July 15, 2025

Alberta Transportation and Economic Corridors
4th Floor, Provincial Building
4920 – 51st Street
Red Deer, Alberta
T4N 6K8

Tony Penney, P.Eng.
Construction Engineer

Dear Mr. Penney:

CON0022160 Central Region GRMP Instrumentation Monitoring
Site C003; H872:06, km 0.278 Burma Park Slide
Section C – 2025 Spring Readings

1 GENERAL

Five standpipe piezometers (SPs) (SP92-12, SP92-13, and SP07-11 through SP07-13) were read at the C003 site in the Central Region on May 21, 2025 by Evan Hergott, E.I.T. of Klohn Crippen Berger Ltd. (KCB). These instruments were read as part of the Central Region Geohazard Risk Management Program (GRMP). The site is located on Hwy 872:06, km 0.278, approximately 0.5 km north of the Battle River crossing and 10 km north of Brownfield, Alberta. The approximate site coordinates are 5806345 N, 471780 E (UTM Zone 12, NAD 83). A site plan is presented in Figure 1.

The geohazard at the C003 site consists of a large, deep-seated landslide along the north valley slope of the Battle River. The slide crosses both lanes of Hwy 872:06 from northwest to southeast. An erosion gulley is also present in the west (southbound) ditch, indicating the presence of highly erodible or dispersive soils. Previous remedial actions at this site include:

- 1998 – The installation of a buried 150-mm-diameter perforated drainpipe in the west (southbound) ditch to intercept groundwater flows. The perforated pipe was installed at the base of a 2 m thick gravel drain. The invert elevation of the pipe ranges from approximately elevation 655 m at the upstream end and elevation 646 m at its outlet.
- 2003 – Paving and subgrade improvements. Since 2003, regular asphalt patching has been required at the site.

Geotechnical site investigations (test pit and drilling programs) have been completed at the C003 site in 1990, 1991, 1992, 2000, and 2007. Instruments were installed during the 1992 investigation, and new or replacement instruments were installed during the 2000 and 2007 investigations. During the 2007 investigation, the encountered stratigraphy was as follows: silty clay interbedded with sand overlying bedrock, which was identified as clay shale with bentonitic and sandstone layers.

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KCB and Alberta Transportation and Economic Corridors (TEC) have been regularly inspecting the site as part of the Section B inspections since 2019 (every two years). On June 24, 2022, TEC requested a call-out inspection at the site due to additional movement indicated by pavement distress (e.g., cracking and settlement) and guardrail deflection. KCB completed the call-out inspection on July 12, 2022 and the call-out report was issued to TEC on September 9, 2022.

1.1 Instrumentation

In 2021, KCB began reading the instruments at the C003 site as part of the GRMP. TEC did not request KCB to complete readings before 2021 due to most of the instruments being inoperable, and no significant changes being observed during the Central Region GRMP Section B inspections. As part of the 2019 Section B inspection, KCB read the instruments at the site to assess which SPs were operable, measure water levels inside the SPs (if operable), and to measure the depth of shearing in the SIs (all inoperable). Instrumentation installation details are tabulated in Table 1.1. Instrument locations are presented in Figure 1.

Between 1992 and 2007, several slope inclinometers (SIs), pneumatic piezometers (PNs), and SPs were installed to monitor depth of movement and groundwater conditions, respectively. Some of these instruments have since become inoperable (e.g., destroyed, sheared, or lost), including all 14 SIs and all 4 PNs as detailed in Table 1.1 (see table notes). Only 5 of 12 SPs remain operable.

Some of the inoperable instruments are protected by above-ground casing protectors or tires backfilled with earth. The operable SPs are protected by above-ground polyvinyl chloride (PVC) pipe casing protectors.

The operable SPs were read using a Heron Water Level Meter.

