

November 26, 2025

Alberta Transportation and Economic Corridors  
2<sup>nd</sup> Floor, 803 Manning Road N.E.  
Calgary, Alberta  
T2E 7M8

**Alex Frotten, P.Eng.**  
**Construction Engineer – Delivery Services Division (Southern Region)**

Dear Mr. Frotten:

**CON0022161 Southern Region GRMP Instrumentation Monitoring**  
**Site S054; H22:10, km 37.817 Longview Bridge**  
**Section C – 2025 Fall Readings**

## **1 GENERAL**

One shape array accelerometer (SAA) (SAA17-02) was read at the S054 site in Southern Region on October 8, 2025, by Mr. Shawn Keegan, E.I.T., of Klohn Crippen Berger Ltd. (KCB). This instrument was read as part of the Southern Region Geohazard Risk Management Program (GRMP). The site is located on Hwy 22:10 km 37.817, at the north abutment of the Highwood River Bridge (BF1741), approximately 1 km south of Longview, Alberta. The approximate site coordinates are 5600426 N, 696051 E (UTM Zone 11, NAD 83). A site plan is presented in Figure 1.

The geohazard at the S054 site consists of surface-runoff, riverbank erosion and slope instabilities in the north bank of the Highwood River. The undermining of a gabion wall at the toe of the slope occurred during a 2013 flood event. Surface-runoff erosion appears to be removing lateral earth support from one of the bridge piers (Pier 1A) and its foundation. Rotational movement in the pile cap of Pier 1A to the southwest was reported by the previous consultant. Pier 1A is reported to be founded on 24 piles embedded to a depth of approximately 3.7 m.

The north abutment height is approximately 22 m, and the north riverbank slope from the south side of Pier 1A to the top of the gabion wall was estimated to be approximately 1.2H:1V. Immediately downslope of the south side of Pier 1A, tension cracking approximately 12 m to 15 m in length has been observed during previous site inspections.

In 2016 and 2017, geotechnical site investigations were completed at the S054 site by previous consultants to support design and construction work. In 2017, one SAA and three vibrating wire piezometers (VWPs) were installed to monitor movement and groundwater conditions, respectively. In general, the encountered stratigraphy is as follows: medium-plastic clay, overlying silty gravel, and overlying sedimentary bedrock (sandstone, siltstone, and claystone).

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## 1.1 Instrumentation

KCB has been reading the instruments at this site since 2020. Between 2016 and 2020, instruments were read by Thurber Engineering Ltd. (Thurber) on behalf of ISL Engineering and Land Services Ltd. (ISL Engineering) as part of a slope stability monitoring project. Instrumentation installation details are tabulated in Table 1.1. Instrument locations are shown in Figure 1.

SAA17-02 (Serial No. 147741) is 31 m deep and located below the bridge deck at the crest of the north riverbank, in the southeast corner of Pier 1A. SAA17-02 is connected to a data-logger system consisting of a CR800 data logger, SSA232 connection cable, Microhard Bullet-LTE gateway telemetry system (no sim card), and an antenna. However, there is no long-term power supply for the data-logger system (KCB has replaced the battery five times since 2020), so the instrument is read manually using a USB-Serial cable and Campbell Scientific LoggerNet software.

SAA17-02 is protected by an above-ground lockable box that contains the data-logger system.

**Table 1.1 Instrument Installation Details**

Instrument No.	Instrument Type	Date Installed	UTM Coordinates <sup>1</sup> (m)		Stick Up (m)	Depth (mbgs <sup>1</sup> )	Condition
			Northing	Easting			
SAA17-02	SAA	Mar. 2017	5600431	696051	N/A	29.8	Operable
VW16-01A	VWP	May 2016	5600472	696087	N/A	27.4	Inoperable <sup>3</sup>
VW16-01B	VWP	May 2016	5600472	696087	N/A	17.4	Inoperable <sup>3</sup>
VW16-01C	VWP	May 2016	5600472	696087	N/A	7.3	Inoperable <sup>3</sup>

**Notes:**

<sup>1</sup> Coordinates reported by the previous consultants were confirmed by KCB with a handheld GPS (accuracy of  $\pm 5$  m).

<sup>2</sup> Meters below ground surface (mbgs). Bottom reading depth for SI and tip depth for VWPs.

<sup>3</sup> Flush-mounted casing protector for VW16-01A/B/C paved over in 2021 and the instruments are no longer readable.

Prior to October 31, 2017, the instruments were monitored by Thurber. No previous instrumentation reports were available to KCB for review.

## 2 INTERPRETATION

### 2.1 General

The SAA plots presented in the report include cumulative displacement, incremental displacement, and displacement-time data (Appendix I). The displacement-time data is plotted in the A-direction (i.e., the direction of the A0-groove) and, also, the X-direction (i.e., the direction of maximum movement obtained at a skew angle from the A0-grooves). SAA17-02 has a skew angle of 85°, measured clockwise from the direction of the A0 grooves.

The pile-cap thickness has not been measured by KCB. However, based on the ground surface elevation of 1202.1 m for a nearby test hole (reported by the previous consultant), the tip of the pile is estimated to be at an approximate elevation of 1198.0 m (an approximate depth of 4.2 m below ground surface).

The SAA data plots are included in Appendix I.

## 2.2 Zones of Movement

There are three zones of distributed movement being recorded in SAA17-02, which include:

- a shallow zone from ground surface to an approximate depth of 2.5 m below ground surface, in the medium plastic clay;
- a deeper zone from an approximate depth of 17.0 m to 21.5 m below ground surface, at the base of the sandstone/siltstone unit and into the underlying claystone; and,
- the deepest zone from an approximate depth of 22.0 m below ground surface to near the base of the instrument, from the base of the identified claystone unit to a lower unidentified unit.

These zones of differential movement could also indicate sections of poor casing backfill or other installation issues.

## 2.3 Interpretation of Monitoring Results

Since December 2020, the SAA has shown small fluctuations in the rate of movement (less than 5 mm/year) in SAA17-02. Based on the May 2025 data obtained from this instrument; the SAA has shown an increasing trend of movement across the three zones. This increment is most significant in the middle zone between 17 m and 21.5 m below ground surface, while there is little to no change in the movement in the upper and lower zones. Overall, the instruments show:

- in the upper monitoring zone approximately 7 mm of distributed movement has been recorded in the medium plastic clay, with most of the movement occurring shortly after installation.
- in the middle monitoring zone approximately 9 mm of distributed movement has been recorded from near the base of the sandstone/siltstone to the base of the claystone unit, with most of the movement occurring before 2020.
- in the lower monitoring zone approximately 5 mm of distributed movement has been recorded from near the base of the claystone unit to the base of the instrument, with most of the movement occurring shortly after installation.

## 2.4 Summary

A summary of the SAA data is provided in Table 2.1.

