



TECHNICAL MEMORANDUM

DATE September 19, 2024

Reference No. CA0029692.9234-TM-02-Rev1

TO Vanessa Heilman, P.Eng.
City of Saskatoon

FROM Blaise Wilson, Hung Vu

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hung.vu@wsp.com

NUTANA SLOPE STABILITY UPDATE – AUGUST 2024

1.0 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the City of Saskatoon (COS) to complete the monitoring of select geotechnical instrumentation and provide the monitoring data results for the slope failures (referred to as the west slide and east slide) at the Nutana Slope Instability site. Locations of the slope inclinometers and tilt plates are shown in Figure 1.

1.1 Background

The west slide occurred in June 2012 and impacted a slope area approximately 70 m (230 ft) long and 40 m (130 ft) wide. It is most pronounced in the back yards of 229, 231, 233/235, and 237/239 11th Street East, through the back alley, and into the back yard of 222 Saskatchewan Crescent East.

The east slide occurred in June 2013 and impacted a slope area of approximately 50 m (165 ft) long and 30 m (100 ft) wide. It is most pronounced in the back yards of 303, 305, 307, and 309 11th Street East, through the back alley, and into the back yard of 306, 310 and 316 Saskatchewan Crescent East.

2.0 FIELD MONITORING RESULTS

Instrumentation monitoring of the slope inclinometers and tilt plates were collected by WSP on August 12, 2024. The monitoring results for this period are summarised below. Photos of the site conditions are attached to this memorandum in Appendix A. The results of the instrumentation monitoring are presented in Appendix B.

2.1 Slope Inclinometer Data

The slope inclinometer monitoring plots are shown in Appendix B:

- Inclinometer COS-13-002 indicated insignificant movement (less than 2 mm or 0.08 in), between May 8 and August 12, 2024.
- Inclinometer COS-13-004 showed a drift in the displacement plots with less than 2mm (0.08 in) between August 16, 2023 and August 12, 2024.
- Inclinometer COS-13-005 indicated insignificant movement (less than 2 mm or 0.08 in) between August 16, 2023 and May 8, 2024.

- Inclinometer 20-109 indicated approximately 25 mm of cumulative downslope movement between October 28, 2020 and August 12, 2024, including 4.5 mm (0.18 in) of movement between May 8 and August 12, 2024. The zone of movement is approximately 2.5 m below the top of casing. The rate of slope movement increases from approximately 1 mm/yr between October 28, 2020 and May 5, 2022 to 6 mm/yr between May 5, 2022 and August 12, 2024.
- Inclinometer 20-111 indicated approximately 2.5 mm (0.10 in) of movement in the upslope direction, between May 8, 2024 and August 12, 2024.

2.2 Tilt Plate Data

The results of the tilt plate monitoring are shown on Figure B1 for the City of Saskatoon tilt plates, and in Figure B2 for the tilt plates installed on Saskatoon Light and Power power poles:

- Tilt plates TP4, TP5, TP6 and TP7 indicate insignificant changes in angle of tilt (less than 0.05 degrees) between August 2019 and August 2024.
- Tilt Plate SLP3 indicated a change in angle of tilt of approximately 0.10 degrees, towards the south, between May 8 and August 12, 2024. However, past readings for SLP3 have been erratic and appear to be affected by seasonal changes.
- Tilt Plate SLP4 indicated an increased change in angle of tilt in this monitoring period, with a change in angle of tilt of approximately 0.10 degrees, towards the north, between May 8 and August 12, 2024. This change trend will be confirmed in the next monitoring period.
- Tilt plate SLP5 indicated an insignificant change in angle of tilt (less than 0.05 degrees) between August 16, 2023 and August 12, 2024.
- Tilt plate SLP6 indicated a change in angle of tilt of approximately 0.08 degrees, towards the south, between May 8 and August 12, 2024.

3.0 RECOMMENDATIONS

Slope inclinometer 20-109 indicates a zone of movement a depth of approximately 2.5 m below the top of casing with a rate of movement approximately 6 mm/yr between May 5, 2022 and August 12, 2024, an increase from 1 mm/yr for the period between October 28, 2020 and May 5, 2022. WSP recommends that COS consider increasing the frequency of monitoring for the two inclinometers located in the west slide (20-109 and 20-111). WSP could assist with additional instrumentation monitoring if COS requests.

4.0 CLOSURE

This memorandum provides a factual summary of the instrumentation monitoring results from the August 2024 period. WSP is providing this information for the specific use of the City of Saskatoon. No other party may rely on the information provided herein, or any portion thereof. This memorandum is not intended to serve as a geotechnical assessment and therefore should not be used as the geotechnical basis for any future developments.

We trust that this memorandum provides you with the information you require at this time.

WSP Canada Inc.



Blaise Wilson, P.Eng.
Senior Geotechnical Engineer

Hung Vu, Ph.D., P.Eng.
Senior Principal Geotechnical Engineer

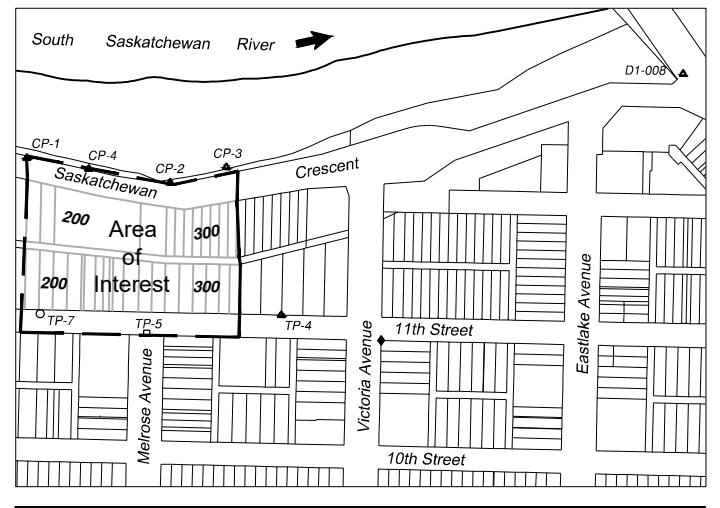
BW/HV/jlb

Attachments: Figure 1: Instrumentation Plan
Appendix A: Site Photographs
Appendix B: Instrumentation Monitoring Results

APPENDIX A

Figures

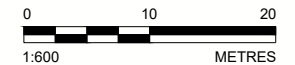
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LEGEND

- TILT PLATE LOCATION
- SLOPE INCLINOMETER
- POWER POLES
- 303** LOT NUMBER

REFERENCE(S)
 LOT LOCATIONS PROVIDED BY CITY OF SASKATOON
 CITY OF SASKATOON DATUM
 IMAGE OBTAINED FROM GOOGLE EARTH © 2024 GOOGLE INC. USED WITH PERMISSION. GOOGLE AND GOOGLE LOGO ARE REGISTERED TRADEMARKS OF GOOGLE INC. IMAGERY DATE: OCTOBER 14, 2023. GOOGLE EARTH IMAGE IS NOT TO SCALE.



CLIENT

PROJECT
 NUTANA SLOPE INSTABILITY

TITLE
INSTRUMENTATION LOCATION PLAN

CONSULTANT	YYYY-MM-DD	2024-09-18
	DESIGNED	BW
	PREPARED	SL
	REVIEWED	BW
	APPROVED	HV

PROJECT NO. CA0029692.9234 CONTROL 1000 REV. 0 FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANS/B 25 mm

APPENDIX B

Site Photographs



Photograph 1: Looking west down the back alley at the East Failure (August 12, 2024)



Photograph 2: Looking west down the back alley at the West Failure (August 12, 2024)

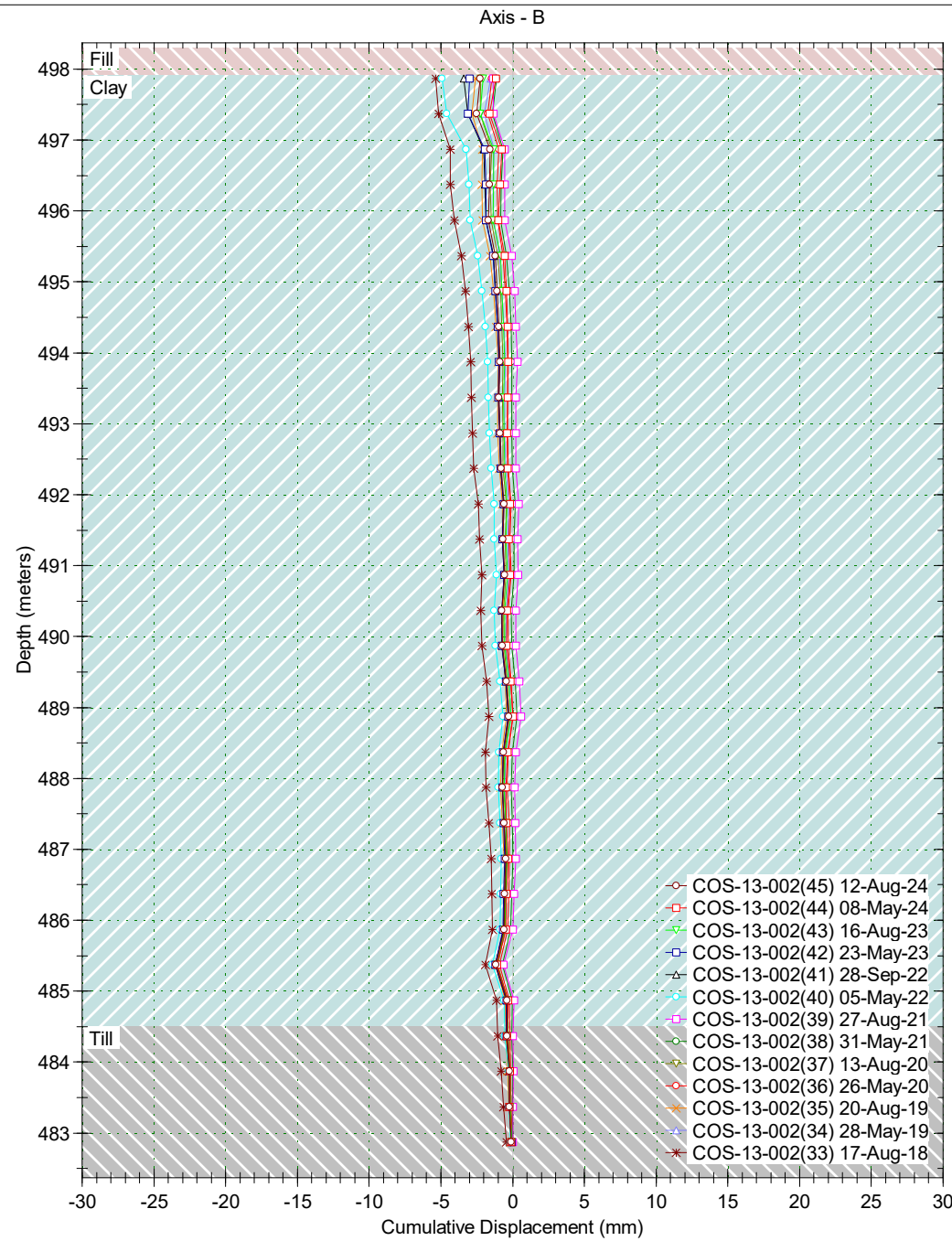
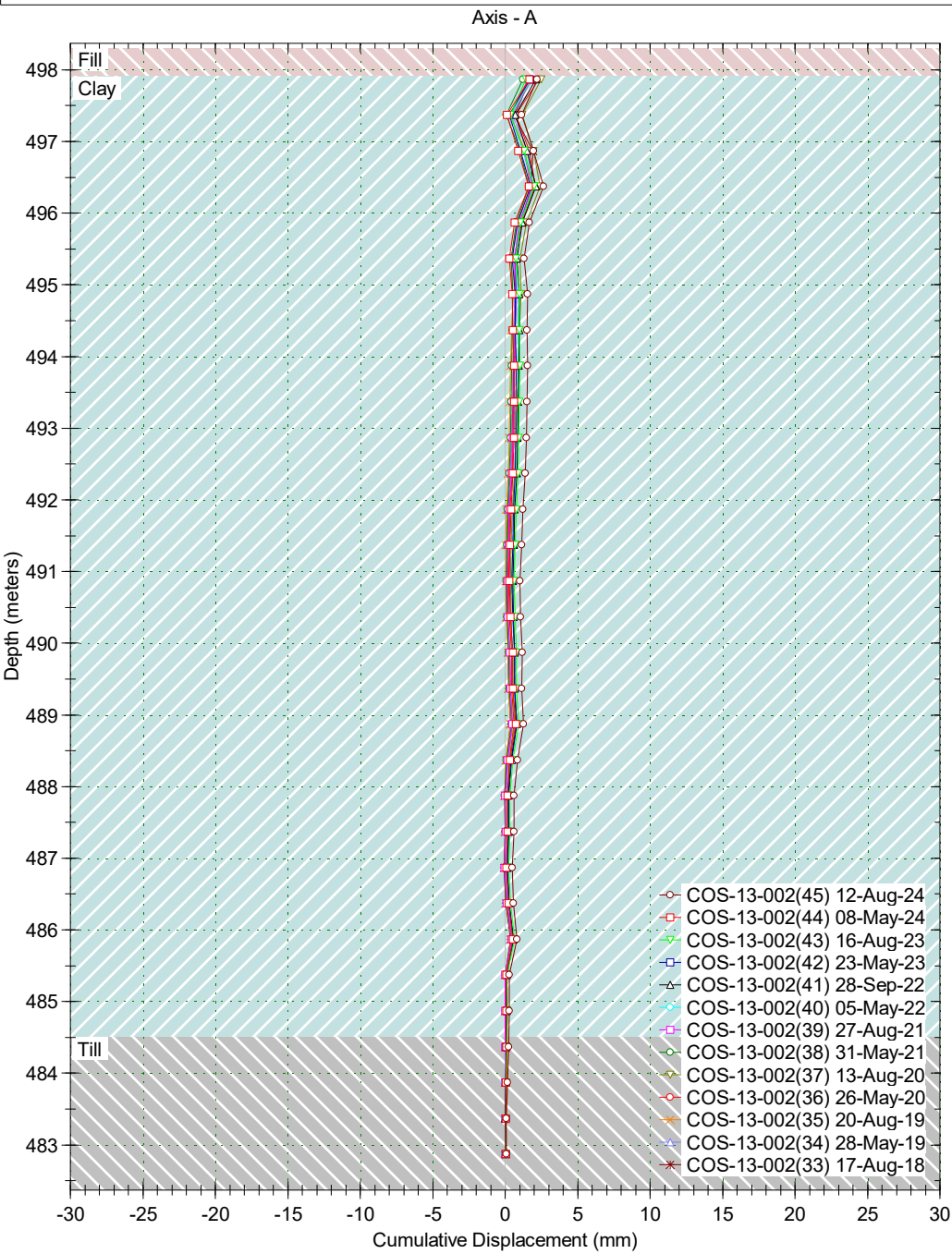
APPENDIX C

