

SITE INSPECTION FORM

SITE NUMBER AND NAME: GP054 Debris Flow Corridor South of McIntyre Mine		HIGHWAY & KM: 40:36, 8.119 to 12.262	PREVIOUS INSPECTION DATE: June 14, 2022	INSPECTION DATE: June 12, 2023
LEGAL DESCRIPTION: South NW 29-57-08-W6M North NW 04-58-08-W6M	NAD 83 COORDINATES: UTM Northing Easting 11 5981027 358454 11 5984770 360291		RISK ASSESSMENT: No Recent Occurrence PF: 7 CF: 6 TOTAL: 42 Recent Occurrence PF: 5 CF: 2 TOTAL: 10	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 780 (north) & 980 (south) (Reference No. 25592, 2022)			CONTRACT MAINTENANCE AREA (CMA): 504	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the GP054 site. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) Courtney Mulhall (KCB) Roger Skirrow (TEC) Max Shannon (TEC) Renato Macciotta (UofA)
PRIMARY SITE ISSUE: Series of recent and possible debris flow locations along backslope on west side of Hwy 40:36, which have/could deposit debris onto highway causing a traffic hazard or into ditches impeding flow. Debris flows (and possible) locations generally correspond to or are adjacent to water courses or smaller gullies/drainage paths down the mountain side. The site is located along the west valley slope of the Smoky River. This site is the debris flow component of the former GP036 and GP049 sites that has been made into a separate site in 2022 for debris flows only. GP036 and GP049 sites are now for rockfalls only.	
APPROXIMATE DIMENSIONS: Corridor is approximately 4.5 km long.	
DATE OF ANY REMEDIAL ACTION: Ongoing cleaning of debris flow material from highway ditch and pavement surface.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X	None observed at time of 2023 inspection.		X
Slope Movement	X		Debris flow material continues to slump towards highway at some locations. Slope failure along backslope at some debris flow locations expanding laterally, parallel to highway likely due to saturation and softening of materials (e.g., at km 11.1).	X	
Erosion	X		Erosion along debris flow path, and gullies being eroded in some debris flow fans (e.g., at km 12.1).		X
Seepage		X	None observed at time of 2023 inspection.		X
Culvert Distress		X	No culverts observed by KCB.		X

COMMENTS

Five event sites were visited during the 2023 inspection, one at km 8.1 (WP296), km 9.3 (WP297), km 11.1 (WP298), km 11.4 (WP299), and km 11.4 (WP300). Several other event sites previously observed/inspected by KCB and others along corridor, e.g., at km 8.8, 10.9, 11.2, 11.6.

Last known date of debris flow occurrence (if known):

Km	8.1	8.8	10.9	11.2	11.6	12.1
Year	2017	2017	2020	2019 & 2020	2017	2017

Debris flow locations correspond to or are adjacent to water courses or smaller gullies/drainage paths down the mountain side. Water courses that have not generated debris flows yet will eventually generate a debris flow. Depending on the severity of rainfall and timing of last debris flow, higher rainfall amounts could generate another debris flow from a water course that has already generated a debris flow. Additionally, with time, debris will build up in the water course that will eventually get mobilized by a runoff event, possibly smaller or larger than the last triggering event, creating another debris flow.

KCB reviewed available precipitation data for the site from 1967 to 2023 (record discontinuous before 1990). The rainfall data indicates that the debris flows tabulated in the table above each occurred around the same time as a high-than-average rainfall event as shown in Figure 2. Based on the data from Kakwa station (located approximately 30 km northeast of the site) higher-than-average rainfall events were recorded on June 9, 2017 (approximately 80 mm), June 28, 2019 (approximately 70 mm), July 1, 2020 (approximately 70 mm), and June 29, 2022 (approximately 70 mm). The last time a similar rainfall event occurred was 2009 and before that 2001. It is noted that despite a higher-than-average rainfall event on June 19, 2023 (approximately 110 mm) no debris flows were reported, except north of the site at km 13.8, indicating the debris flow channels within the current extents of the corridor are likely in the process of recharging following the debris flow events that occurred between 2017 and 2020.

Debris flow at approximately km 8.1 at WP296:

- Last documented debris flow occurred at this location in 2017, but there is evidence of more recent events.
- Debris fan extends from an erosion gully approximately 4 m high into the west (southbound) highway ditch. Debris fan material mostly consists of sand and gravel with some cobbles.

