



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



**SITE INSPECTION FORM**

SITE NUMBER AND NAME: <b>NEW SITE Debris Flow near McIntyre Mine</b>		HIGHWAY & KM: 40:36, 13.700	PREVIOUS INSPECTION DATE: June 22, 2023	INSPECTION DATE: <b>June 10, 2024</b>
LEGAL DESCRIPTION: NE 09-58-08-W6M	NAD 83 COORDINATES: UTM Northing Easting 11 5985608 361022		RISK ASSESSMENT: PF: 8 CF: 5 TOTAL: 40	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 760 (north) & 960 (south) (Reference No. 25592, 2023)			CONTRACT MAINTENANCE AREA (CMA): 504	

SUMMARY OF SITE INSTRUMENTATION:  There is no instrumentation at this site.  LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) Courtney Mulhall (KCB) Robert Senior (TEC) Rishi Adhikari (TEC) Babatunde Awokunle (TEC)
PRIMARY SITE ISSUE: Debris flows originating from former McIntyre Mine (now CST Canada Coal Ltd.), located upslope/west of highway, reach west highway ditch and sometimes cross highway. Large debris flow event that occurred in June 2023 crossed highway eroding several gullies on east side of highway. Site located on west valley slope of the Smoky River valley, approximately 50 m upslope of a rail line and 70 m upslope of Smoky River.	
APPROXIMATE DIMENSIONS: Debris flow on west side of highway approximately 110 m long. Erosion gullies on east side of highway approximately 35 m long.	
DATE OF ANY REMEDIAL ACTION: Clean-up of debris flow material as needed.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Subgrade exposed and pavement partially undermined on west south side of highway due to erosion (Photo 8).		X
Slope Movement		X	None observed at time of 2024 inspection.		X
Erosion	X		Debris flow material/fan along west side of highway (approximately 110 m long) (Photos 1 to 4). Erosion gullies on east side of highway (approximately 35 m long) (Photos 2 and 7), which appear deeper and wider since previous inspection.	X	
Seepage	X		Seepage from toe of mine-waste dump flows through treed area down backslope into west highway ditch, which flows to culvert at north end of site across highway (Photos 1, 5, and 6). Seepage location may be a possible drain below mine-waste dump.		X
Culvert Distress		X	None observed at time of 2024 inspection (Photo 6).		X

**COMMENTS**

Area upslope of site includes mine-waste dumps and mine (haul and access) roads developed on mountain side. Mine-waste dumps and mine roads appear to be composed of varying mixtures of fine grained and coarse-grained materials, including some boulders. We understand from previous discussions with TEC that a rockfall fence was previously installed at the adjacent unnumbered rockfall site in 2011 or 2012 to protect public using highway from fly rock during blasting and rockfall from waste-dump construction.

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A TransCanada Pipelines Ltd. high-pressure natural-gas pipeline is located below west highway ditch. TEC has indicated that pipeline is shallow and that any excavation of debris flow material from ditch must be undertaken with a pipeline representative present.

Debris flow material source appears to consist of erodible soils (mainly mine-road and mine-waste-dump materials) with little to no vegetation soil cover, and erosion is likely to occur during most precipitation events. Debris fan mainly consisted of coarse-grained material, including some cobbles and a few boulders, in a matrix of fine-grained material.

Volume of eroded material and surface water overflow is influenced by operations within mine and increased erosion and more frequent debris flows of a higher severity may be occurring than in a natural state (i.e., before mine). Unless revisions to mine surface water drainage are undertaken, erosion and subsequent debris flow/deposition of materials in and across highway right of way is likely to occur again under similar heavy precipitation events.

KCB reviewed available precipitation data recorded at Kakwa weather station (located approximately 30 km northeast of site) from 1967 to 2024. Record discontinuous before 1990, but average daily precipitation data from 1990 to 2024 is shown on Figure 2. Based on data from Kakwa weather station 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), June 29, 2022 (approximately 70 mm), and June 19, 2023 (approximately 110 mm). Based on available data intensity and frequency of heavy precipitation events appears to be increasing in recent years.