Table 1.1 Instrumentation Installation Details

Instrument ID	Instrument Type	Date Installed[1]	UTM Coordinates[2] (m)		Ground Surface Elevation[2] (m)	Stick Up (m)	Depth[1] (mbgs[3])	Depth Sheared[1] (mbgs[3])	Condition
			Northing	Easting					
~~SI92-01~~	~~SI~~	~~Sep. 24, 1992~~	~~Unknown~~	~~Unknown~~	~~655~~	~~0.9~~	~~37.5~~	~~9.5~~	~~Inoperable[4]~~
~~SI92-02~~	~~SI~~	~~Sep. 24, 1992~~	~~Unknown~~	~~Unknown~~	~~650~~	~~1.2~~	~~16.4~~	~~5.8~~	~~Inoperable[4]~~
~~SI92-03~~	~~SI~~	~~Sep. 25, 1992~~	~~Unknown~~	~~Unknown~~	~~659~~	~~0.9~~	~~40.5~~	~~12.0~~	~~Inoperable[4]~~
~~SI92-04~~	~~SI~~	~~Sep. 26, 1992~~	~~Unknown~~	~~Unknown~~	~~653~~	~~0.9~~	~~34.4~~	~~9.5~~	~~Inoperable[4]~~
~~SI92-05~~	~~SI~~	~~Sep. 27, 1992~~	~~Unknown~~	~~Unknown~~	~~650~~	~~0.9~~	~~25.3~~	~~N/A~~	~~Inoperable[5]~~
~~SI92-06~~	~~SI~~	~~Sep. 28, 1992~~	~~Unknown~~	~~Unknown~~	~~649~~	~~1.0~~	~~16.2~~	~~4.0~~	~~Inoperable[4]~~
~~SI92-07~~	~~SI~~	~~Sep. 28, 1992~~	~~Unknown~~	~~Unknown~~	~~658~~	~~1.2~~	~~19.5~~	~~13.0~~	~~Inoperable[4]~~
~~SI00-08~~	~~SI~~	~~Nov. 14, 2000~~	~~Unknown~~	~~Unknown~~	~~658~~	~~0.6~~	~~23.7~~	~~11.5~~	~~Inoperable[4]~~
~~SI00-09~~	~~SI~~	~~Nov. 13, 2000~~	~~Unknown~~	~~Unknown~~	~~657~~	~~0.6~~	~~20.7~~	~~11.0~~	~~Inoperable[4]~~
~~SI00-10~~	~~SI~~	~~Nov. 14, 2000~~	~~Unknown~~	~~Unknown~~	~~653~~	~~0.6~~	~~17.6~~	~~7.5~~	~~Inoperable[4]~~
~~SI07-11~~	~~SI~~	~~Oct. 23, 2007~~	~~Unknown~~	~~Unknown~~	~~658~~	~~0.6~~	~~23.6~~	~~11.8~~	~~Inoperable[4]~~
~~SI07-12~~	~~SI~~	~~Oct. 24, 2007~~	~~Unknown~~	~~Unknown~~	~~656~~	~~0.66~~	~~20.5~~	~~12.0~~	~~Inoperable[4]~~
~~SI07-13~~	~~SI~~	~~Oct. 24, 2007~~	~~Unknown~~	~~Unknown~~	~~653~~	~~0.7~~	~~17.5~~	~~8.0~~	~~Inoperable[4]~~
~~SI07-14~~	~~SI~~	~~Oct. 24, 2007~~	~~Unknown~~	~~Unknown~~	~~650~~	~~0.8~~	~~14.5~~	~~12.9~~	~~Inoperable[4]~~
~~PN92-8A~~	~~PN~~	~~Sep. 24, 1992~~	~~Unknown~~	~~Unknown~~	~~656~~	~~N/A~~	~~17.7~~	~~N/A~~	~~Inoperable[8]~~
~~PN92-10A~~	~~PN~~	~~Sep. 25, 1992~~	~~Unknown~~	~~Unknown~~	~~658~~	~~N/A~~	~~21.2~~	~~N/A~~	~~Inoperable[8]~~
~~PN92-12A~~	~~PN~~	~~Sep. 26, 1992~~	~~Unknown~~	~~Unknown~~	~~653~~	~~N/A~~	~~14.9~~	~~N/A~~	~~Inoperable[8]~~
~~PN92-15A~~	~~PN~~	~~Sep. 27, 1992~~	~~Unknown~~	~~Unknown~~	~~649~~	~~N/A~~	~~12.2~~	~~N/A~~	~~Inoperable[8]~~
~~SP92-08~~	~~SP~~	~~Sep. 24, 1992~~	~~Unknown~~	~~Unknown~~	~~655~~	~~0.69~~	~~18.7~~	~~Unknown~~	~~Inoperable[6]~~
~~SP92-09~~	~~SP~~	~~Sep. 26, 1992~~	~~Unknown~~	~~Unknown~~	~~655~~	~~1.2~~	~~5.5~~	~~Unknown~~	~~Inoperable[6]~~
~~SP92-10~~	~~SP~~	~~Sep. 26, 1992~~	~~Unknown~~	~~Unknown~~	~~658~~	~~0.8~~	~~6.1~~	~~N/A~~	~~Inoperable[6]~~
~~SP92-11~~	~~SP~~	~~Sep. 26, 1992~~	~~Unknown~~	~~Unknown~~	~~658~~	~~1.1~~	~~10.0~~	~~N/A~~	~~Inoperable[6]~~
SP92-12	SP	Sep. 26, 1992	5806320	471788	654	0.11	16.4	N/A	Operable
SP92-13	SP	Sep. 26, 1992	5806320	471788	654	0.0	7.6	N/A	Operable
~~SP92-14~~	~~SP~~	~~Sep. 27, 1992~~	~~Unknown~~	~~Unknown~~	~~649~~	~~1.0~~	~~5.1~~	~~Unknown~~	~~Inoperable[6]~~
~~SP92-15~~	~~SP~~	~~Sep. 27, 1992~~	~~Unknown~~	~~Unknown~~	~~649~~	~~1.1~~	~~12.2~~	~~Unknown~~	~~Inoperable[6]~~
SP07-11	SP	Oct. 23, 2007	5806382	471788	658	0.18	13.9	N/A	Operable
SP07-12	SP	Oct. 24, 2007	5806320	471788	656	0.15	11.5	N/A	Operable
SP07-13	SP	Oct. 24, 2007	5806290	471788	653	0.0	9.9	N/A	Inoperable
~~SP07-14~~	~~SP~~	~~Oct. 24, 2007~~	~~5806259~~	~~471787~~	~~650~~	~~0.7~~	~~5.4~~	~~N/A~~	~~Inoperable[7]~~

Notes:

[1] Instrument installation details taken from reports prepared by previous consultants or TEC.

