

To: Amy Driessen
Alberta Transportation
File: 123315222

From: Leslie Cho and Xiteng Liu
Stantec Consulting Ltd.
Date: June 2, 2022

Reference: North Central Region, Edson, Site NC050 - Highway 40:28 Gregg River Slide, Spring 2022 Instrumentation Monitoring Report

1.0 OBSERVATIONS

1.1 FIELD PROGRAM AND INSTRUMENTATION STATUS

The Spring 2022 reading cycle consisted of instrument readings on four slope inclinometers (SI09-5, SI10-11, SI10-12 and SI10-13) and three pneumatic piezometers (PN09-5, PN09-7 and PN09-10). **Figures 1 and 2** attached provides a schematic of the site. The instruments were read by Mahendran Senthoooran, M.Eng., EIT and Akintola Fakinlede, M.Sc., Engineering Technologist on May 3, 2022.

The slope inclinometers (SI) were measured using an RST MEMS digital inclinometer probe with 0.5 m increments and RST handheld PC. The Pneumatic piezometers (PN) were read with an RST C109 readout box.

GPS coordinates of all instruments were obtained using a Garmin eTrex 10 handheld GPS unit.

2.0 INSTRUMENTATION READINGS

2.1 GENERAL

The SI plots are provided in the attachments and summarized in the following sections. Displacement-time plots in the resultant x-direction (i.e. slope movement direction) along with movement rates, total cumulative movement, maximum movement rates, and incremental movements are provided in **Table NC050-1** and the attachments.

The PN results are summarized in **Table NC050-2** and in the following sections with resulting plots attached.

2.2 ZONES OF MOVEMENT

No new zones of movement were observed in any of the operational slope inclinometers. Directions of movement are referenced to the azimuth of the A+ groove in each SI casing in **Table NC050-1**.

2.3 INSTRUMENTATION READINGS

2.3.1 Slope Inclinometers

SI09-5 had an average movement rate of about 40 mm/year prior to pile wall construction in 2010. After construction, the average movement rate decreased to approximately 2 mm/yr until 2014. Since 2014, the

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average rate of movement is about 5 mm/yr. The current movement rate is about 4 mm/yr corresponding to an increase of approximately 2 mm/yr since the previous reading cycle.

SI10-11 was installed within the pile wall and shows two zones of fluctuating cumulative movement at depths from 8.8 m to 9.8 m and from 13.3 m to 15.8 m. The average movement rates are less than 1 mm/yr since 2016. The cumulative movement has returned to 2 mm and 3 mm. It is surmised that the historical fluctuations may be related to the load (bending moment) change or redistribution in the pile.

SI10-12 was installed within the pile wall and shows negligible cumulative movement (less than 1 mm) since initialization in 2010 in two movement zones at depths from 4.9 m to 6.9 m and from 13.9 m to 15.9 m. The most recent reading cycle showed less than 1 mm movement compared to the previous reading cycle for both potential zones. Historically, SI10-12 has shown fluctuations in cumulative movement, and it is surmised that this is a result of load (bending moment) change or redistribution in the pile.

SI10-13 had no discernable movement since initialization in 2010.

Note that during the work transfer to Stantec in 2016, a slight depth discrepancy was observed in SI10-11 and 10-13 due to different unit of measurements used during data collection. In order to present more accurate information, data prior to 2016 have not been included on the SI plots.

2.3.2 Piezometers

The piezometers show a decrease in water level up to 0.4 m decrease since the previous Spring 2021 readings. The water levels at the site range from 10.5 m at **PN09-5** to 13.0 m at **PN09-10** below ground surface (bgs) corresponding to elevations of 1560.6 m and 1551.8 m, respectively. Overall, all three pneumatic piezometers continue to show relatively stable piezometric levels.

3.0 RECOMMENDATIONS

FUTURE WORK

It is recommended that the next reading cycle take place in Spring 2023.

3.1 INSTRUMENTATION REPAIRS

No instruments require repair at this time.

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Table NC050-1: Spring 2022 Slope Inclinometer Reading Summary

Instrument Name	Date Initialized	Coordinates ⁽¹⁾ (UTM 11U, NAD1983) (m)		Total Cumulative Resultant Movement and Depth of Movement to Date (mm)	Maximum Rate of Movement (mm/yr)	Current Status	Date of Previous Reading	Incremental Movement Since Previous Reading (mm)	Current Rate of Movement (mm/yr)	Change in Rate of Movement Since Previous Reading (mm/yr)
		Northing	Easting							
SI09-5	May 22, 2009	5883286	469342	108 over 3.2m to 8.2m depth in the 10° direction	176 in Sept. 2009	Operational	July 3, 2021	3	4	2
SI09-7	May 22, 2009	-	-	67 over 4.2m to 8.2m depth at 0° direction	125 in Sept. 2009	Non-Operational	Sept. 24, 2016	Sheared at 1.5 m below top of casing		
SI10-11	Feb 26, 2009	5883284	469355	2 over 8.8m to 9.8 m depth in 0° direction	5 in Sept. 2017	Operational	July 3, 2021	-4	4	1
				3 over 13.3m to 15.8m depth in 0° direction	6 in Sept. 2017			-5	5	<1
SI10-12	Feb 26, 2009	5883286	469326	1 over 4.9m to 6.9m depth in 0° direction	4 in May 2016	Operational	July 3, 2021	No Discernable Movement (Less than 1 mm/yr movement)		
				1 over 13.9m to 15.9m depth in 0° direction	3 in Oct. 2013			No Discernable Movement (Less than 1 mm/yr movement)		
SI10-13	Feb 26, 2009	5883287	469311	No Discernable Movement		Operational	July 3, 2021	No Discernable Movement		

(1) Updated on May 3, 2022, with approximate accuracy of ± 3 m

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Table NC050-2: Spring 2022 Piezometer Reading Summary

Instrument Name	Date Initialized	Coordinates ⁽¹⁾ (UTM 11U, NAD1983) (m)		Bottom/Tip Elevation (m)	Current Status	Maximum Piezometric Level (m bgs)	Measured Water Level (m bgs) (Elevation)	Previous Water Level, (Spring 2021) (m bgs) (Elevation)	Change in Water Level (m)
		Northing	Easting						
PN09-5 (32602)	May 22, 2009	5883286	469345	1558.1	Operational	9.1 Spring 2019	10.5 (1560.6)	10.2 (1560.9)	-0.3
PN09-7 (32600)	May 22, 2009	5883293	469310	1553.5	Operational	10.5 Sept. 2012	11.8 (1557.3)	11.4 (1557.7)	-0.4
PN09-10 (32601)	May 22, 2009	5883306	469165	1550.3	Operational	12.4 Oct. 2013	13.0 (1551.8)	13.0 (1551.8)	-<0.1
(1) Updated on May 3, 2022, with approximate accuracy of ± 3 m.									

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4.0 CLOSING

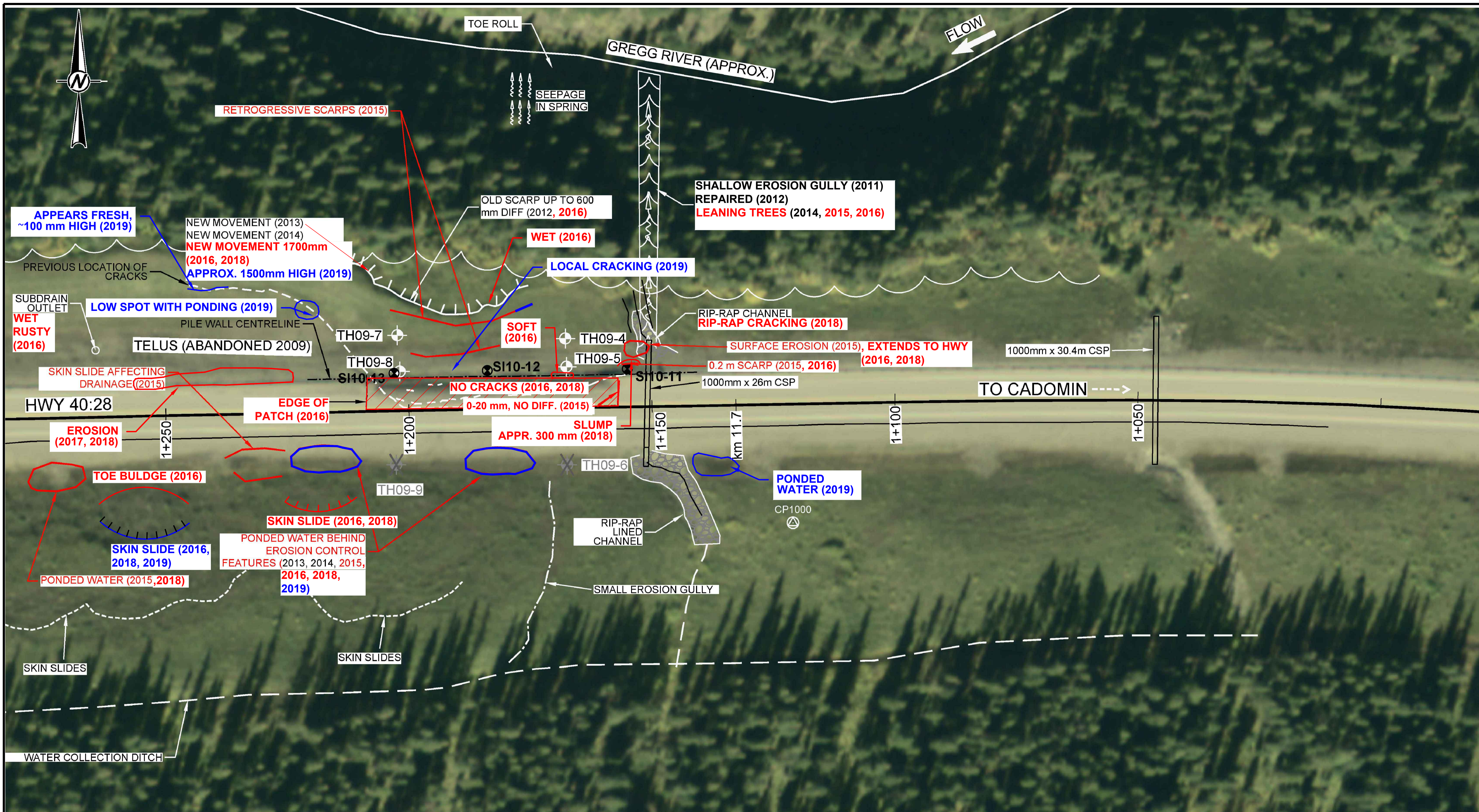
We trust this instrumentation report meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