Instrumentation Monitoring Results

SLOPE INCLINOMETERS

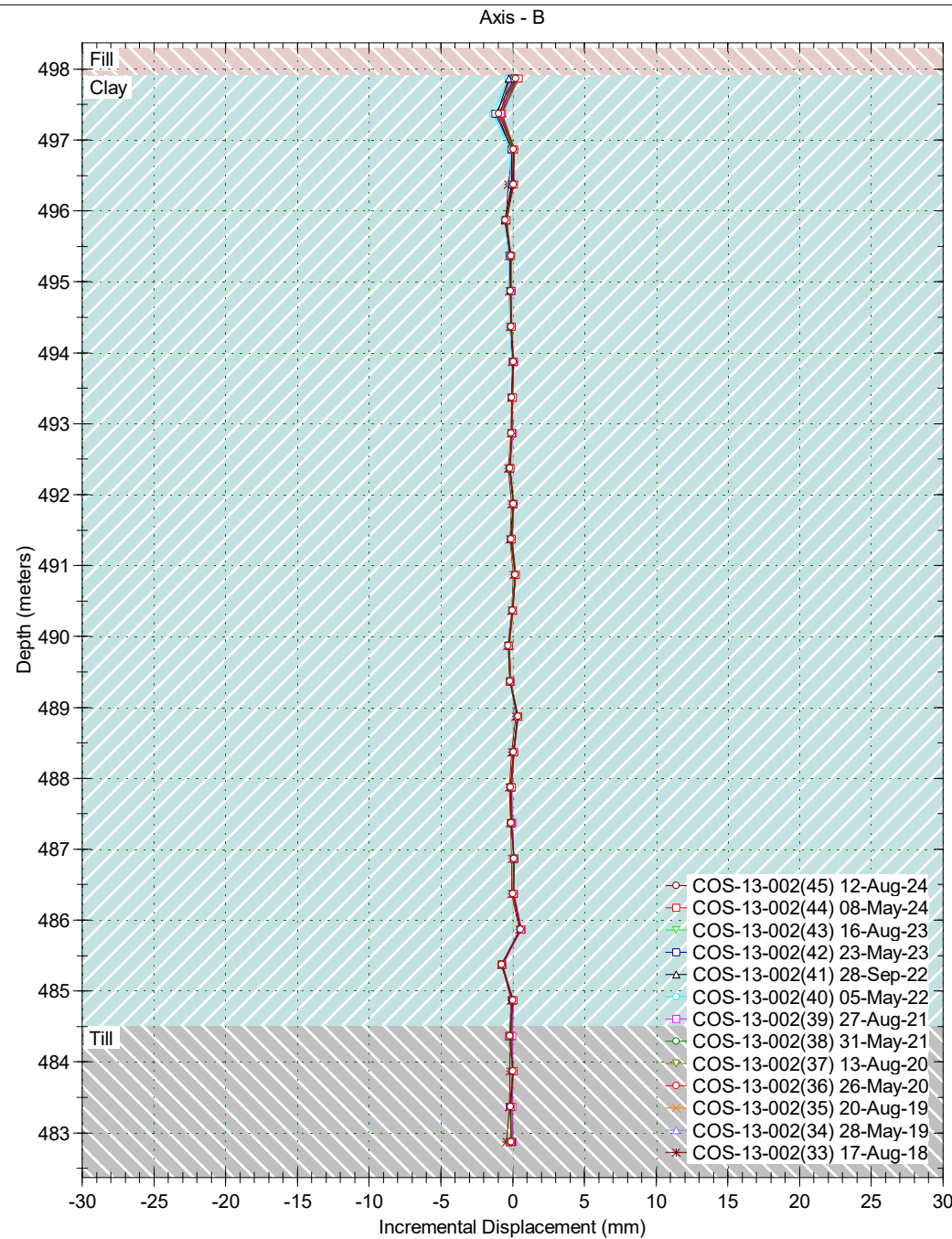
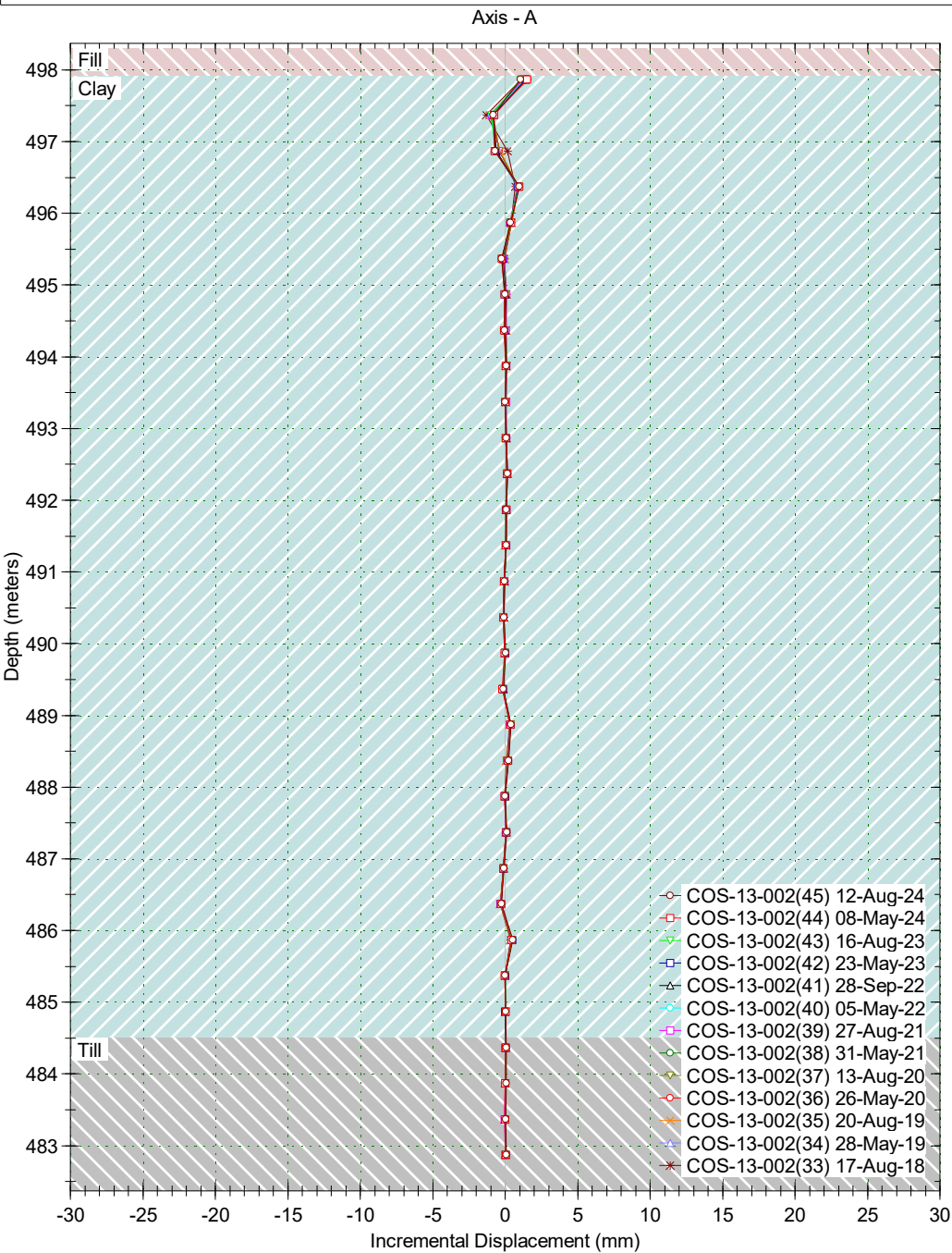
Borehole : COS-13-002
 Project : Nutana Slope
 Location : 307 11th St. E. (Front)
 Northing : 5775567.41
 Easting : 386043.54
 Collar : -0.113

Spiral Correction : N/A
 Collar Elevation : :498.37 meters
 Reading Depth : 15.5 meters
 A+ Groove Azimuth :
 Base Reading : 2013 Jul 30 16:18
 Applied Azimuth : 0.0 degrees