[2] Coordinates and ground surface elevations have not been surveyed. Ground surface elevations were estimated from July 2018 survey data and coordinates were taken with a handheld GPS with a horizontal accuracy of ± 5 m.

[3] Metres below ground surface (mbgs).

[4] SI92-01 through SI92-07 (excluding SI92-05), SI00-08 through SI00-10, and SI07-11 through SI07-14 have all sheared at depths between approximately 4 m and 13 m below ground surface.

[5] SI92-05 was damaged near top of casing in 2006.

[6] SP92-08, SP92-09, SP92-14, and SP92-15 are blocked. SP92-10 and 11 are damaged.

[7] SP07-14 was buried between the fall 2021 and spring 2022 readings and is inoperable.

[8] PN92-8A, PN92-10A, PN92-12A, and PN92-15A are damaged (no air return).

[9] SP92-12, SP92-13, and SP07-13 were damaged between the fall 2023 and spring 2024 readings. KCB suspects the damage was caused by vehicle activity.

2 INTERPRETATION

2.1 General

For the operable SPs, the recorded water levels were converted to an equivalent water elevation and plotted relative to ground surface elevation and the screen elevation for each instrument.

The piezometer data plots are included in Appendix I and a summary of the piezometer data is provided in Table 2.1.

No data is available for the instruments at this site between 1994 and 2000, or 2011 and 2020 except for one reading taken in 2019 (as described in Section 1.1).

2.2 Zones of Movement

No operable SIs remain at the site. SI92-01 through SP92-07 (excluding SI92-05, which was damaged before shearing), SI00-08 through SI00-10, and SI07-11 through SI07-14 have all sheared at depths between approximately 4 m and 13 m below ground surface (approximately elevation 643 m to 647 m).

Table 2.1 Standpipe Piezometer Reading Summary

Instrument ID	Date			Ground Surface Elevation (m)	Screen Depth (mbgs[1])	Water Level		
	Installed	Previous Reading	Most Recent Reading			Previous Reading (mbgs[1])	Most Recent Reading (mbgs[1])	Change from Previous Reading (m)
SP92-12	Sep. 26, 1992	May 14, 2024	May 21, 2025	654	16.4	2.6	2.0	0.6
SP92-13	Sep. 26, 1992	May 14, 2024	May 21, 2025	654	7.6	2.8	2.2	0.5
SP07-11	Oct. 24, 2007	May 14, 2024	May 21, 2025	658	13.9	2.3	2.0	0.3
SP07-12	Oct. 24, 2007	May 14, 2024	May 21, 2025	656	11.5	4.0	3.1	0.8
SP07-13[2]	Oct. 24, 2007	May 14, 2024	May 21, 2025	653	9.9	0.1	2.4	-2.3

Notes:
[1] Metres below ground surface (mbgs).
[2] SP07-13 was dry before the September 8, 2022 readings.
[3] The stickup of SP07-13 was sheared at ground surface before the May 14, 2024 reading and the instrument did not have a PVC cap at the time of the reading.

2.3 Interpretation of Monitoring Results

2.3.1 General

No instrumentation data is available for the site between 1994 and 2000, or 2011 and 2020 except for one reading taken in 2019, making it difficult to assess the long-term trends of these instruments. Additionally, all the SIs are inoperable, so no movement data is available for KCB to interpret.

2.3.2 Movement

Previously, KCB's assessment was the movement being recorded in the SIs may be due to localized sliding only in the area of the pavement cracking. However, upon review of aerial photos taken using our Unmanned Aerial Vehicle (UAV) and site observations made during the 2021 Section B inspection and 2022 call-out inspection, the extent and depth of sliding appears to be larger than previously thought. The C003 site appears to be in a more active zone of sliding within a larger landslide mass along the north valley slope of the Battle River.

Based on the available historical data, the zone of movement recorded in the SIs appears to be relatively discrete and occurring at or just above the top of bedrock. Prior to being sheared, some of these instruments recorded moderate to high rates of movement (between approximately 30 mm/year and 55 mm/year).

Movement is difficult to assess due to regular (1-2 times per year) pavement patching at the site. However, during the spring 2024 and spring 2025 readings, increased pavement distress (settlement, heaving, and transverse cracking) in both the northbound and southbound lanes and guardrail deflection and settlement were observed. This indicates that the deep-seated slide is active and there is ongoing movement at the site.