During the large precipitation event in June 2023, material (mainly mine-road and mine-waste-dump material) was eroded and transported downslope through an existing erosion gully onto highway and railway tracks and into Smoky River. Based on the available aerial imagery and UAV photos:

- two smaller erosion gullies, one on side of a mine road bench and another between north flank of mine-waste dump and natural ground, appear to have connected and eroded further downslope below rockfall fence and through mine road at toe of mine-waste dump prior to our May 2023 fieldwork at adjacent unnumbered rockfall site and our June 2023 inspection of this site; and
- erosion gullies observed on east side of highway during our June 2023 inspection of subject site were not visible during our May 2023 fieldwork at adjacent unnumbered rockfall site.

These observations indicate erosion at site is active, and increased erosion and more frequent debris flows of a higher severity may be occurring.

Since call-out inspection in June 2023,

- Debris flow material in west highway ditch has been removed and graded back to tree line (backslope up to approximately 4 m high) improving storage capacity in ditch and removing load/weight from high-pressure natural-gas line. It appears majority of flow material otop of high-pressure natural-gas line has been removed. It does not appear any debris flow material has been removed upslope of ditch within treed area (approximate distance of 60 m).
- Erosion channel under rockfall fence and part of erosion channel between mine-waste dump and natural slope has been backfilled with waste rock.
- Area of ponded water at northeast corner of mine-waste dump has also been backfilled with waste rock. No ponded water observed at time of inspection.
- KCB spoke with mine personnel in September 2023 and September 2024. Based on these conversations, it is our understanding that the mine:
  - has taken efforts to divert drainage and reduce erosion on their site, which should reduce the reoccurrence of debris flow reaching highway;
  - is frequently monitoring mine-waste dump for instability and they have no concerns about mine-waste dump stability; and,
  - is in the process of updating their emergency response plan.

Maintenance/Repair/Monitoring Recommendations:

- Short-term:
  - Debris flows crossing highway have eroded channels on east side of highway, partially exposing highway subgrade, partially undermining pavement, and leaving some w-beam guardrail posts unsupported along east highway shoulder. The erosion gullies on the east side of the highway should be backfilled to provide support to the highway pavement, subgrade, and guardrail posts where exposed. The estimated cost for the HMC to complete this work is between \$20,000 and \$40,000.
  - Debris flow reporting could be improved by maintaining a record of debris flows that reach the highway, including the date of event, approximate location, volume of particles, and maximum particle size. It appears that TEC may already be doing this, but a formal record could be prepared by the HMC or MCI based on e-mails to TEC and the regional geotechnical consultant.
- Long-term:
  - As discussed above, the intensity and frequency of heavy precipitation events appears to be increasing in recent years. A study should be completed to assess the potential impacts of increased precipitation on debris flow, not only originating at the mine site but along the subject section of Hwy 40:36, including the GP054 site.
  - If efforts taken by mine to divert drainage and reduce erosion on their site does not mitigate the occurrence of debris flows that impact highway, and therefore the safety of motorists, TEC should conduct a debris flow risk assessment to verify the cause of the debris flows, assess the risk of future debris flows, and assess how the public could be protected (e.g., debris flow barrier, increased debris flow storage capacity, and/or improved drainage measures, including how much maintenance and removal of material is needed).