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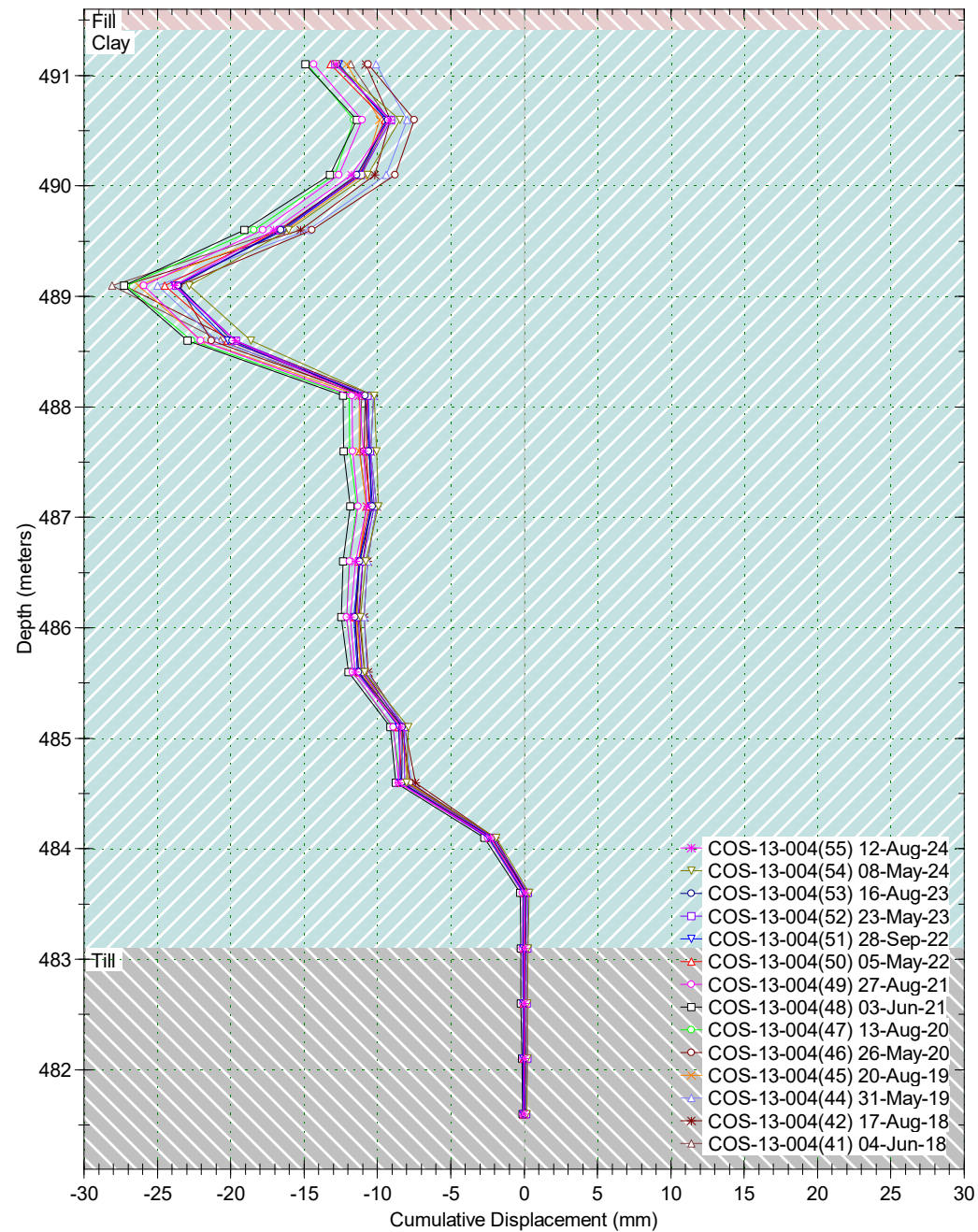
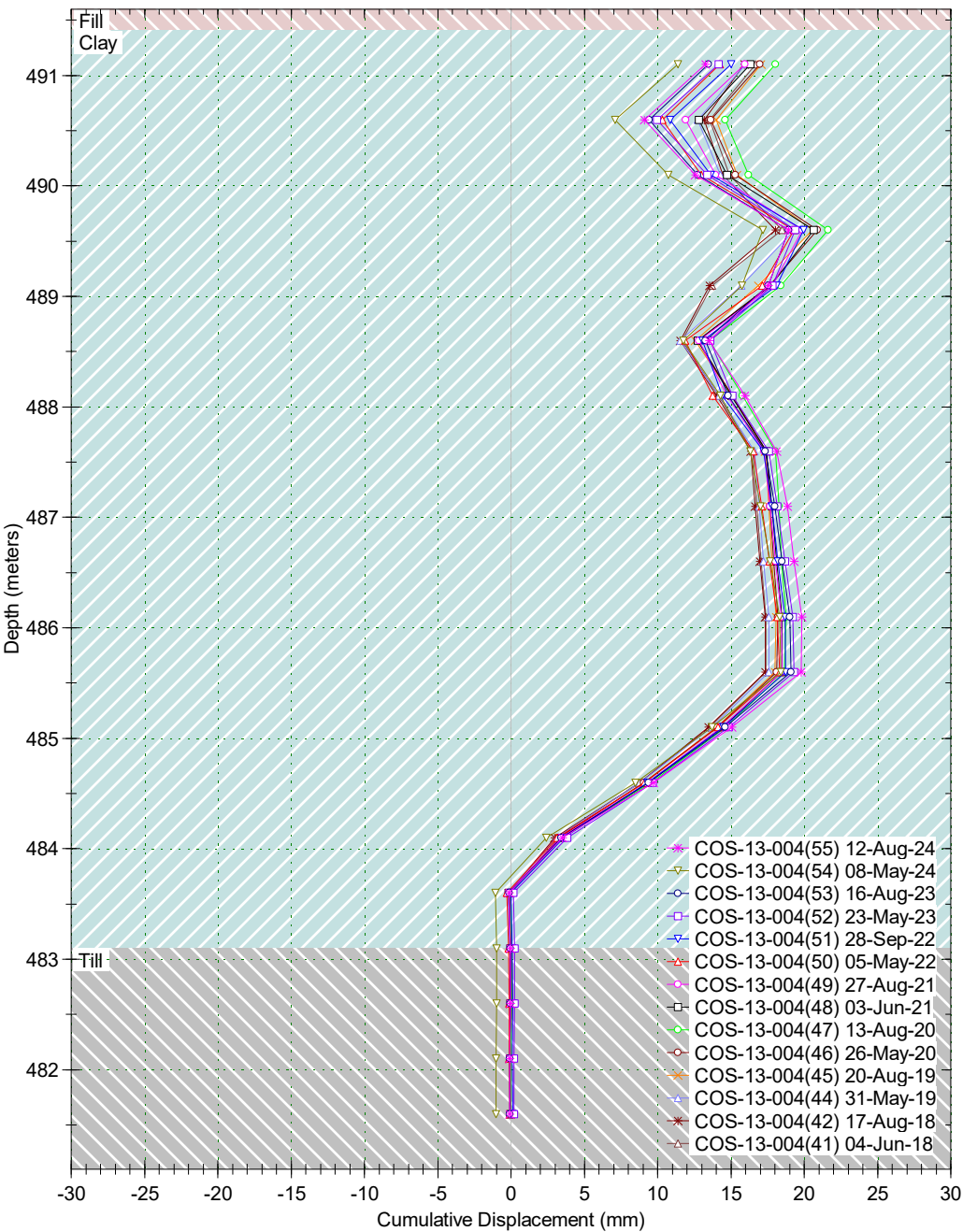


Borehole : COS-13-004
 Project : Nutana Slope
 Location : 307 11th. St. E. (back)
 Northing : 5775604.97
 Easting : 386050.63
 Collar : -0.677

Spiral Correction : N/A
 Collar Elevation : :491.60 meters
 Reading Depth : 10.0 meters
 A+ Groove Azimuth :
 Base Reading : 2013 Aug 28 08:30
 Applied Azimuth : 0.0 degrees

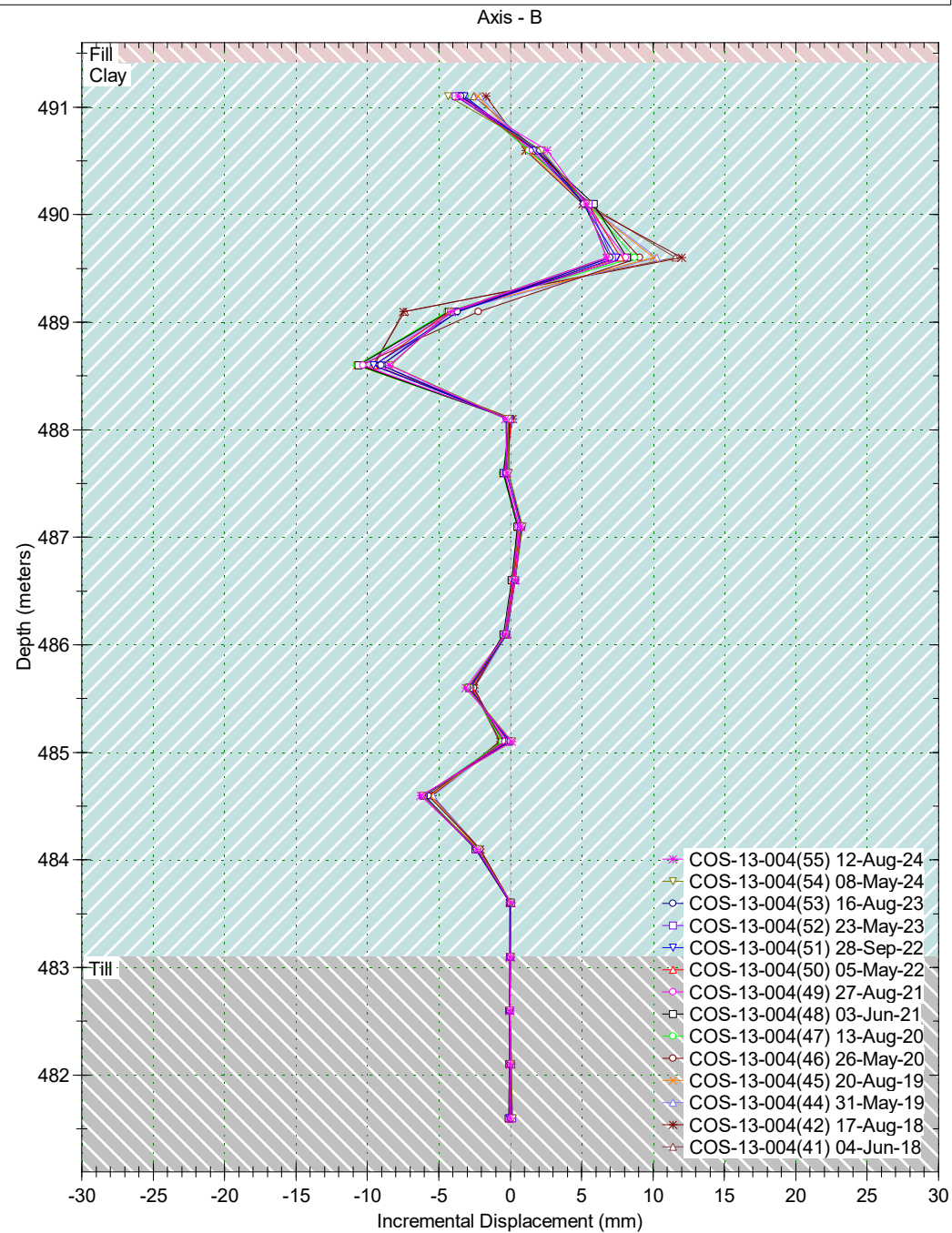
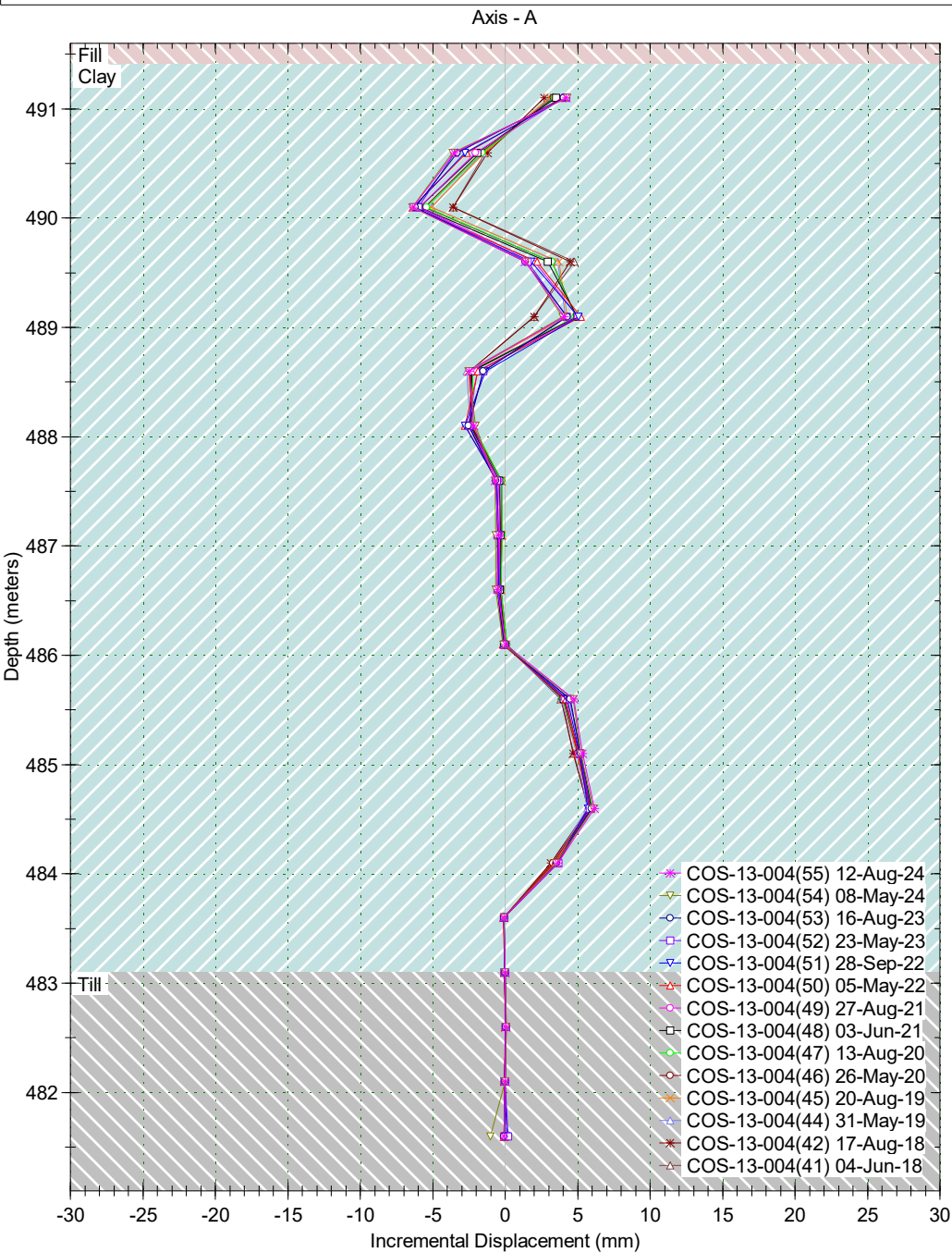
Axis - A