Table 2.1      Shape Array Accelerometer Readings Summary

Instrument ID	Date				Recorded Reading Frequency (Last reading date)	Ground Surface Elevation (m)	Depth of Movement (mbgs <sup>1</sup> )	Direction of Movement, Skew Angle <sup>2</sup>	Movement (mm)		Rate of Movement (mm/year)		
	Initialized	Previous Maximum Cumulative Movement Recorded	Previous Reading	Most Recent Reading					Maximum Cumulative	Incremental Since Previous Maximum Cumulative	Previous Maximum	Most Recent Reading	Change from Previous Reading
SAA17-02	Mar. 24, 2017	Jan. 11, 2025	May 20, 2025	Oct. 8, 2025	Every 12-hours (Oct. 8, 2025)	1202.1	0.0 – 2.5	X-Direction, 85°	7.1	-0.1	107.0	6.5	4.6
		Aug. 1, 2025					17.0 – 21.5		9.2	-0.4	23.8	-1.9	2.0
		Sept. 1, 2025					22.0 – 30.0		4.9	-0.4	31.4	1.9	1.8

**Note:**  
<sup>1</sup> Meters below ground surface (mbgs).  
<sup>2</sup> Skew angle of X-direction measured clockwise from A-direction.

## 3 RECOMMENDATIONS

### 3.1 Future Work

The SAA should continue to be read twice per year (spring and fall).

The paved-over VWP's were located beneath the pavement by KCB in June 2023 using a metal detector and marked with spray paint. It is recommended that the HMC try and remove the pavement above the headbox so the VWP's can continue to be read.

KCB recommends that a topographic survey of the north riverbank be carried out and that two new boreholes be drilled, one east and one west of the north bridge abutment. The west borehole should include installing a new SI, and the east borehole should include installing new VWP's to replace those paved over in 2021 (if they cannot be recovered by the maintenance contractor).

### 3.2 Instrument Repairs and Maintenance

As previously discussed with TEC, a comprehensive slope stability and bridge deck monitoring plan should be developed for this site, including upgrading SAA17-02 with a long-term solution that includes a new battery and a permanent power supply (e.g., installation of a solar panel and mount). In the 2025 spring readings, the battery was replaced to ensure continuous SAA readings.

## 4 CLOSING

This report is an instrument of service of Klobn 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 Southern Region Geohazard Risk Management Program (Contract No. CON0022161), 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.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. 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.
3. 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.

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.**

Jorge Rodriguez, Ph.D, M.Sc., P.Eng.  
Geotechnical Engineer

JT&JR:bb

## ATTACHMENTS

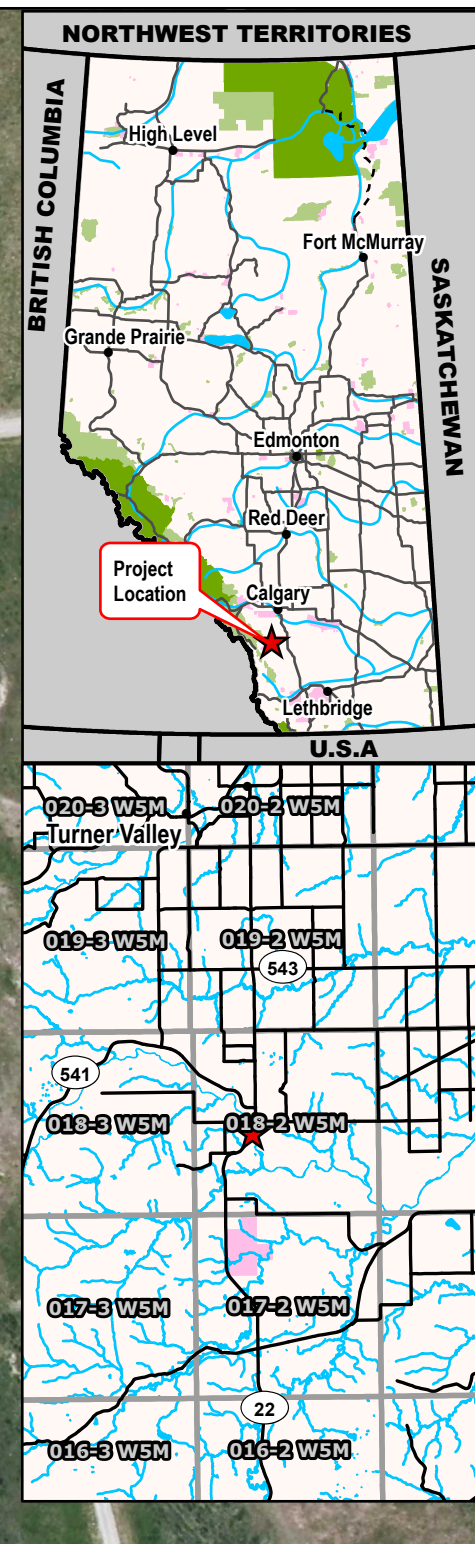
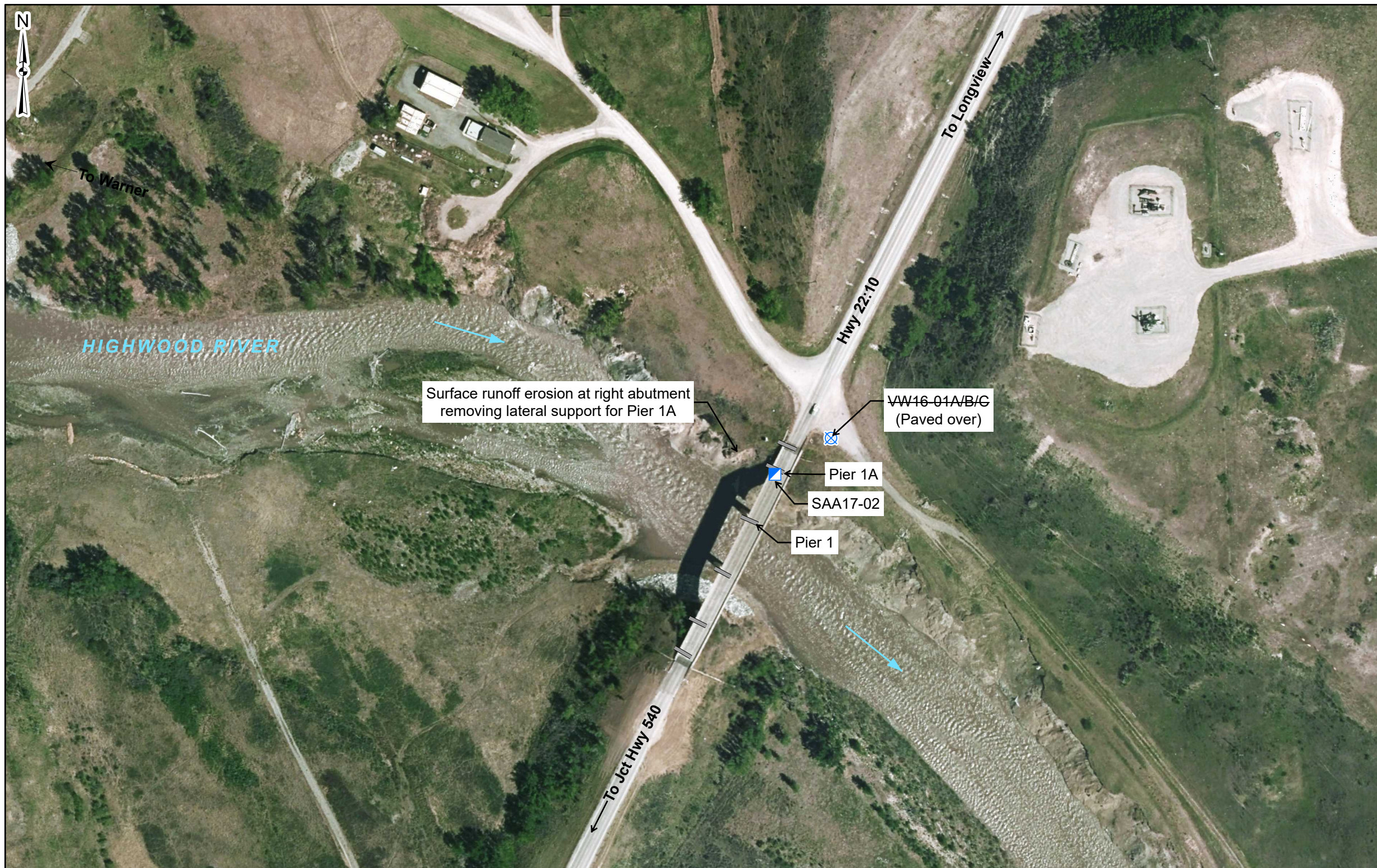
Figure