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Attachment: Figure 1 – Pile Wall Site Plan
Figure 2 – Culvert Site Plan
SI09-5 Slope Inclinator Plots
SI10-11 Slope Inclinator Plots
SI10-12 Slope Inclinator Plots
SI10-13 Slope Inclinator Plots
Pneumatic Piezometer Depth vs Time Plot

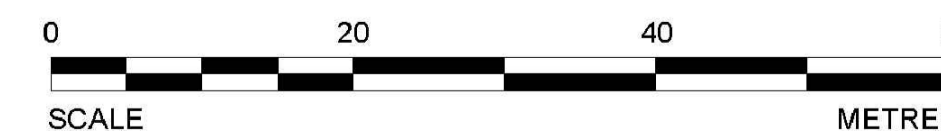


LEGEND

	APPROXIMATE LOCATION OF 2010 SLOPE INCLINOMETER
	APPROXIMATE LOCATION OF PREVIOUS TEST HOLES
	DESTROYED SLOPE INCLINOMETER OR STANDPIPE PIEZOMETER

- NOTES**
1. FEATURE LOCATIONS ARE APPROXIMATE
 2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
 3. 2015-18 OBSERVATIONS SHOWN IN RED
 4. 2019 OBSERVATIONS SHOWN IN BLUE

REFERENCE
 THURBER ENGINEERING LTD, PROJECT #15-16-258,
 ORIGINAL SCALE 1:1,000, DATE AUGUST 2011.

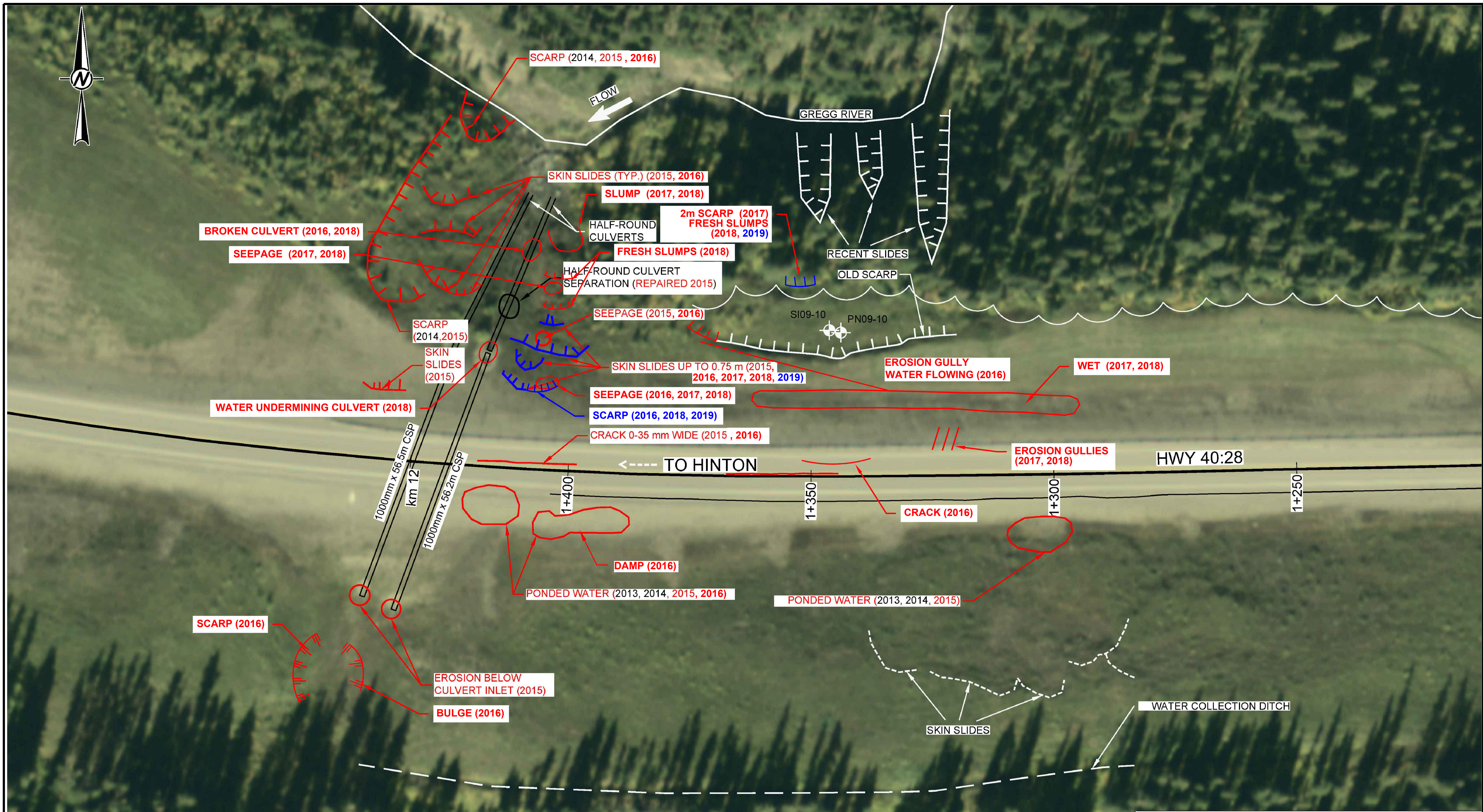


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ALBERTA TRANSPORTATION
 GEOHAZARD MONITORING PROGRAM
 NC50 GREGG RIVER SLIDE
 PILE WALL SITE PLAN

DRAWN WW / MK	CHECK XL	APPROVE LC
DATE 17 JUL 2019	SCALE AS SHOWN	PROJECT # 123312435

FIGURE 1



LEGEND

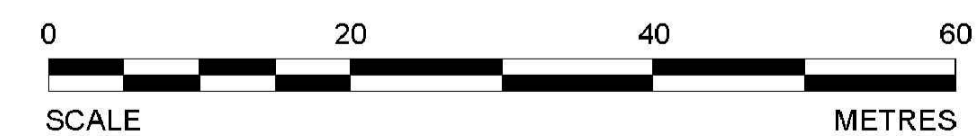
-  APPROXIMATE LOCATION OF 2010 SLOPE INCLINOMETER
-  APPROXIMATE LOCATION OF PREVIOUS TEST HOLES

NOTES

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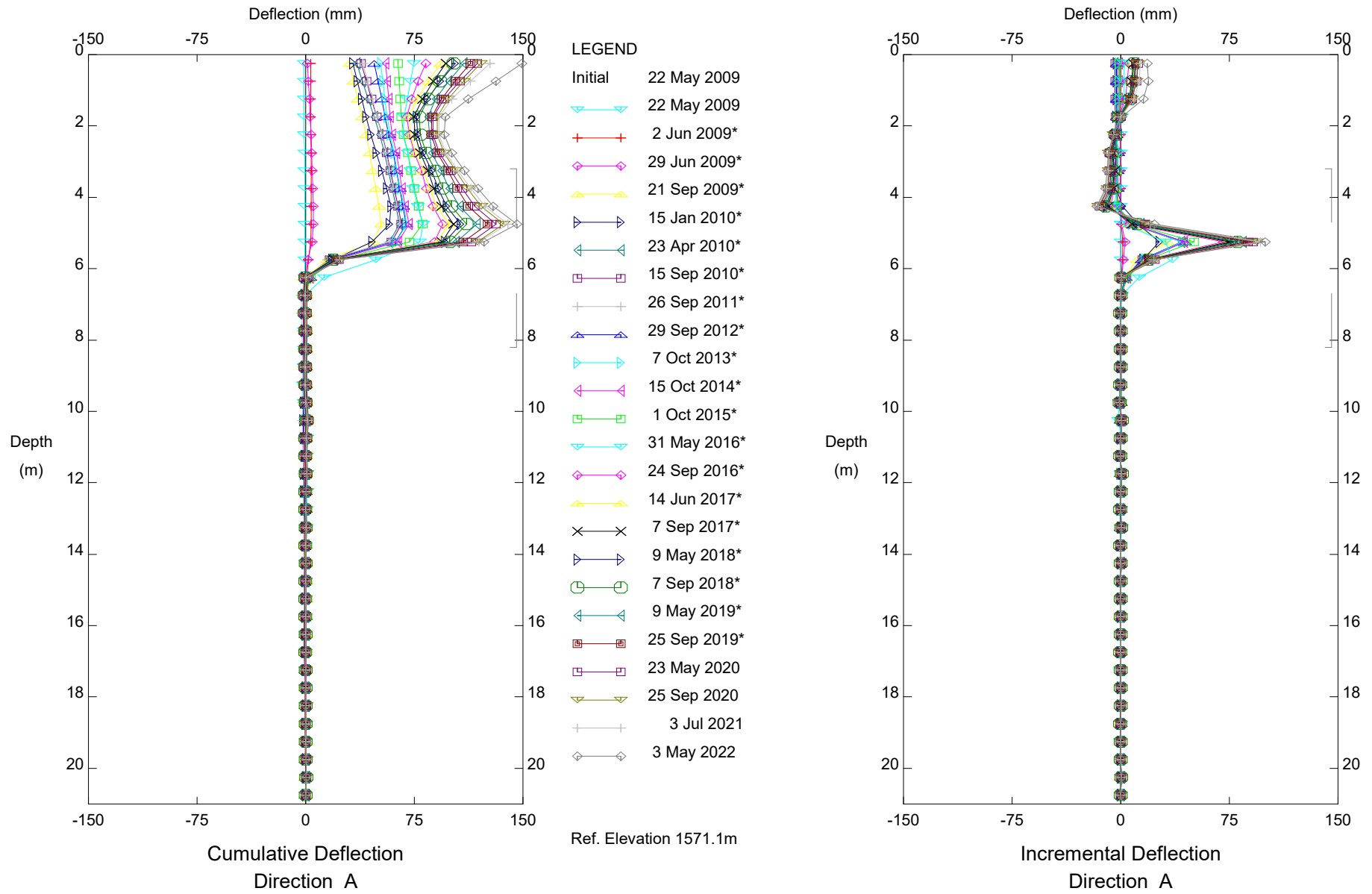


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ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC50 GREGG RIVER SLIDE
CULVERT SITE PLAN