Axis - B



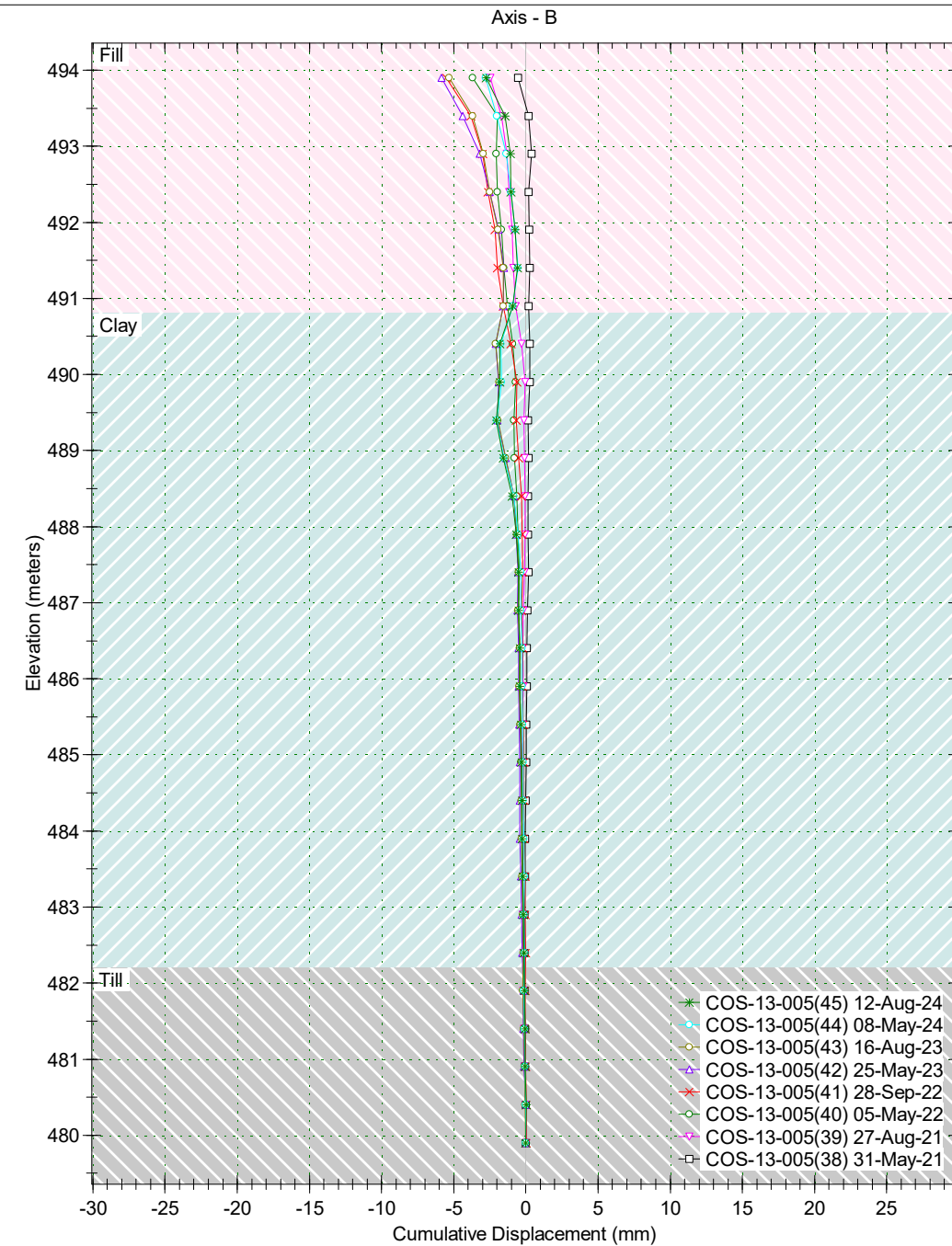
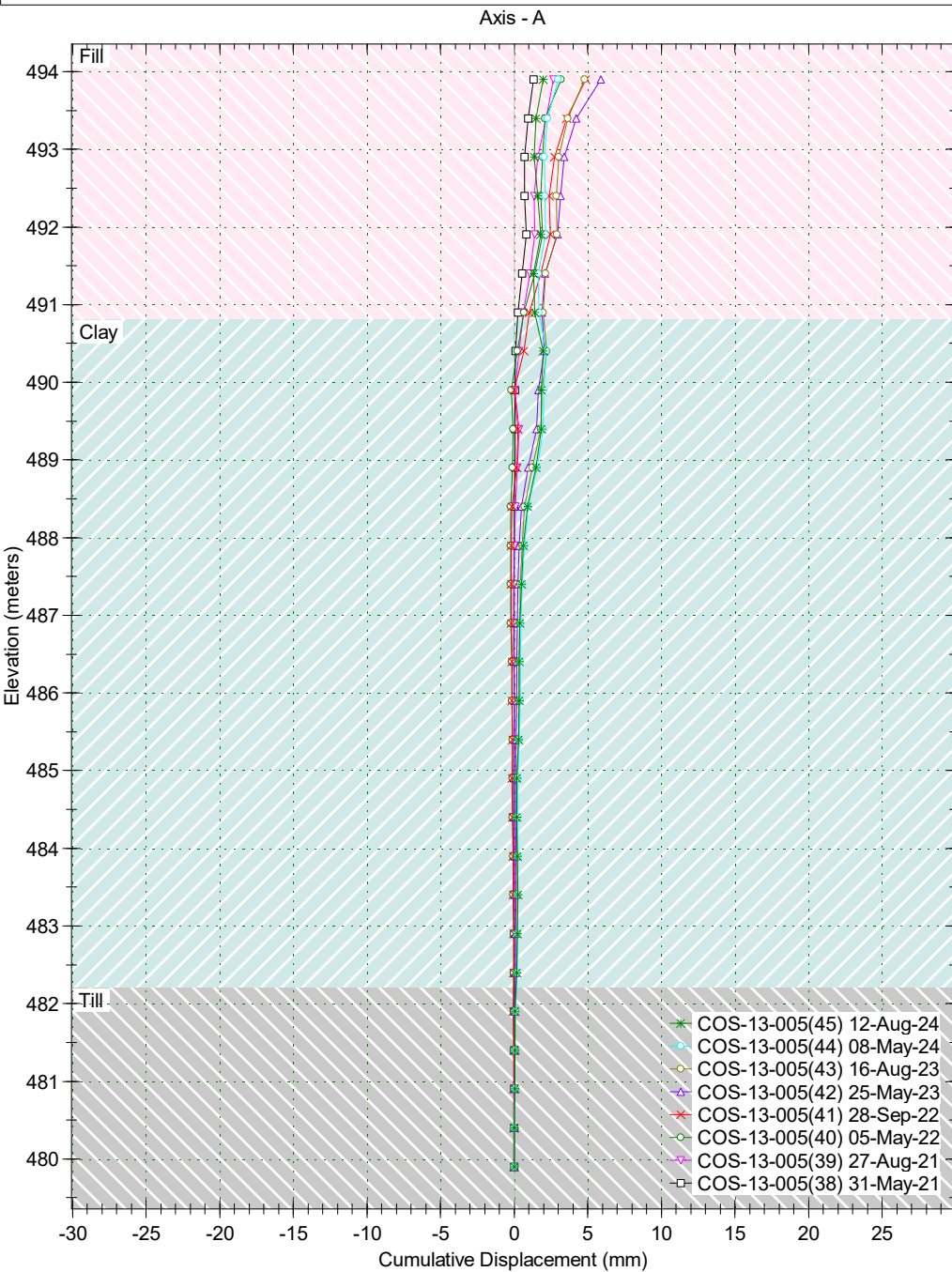
Borehole : COS-13-004
 Project : Nutana Slope
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 Northing : 5775604.97
 Easting : 386050.63
 Collar : -0.677

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 Collar Elevation : :491.60 meters
 Reading Depth : 10.0 meters
 A+ Groove Azimuth :
 Base Reading : 2013 Aug 28 08:30
 Applied Azimuth : 0.0 degrees



Borehole : COS-13-005 (Aug 13 2020 Baseline)
Project : Nutana Slope
Location : 316 Sask. Cres. E.
Northing : 5775631.299
Easting : 386078.8467
Collar : -0.1

Spiral Correction : N/A
Collar Elevation : :494.40 meters
Reading Depth : 14.5 meters
A+ Groove Azimuth :
Base Reading : 2020 Aug 13 12:59
Applied Azimuth : 0.0 degrees