Debris flow at approximately km 9.3 at WP297:

- Fan is fairly well vegetated, indicating no recent debris flow activity.

Possible debris flow at approximately km 11.1 at WP298:

- Debris flow material continues to slump towards highway with slope failure along backslope expanding laterally, parallel to highway likely due to saturation and softening of materials. Backslope failure is approximately 50 m wide. Slope is approximately 10 m high.
- Ponded water and cattails observed in highway ditch at toe of debris flow.

Possible debris flow at approximately km 11.4 at WP299:

- Area fairly well vegetated, indicating no recent debris flow activity.

Debris flow at approximately km 12.1 just south of WP300:

- Last documented debris flow occurred at this location in 2017.
- Debris fan is poorly vegetated with erosion gully eroded down center, indicating higher water flows at this site are possibly hindering vegetation growth.
- Debris flow deposit appears wet, and water visible at toe of debris flow in highway ditch.

Maintenance/Repair/Monitoring Recommendations:

- Clean ditch regularly to maintain debris flow storage volume (i.e., keep ditch as wide and deep as possible to retain material within the ditch) and reduce the potential for material reaching the highway.
- There is no debris flow related signage along corridor. Only “watch for fallen rock” signs on either side of GP036 site. Additional signage should be installed along corridor warning motorist of the debris flow risk, especially during rainfall events.
- TEC could consider a placing a net over the debris flow channel at the km 8.1 site.
- TEC should add the km 13.8 debris flow site to the GP054 corridor site.

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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

Inspection Photographs

Photo 1 Debris flow at km 8.1 on west side of Hwy 40:36 at WP296. Note erosion gully is approximately 4 m high. Photo taken June 12, 2023, facing northwest.



Photo 2 Debris flow at km 8.1 on west side of Hwy 40:36 at WP296. Note debris fan (mostly sand and gravel with some cobbles) in highway ditch. Photo taken June 12, 2023, facing northwest.



Photo 3 Debris flow at km 9.3 on west side of Hwy 40:36 at WP297. Photo taken June 12, 2023, facing northwest.



Photo 4 Possible debris flow at km 11.1 on west side of Hwy 40:36 at WP298. Photo taken June 12, 2023, facing west.