**SITE INSPECTION FORM**

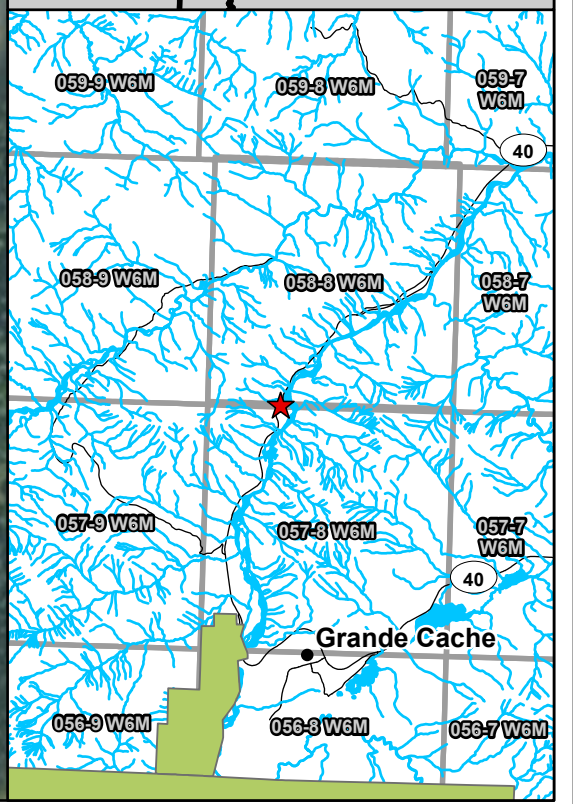
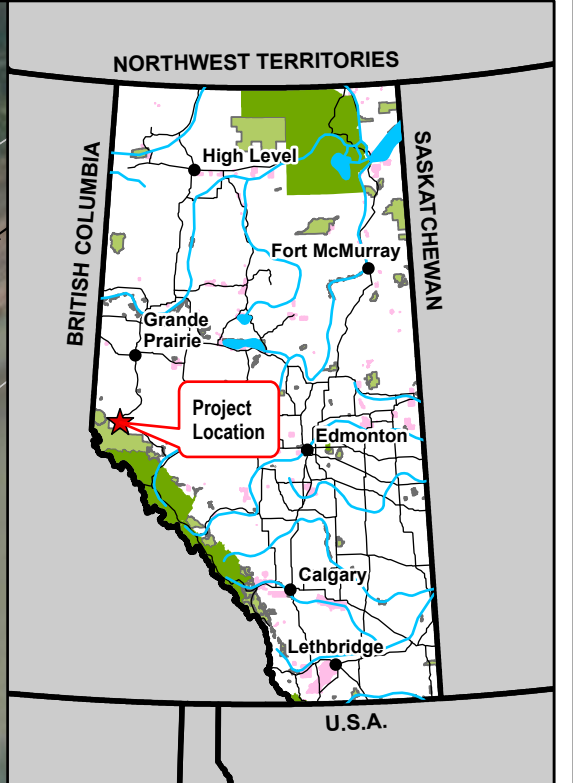
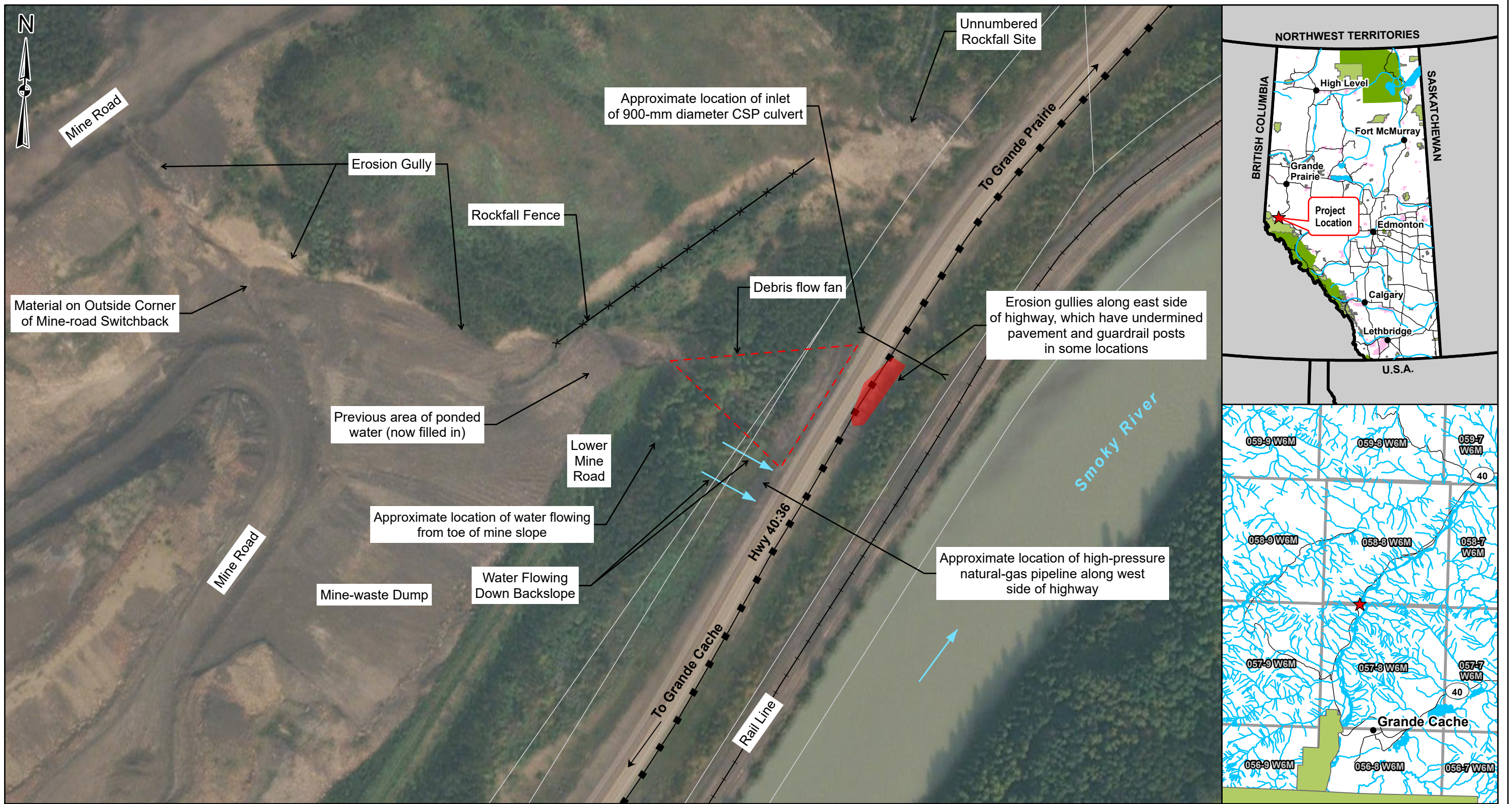
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- (i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
- (ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
- (iii) The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
- (iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
- (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