Appendix I	Instrumentation Plots
Appendix II	ISL – Historic Ground Slope Profiles





## FIGURE

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**Legend**

-  Shape Array Accelerometer
-  Vibrating Wire Piezometer
-  Bridge Pier Location
-  Flow Direction



<div>NOTES:</div> <div>1. HORIZONTAL DATUM: NAD83</div> <div>2. GRID ZONE: UTM ZONE 11N</div> <div>3. IMAGE SOURCE: 2022 MICROSOFT CORPORATION, 2022 MAXAR CNES, DISTRIBUTION AIRBUS DS</div> <div>4. INSTRUMENT AND BRIDGE PIER LOCATIONS ARE APPROXIMATE</div>	CLIENT		PROJECT	
			SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM	
	 Klohn Crippen Berger		TITLE	
			Site Plan	
			S054 - Longview Bridge	
		Hwy 22:10, km 37.817		
		SCALE	PROJECT No.	FIG No.
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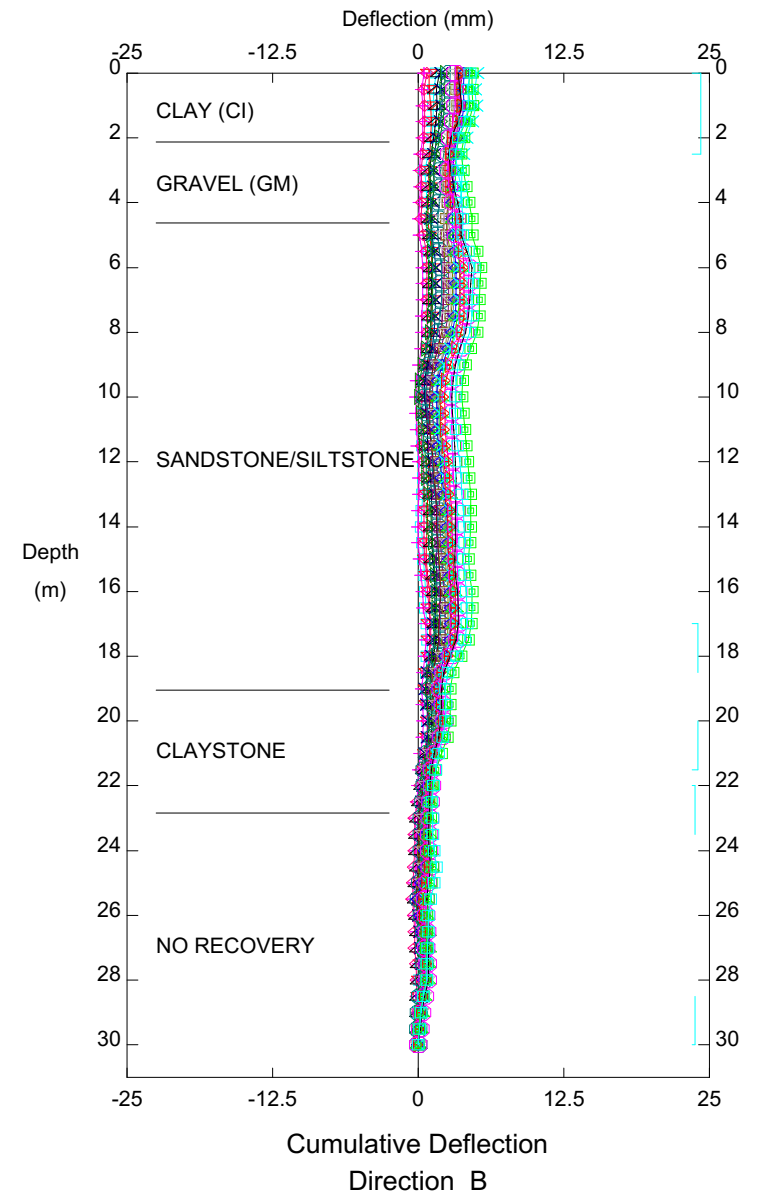
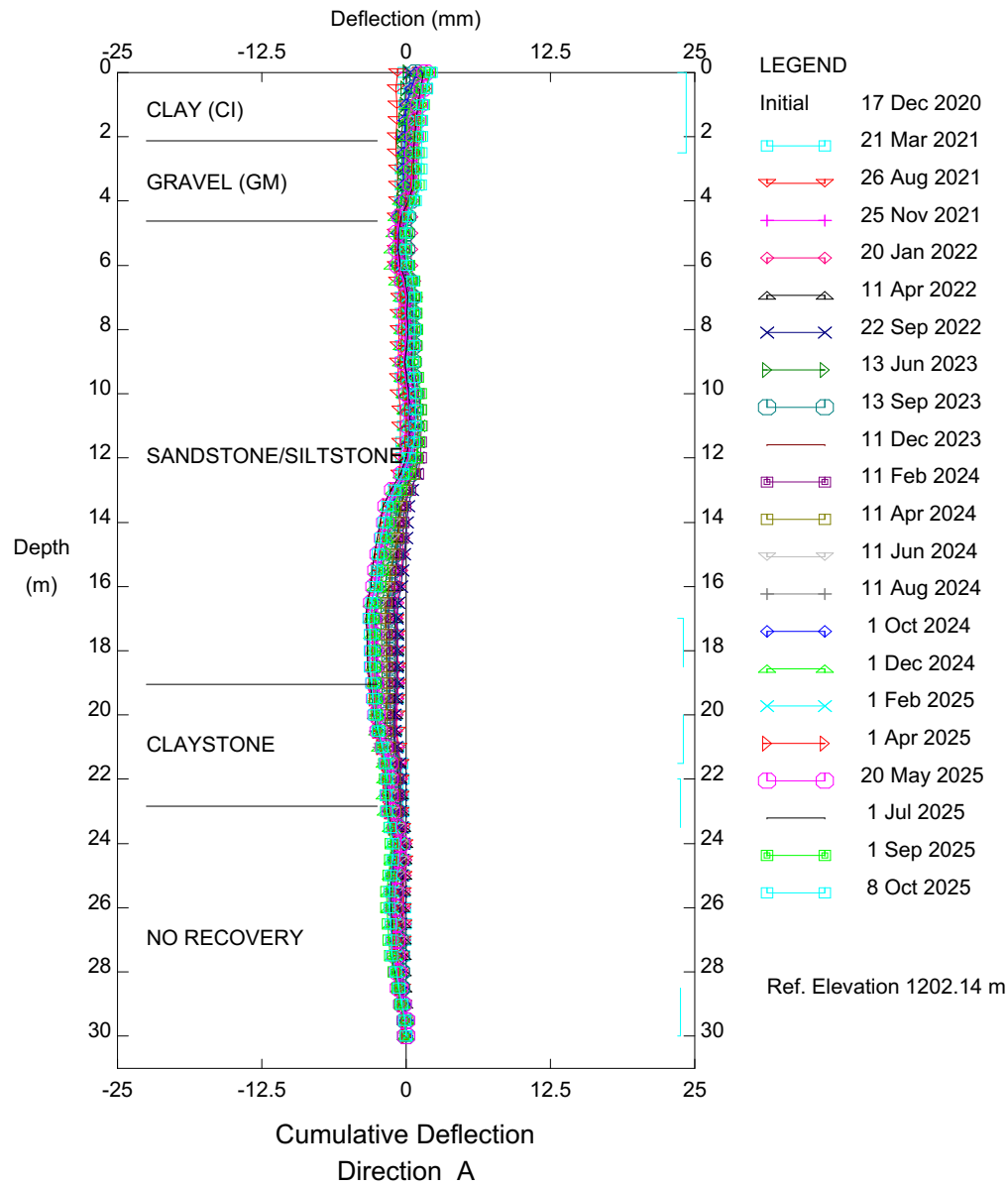