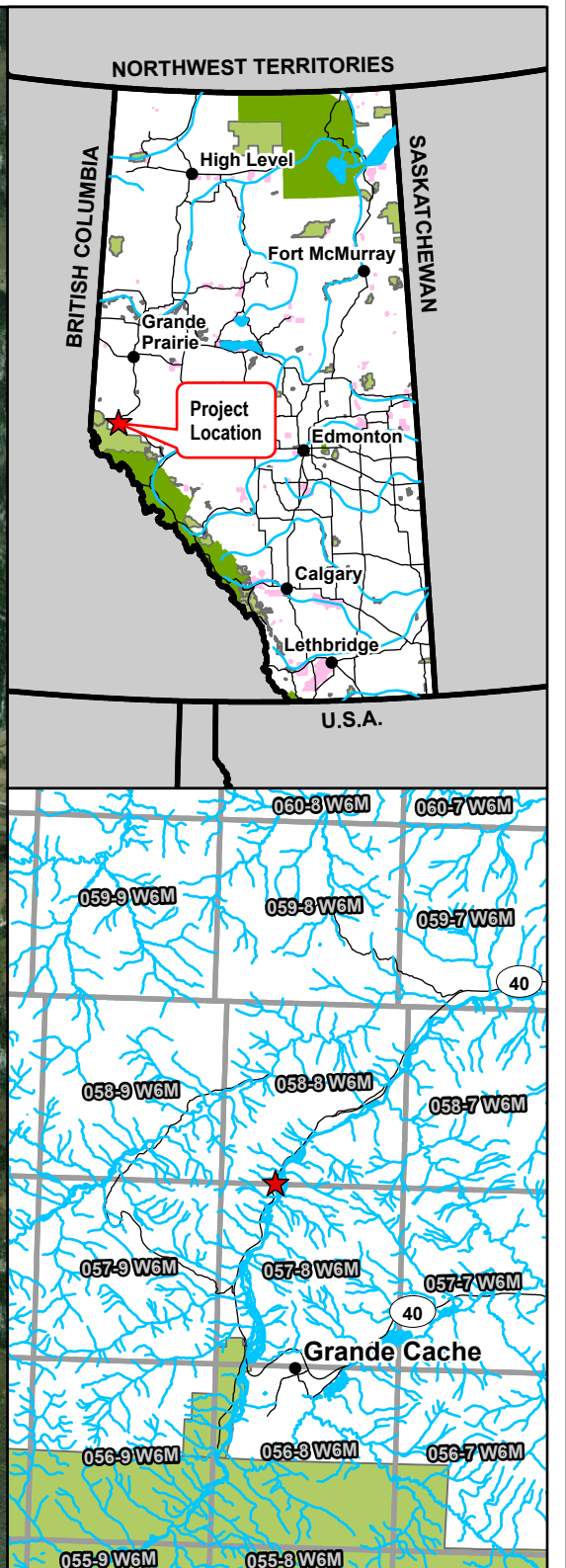
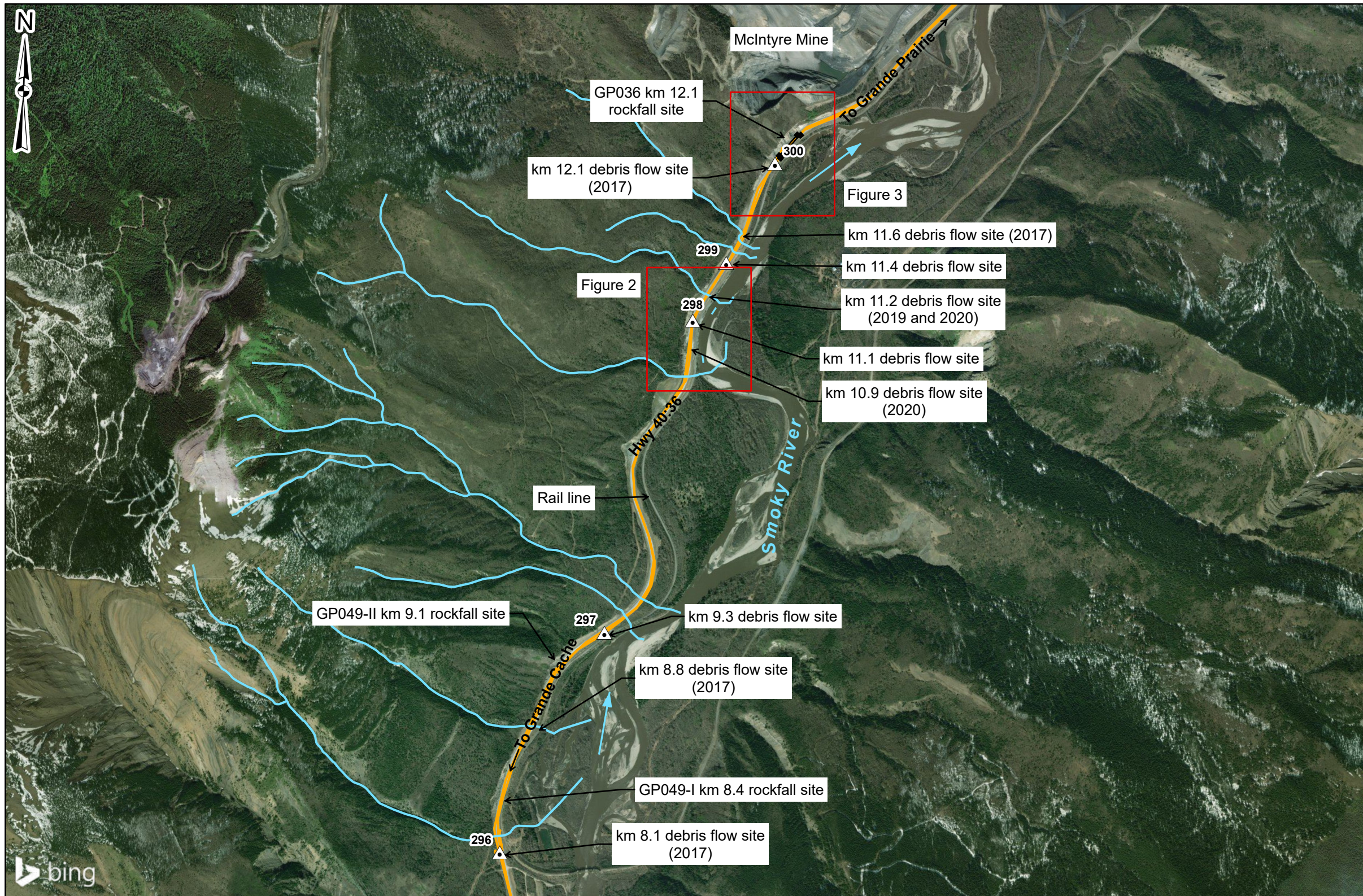