Ongoing movement at the site may have caused damage to the operable SPs below the current measured water level. During the spring 2024 readings, the bottom casing depth of the SPs were measured with a cloth tape and compared to the installation depth to assess if the instruments have sheared. Each of the active standpipe piezometers appear to have sheared within a 2.6 m zone between the approximate elevations of 646.0 m and 648.6 m, which is consistent with the shearing depth of the inoperable SIs. This indicates that there likely is a localized failure zone between elevation 646.0 m and elevation 648.6 m. There is now a concern with the reliability of the water levels recorded in the SPs as the instruments could be blocked or allowing groundwater to flow through casing fractures above or below the screen elevation.

2.3.3 Piezometric Levels

From spring 2022 to spring 2024, the water level recorded in all SPs (except SP07-13) were steady or decreasing (decreases between approximately 0.15 m and 2.30 m). However, from spring 2024 to spring 2025, the water level recorded in all instruments (except for SP07-13) were increasing (increases between approximately 0.2 m to 0.8 m). This increase may be attributed to spring freshet and/or precipitation (heavy or prolonged rainfall).

Based on the piezometer data, it is likely that the movement observed in 2022 (increased pavement cracking, settlement, and guardrail deflection) at the site occurred in response to elevated groundwater levels within the slide mass.

The variation in water level recorded between SI92-12, SP92-13, SP07-11 and SP07-12, and SP07-13, may be due to these instruments being installed on either side of a culvert that receives flows from a wet area upslope and to the east of the instruments. Whereas water levels recorded in the instrument upslope to the north have remained relatively steady or decreasing since the spring of 2021, while the water level recorded in SP07-13 has been increasing (approximately 1.1 m) since spring of 2021, excluding the reading from spring 2024, which may have been attributed to damage to the instrument casing (as discussed below).

Historically, SP07-13 (instrument downslope to the south) has been dry since installation. However, since fall of 2022, steadily increasing water levels from approximately 3.4 m and 2.4 m below ground surface were recorded in this instrument. KCB suspects the water in the instrument may be due to slope movement shearing the SP casing, resulting in groundwater infiltrating the casing. Between the fall 2023 and spring 2024 readings, SP07-13 was broken off at ground surface (likely due to vehicle activities). KCB suspects that surface water may be flowing into the standpipe, resulting in higher-than-actual water levels. Between spring 2024 to spring 2025, a 2.3 m decrease was recorded in SP07-13, potentially attributed to the repairs completed in spring 2024 resulting in groundwater no longer infiltrating the casing and/or surface water flows entering the top of the casing.

As the slide on the north valley wall of the Battle River is relatively large, there may be additional mechanisms contributing to the continued movement being observed at the site since 2021, such as continued movement after the initial acceleration that appears to have happened in 2022, as indicated by increased damage to the pavement between 2022 and 2025. The drainage improvements installed in 1998 and 2003 may only be effective for higher water levels below the highway.

3 RECOMMENDATIONS

3.1 Future Work

The reading frequency for all operable instruments should continue to be once per year (spring only).

The site should continue to be inspected by TEC's Maintenance Contract Inspector (MCI) and every two years as part of the Central Region GRMP Section B inspections.

Recommendations for this site include:

- Perform a change detection assessment of the site to help improve our understanding of the movements at the site (including large-scale movements within the north valley slope). In early-2025, KCB began this assessment, including having Challenger Geomatics Ltd. perform a topographic survey in June 2025, and we have retained Hendry and Macciotta (HM) to support this work.

- Complete a drainage improvement design for the site to lower the groundwater table. The new drainage system should be installed in the west highway ditch that is deeper than the current system to lower the groundwater table, and protecting the west highway ditch against erosion.

3.2 Instrument Repairs and Maintenance

Casing protectors should be installed for the SPs. SP92-12, SP92-13, and SP07-13 were damaged between the fall 2023 and spring 2024 readings and was likely caused by snow clearing activities or all-terrain vehicles.

4 CLOSING

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Central Region Geohazard Risk Management Program (Contract No. CON0022160), and it may not be relied upon by any other party without KCB's written consent.

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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4. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
5. 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.

Please contact the undersigned if you have any questions or comments regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

PROFESSIONAL ENGINEER ALBERTA
JAMES LYONS
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PERMIT TO PRACTICE
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ATTACHMENTS
Figure
Appendix I Instrumentation Plots

FIGURE

Legend

- Slope Inclinometer (SI)
- Standpipe Piezometer (SP)
- Culvert
- Fence
- Guardrail
- Crack

0 50 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM Zone 12N
3. IMAGE SOURCE: WORLD IMAGERY, ESRI ARCGIS ONLINE SOURCE DATE JULY 2019 (PAINTEARTH COUNTY NO. 18)
4. STRIKETHROUGH INDICATES INSTRUMENT IS INACTIVE.