DRAWN WW / MK	CHECK XL	APPROVE LC
DATE 18 JUL 2019	SCALE AS SHOWN	PROJECT # 123312435

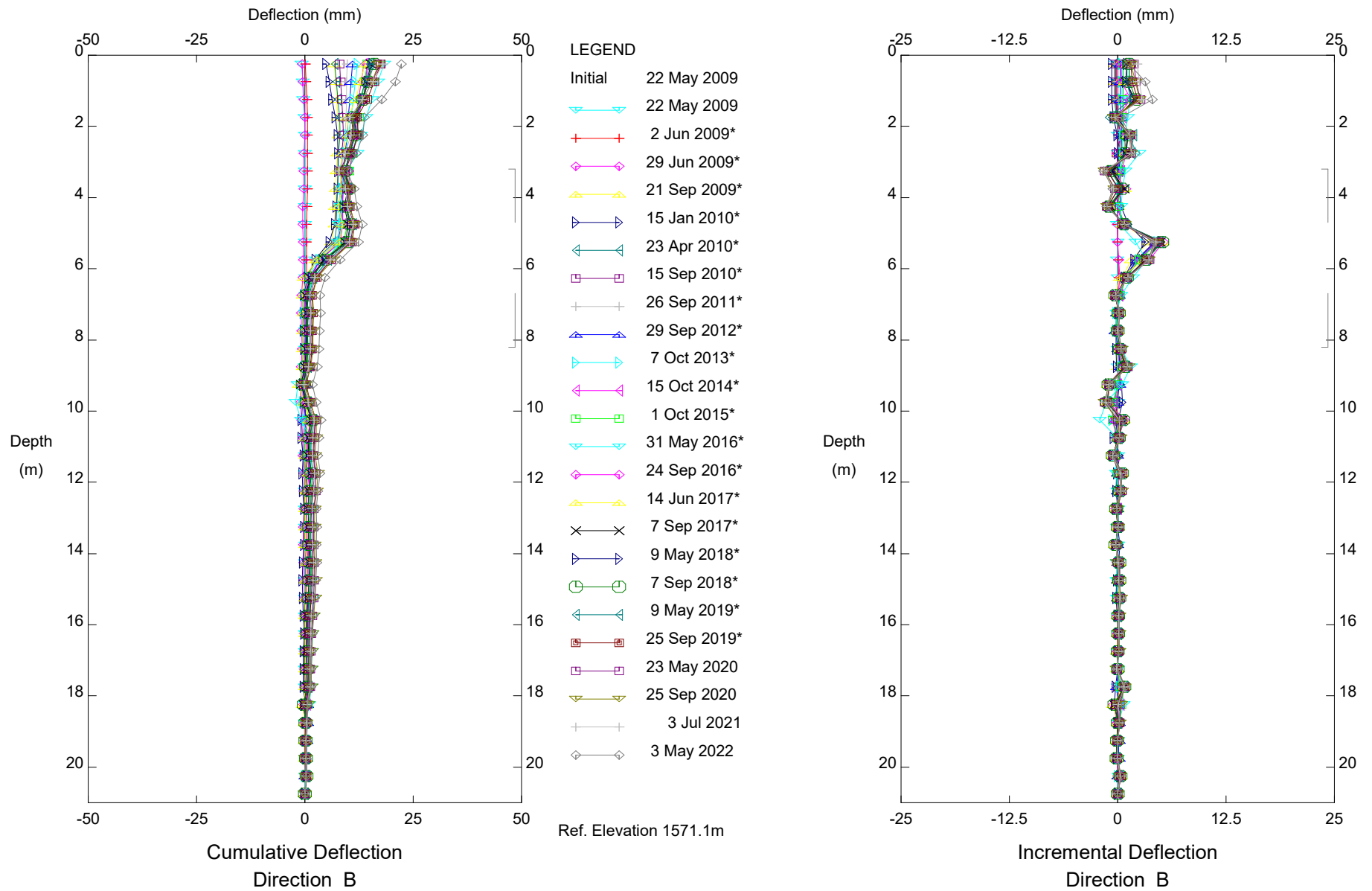
FIGURE - 2



HWY 40:28 Gregg River Slide (NC50), Inclinometer SI09-5
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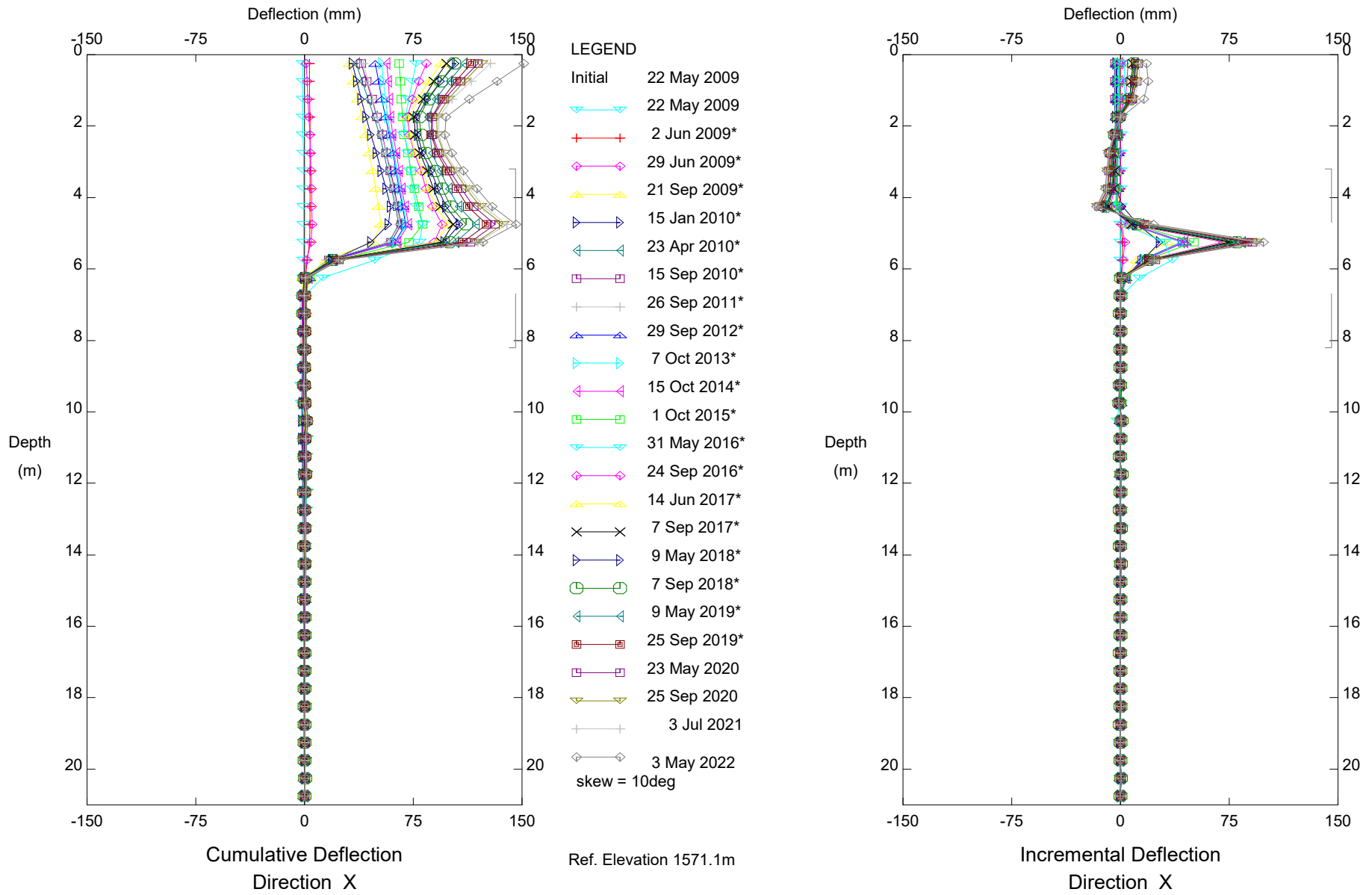
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HWY 40:28 Gregg River Slide (NC050), Inclinometer SI09-5
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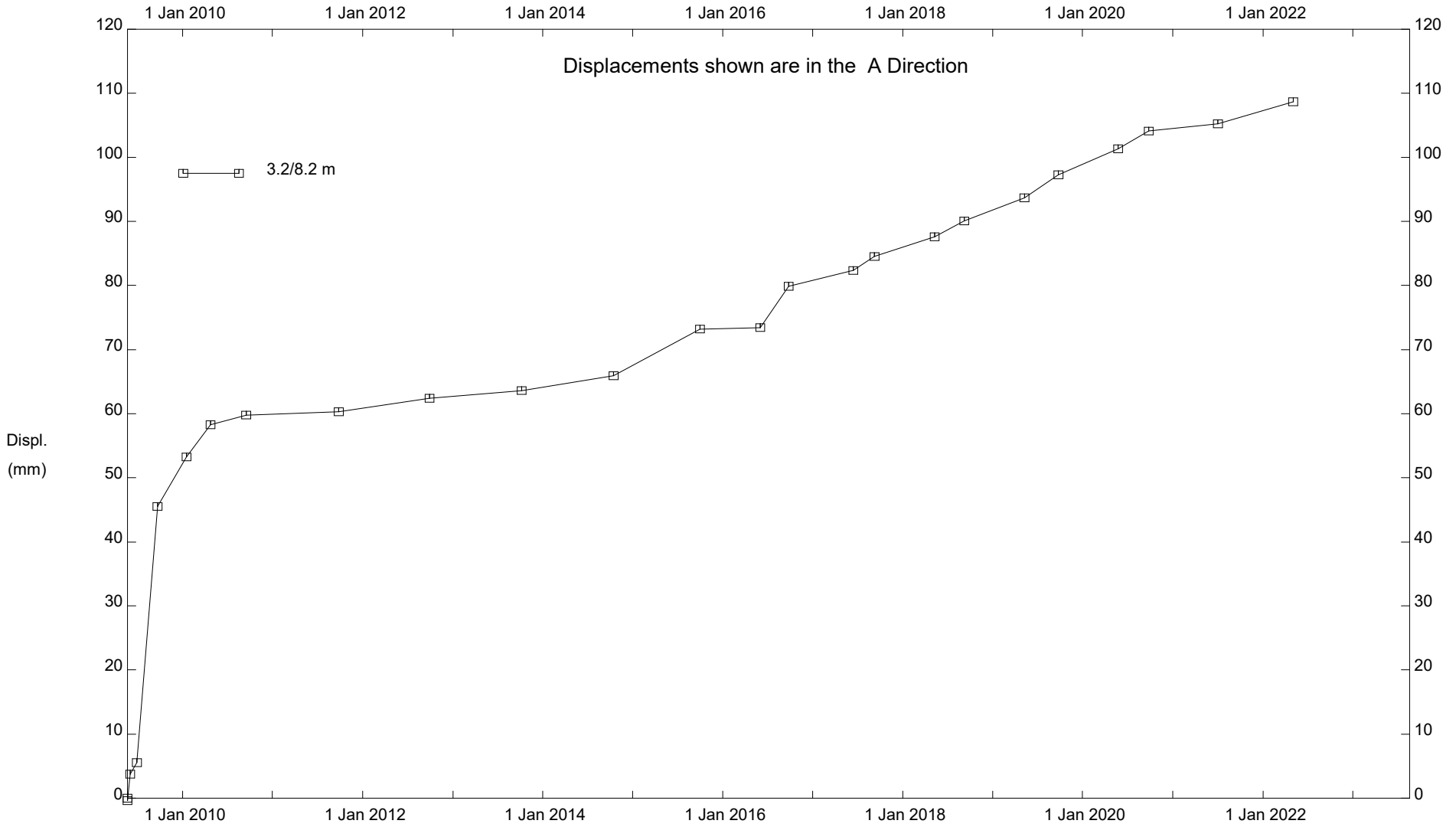
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HWY 40:28 Gregg River Slide (NC050), Inclinometer SI09-5
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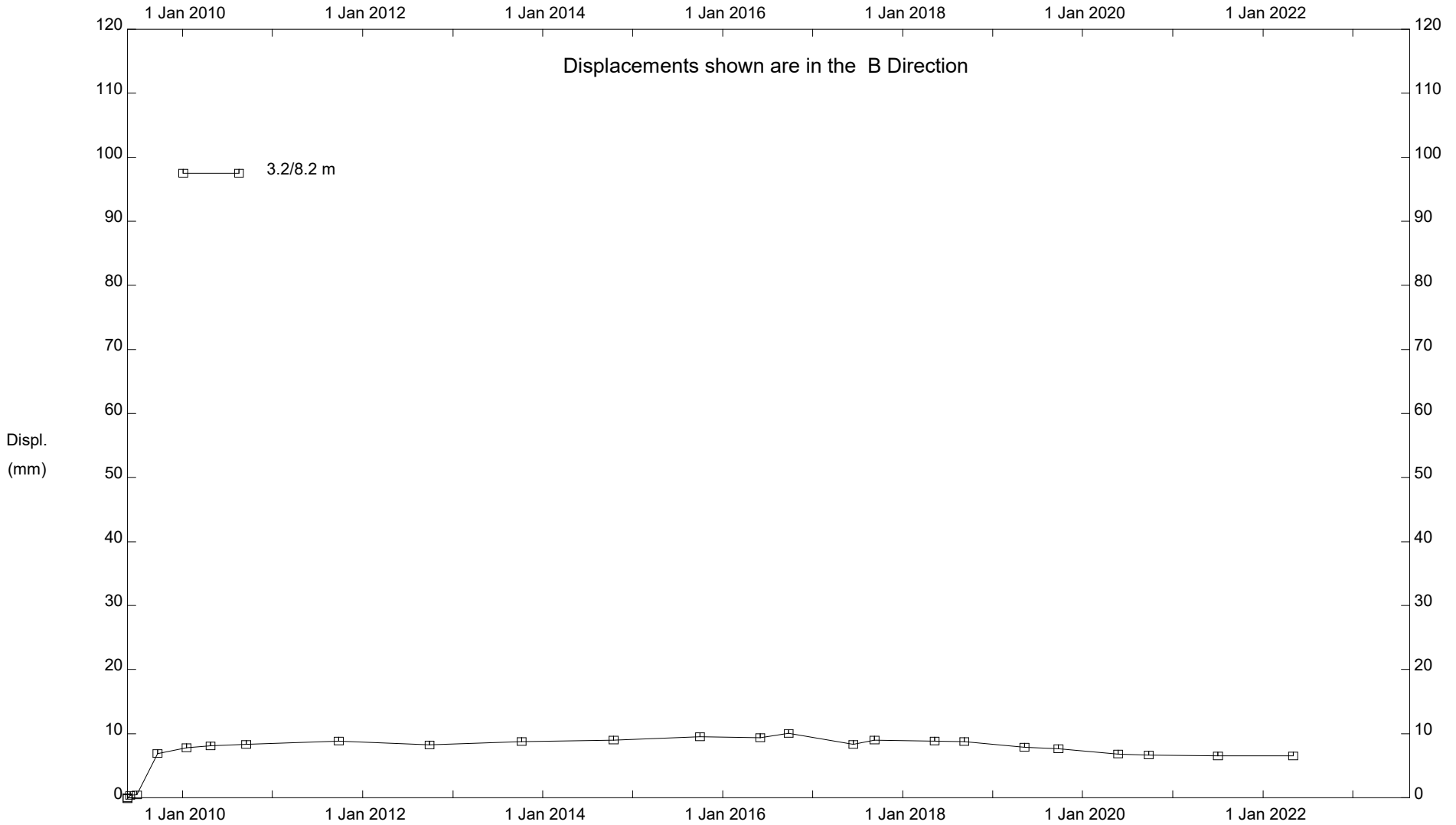
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HWY 40:28 Gregg River Slide (NC050), Inclinator SI09-5