## APPENDIX I

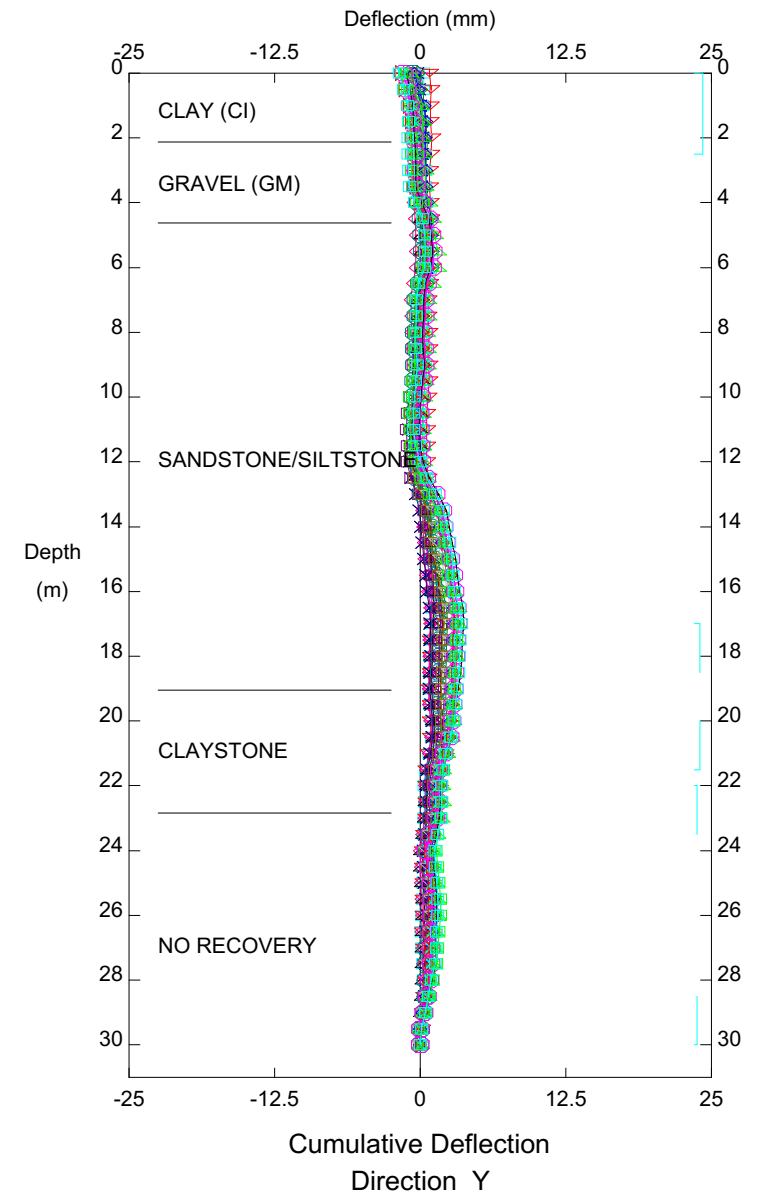
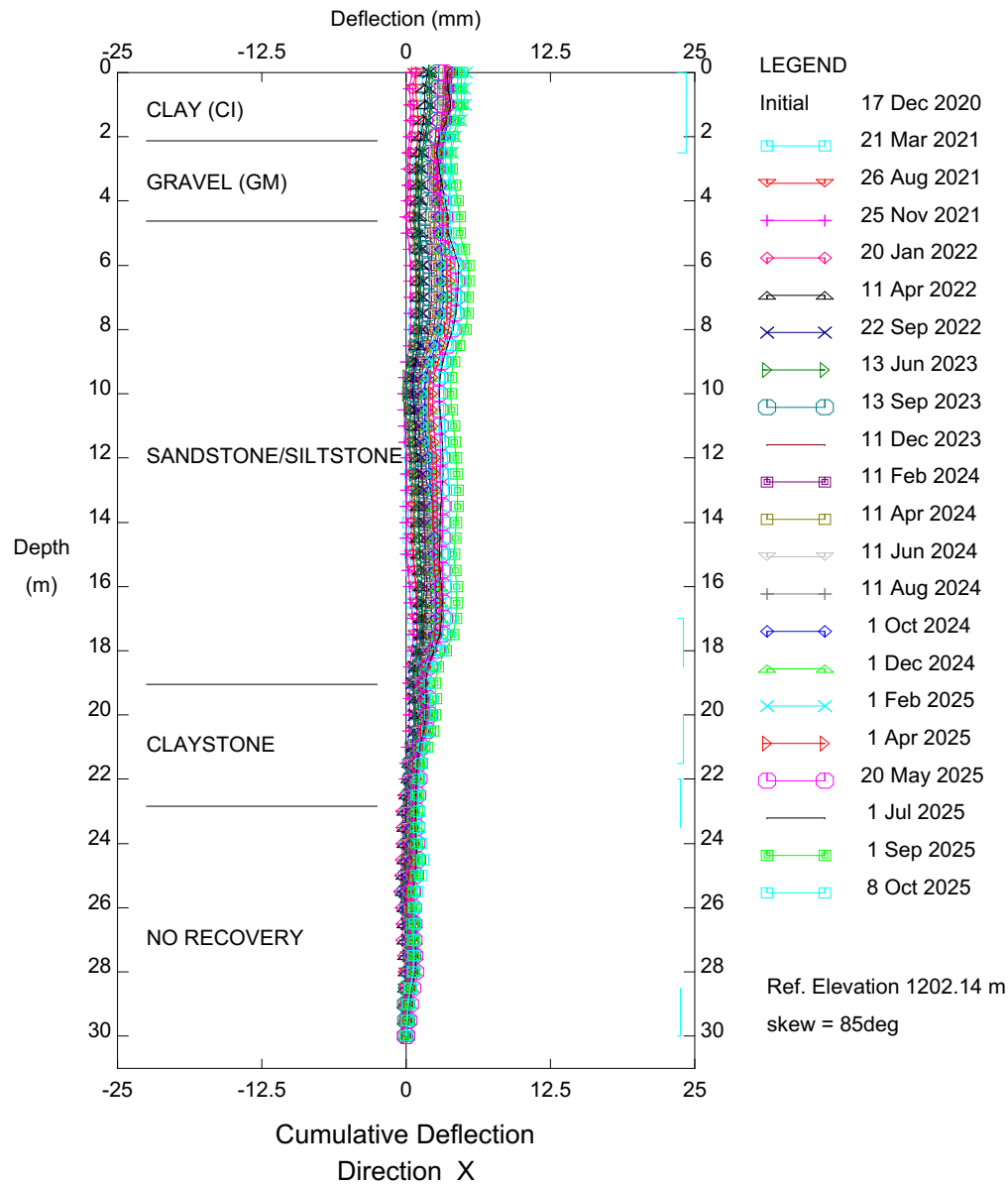
### Instrumentation Plots