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C003 - Burma Park Slide
Hwy 872:06, km 0.278

SCALE	PROJECT No.	FIG No.
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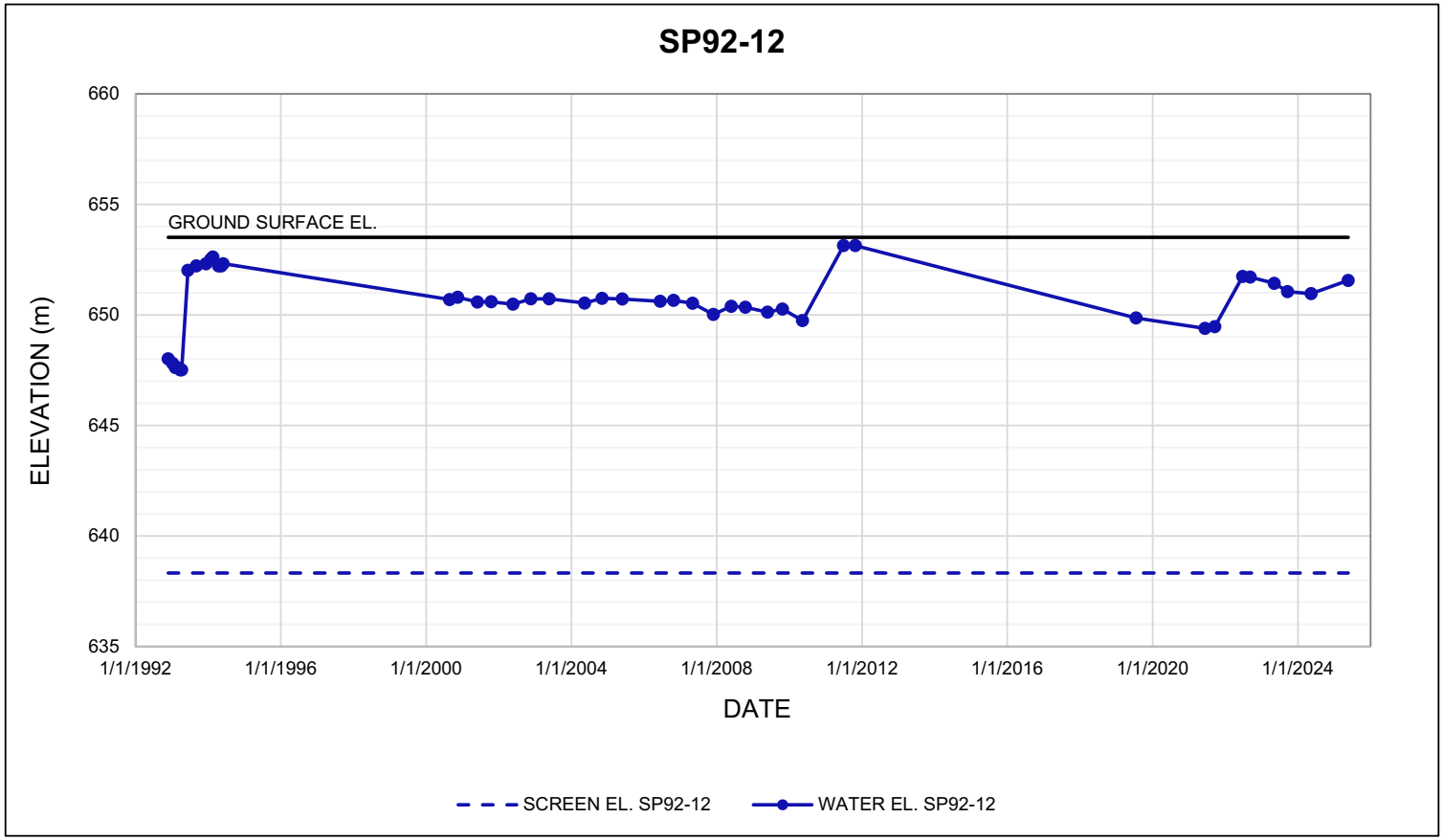
APPENDIX I

