influenced by fill placement or water infiltration into slide scarps at highway level. However, without any changes to the slide or highway geometry, continued movement of the lower portions of the slide or prolonged periods of wet weather causing groundwater levels to rise could eventually result in movements further upslope.
Sinkholes observed along upslope/north highway ditch, which appear to correspond with the location of a fiber optics line.
The area downslope/south of Hwy 40:36 was not visited during the 2024 inspection, but the following was previously observed by KCB in 2022: <ul style="list-style-type: none"> • A series of ridges and troughs on the slope, which are visible in historic air photos and the bare-earth light detection and ranging (LiDAR) data. It was discussed that the ridges and troughs could be the result of blocks sliding and eroding overtime becoming more dome shaped. Generally, no pattern to ridges and troughs. • A pond of water located on the mid-slope. As well as other wet spots on the slope, and ponded and flowing water in two locations on former Wanyandie Road. Note pore pressures/water levels recorded in PN-3, located along former Wanyandie Road, were above ground surface before the instrument became inoperable in 2011.
Several geotechnical site investigations completed by others between 1998 and 2020, which included installing 14 SIs and 21 piezometers. <ul style="list-style-type: none"> • Several of these piezometers have been dry or near dry (i.e., recording water levels below or near their tip elevations) since installation with a water level/porewater pressure above tip elevation only being recorded in the spring of 2020 and/or 2021. A sustained water level/porewater pressure has only been recorded in PN98-1, PN98-3, and the piezometers at the east end of the site (VW20 02A/B, -03A/B, and 06A/B, and SP20-4). • Several of these SIs were either not installed deep enough (e.g., SI98-4 and -6, SI02-11 and -12, and TH20-2, -3, and -6) or did not record clear movement patterns before they became inoperable (e.g., SI98-1).

SITE INSPECTION FORM

KCB subsequently completed a geotechnical site investigation in May 2022, which included installing 4 deep SIs and 13 deep VWP's.

To record year-round groundwater-fluctuations and improve our understanding of groundwater conditions below Hwy 40:36, KCB:

- installed data loggers on all 19 VWP's in the spring of 2022; and
- installed small-diameter VWP's connected to data loggers in 2 SP's in the spring of 2023.

Highway re-alignment to north/upslope previously studied and designed by others. The re-alignment design involved:

- large excavations of the mountain slope and high backslopes above/north of Hwy 40:36, which was judged by KCB and TEC to have a high risk of exacerbating existing movements or triggering other movements further upslope above/north of Hwy 40:36; and
- extension of the existing 1980's bridge-sized culvert at the eastern site limit.

Subsequent discussions with TEC indicated that they would like to see additional preliminary engineering assessments from KCB for re-alignment/lowering downslope/south and drainage/dewatering.

KCB presented our preliminary engineering work to TEC on March 18 and April 21, 2022. The main conclusions of the April 21, 2022, meeting were that:

- TEC will no longer be considering realignment and lowering/unloading of Hwy 40:36 to address slides movements; and
- there was insufficient piezometric and groundwater level data to full assess the feasibility of a dewatering solution.

A subsequent drilling investigation completed in May 2022 (see above) indicated dewatering would be challenging due to the fine-grained materials (soils and bedrock) present and the depth to bedrock (30 m to 40 m versus the 10 m to 20 m expected based on previous geotechnical site investigations).

Preliminary engineering report to be issued in late 2024.

Maintenance/Repair/Monitoring Recommendations:

- Portion of north highway ditch at west end of site regraded in fall 2023 has not re-vegetated and there are pieces of unsecured and piled up rolled erosion control product (RECP) in the ditch (Photos 2 and 3). The RECP should be re-anchored or replaced, and the area seeded again. Estimated cost: \$10,000 to \$20,000.
- Guardrail on south side of highway at east end of site is low (approximately 0.5 m above pavement surface) and located too far from highway (approximately 0.6 m from edge of pavement) and may not redirect motorist back onto highway (Photo 9). There is also an approximate 0.9 m drop below guardrail that could trap a tire and some guardrail rail posts that are unsupported. Guardrail should be moved closer to pavement surface. Estimated cost: \$20,000 to \$40,000 depending on the length.
- Most of the slide mass is not instrumented and the available LiDAR data indicates slide terrain extends well above/north of the highway where there are no instruments. Interferometric Synthetic Aperture Radar (InSAR) monitoring could be used to further study the slide and assess how the slope is moving and over what extent, which would be useful if TEC adopts a strategy where the impact of sliding at the site is managed with road repairs. Estimated cost: approximately \$40,000 to \$75,000 per year for InSAR.