- Legend**
- +— Rail Line
  - Guardrail
  - > Flow Direction
  - Right-of-way
  - x— Rockfall Fence
  - - - Debris Flow Fan
  - > Culvert
  - Erosion

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

CLIENT

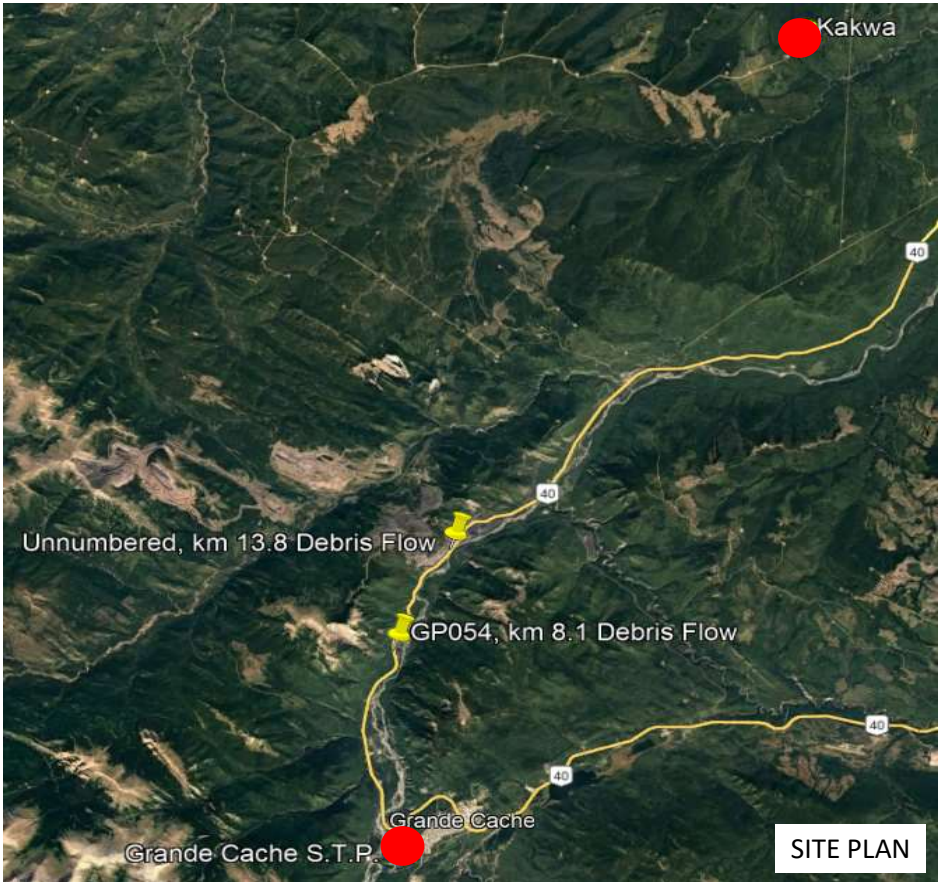
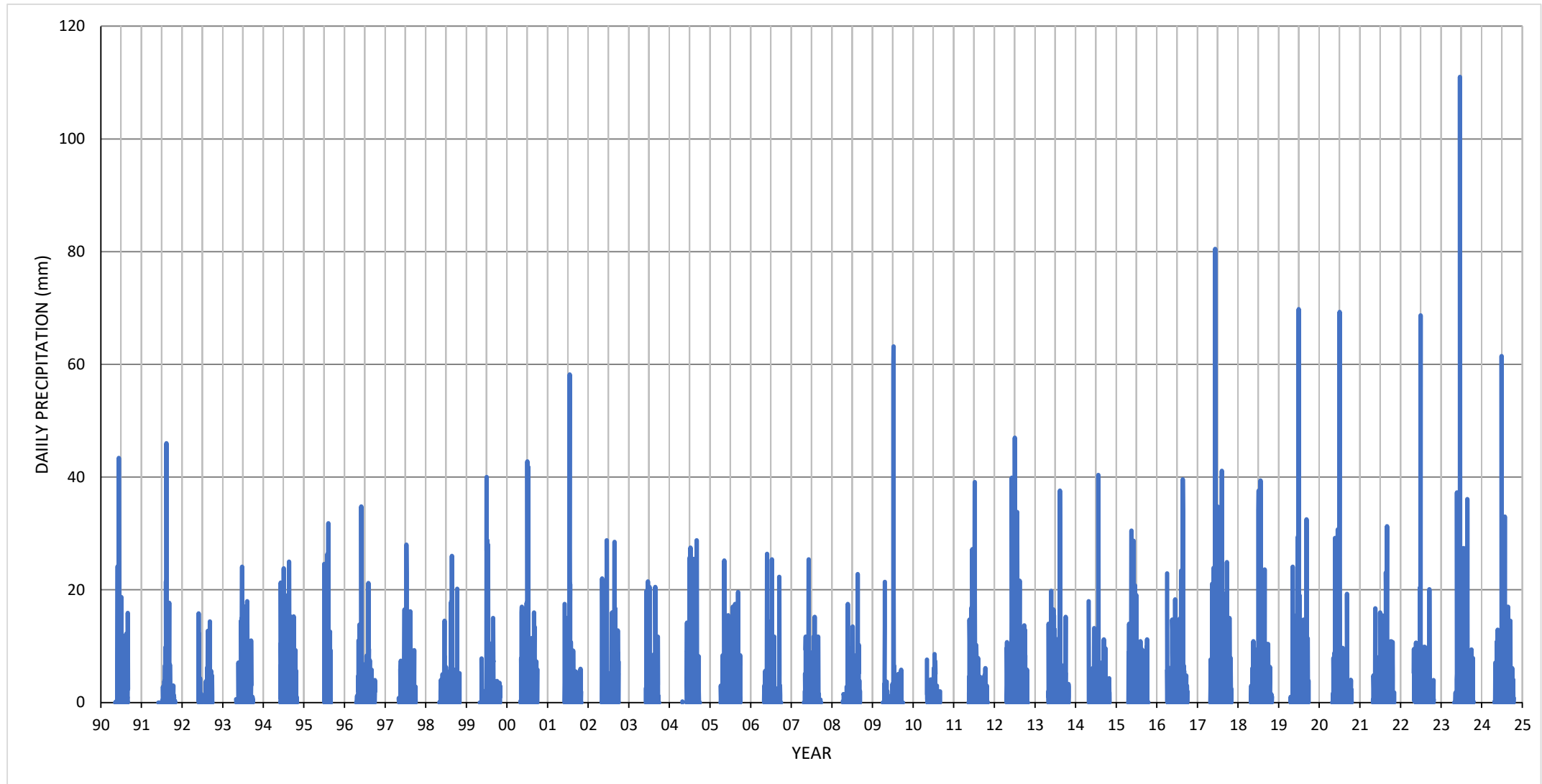