Instrumentation Plots



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Klohn Crippen Berger	TITLE: Piezometer Data C003 - Burma Park Slide Hwy 872:06; km 0.278		
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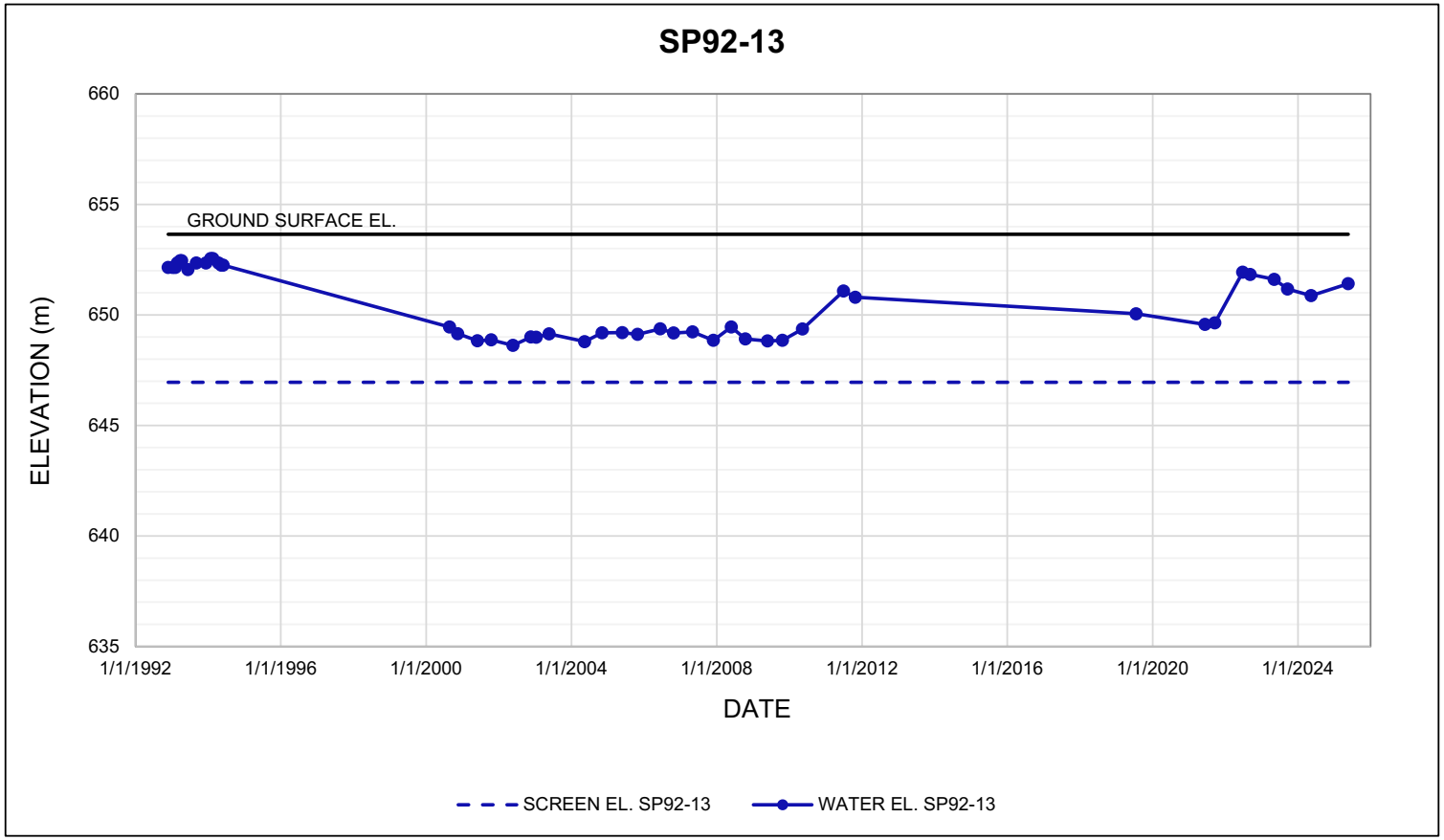

CLIENT Alberta

Klohn Crippen Berger

PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE Piezometer Data
C003 - Burma Park Slide
Hwy 872:06; km 0.278

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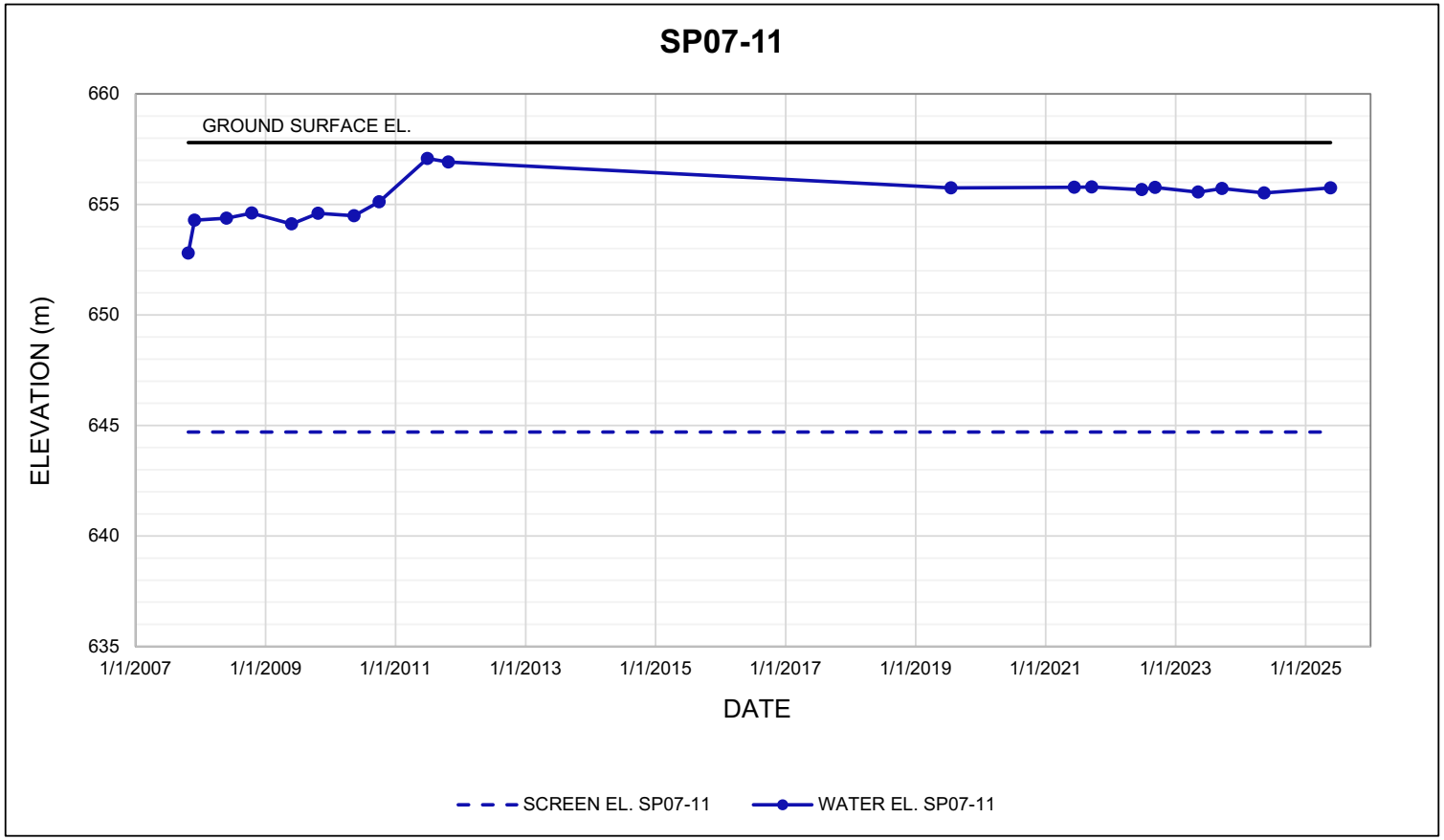