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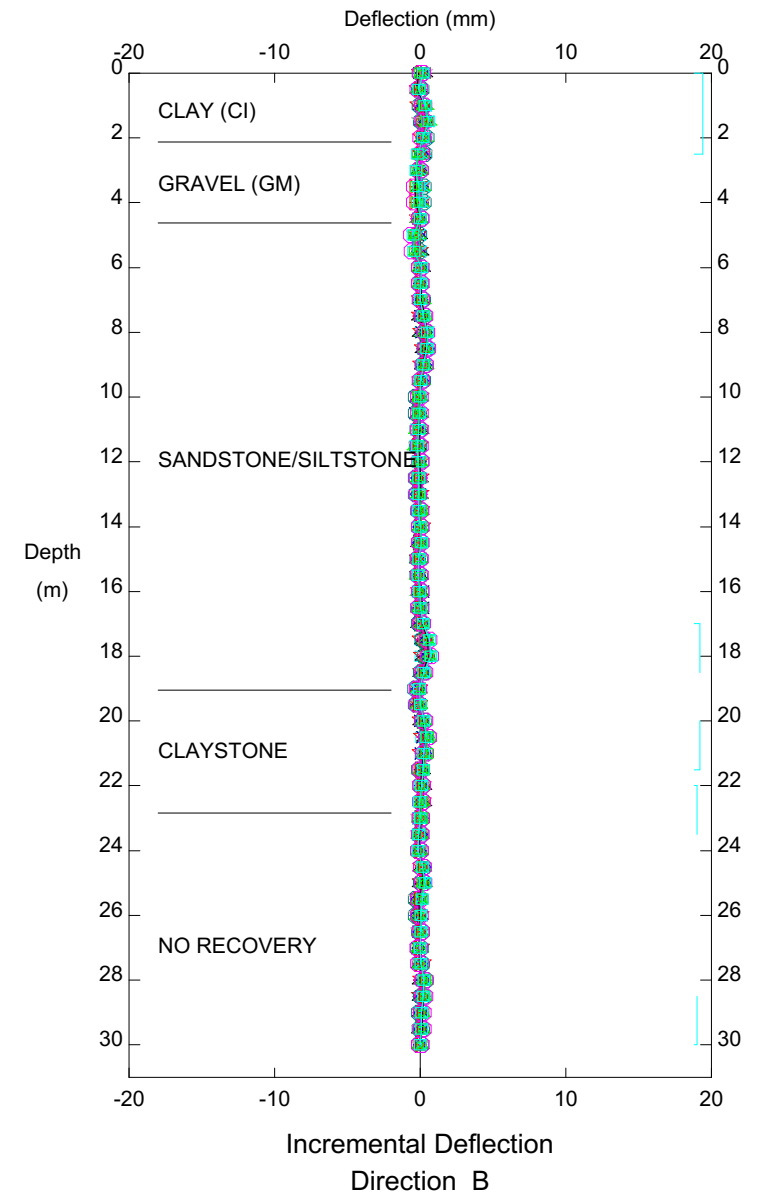
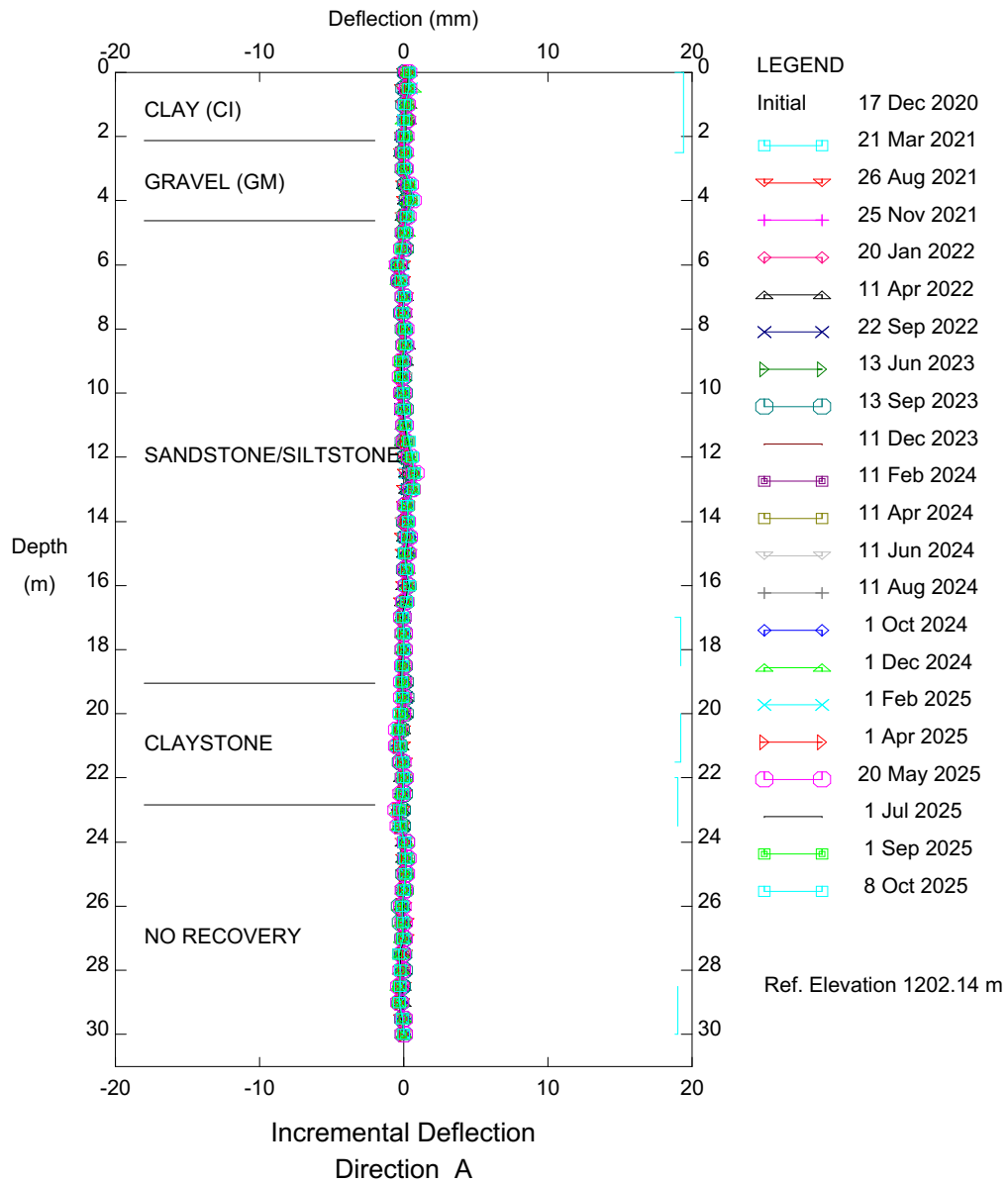