PROJECT  
 PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)  
 GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE  
 Site Plan  
 New Site - Debris Flow Near McIntyre Mine  
 Hwy 40:36, km 13.7

SCALE 1:1,700 PROJECT No. A05116A01 FIG No. 1





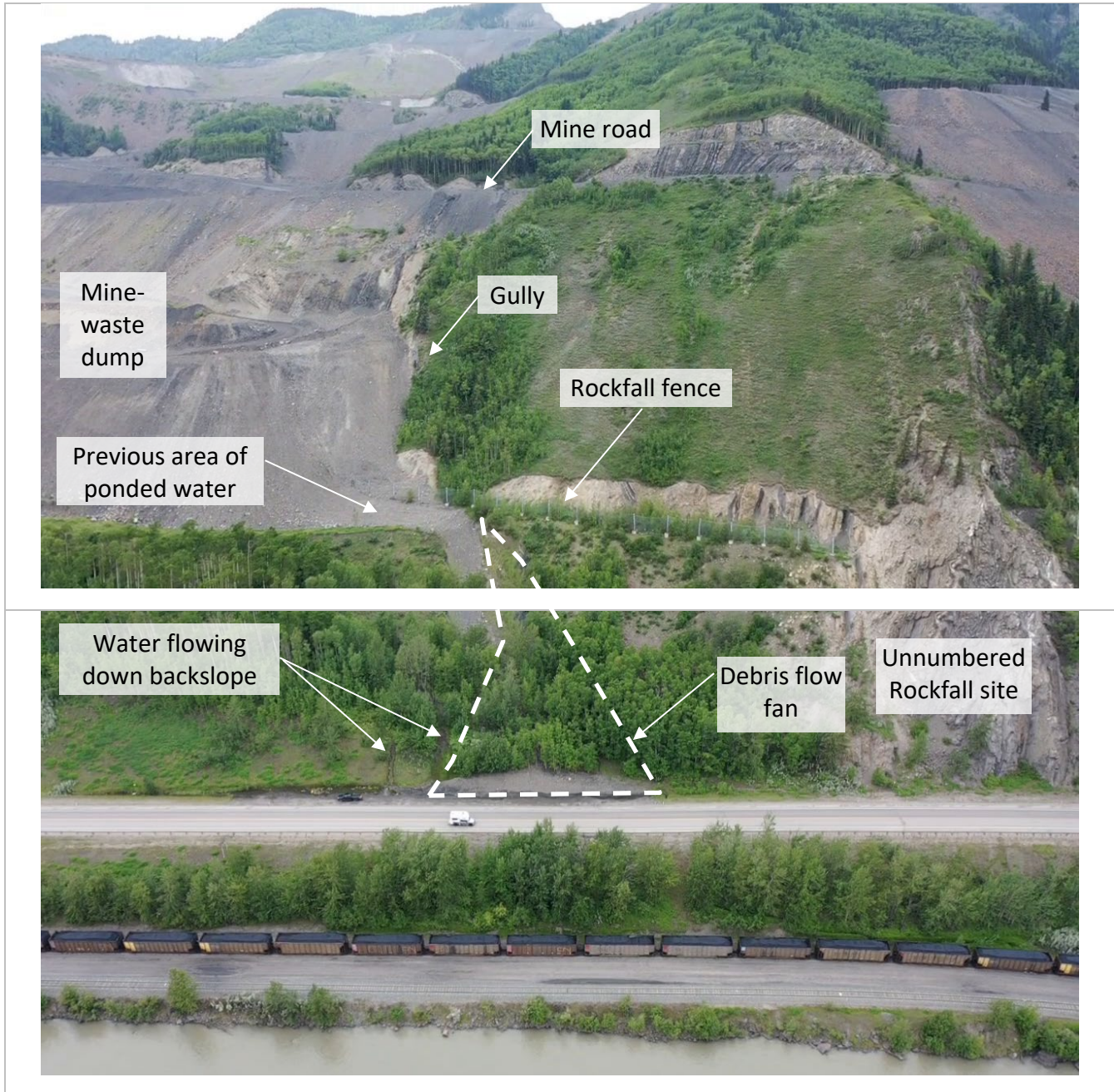
- LEGEND:**
- WEATHER STATION
  - ⚡ DEBRIS FLOW SITE
  - WEATHER STATION DATA - KAKWA