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PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

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C003 - Burma Park Slide
Hwy 872:06; km 0.278

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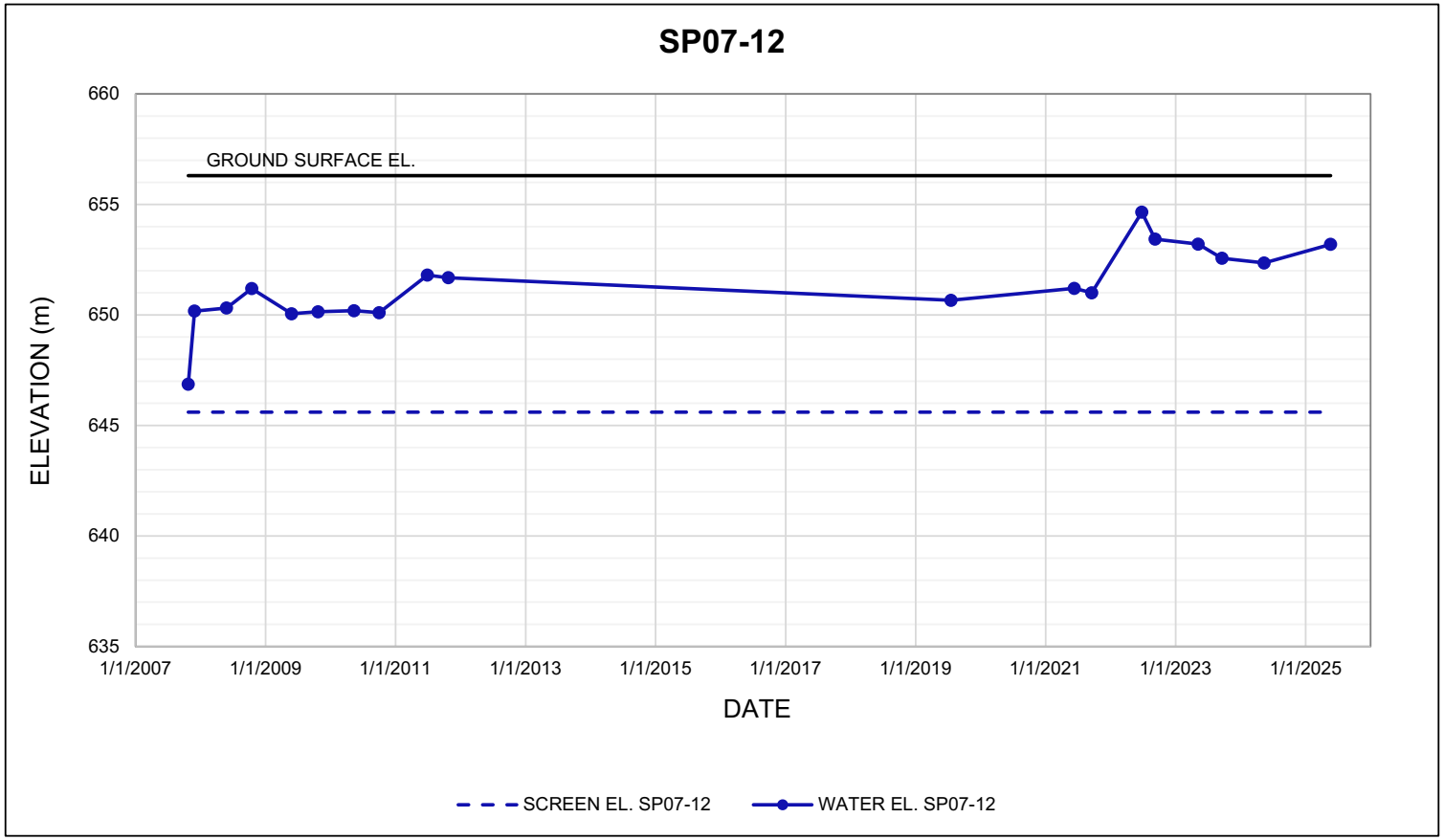