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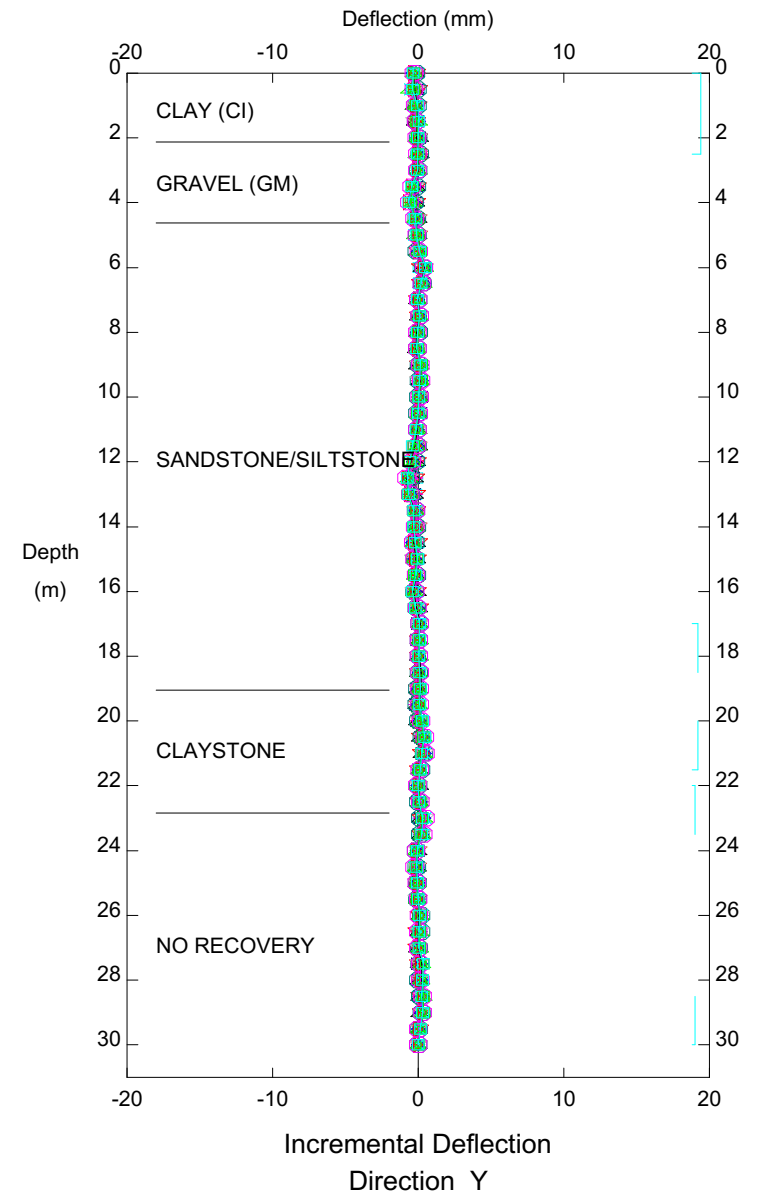
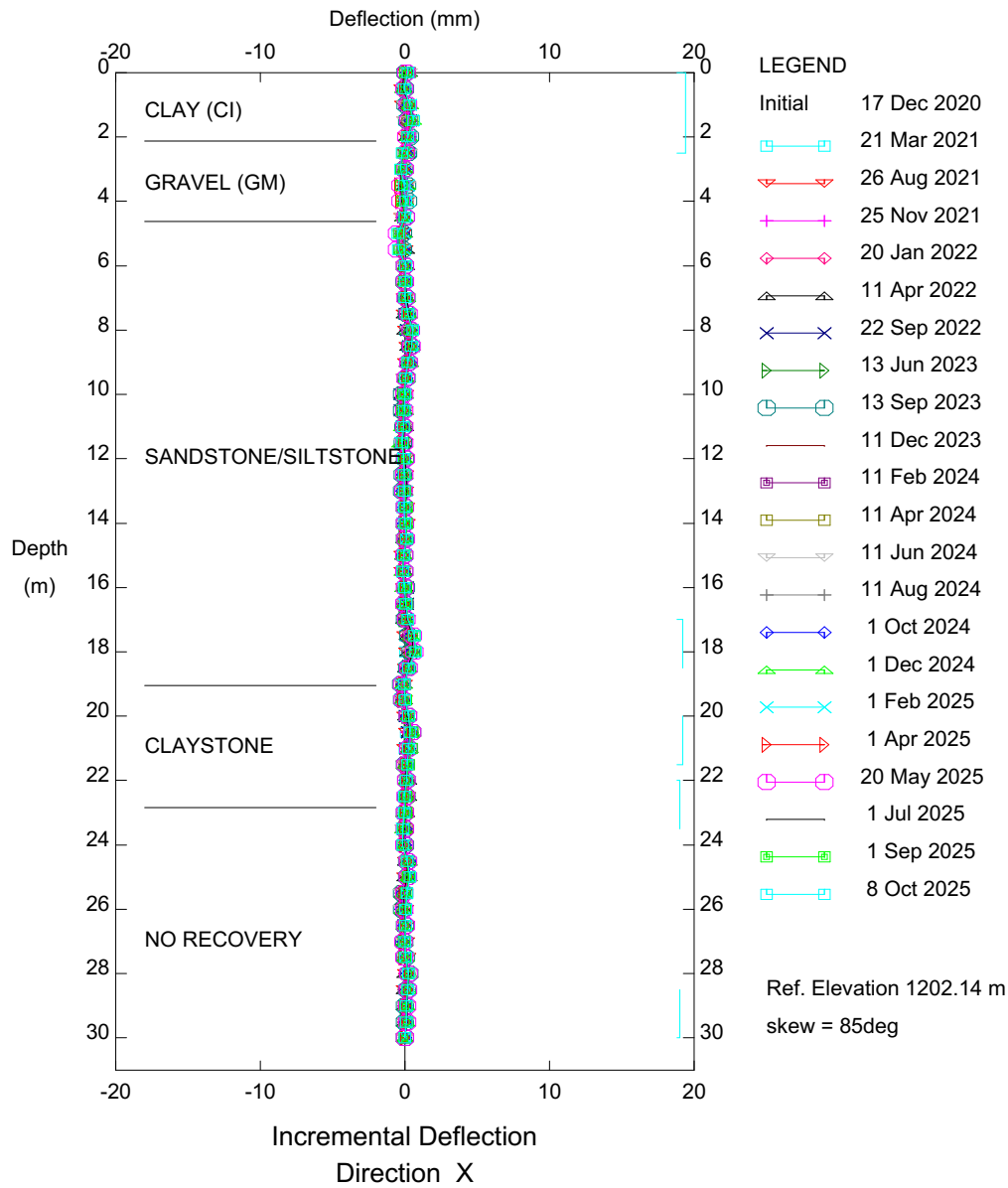