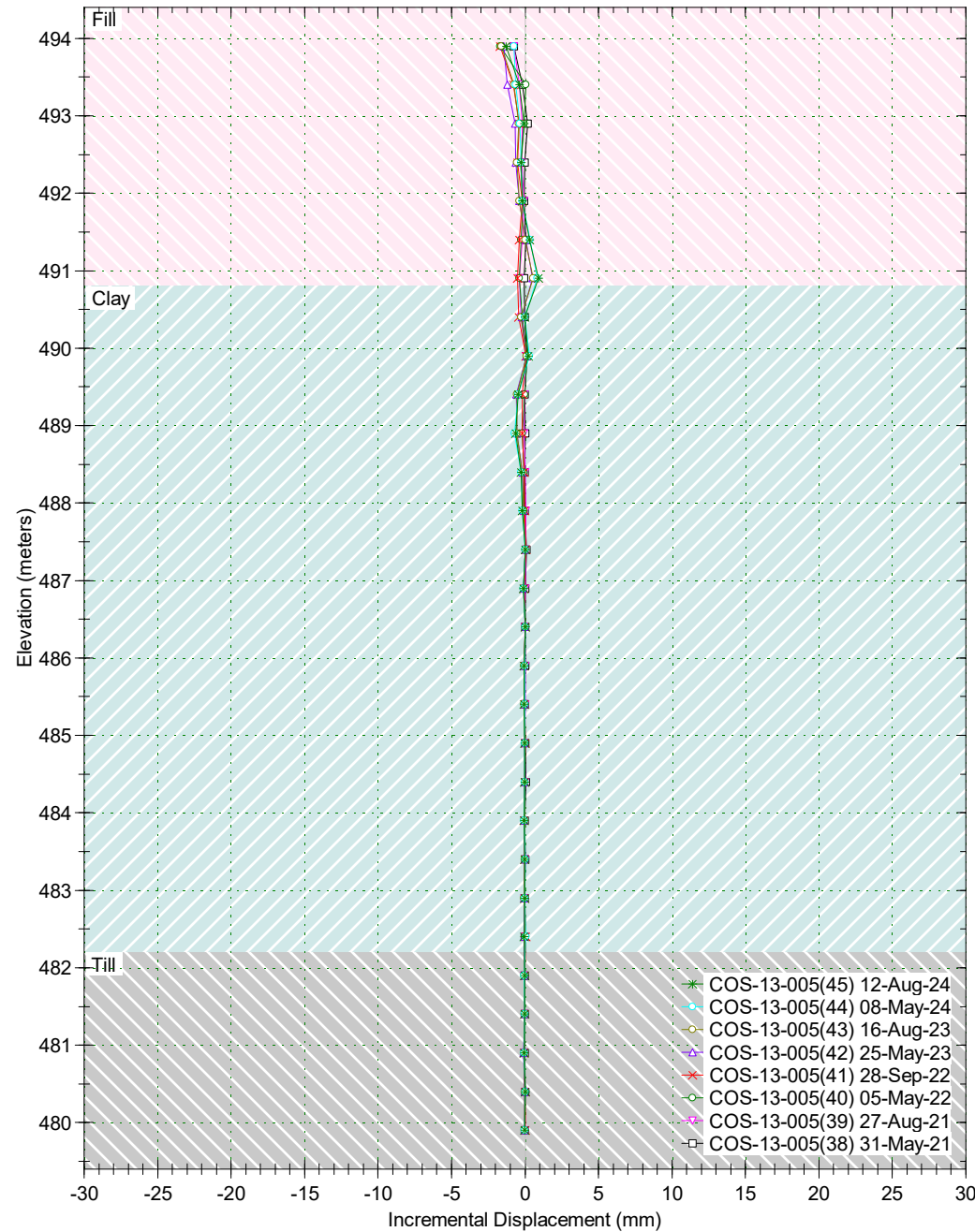
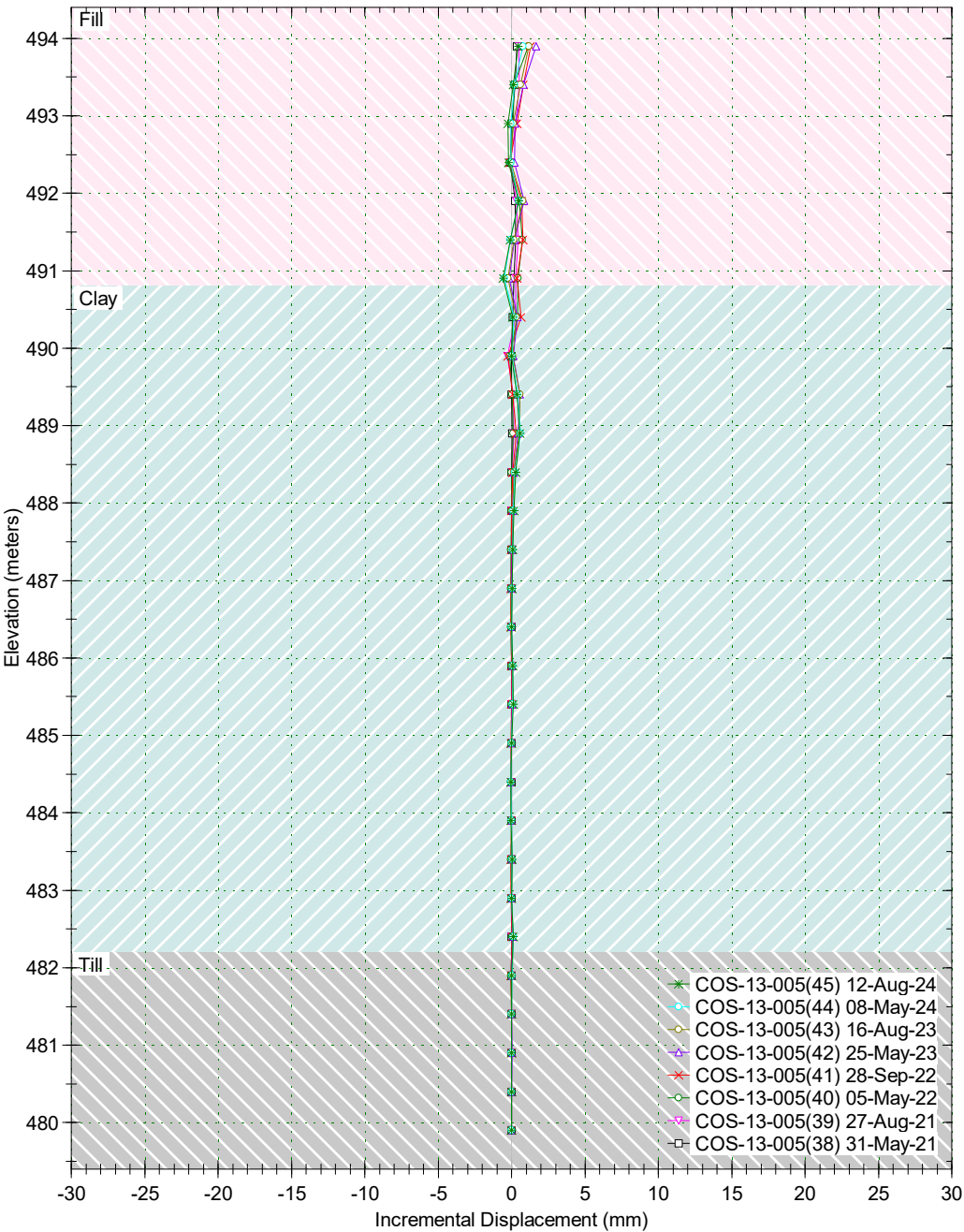


Borehole : COS-13-005 (Aug 13 2020 Baseline)
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 Reading Depth : 14.5 meters
 A+ Groove Azimuth :
 Base Reading : 2020 Aug 13 12:59
 Applied Azimuth : 0.0 degrees

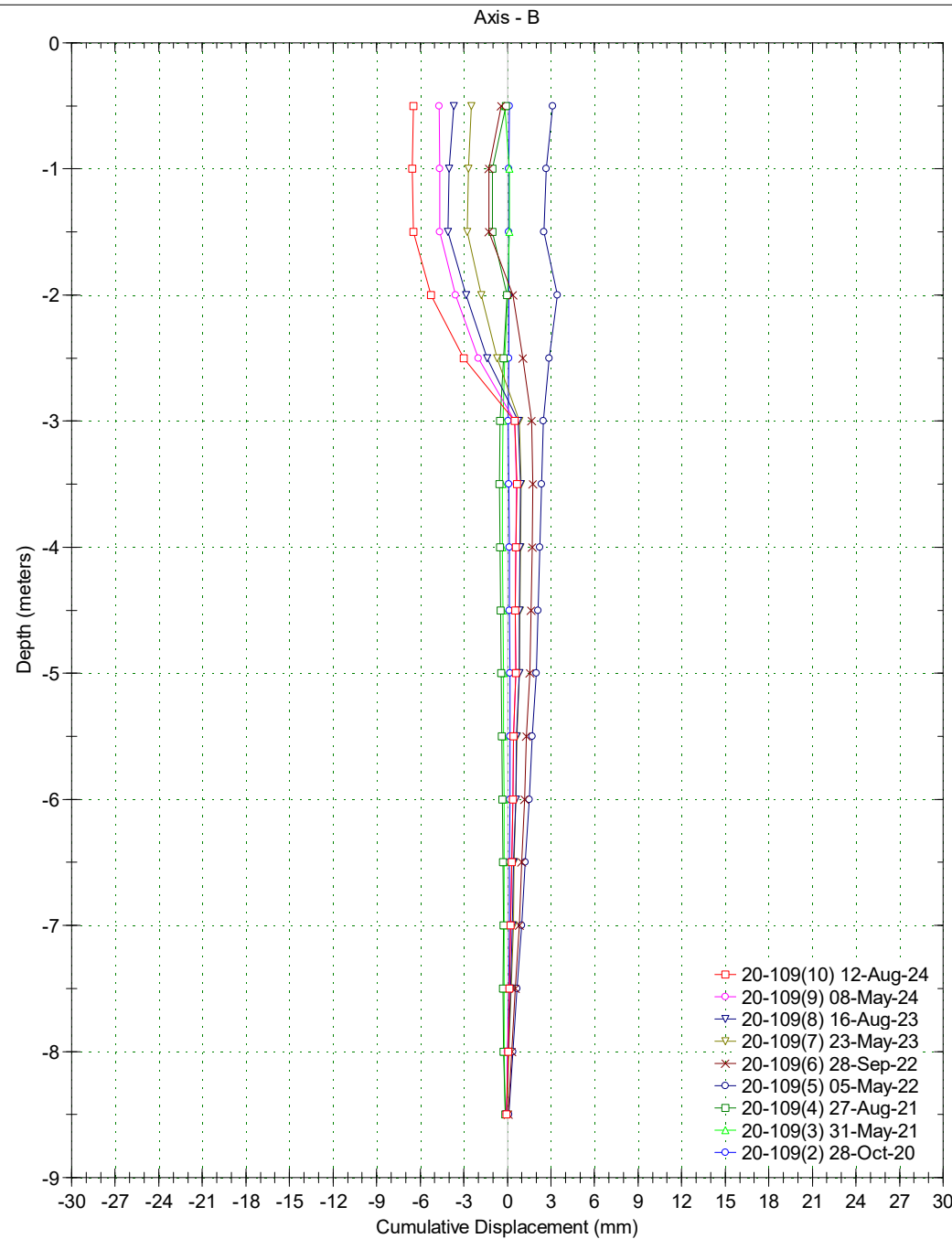
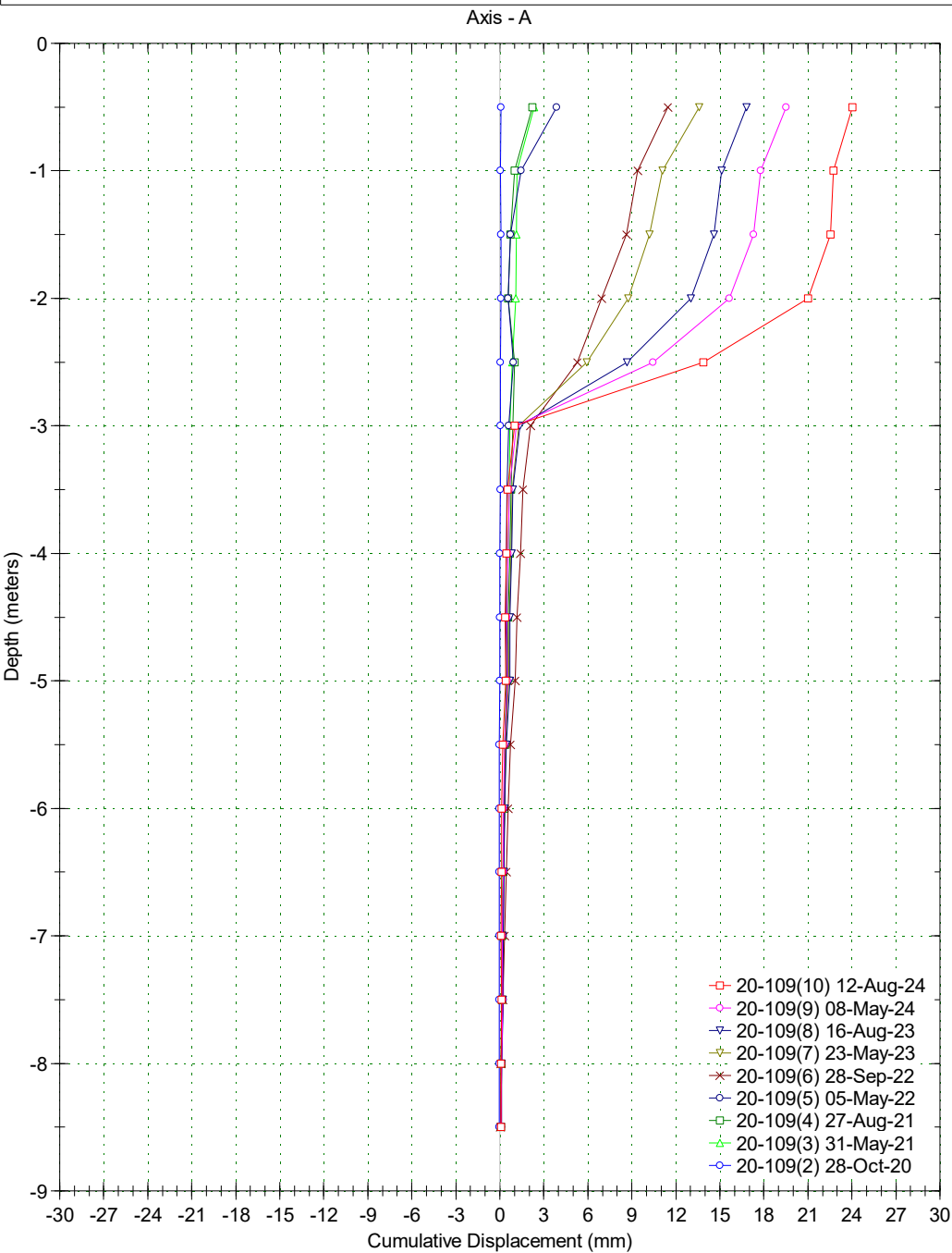
Axis - A