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PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE Piezometer Data
C003 - Burma Park Slide
Hwy 872:06; km 0.278

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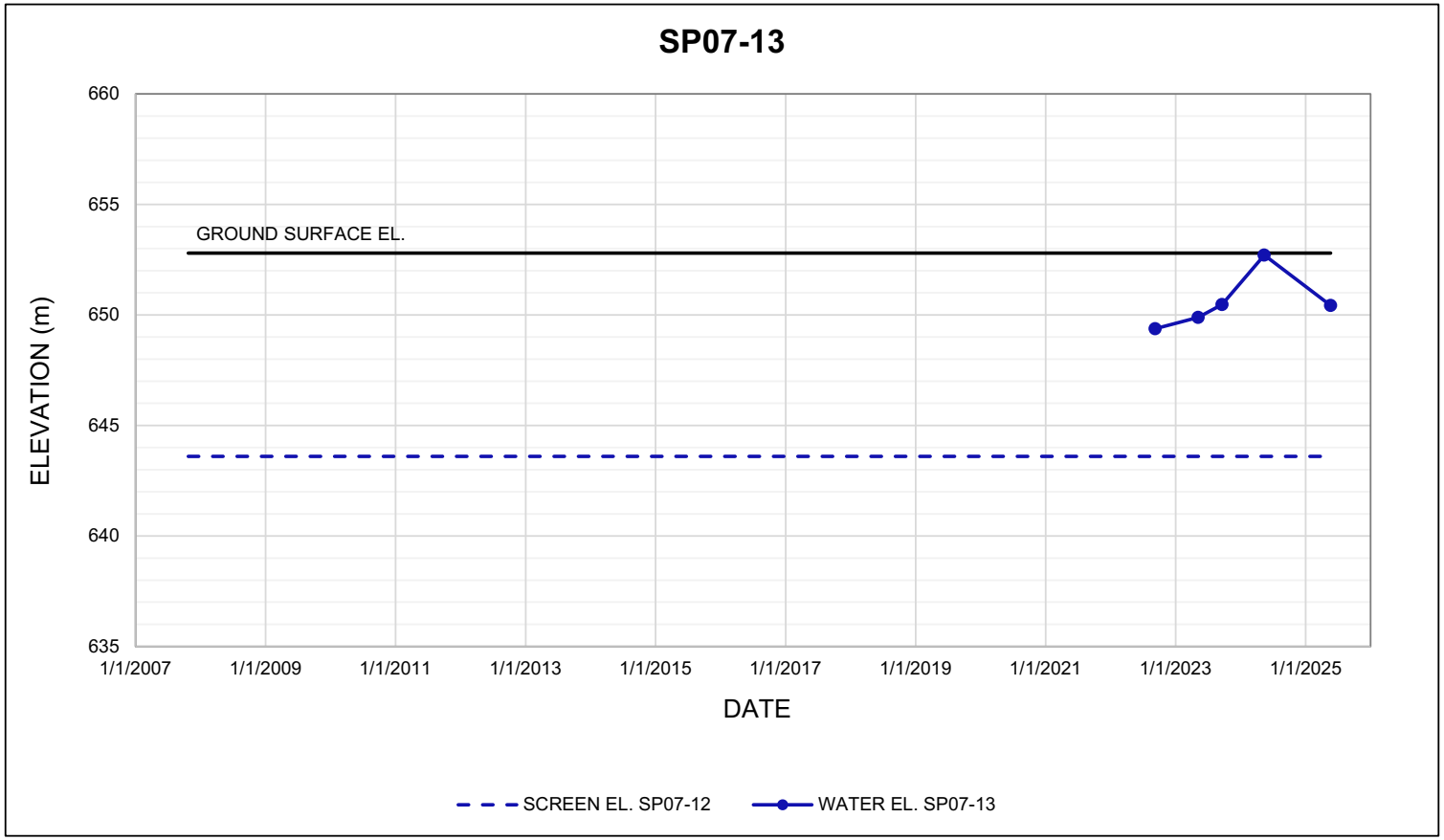

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PROJECT
CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE
Piezometer Data
C003 - Burma Park Slide
Hwy 872:06; km 0.278

SCALE	PROJECT No.	FIG No.
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