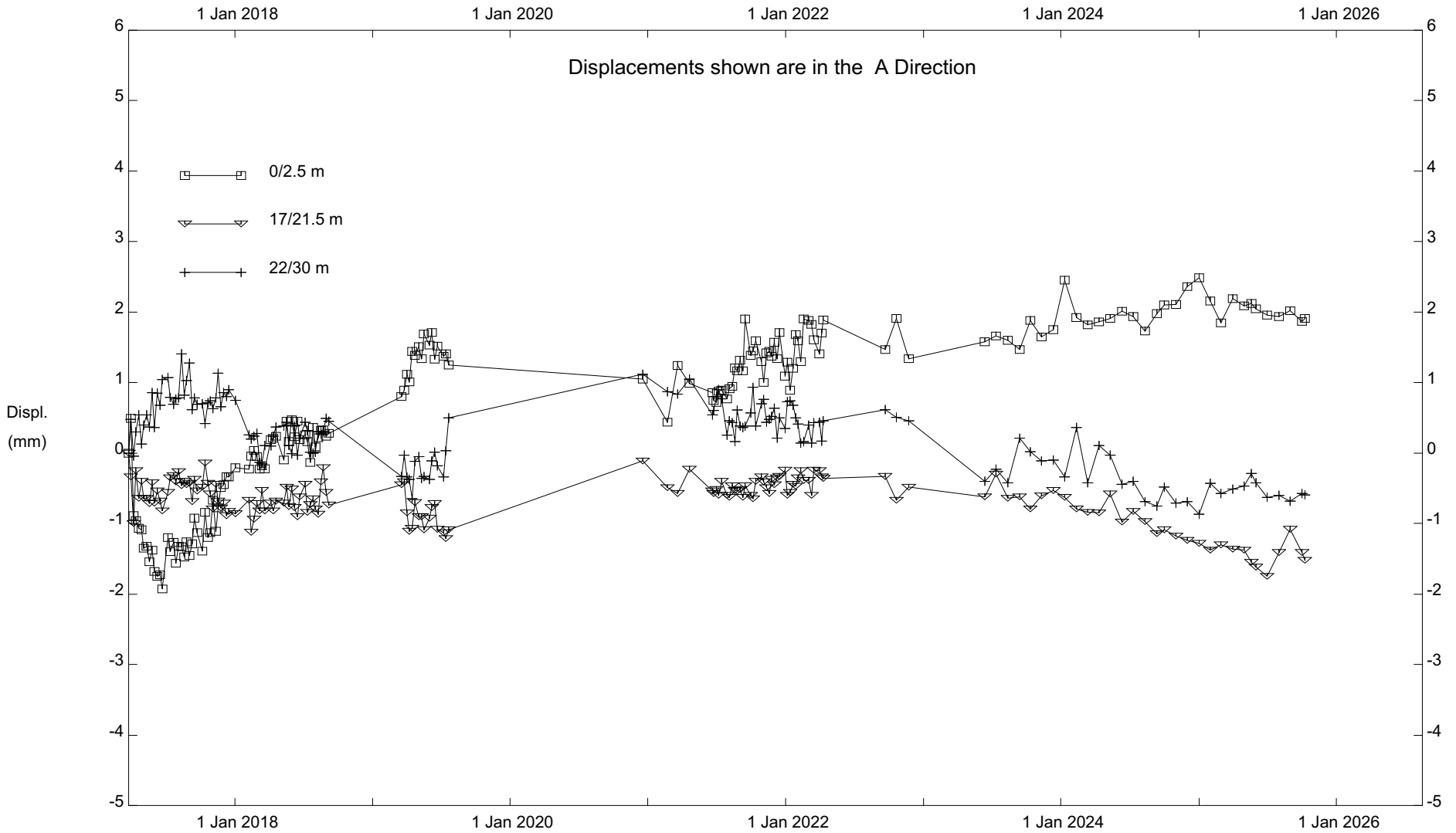
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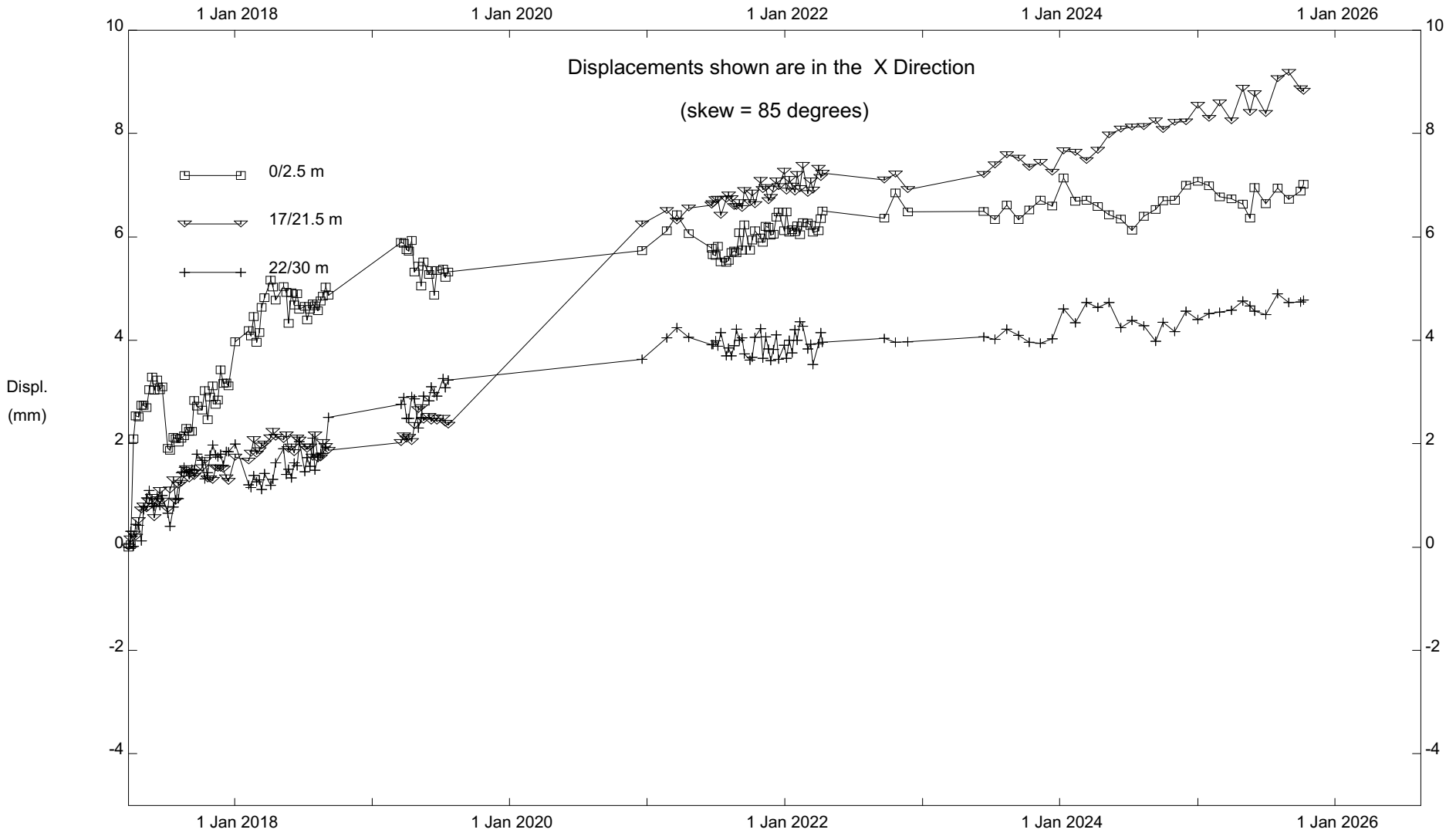