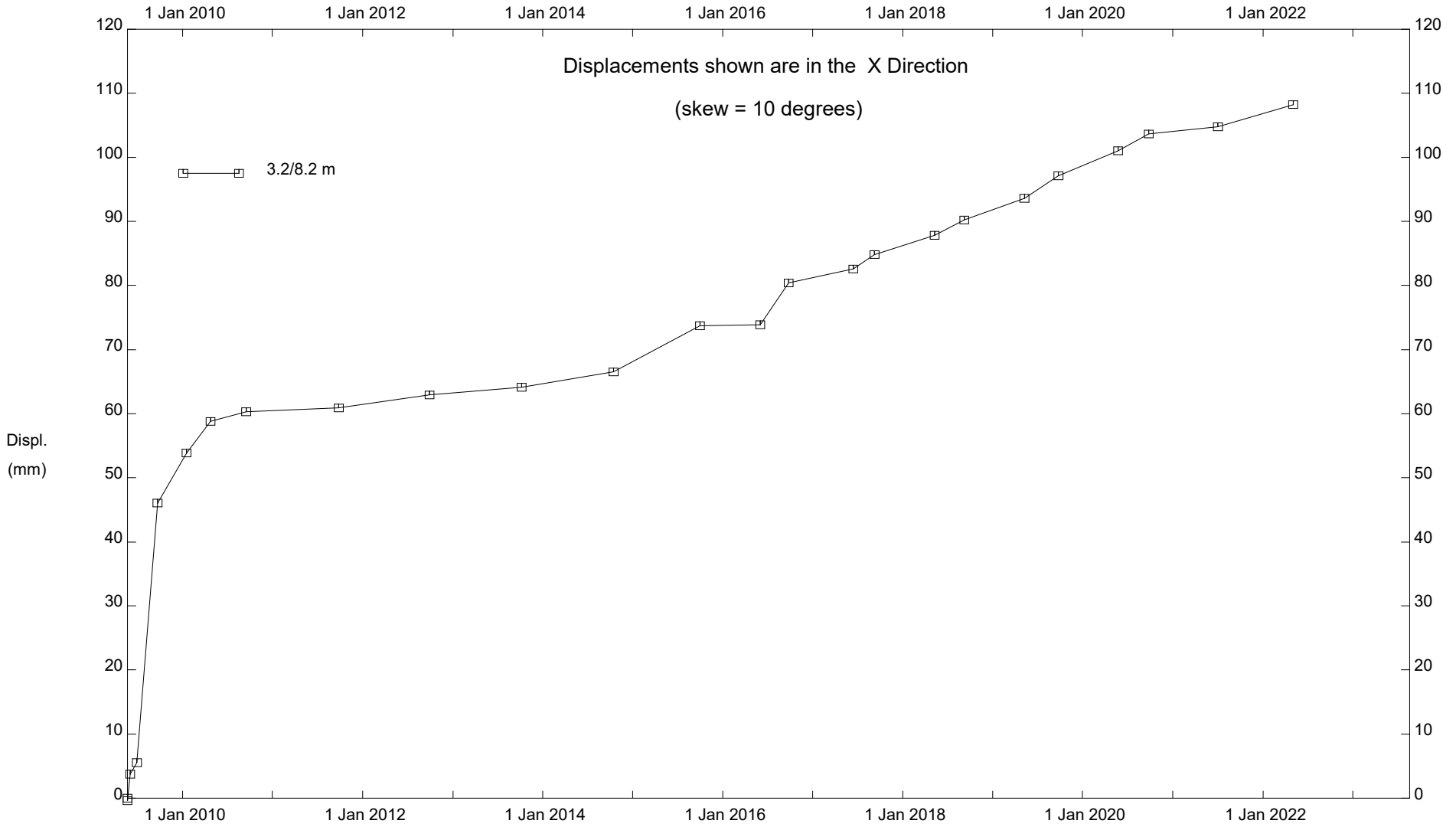
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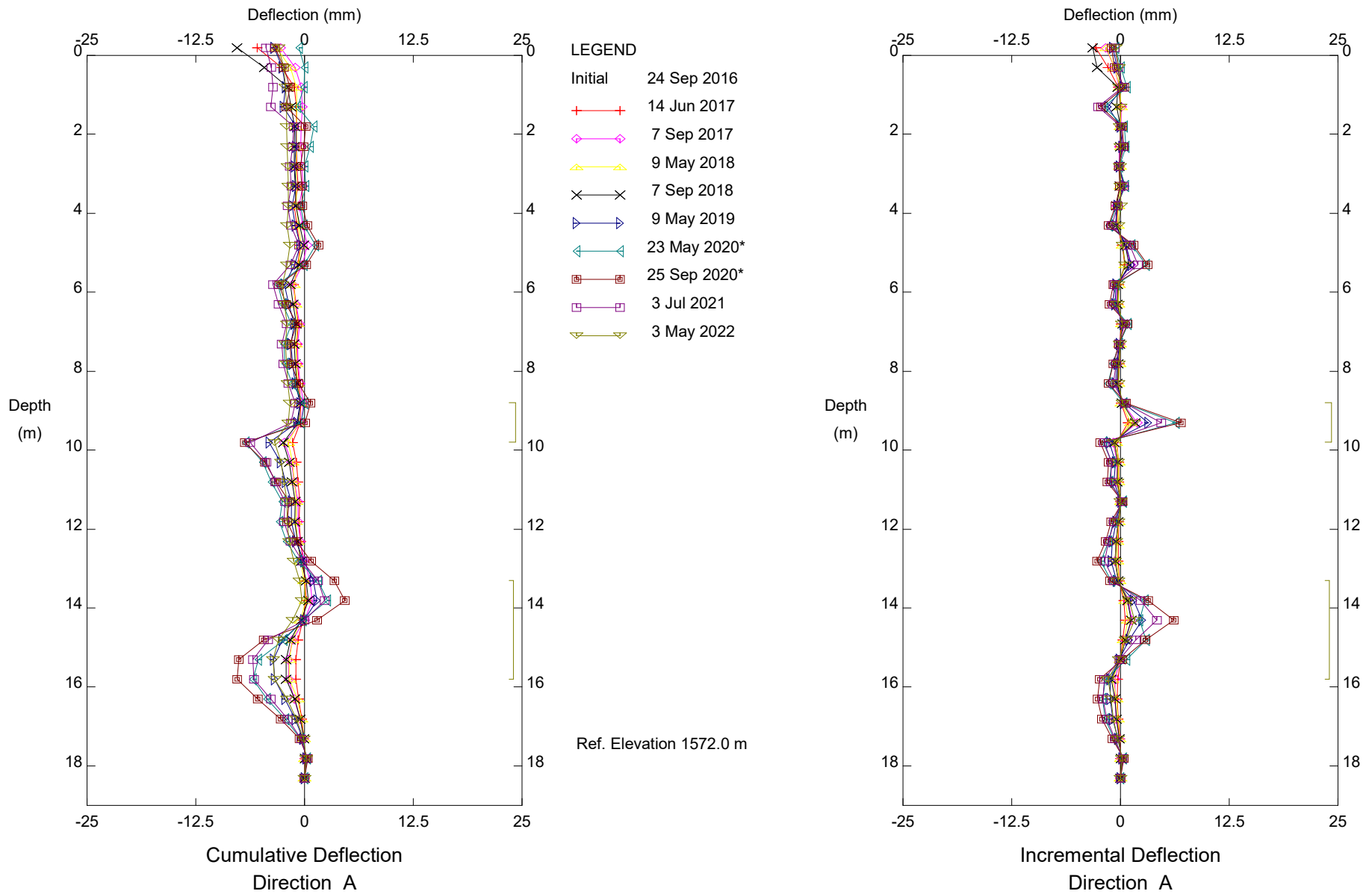
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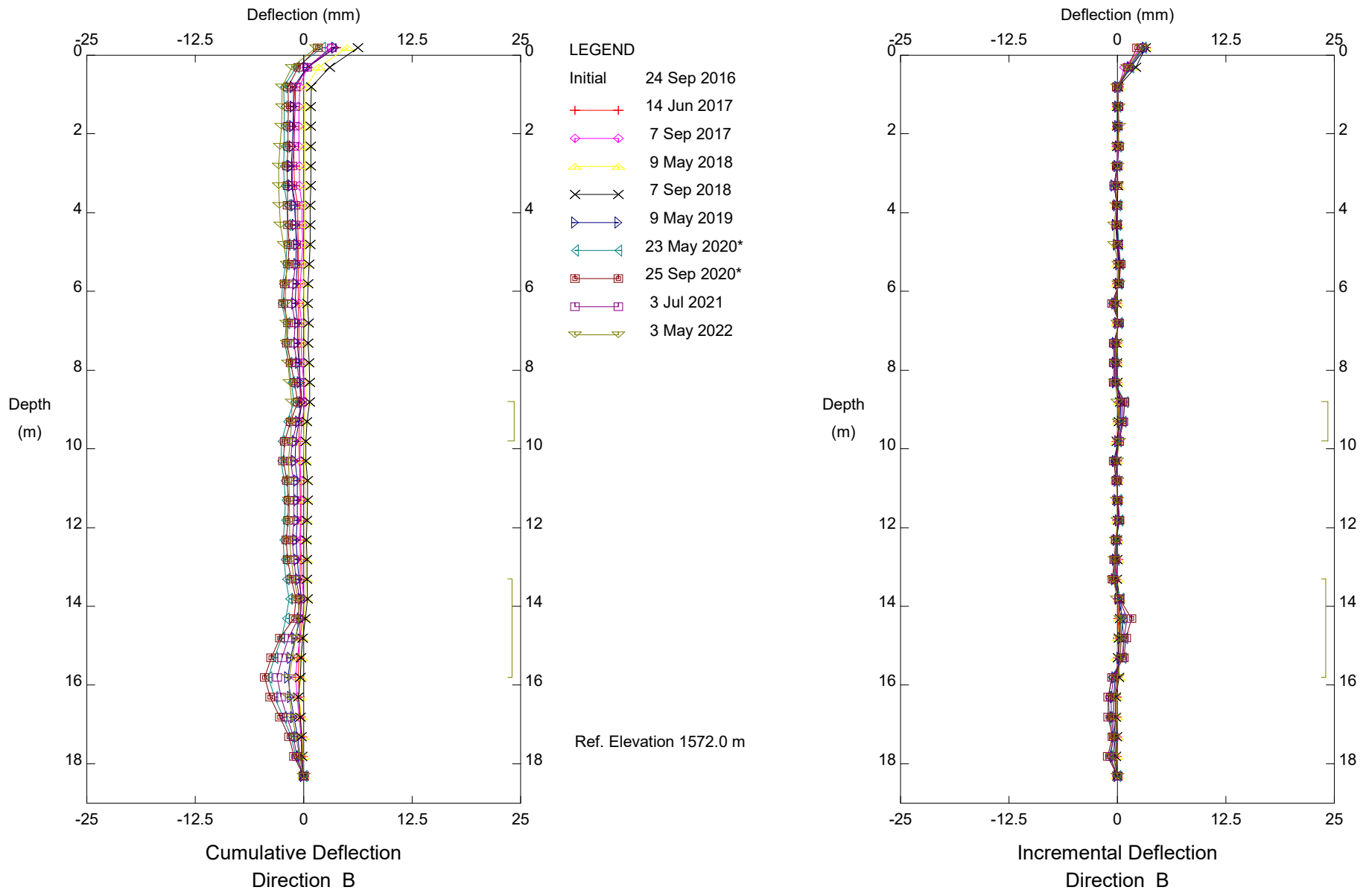
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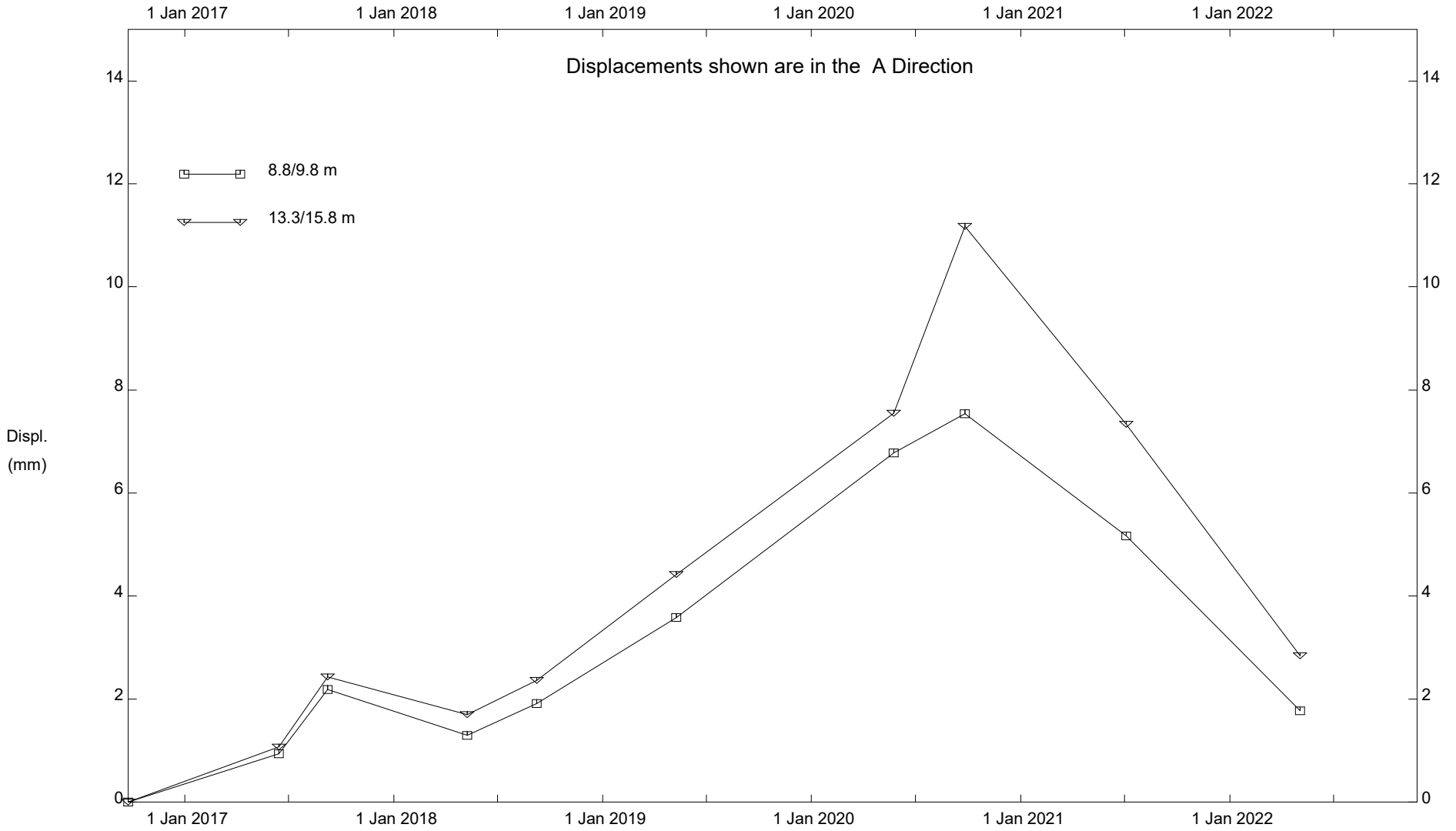
HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-11
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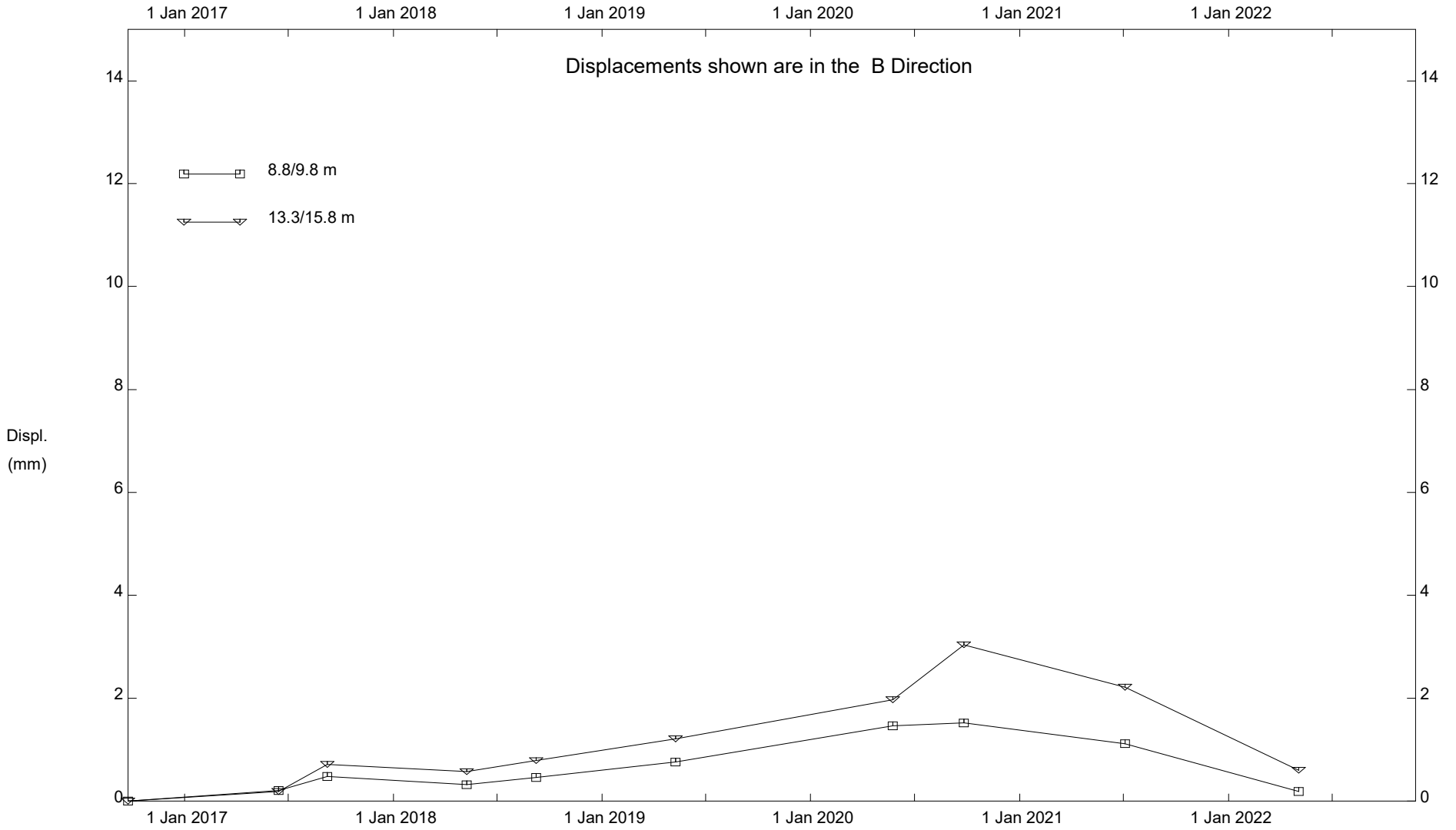
HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-11
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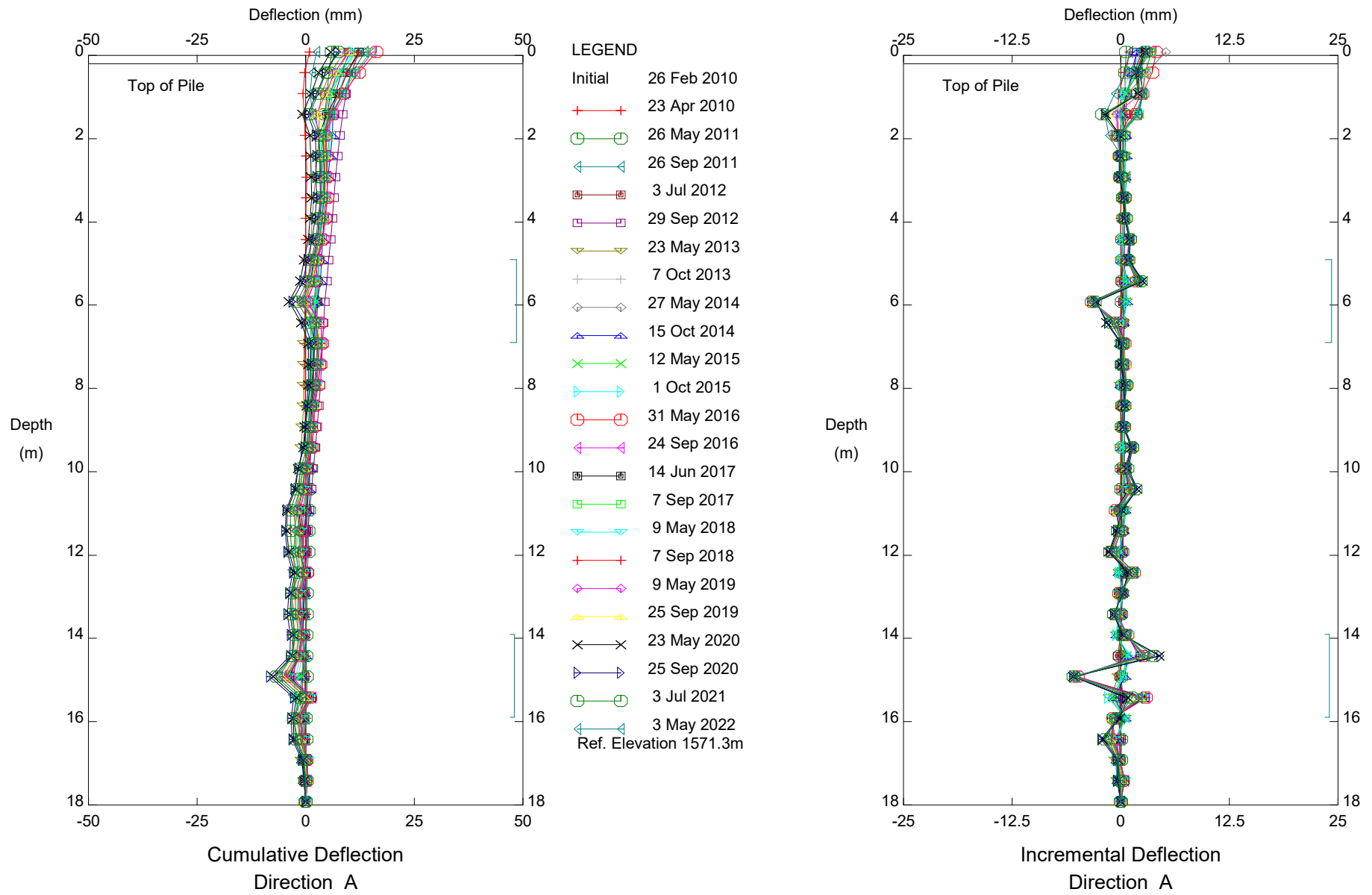
HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-11