Photo 5 Possible debris flow at km 11.4 on west side of Hwy 40:36 at WP299. Photo taken June 12, 2023, facing west.



Photo 6 Debris flow at km 12.1 on west side of Hwy 40:36 at WP300. Note erosion gully down debris fan and water at toe of debris flow in highway ditch. Photo taken June 12, 2023, facing west.





Legend

- ▲ GPS Waypoint (June 12, 2023)
- GPS Track (June 12, 2023)
- Flow Direction
- Watercourse

NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM ZONE 11N
 3. IMAGE SOURCE: 2022 MICROSOFT CORPORATION,
 2022 MAXAR CNES, DISTRIBUTION AIRBUS DS

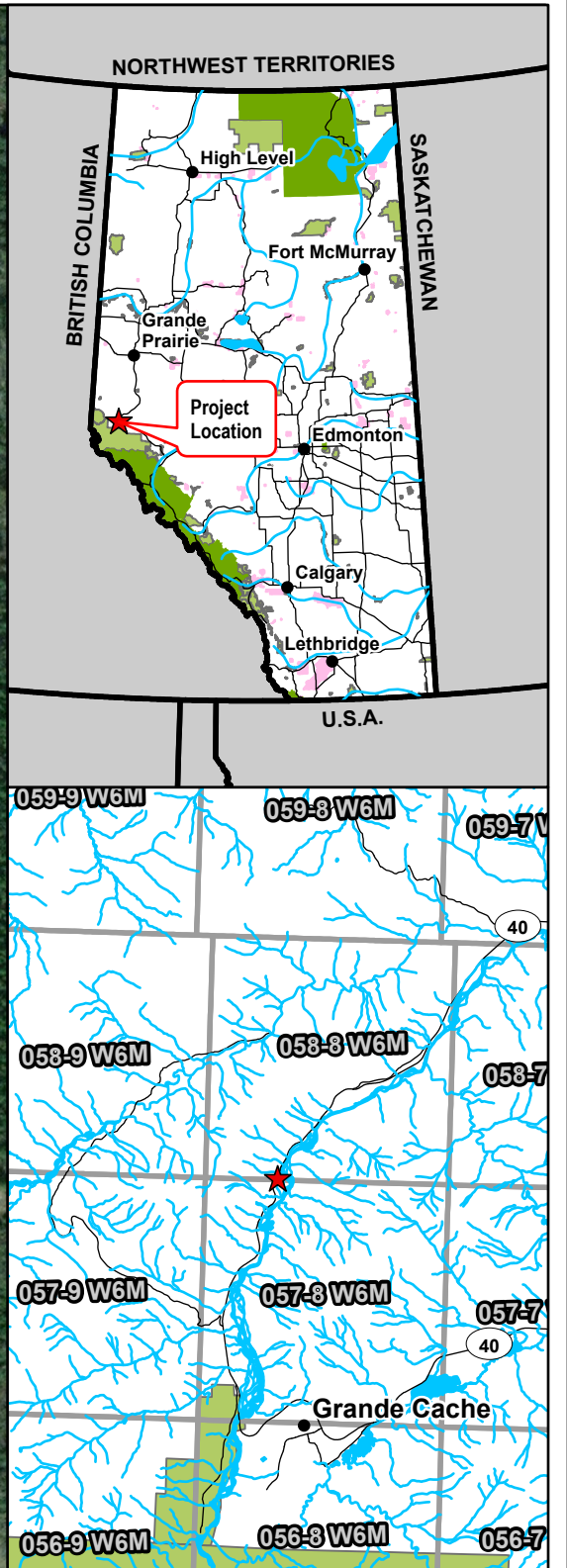
CLIENT







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

TITLE
 Site Plan
 GP054- Debris Flow Corridor South of McIntyre Mine
 Hwy 40:36, km 8.119 to 12.262