Axis - B



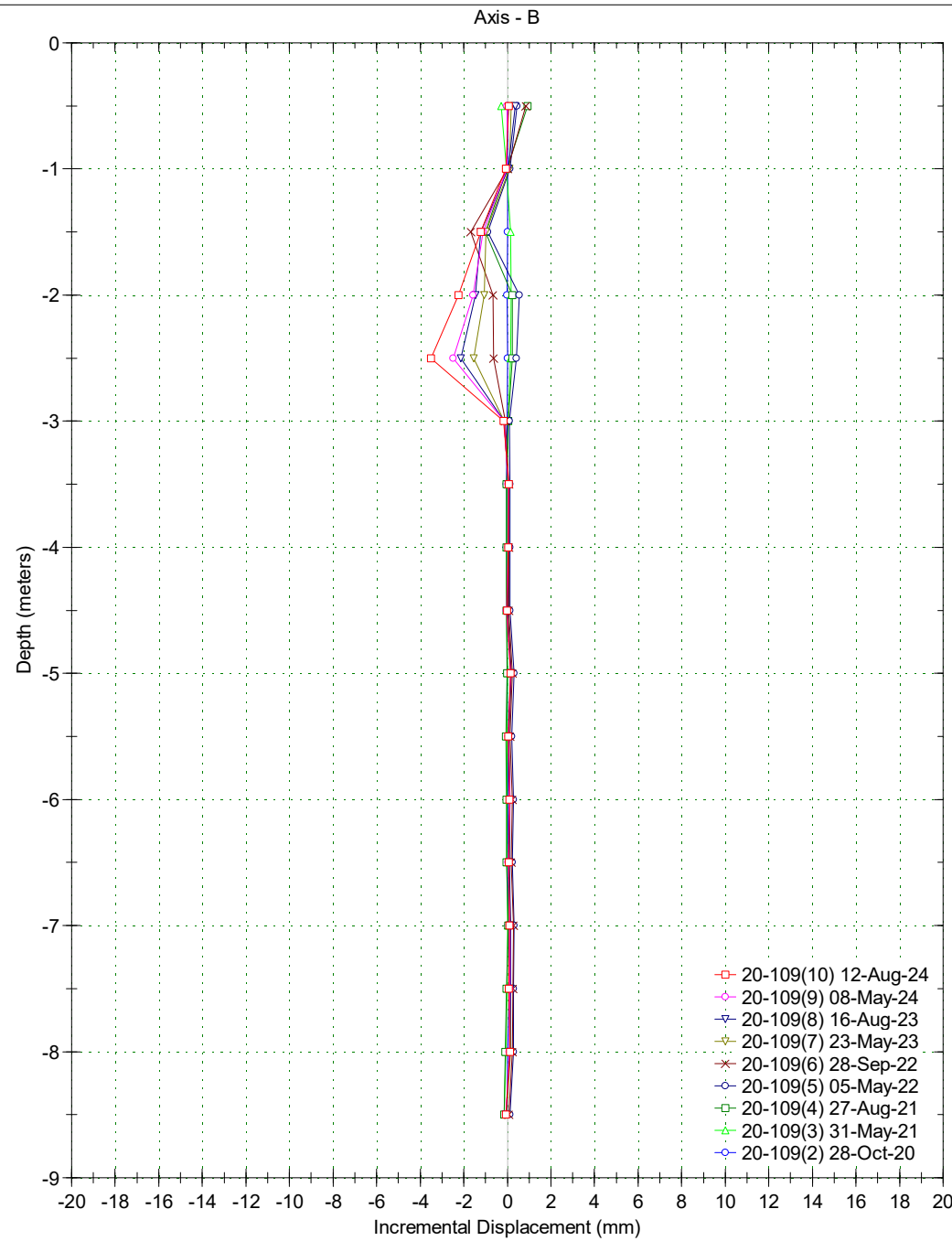
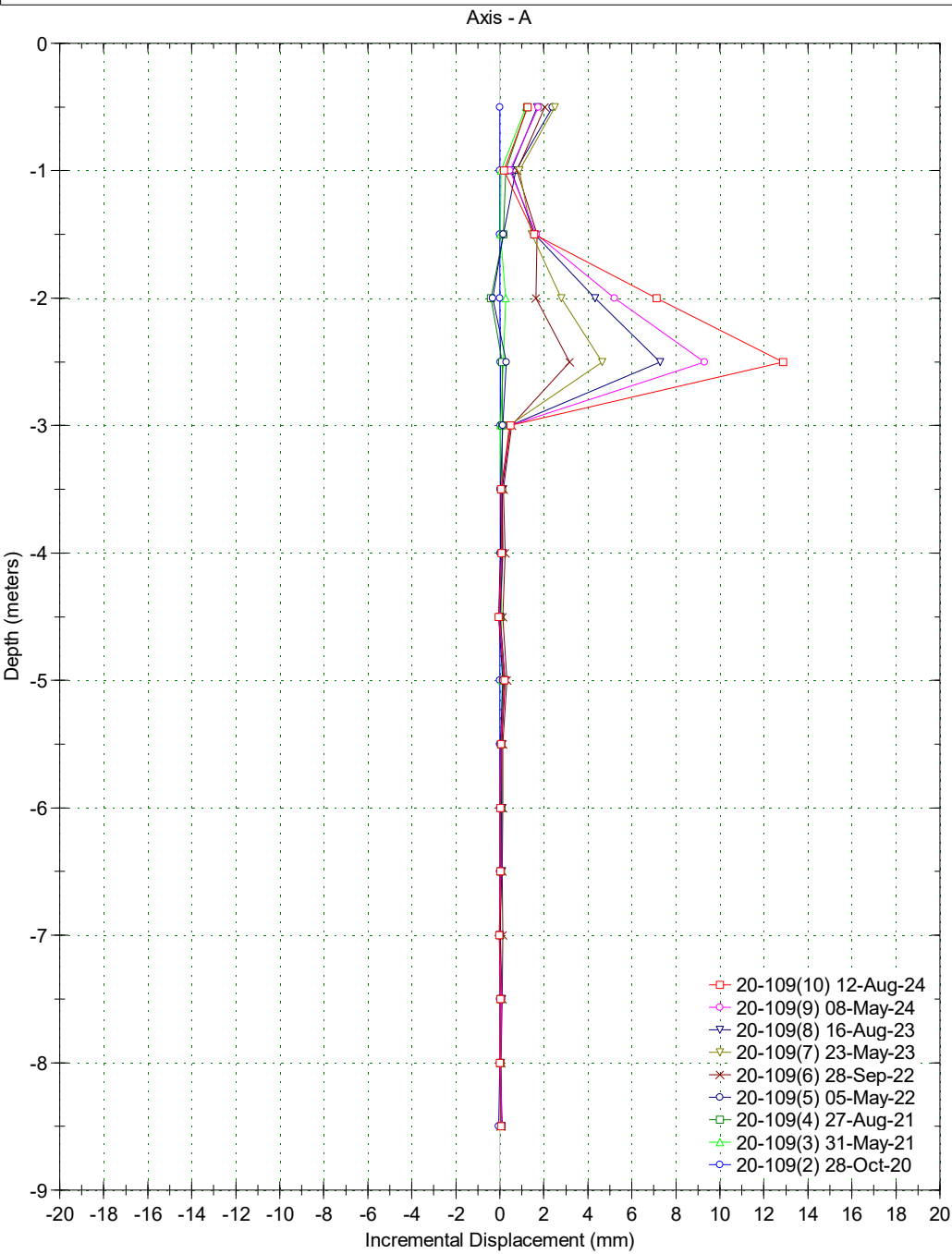
Borehole : 20-109
Project : Nutana Slope
Location :
Northing : 5775622
Easting : 385977
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 8.5 meters
A+ Groove Azimuth :
Base Reading : 2020 Oct 28 16:29
Applied Azimuth : 0.0 degrees



Borehole : 20-109
Project : Nutana Slope
Location :
Northing : 5775622
Easting : 385977
Collar :

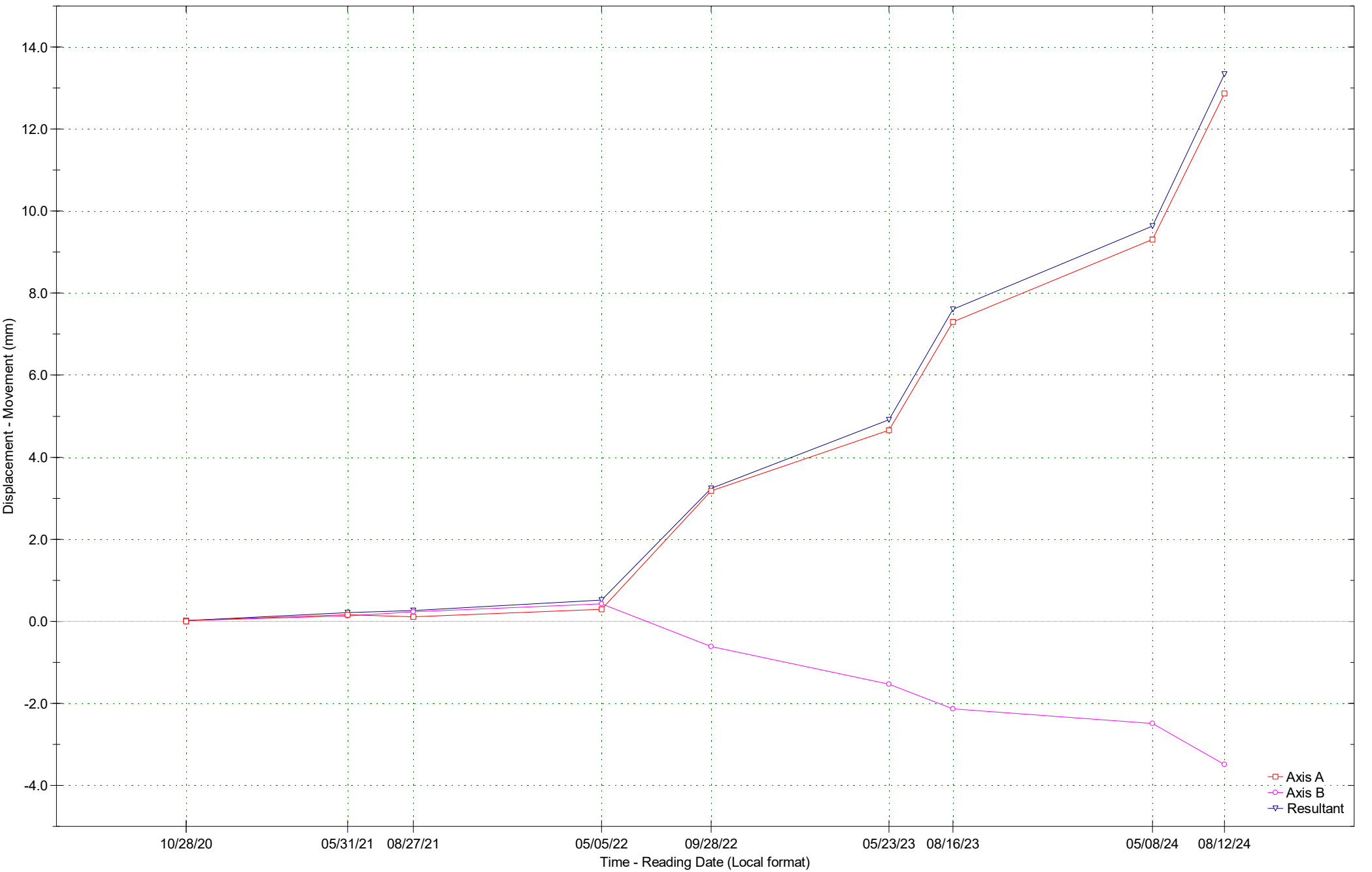
Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 8.5 meters
A+ Groove Azimuth :
Base Reading : 2020 Oct 28 16:29
Applied Azimuth : 0.0 degrees



Borehole : 20-109
Project : Nutana Slope
Location :
Northing : 5775622
Easting : 385977
Collar :
Collar Elev : 0.00 meters