SITE INSPECTION FORM

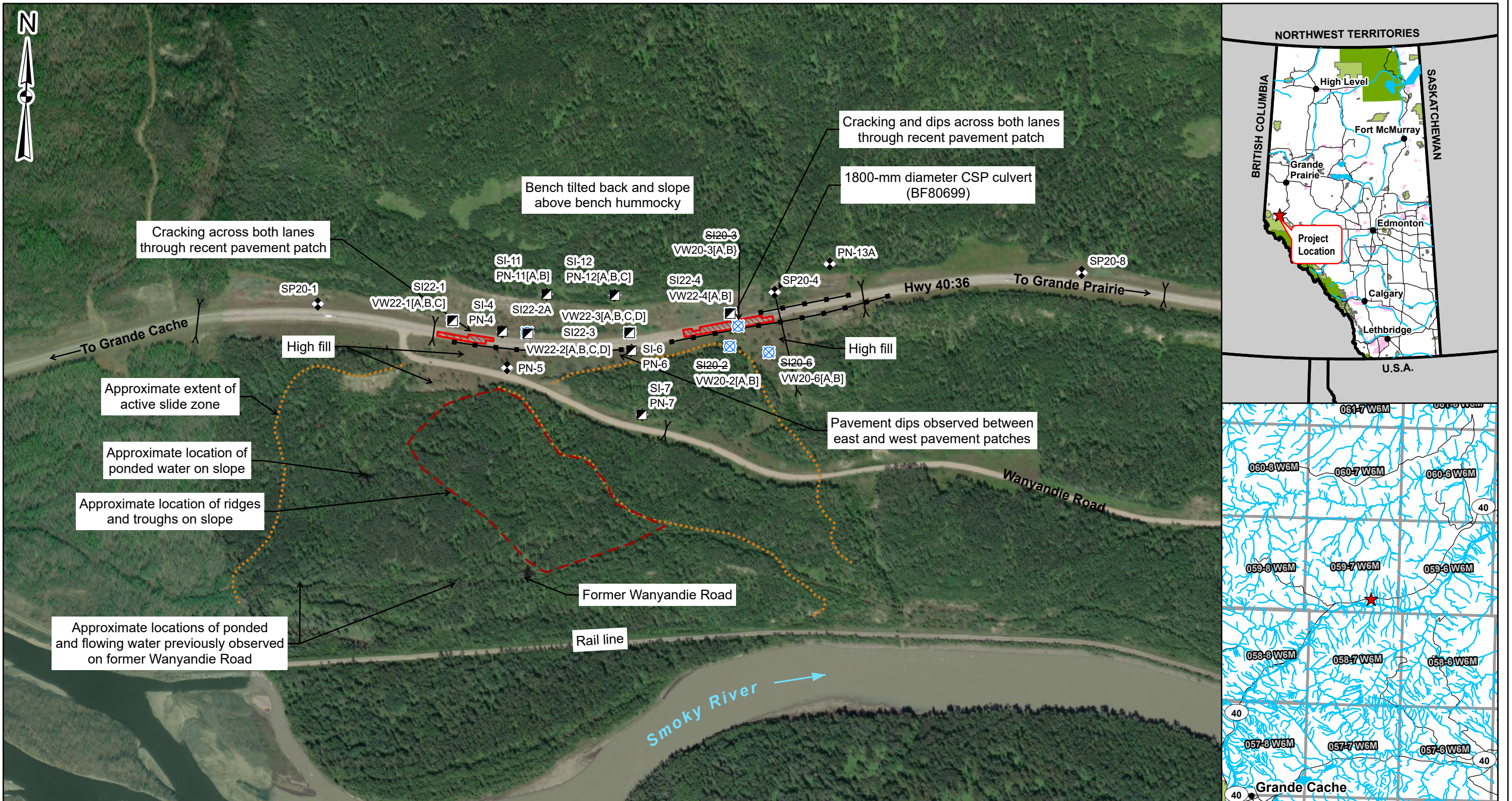
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KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

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- (i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
- (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.
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- (v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

Courtney Mulhall, M.Sc., P.Eng.
Geotechnical Engineer



File: Z:\A\EDM\A05116A01\ABT Grande Prairie South GRMP\400 Drawings\GIS\MXD\2024\Section BIGP044\AT_GPSouth_GP044_20240524.aprx Date: Time: Creator: AHarrison

Legend

- ◆ Approximate Pneumatic Piezometer Location
- ▣ Approximate Slope Inclinometer Location
- ⊠ Approximate Vibrating Wire Piezometer Location
- ➔ Flow Direction
- > Culvert
- Guardrail
- ⋯ Active Slide Zone
- ▭ Ridges and Troughs
- ▨ Pavement Patch

NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM ZONE 11N
 3. IMAGE SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
 4. STRIKETHROUGH INDICATES INSTRUMENT IS INOPERABLE. INSTRUMENTS INOPERABLE PRIOR TO 2021 NOT SHOWN.

CLIENT




PROJECT
 PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)
 GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE
 Site Plan
 GP007 - Wanyandie Road Slide
 Hwy 40:36, km 29.339

SCALE 1:6,000 PROJECT No. A05116A01 FIG No. 1



Inspection Photographs

Photo 1 Cracking and settlement across Hwy 40:36 in recent pavement patch at west end of GP007 site. Photos taken June 10, 2024, facing southeast and southwest, respectively.



Photo 2 Ditch on north side of Hwy 40:36 near west end of GP007 site. Ditch was regarded in fall 2023. Photos taken June 10, 2024, facing southeast and southwest, respectively.



Photo 3 Ditch on north side of Hwy 40:36 near west end of GP007 site. Ditch was regarded in fall 2023. Note rolled erosion control product unsecured from ground. Photos taken June 10, 2024, facing east and west, respectively.



Photo 4 South side of Hwy 40:36 near west end of GP007 site. Photo taken June 10, 2024, facing northeast.



Photo 5 Pavement surface and north side of Hwy 40:36 near middle of GP007 site. Photo taken June 10, 2024, facing east.



Photo 6 Cracking and settlement across Hwy 40:36 near west end of recent pavement patch at east end of GP007 site. Photos taken June 10, 2024, facing southeast and southwest, respectively.



Photo 7 Cracking and settlement across Hwy 40:36 near middle of recent pavement patch at east end of GP007 site. Photos taken June 10, 2024, facing west and northeast, respectively.



Photo 8 Cracking and settlement across Hwy 40:36 near east end of recent pavement patch at east end of GP007 site. Photos taken June 10, 2024, facing west and northeast, respectively.



Photo 9 Guardrail on south side of highway at east end of site is low and located far from highway. Photo taken June 10, 2024, facing east.



Photo 10 Outlet of culvert at east end of GP007 site. Photo taken June 10, 2024, facing northeast.