SCALE 1:21,000 PROJECT No. A05116A01 FIG No. 1



Legend

-  GPS Waypoint (June 12, 2023)
-  GPS Track (June 12, 2023)
-  Flow Direction
-  Watercourse

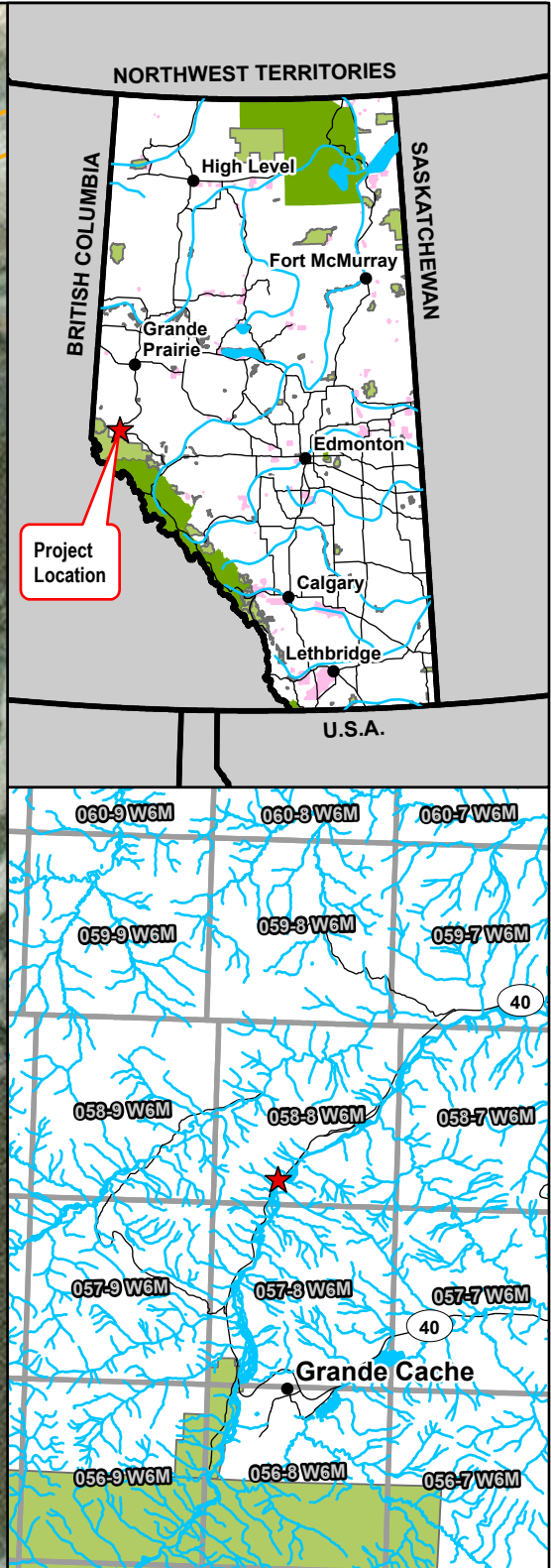


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CLIENT




PROJECT	PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM	
TITLE	Site Plan GP054- Debris Flow Corridor South of McIntyre Mine Hwy 40:36, km 10.9 and 11.2	
SCALE	PROJECT No.	FIG No.
1:3,000	A05116A01	2



- Legend**
- ▲ GPS Waypoint (June 12, 2023)
 - GPS Track (June 12, 2023)
 - Flow Direction
 - Concrete Lock Block
 - Guardrail
 - Culvert

Debris fan at km 12.1 (2017) poorly vegetated and appears wet with erosion gully eroded down center