S054; H22:10 Longview Bridge, Inclinometer SAA17-02

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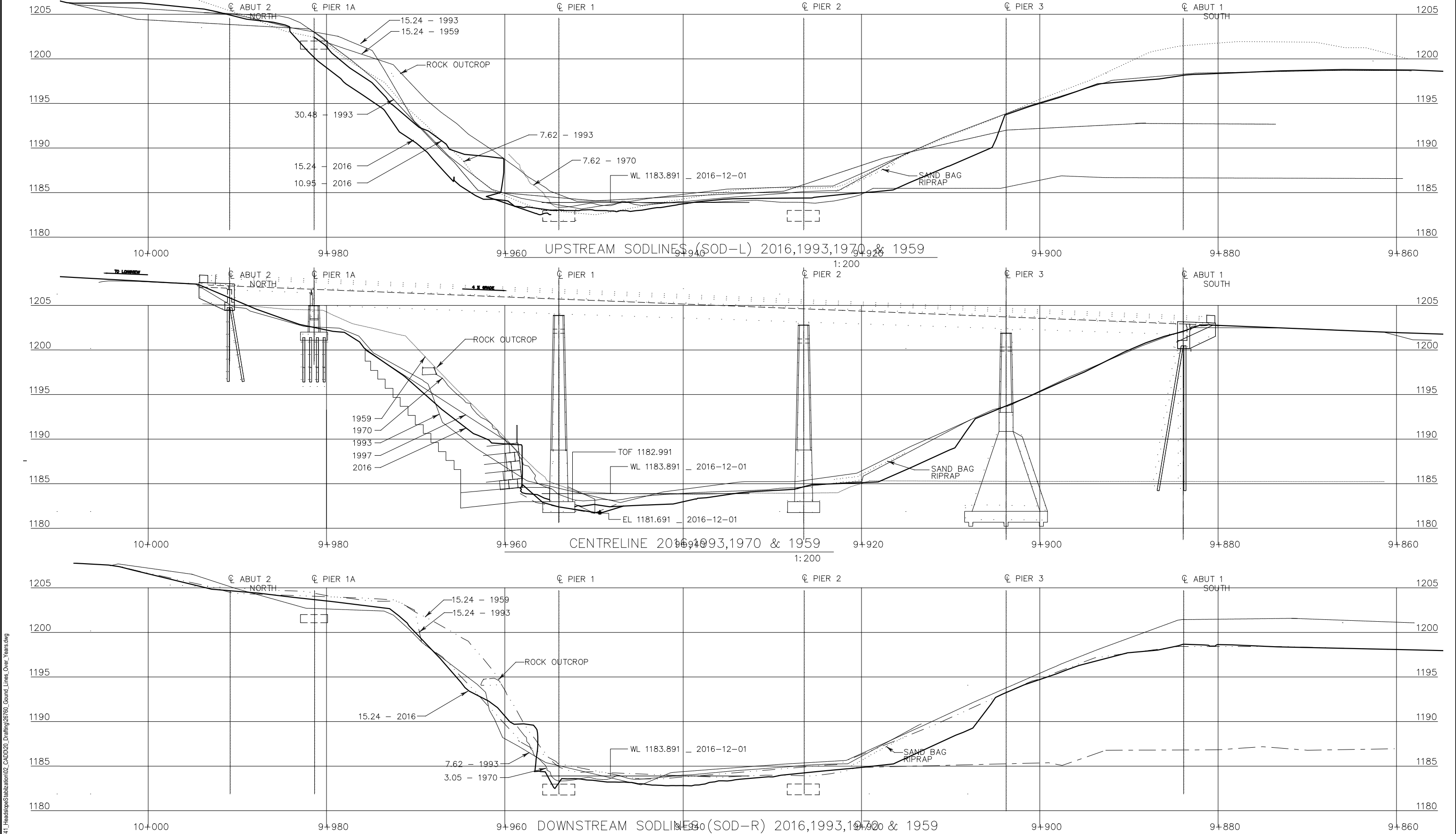
S054; H22:10 Longview Bridge, Inclinator SAA17-02

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## APPENDIX II

### ISL – Historic Ground Slope Profiles

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Doug Savage / Dec. 16, 16 / M:\26700\26760\_BF741\_Headstage\Stationing\2\_CADD\20\_Drafting\26760\_Ground Lines\_Over\_7years.dwg

<div>CONSULTANT</div> <div></div>			<div>DESIGNER</div> <div>DATE <u>DESIGN_DATE</u></div>	<div>CHECKER</div> <div>DATE <u>REVIEW_DATE</u></div>	<div><div><div>5</div><div>?</div><div>?</div></div><div>4</div><div>?</div><div>?</div><div>3</div><div>?</div><div>?</div><div>2</div><div>?</div><div>?</div><div>1</div><div>?</div><div>?</div></div>	<div><div>?</div><div>?</div><div>?</div><div>?</div><div>?</div></div>	<div><div>HIGHWOOD RIVER BRIDGE ON HWY 22, 1 Km S OF LONGVIEW SLOPE STABILIZATION REPORT GROUND LINES 1959 TO 2016</div></div>			
					<div>REV</div> <div>DATE</div> <div>REVISION</div> <div>BY</div>	<div>DATE</div> <div>2016-12-16</div> <div>LOCATION</div> <div>NE17-18-2-5</div> <div>SITE</div> <div>BF 1741</div>	<div>CONTRACT</div> <div>CONTRACT</div> <div>HIGHWAY</div> <div>HWY 22</div> <div>SHEET</div> <div>? OF ?</div> <div>DRAWING</div> <div>SK-4</div>			