- NOTES:**
- 1) DATA DOWNLOADED FROM GOVERNMENT OF CANADA (GoC) OR ALBERTA CLIMATE INFORMATION SERVICE (ACIS) WEBSITES.
  - 2) KAKWA STATION LOCATED APPROXIMATELY 30 KM FROM SITE.
  - 3) DATA DISCONTINUOUS BEFORE 1990 SO NOT INCLUDED. NO DATA RECORDED DURING WINTER MONTHS
  - 5) SITE 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 Site Hwy 40:36	
SCALE	PROJECT No.	A05116A01	FIG No
			2

### Inspection Photographs

**Photo 1** Overview of debris flow site. Photos taken with Unmanned Aerial Vehicle (UAV) on June 26, 2024, facing northwest.



**Photo 2** Overview of debris flow site. Photo taken with UAV on June 26, 2024, facing southwest.





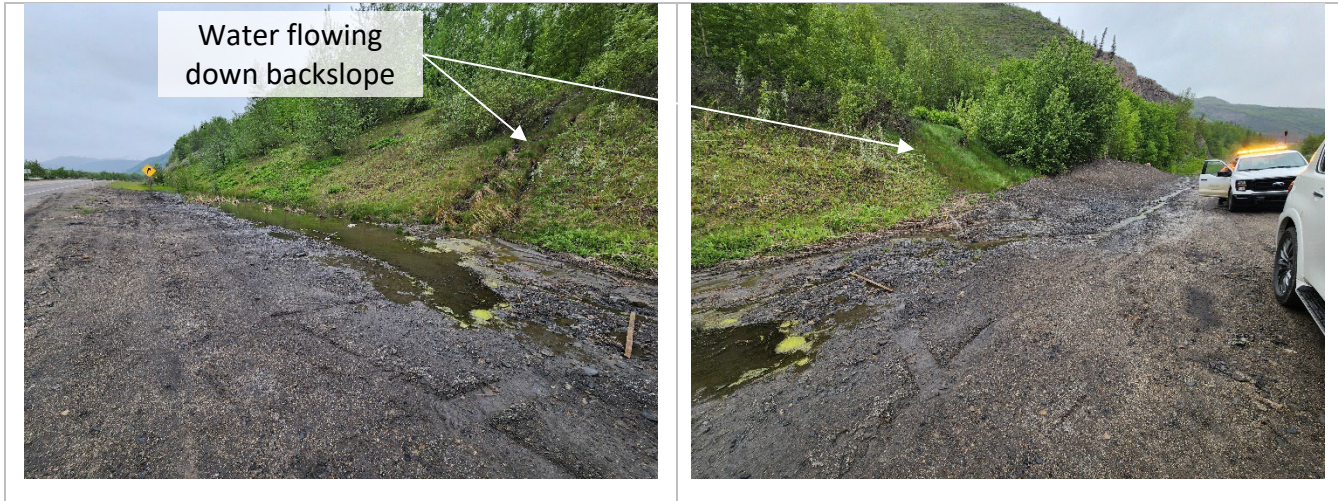
**Photo 3** Debris flow material remaining after clean-up along west side of Hwy 40:36. Photo taken June 11, 2024, facing northwest.



**Photo 4** Debris flow material within trees on west side of Hwy 40:36. Photo taken June 11, 2024, facing southeast.



**Photo 5** Water flowing down backslope on west side of Hwy 40:36. Photos taken June 11, 2024, facing southwest and northeast, respectively.



**Photo 6** Inlet of culvert that conveys flow from west side to east side of Hwy 40:36. Photo taken June 11, 2024, facing south.



**Photo 7** Erosion gullies along east side of Hwy 40:36. Photo taken June 11, 2024, facing northeast.



**Photo 8** Subgrade exposed and edge of pavement partially undermined on east side of Hwy 40:36. Some guardrail posts also unsupported. Photo taken June 11, 2024, facing west.