300

Smoky River



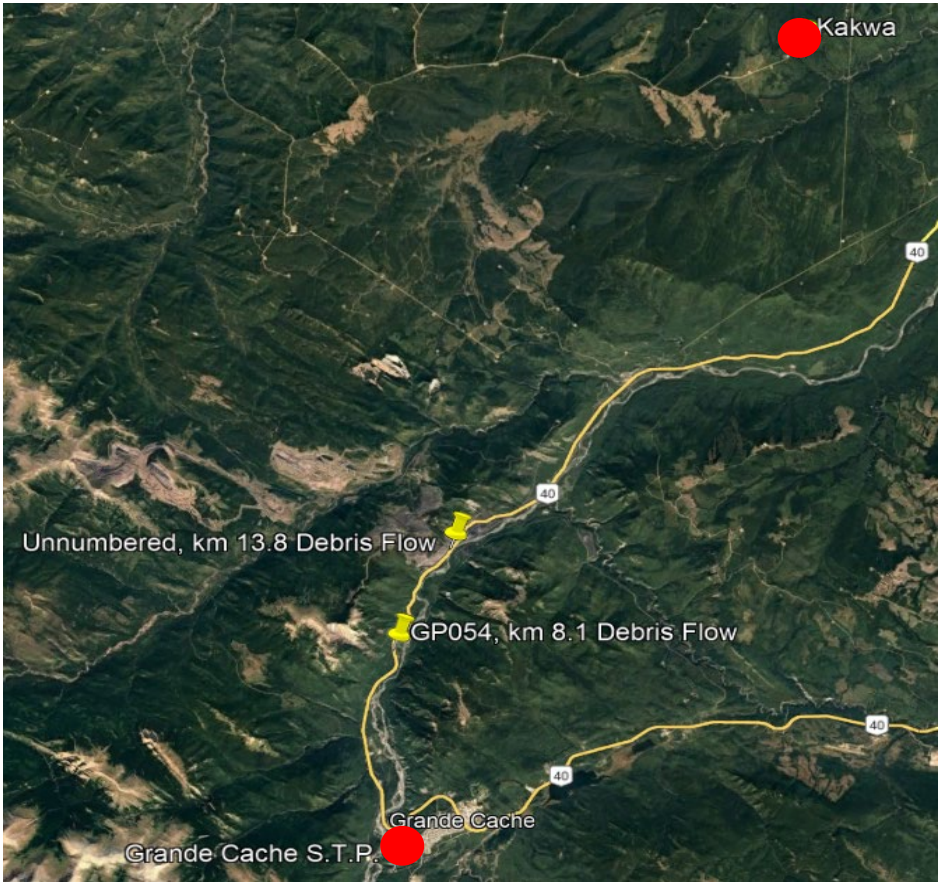
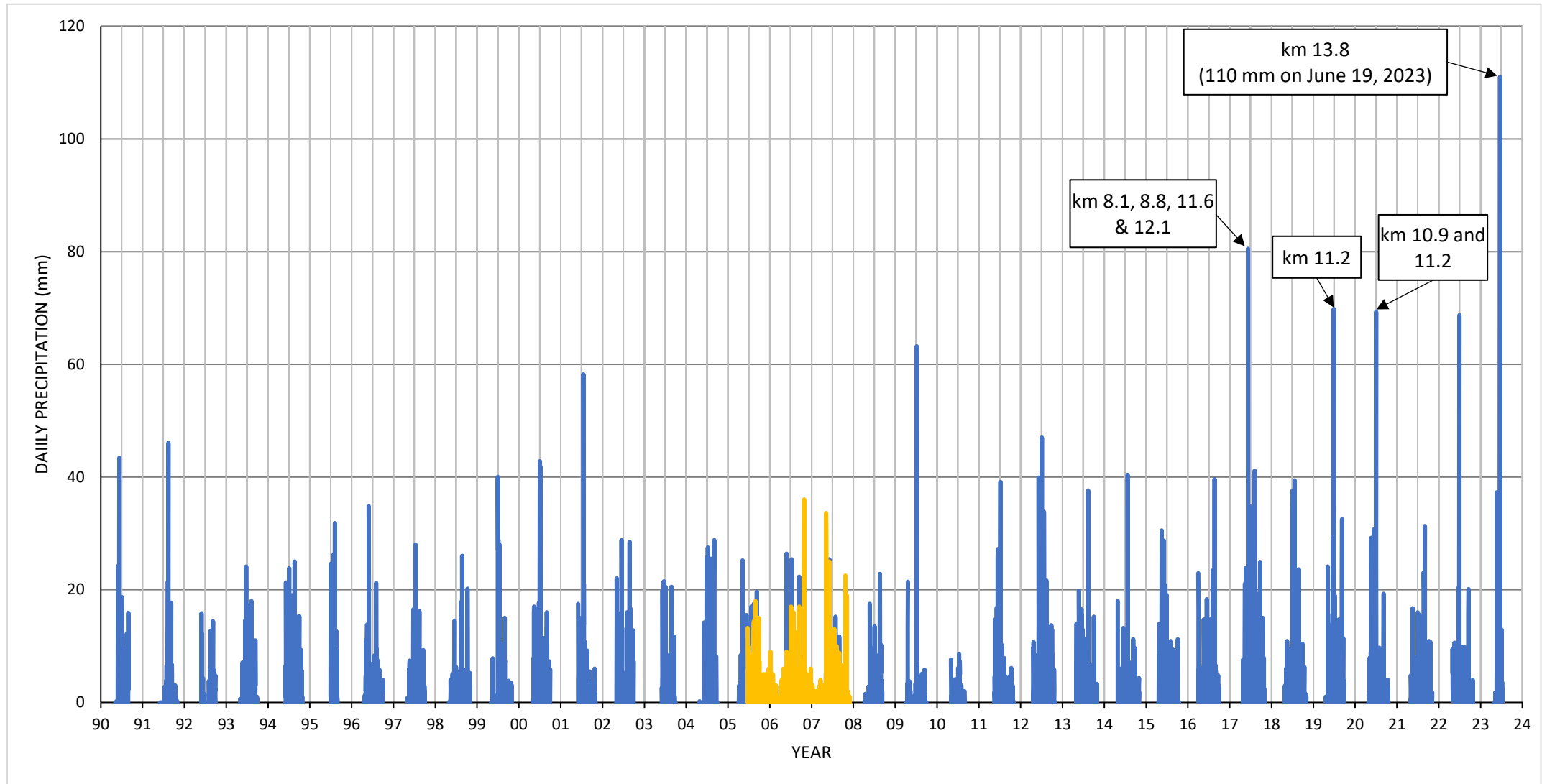
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CLIENT