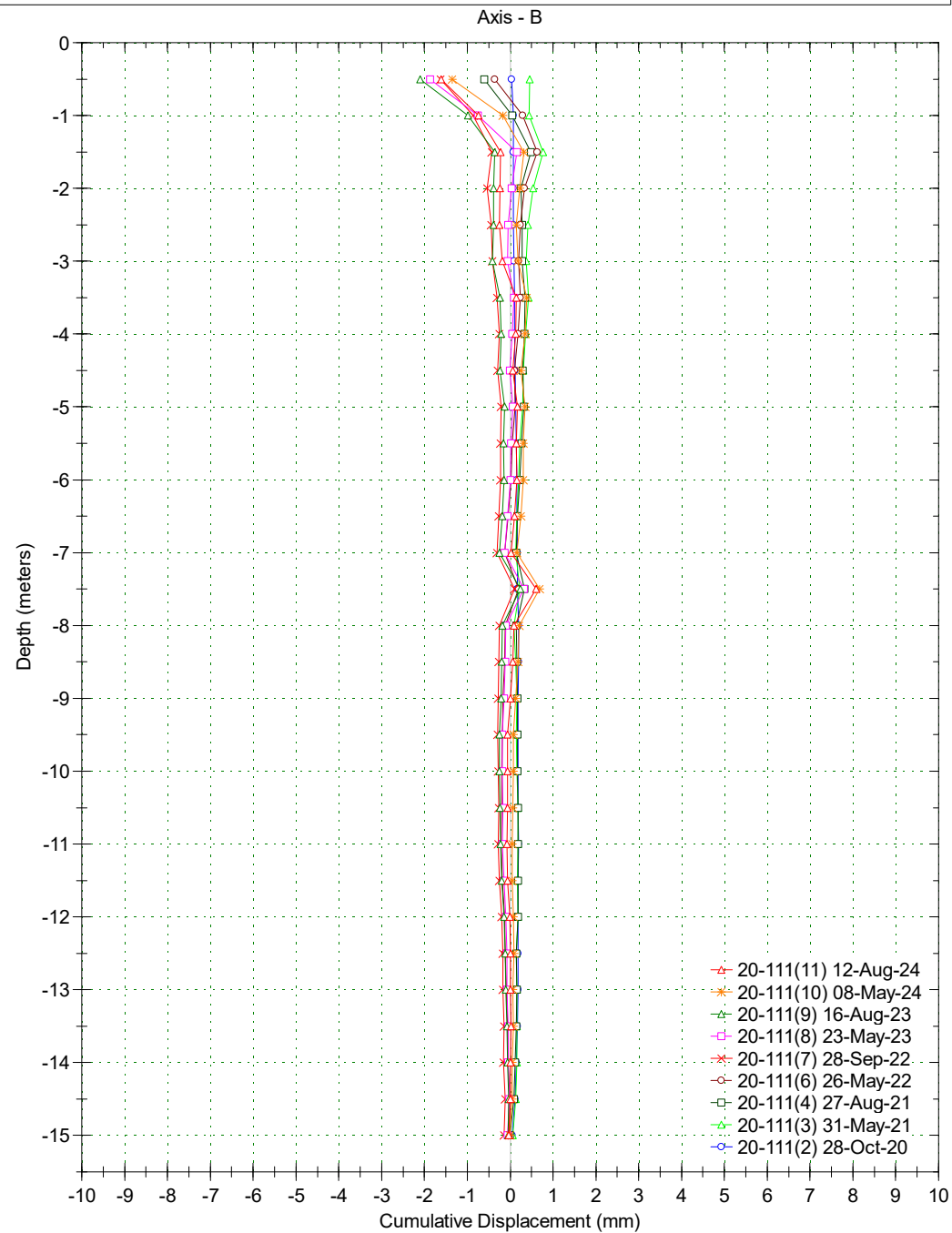
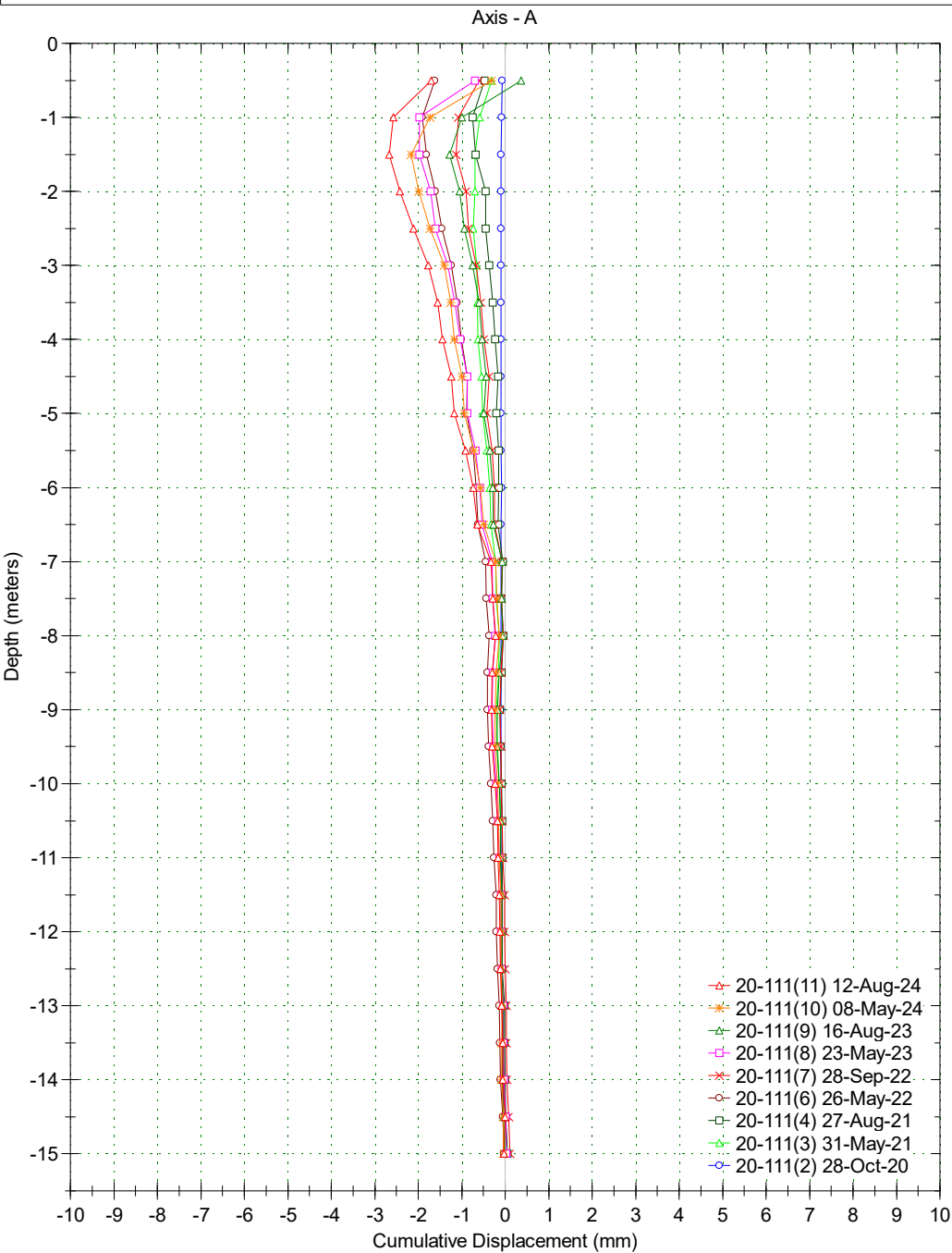
Spiral Correction : N/A
Custom Movement Zone: 2.5 - 2.5 meters
Reading Depth : 8.5 meters
A+ Groove Azimuth :
Latest Reading : 2024 Aug 12 12:36
Initial Reading : 2020 Oct 28 16:29
Applied Azimuth : 0.0 degrees

Time Plot : 2.5 - 2.5 meters



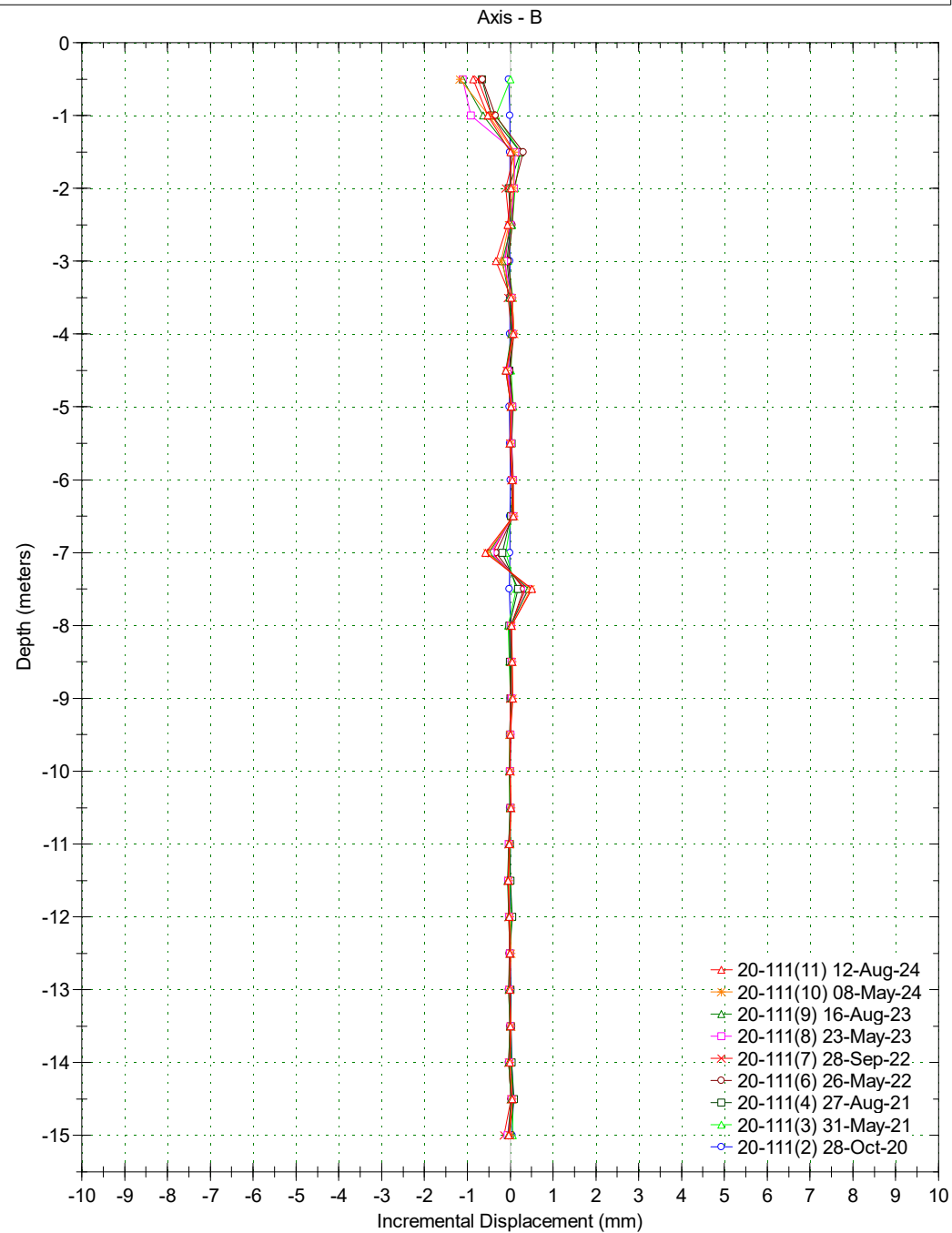
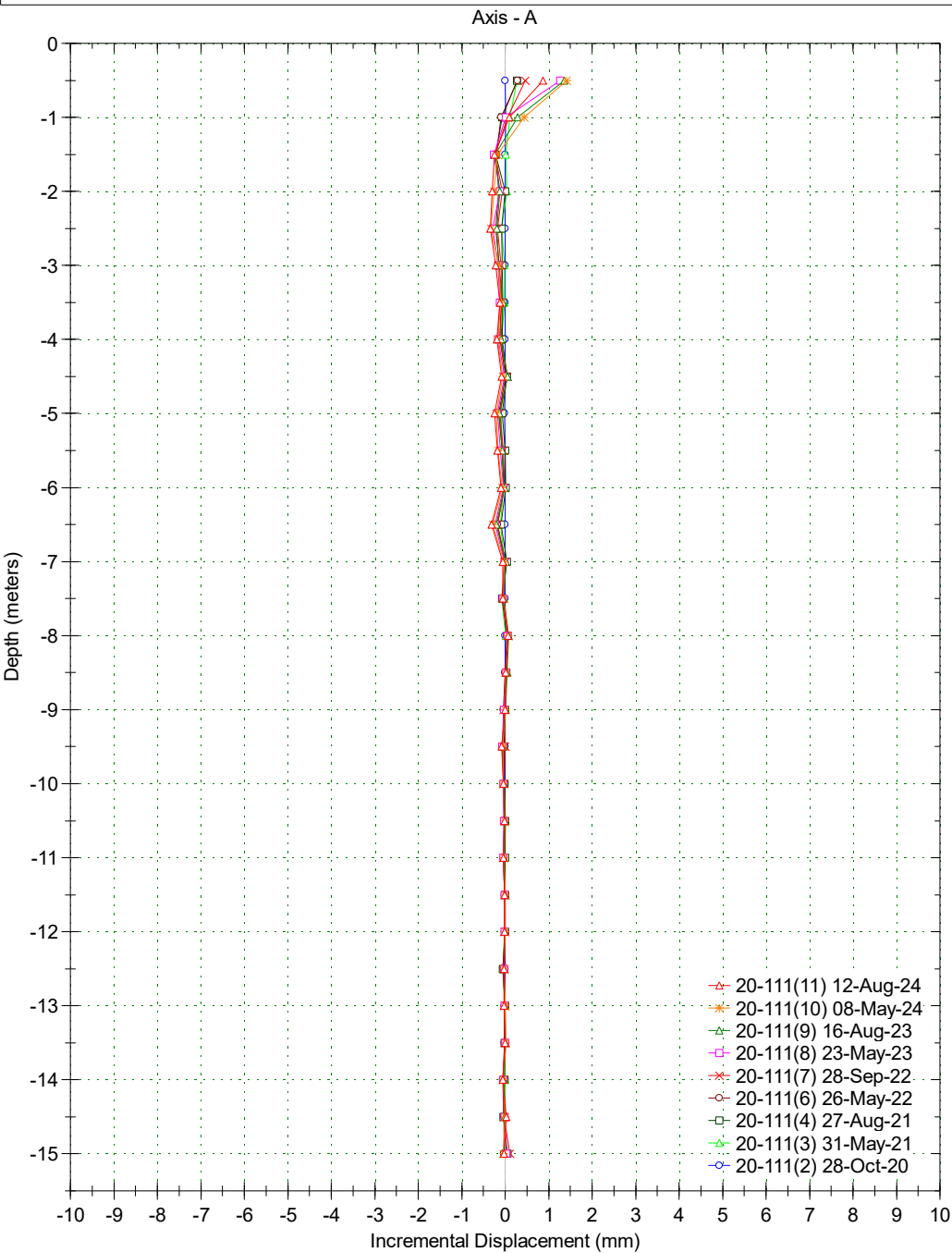
Borehole : 20-111
Project : Nutana Slope
Location :
Northing : 5775568
Easting : 385953
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 15.0 meters
A+ Groove Azimuth :
Base Reading : 2020 Oct 28 15:01
Applied Azimuth : 0.0 degrees