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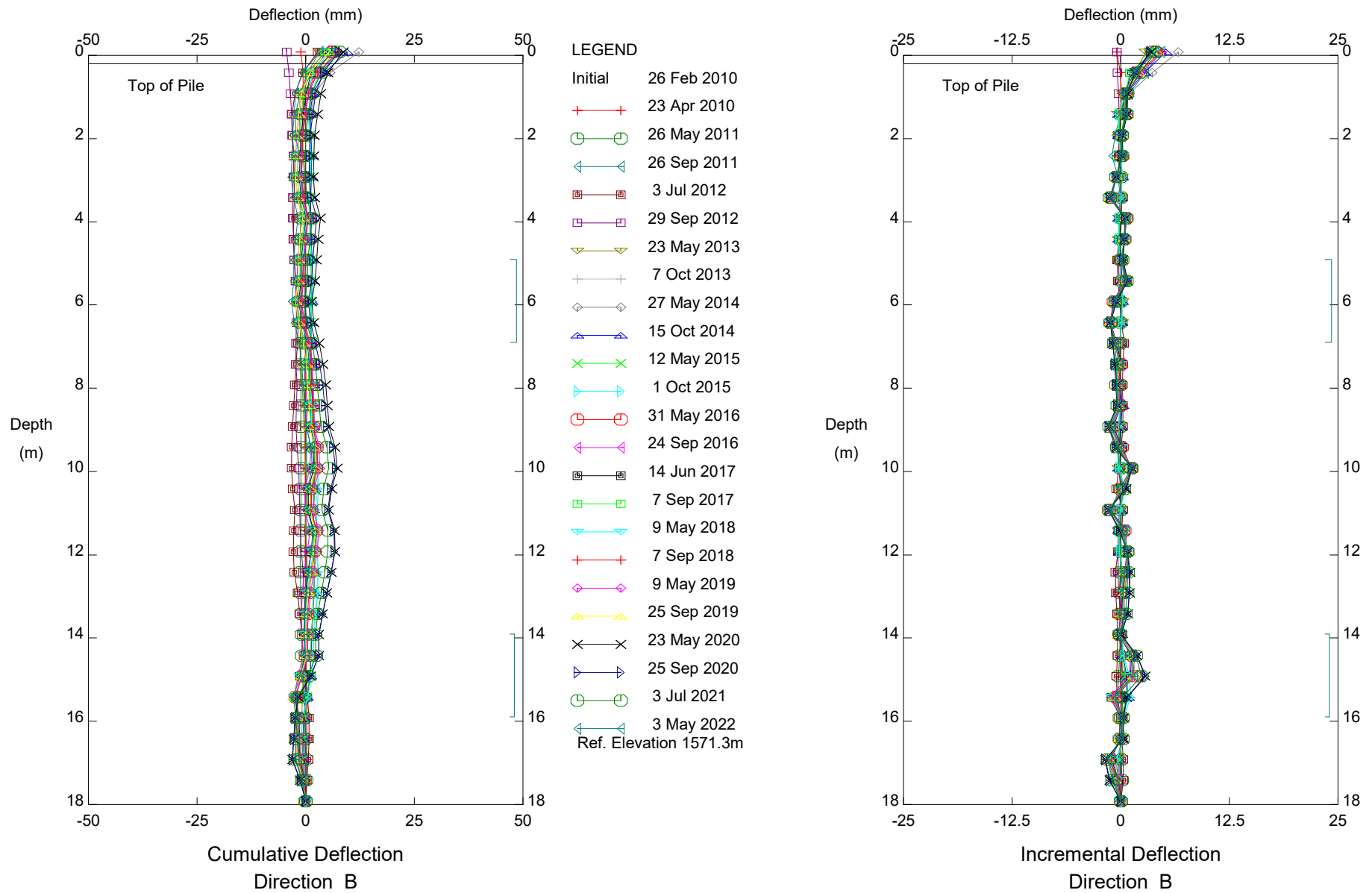


HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-11

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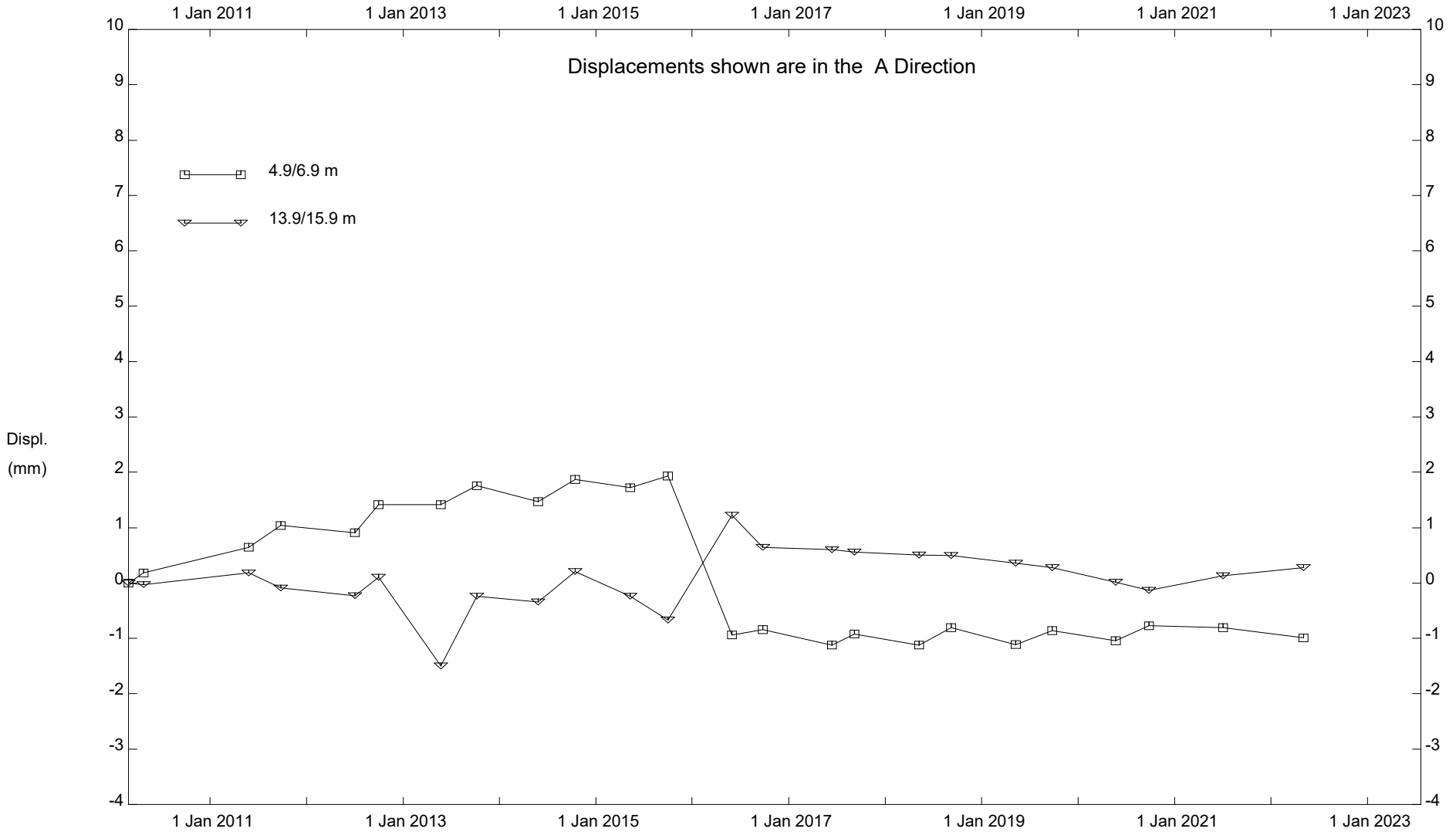