PROJECT PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan GP054 - Debris Flow Corridor South of McIntyre Mine Hwy 40:36, km 12.1		
SCALE 1:1,500	PROJECT No. A05116A01	FIG No. 1



File: \\nt.kohn.com\ProjData\A\EDM\A05116A01\ABT Grande Prairie South GRMP\401 ABT Grande Prairie South GIS\MXD\2023\Section B\ABT_GPSouth_SectionB_230619.aprx Date: Time: Creator: aharrison



- LEGEND:**
- WEATHER STATION
 - ⚡ DEBRIS FLOW SITE
 - ▬ WEATHER STATION DATA - KAKWA
 - ▬ WEATHER STATION DATA - GRANDE CACHE S.T.P.
 - km XX DEBRIS FLOW EVENT LOCATION

- NOTES:**
- 1) DATA DOWNLOADED FROM GOVERNMENT OF CANADA (GoC) OR ALBERTA CLIMATE INFORMATION SERVICE (ACIS) WEBSITES.
 - 2) KAKWA AND GRANGE CACHE S.T.P. STATIONS LOCATED APPROXIMATELY 15 KM AND 26.5 KM FROM SITE.
 - 3) DATA DISCONTINUOUS BEFORE 1990 SO NOT INCLUDED.
 - 4) KAKWA WEATHER STATION DATA INCLUDES DAILY RECORDS FROM GC BETWEEN 1990 AND 2011; AND, ACIS BETWEEN 2005 AND 2023.
 - 5) GRANGE CACHE S.T.P. WEATHER STATION DATA INCLUDES DAILY RECORDS FROM GC BETWEEN 2005 AND 2007.
 - 6) PLAN VIEW SOURCE FROM GOOGLE EARTH PRO.

CLIENT 		PROJECT PEACE REGION (GRANDE PRAIRIE DISTRICT - SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM	
		TITLE Daily Precipitation Data Debris Flow Sites Hwy 40:36	
		SCALE	PROJECT No. A05116A01 FIG No 4