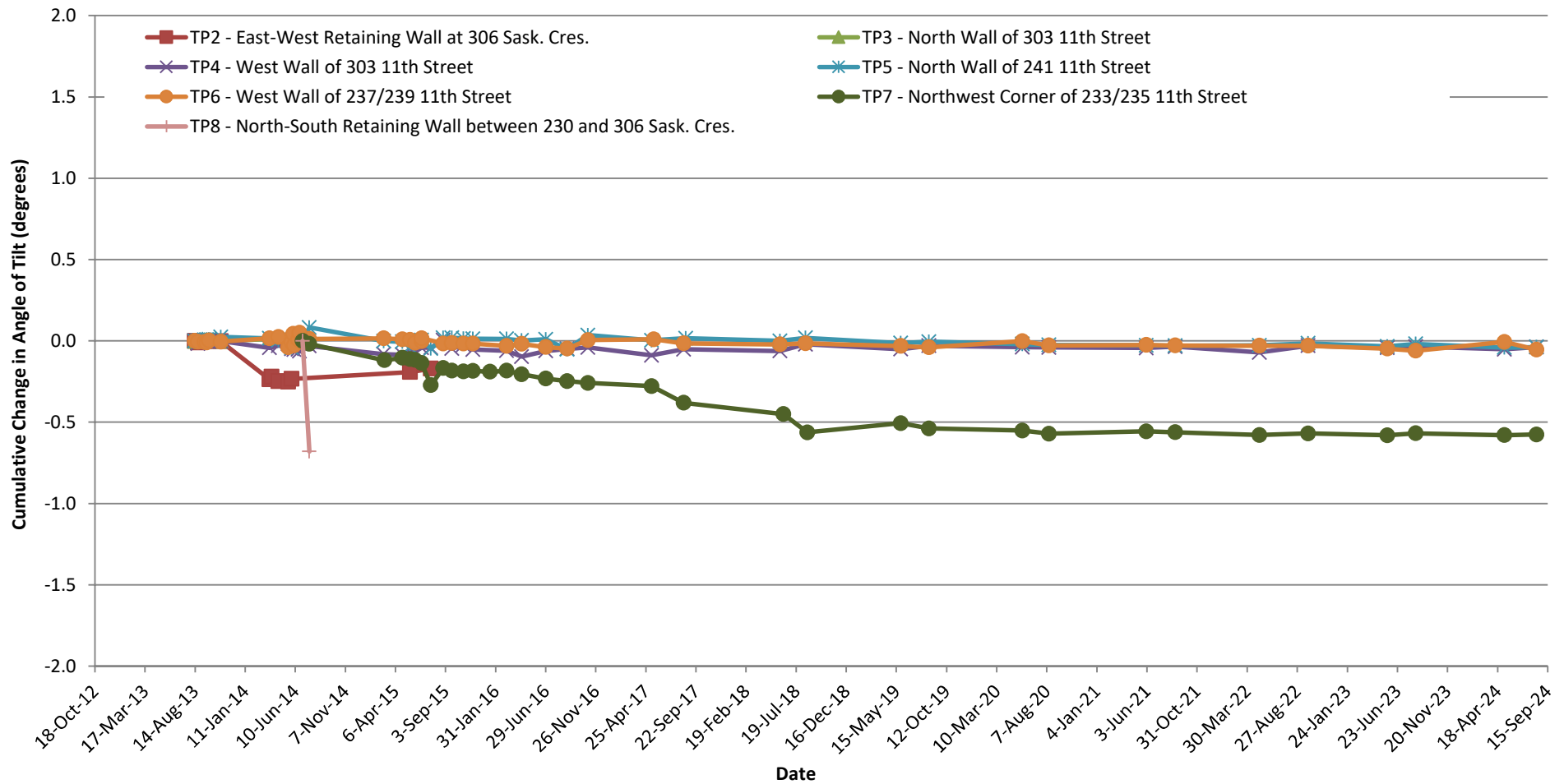


Borehole : 20-111
Project : Nutana Slope
Location :
Northing : 5775568
Easting : 385953
Collar :

Spiral Correction : N/A
Collar Elevation : 0.00 meters
Reading Depth : 15.0 meters
A+ Groove Azimuth :
Base Reading : 2020 Oct 28 15:01
Applied Azimuth : 0.0 degrees

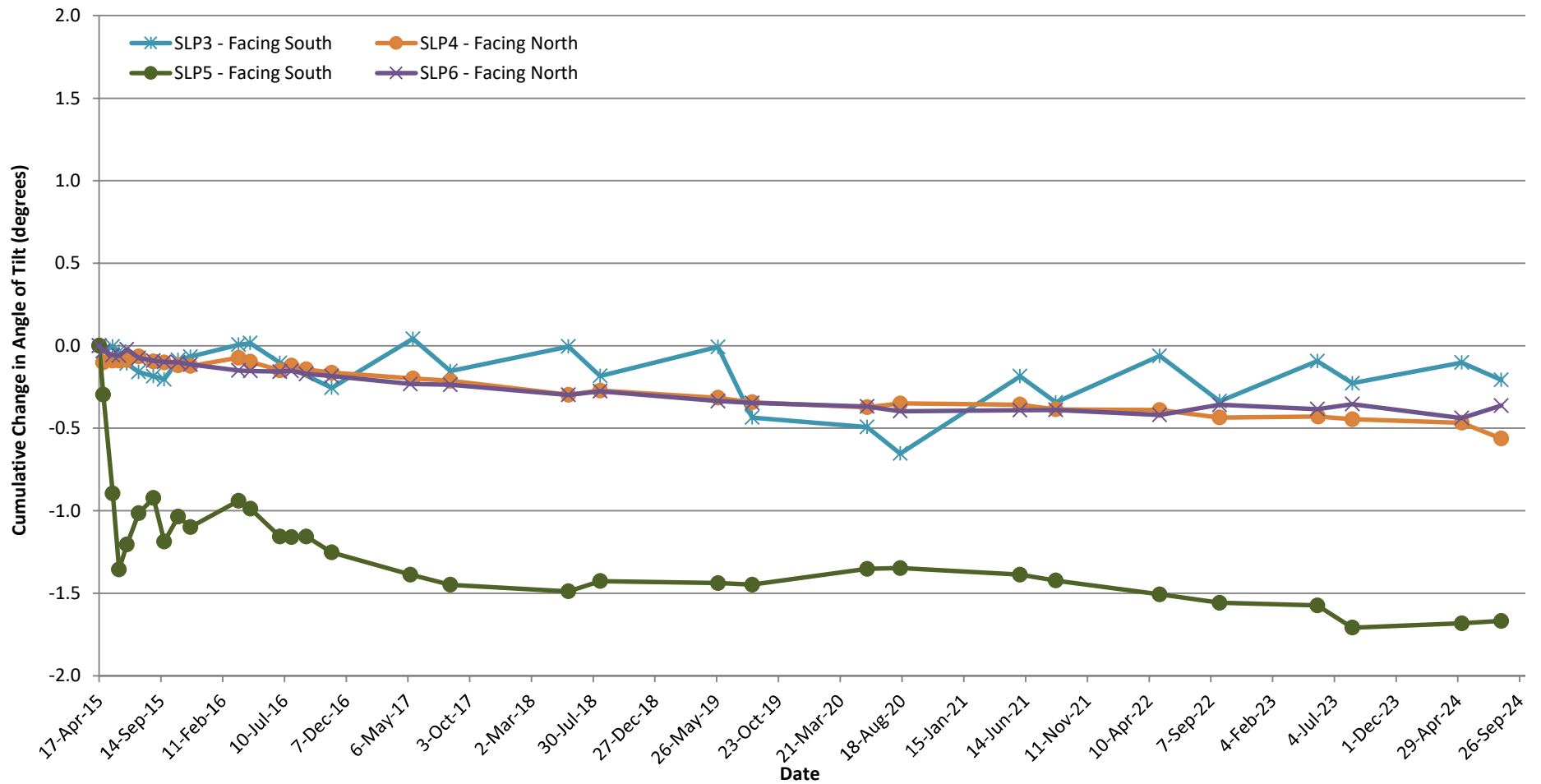


TILT PLATES





Notes:
 1) Positive changes in tilt indicate tilting toward the monitoring structure.
 2) TP1, located on the retaining wall between 230 and 306 Sask. Cres., is not monitored for health and safety reasons; monitoring results for this tilt plate show a change in angle of tilt of approximately 9 degrees between August 2013 and June 2014.
 3) TP3 and TP8 are destroyed, and TP2 is buried.

		NUTANA SLOPE INSTABILITY	
RESULTS OF TILT MONITORING <i>August 2024 Monitoring</i>			
	PROJECT	CA0029692.9234	FILE No.
	DESIGN		SCALE N/A REV.
	CADD		
	CHECK		
	REVIEW		
			FIGURE: B1



Notes:
 1) Positive changes in tilt indicate tilting toward the monitoring structure.

		NUTANA SLOPE INSTABILITY	
RESULTS OF TILT MONITORING Aug 2024 Monitoring			
	PROJECT	CA0029692.9234	FILE No.
	DESIGN		SCALE N/A REV.
	CADD		
	CHECK		
	REVIEW		
			FIGURE: B2