HWY 40:28 Gregg River Slide (NC050), Inclinator SI10-12
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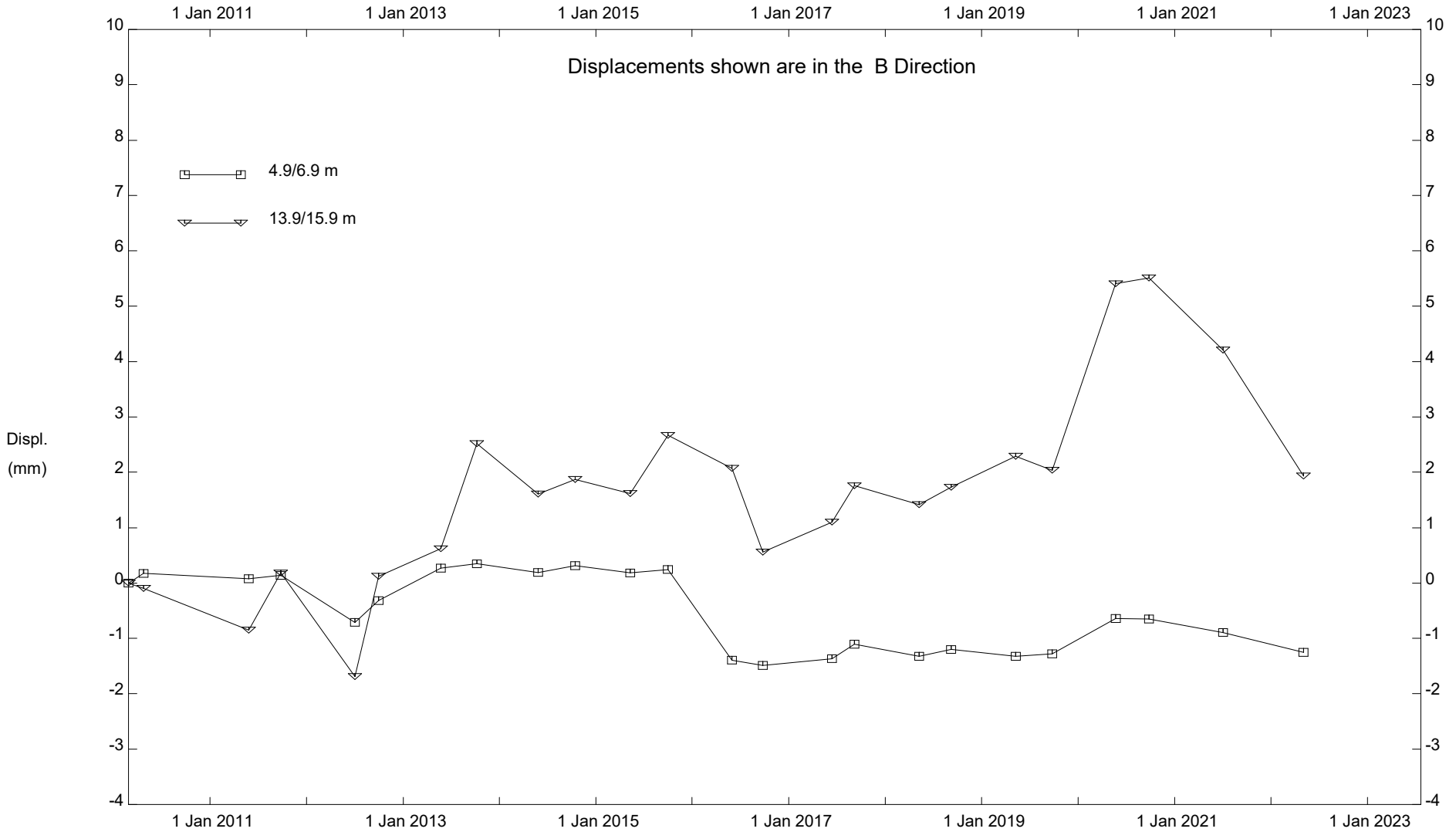
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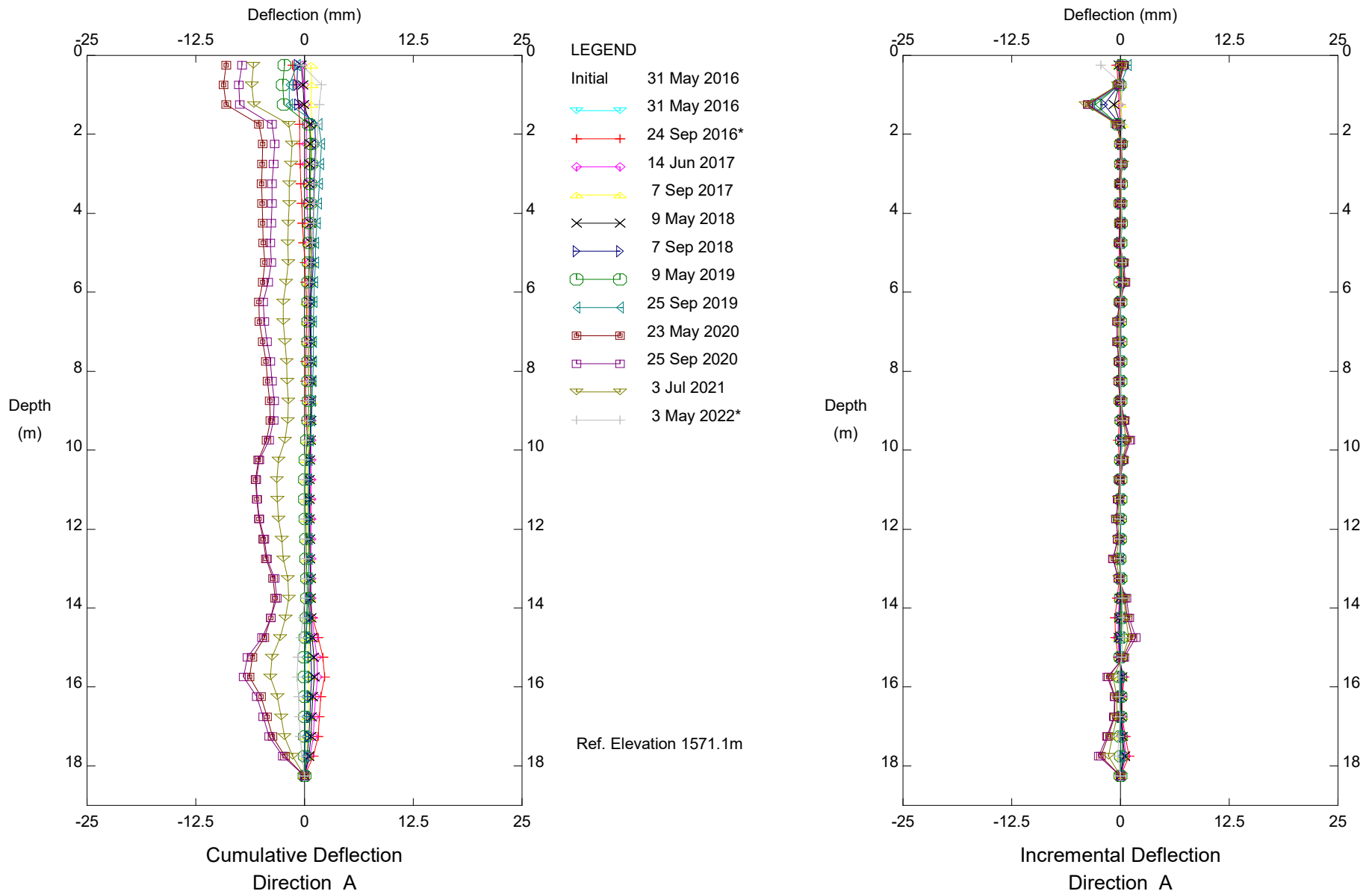
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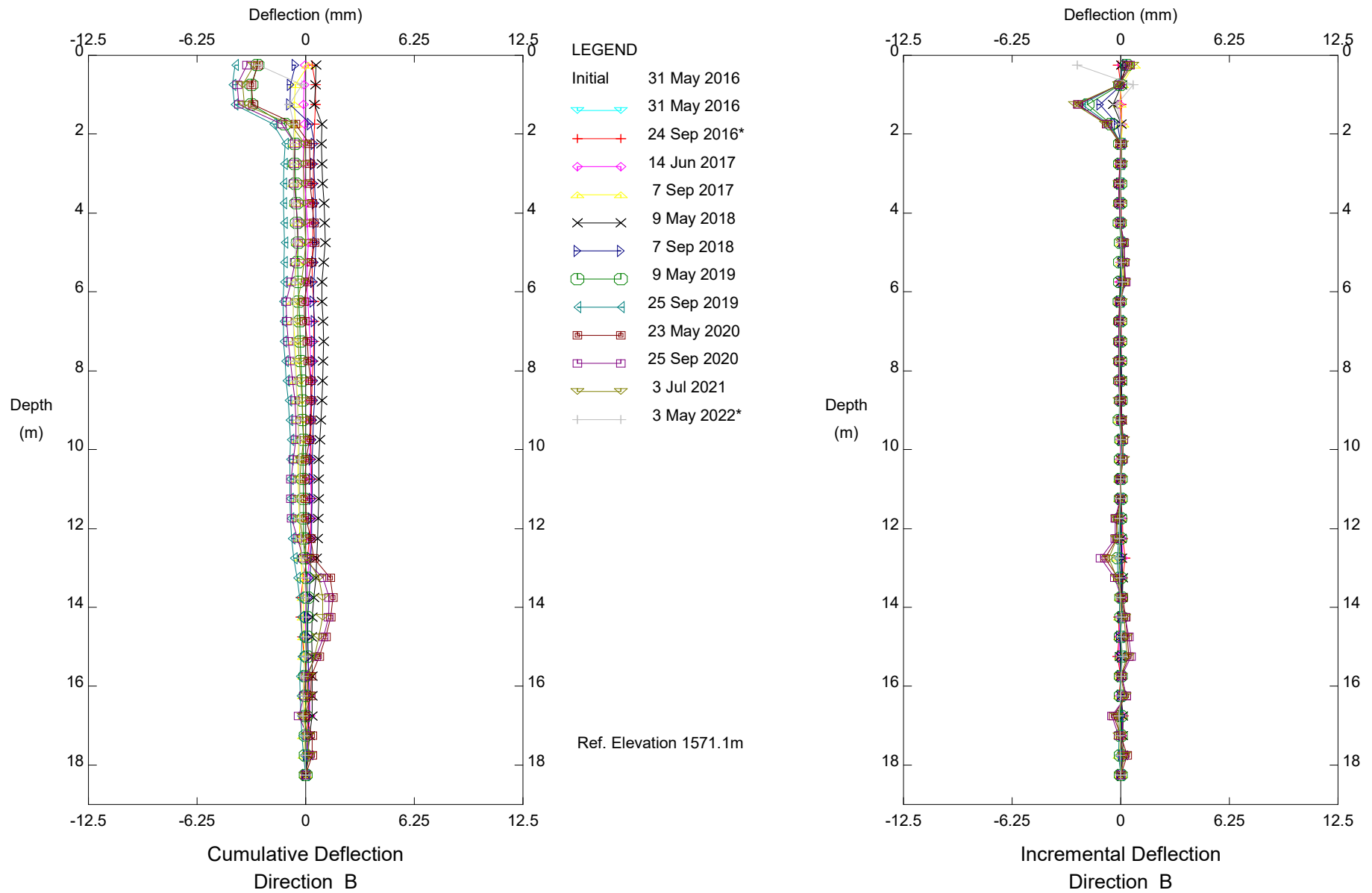
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HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-13
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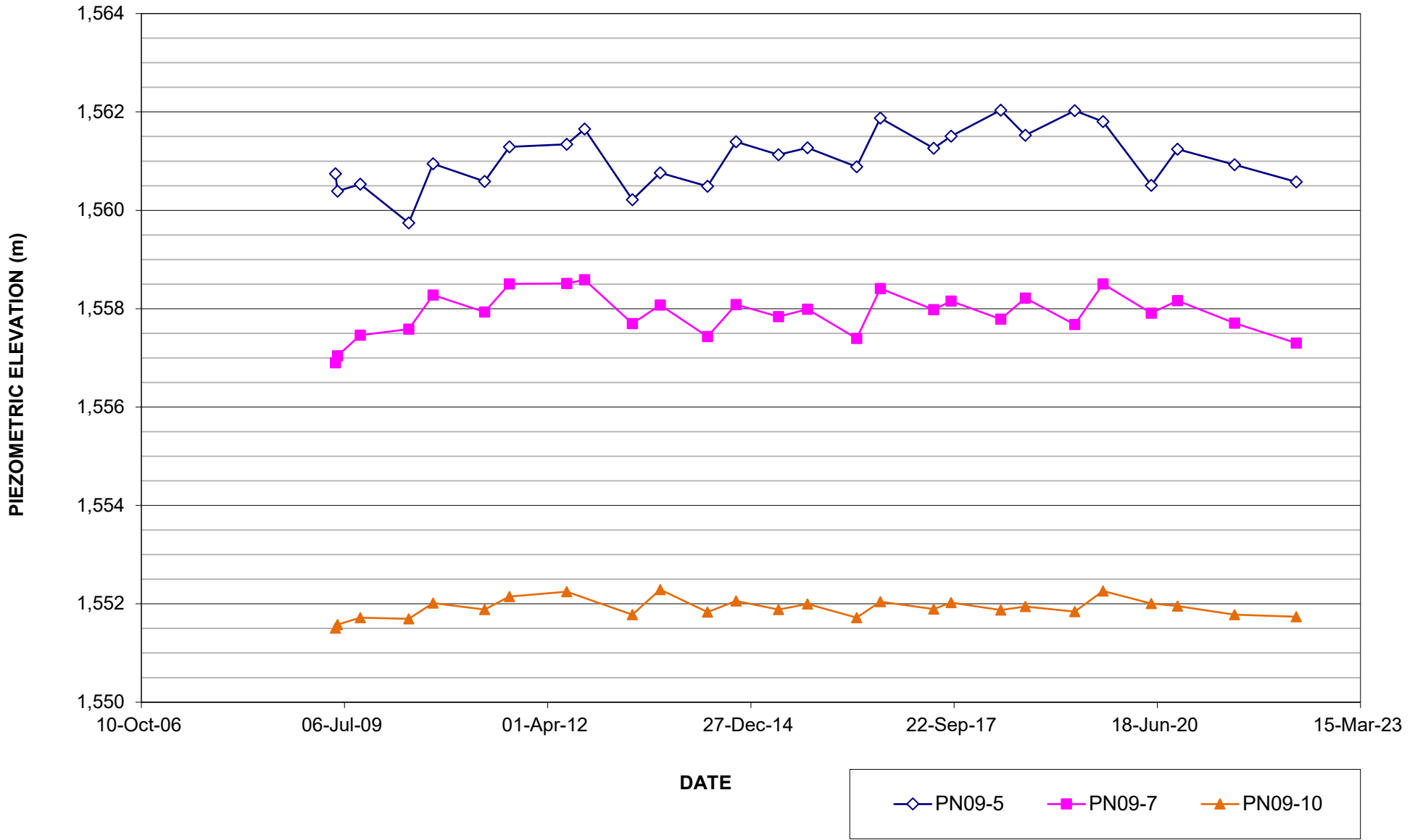
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HWY 40:28 Gregg River Slide (NC050), Inclinometer SI10-13
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Pneumatic Piezometer Piezometric Elevation



Pneumatic Piezometer Piezometric Elevation Below Ground Surface

