Stantec

Memo

To:	Amy Driessen Alberta Transportation	From:	Leslie Cho and Carrie Murray Stantec Consulting Ltd.
File:	123315222	Date:	June 12, 2022

Reference: North Central Region, Edson, Site NC059 - Highway 43:16 Little Paddle 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 of four slope inclinometers (SI05-20, SI14-26, SI14-27, and SI14-28) and four pneumatic piezometers (PN5, PN14-26, PN14-27, and PN14-28). **Figure 1** attached provide a schematic of the site. The instruments were read by Mahendran Senthooran, M.Eng., EIT and Akintola Fakinlede, M.Sc., Engineering Technologist on May 4, 2022.

The slope inclinometers (SI) were measured using an RST MEMS digital inclinometer probe with 0.5 m increments and handheld PC. Readings were taken based on cable markings in relation to the top of SI casing. The pneumatic piezometers (PN) were read with an RST Instruments C-109 Pneumatic 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. Resultant plots in the x-direction along with movement rates, total cumulative movement, maximum movement rates, and incremental movements are provided in **Table NC059-1** and the attachments. Where no skew is observed in the SI data, plots in the A directions are provided.

The PN readings are summarized in **Table NC059-2** and the attachments.

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.

2.3 MONITORING RESULTS

2.3.1 Slope Inclinometers

SI05-20 has been relatively steady since 2010 with an overall rate of movement of about 1 mm/yr.

SI14-26 was previously found to be blocked at 1.5 m during the Spring 2018 reading cycle. It was not blocked after the Spring 2020 reading cycle. SI14-26 has shown negligible movement (less than 1 mm cumulative) since initialization in 2014.

Reference: **North Central Region, Edson, Site NC059 - Highway 43:16 Little Paddle River Slide, Spring 2022 Instrumentation Monitoring Report**

SI14-27 has a current rate of movement of less than 1 mm/year when compared to the Spring 2021 reading with cumulative movement of 10 mm.

SI14-28 shows seasonal variations with higher rates of movement measured in the fall. The current rate of movement is at approximately 3 mm/yr with an overall rate of movement of about 2 mm/yr since initialization.

2.3.2 Piezometers

PN-5 shows an increase in groundwater level of 0.5 m compared to the Spring 2021 reading cycle.

PN14-26 shows a decrease in groundwater level of 0.2 m compared to the Spring 2021 reading cycle.

PN14-27 shows an increase of 0.6 m since the Spring 2021 reading. Artesian conditions were historically measured between Fall 2018 and Spring 2022.

PN14-28 shows an increase in groundwater level of 0.5 m since the Spring 2021 reading cycle.

3.0 RECOMMENDATIONS

3.1 FUTURE WORK

It is recommended that all instruments be read in the Spring 2023 reading cycle.

3.2 INSTRUMENTATION REPAIRS

No repairs are required at this site.

Reference: **North Central Region, Edson, Site NC059 - Highway 43:16 Little Paddle River Slide, Spring 2022 Instrumentation Monitoring Report**

Table NC059-1: Spring 2022 Slope Inclinometer Summary

Instrument Name	Date Initialized	Coordinates (1) (UTM 11U, NAD1983) (m)		Total Cumulative Resultant Movement (mm) and Depth Interval of Movement with Resultant Direction (^{0})	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							
SI05-20	Aug. 22, 2005	5981481	619298	63 over 8.0 m to 10.0 m depth in 3º direction	148 in Oct. 2006	Operational	July 4, 2021	1	1	<1
SI14-26	Oct. 3, 2014	5981520	619345	-1 over 6.0 m to 8.0 m depth in 308º direction	3 in Sep 2017	Operational	July 4, 2021	< 1	< 1	No Change
SI14-27	Oct. 3, 2014	5981470	619283	10 over 7.2 m to 9.2 m depth in 0º direction	7 in Sept. 2019	Operational	July 4, 2021	< 1	< 1	<1
SI14-28	Oct. 3, 2014	5981548	619241	15 over 8.8 m to 10.8 m depth in 338º direction	6 in Sept. 2017	Operational	July 4, 2021	2	3	<1

(1) Updated May 4, 2022, with approximate accuracy of ± 3 m.

Table NC059-2: Spring 2022 Piezometer Reading Summary

Instrument Name	Date Initialized	Coordinates (1) (UTM 11U, NAD1983) (m)		Tip Elevation (m aMSL)(2)	Ground Elevation (m aMSL)	Current Status	Maximum Piezometric Elevation (m aMSL)	Measured Piezometric Elevation (m aMSL) (Measured Pore Pressure)	Previous Piezometric Elevation (m aMSL) (Spring 2021)	Change in Piezometric Level Since Previous Reading (m)
		Northing	Easting							
PN5 (030156)	Aug. 19, 2005	5981481	619298	689.4	702.2	Operational	701.8 Dec. 2006	698.9 (92.7 kPa)	698.4 (88.2 kPa)	0.5
PN14-26 (35510)	Oct. 3, 2014	5981520	619345	694.4	705.3	Operational	705.0 May 2016	704.1 (95.0 kPa)	704.3 (97.0 kPa)	-0.2
PN14-27 (35509)	Oct. 3, 2014	5981470	619283	691.0	699.1	Operational	700.9 Sept. 2018	699.4 (82.8 kPa)	698.8 (77.0 kPa)	0.6
PN14-28 (35508)	Oct. 3, 2014	5981548	619241	689.7	700.6	Operational	700.4 Sept. 2018	698.9 (89.8kPa)	698.4 (85.0 kPa)	0.5

(1) Updated May 4, 2022, with approximate accuracy of ± 3 m.
(2) aMSL = Above Mean Sea Level

Reference: **North Central Region, Edson, Site NC059 - Highway 43:16 Little Paddle River Slide, Spring 2022 Instrumentation Monitoring Report**

CLOSING

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

Stantec Consulting Ltd.

2022-06-12
ID# 139079

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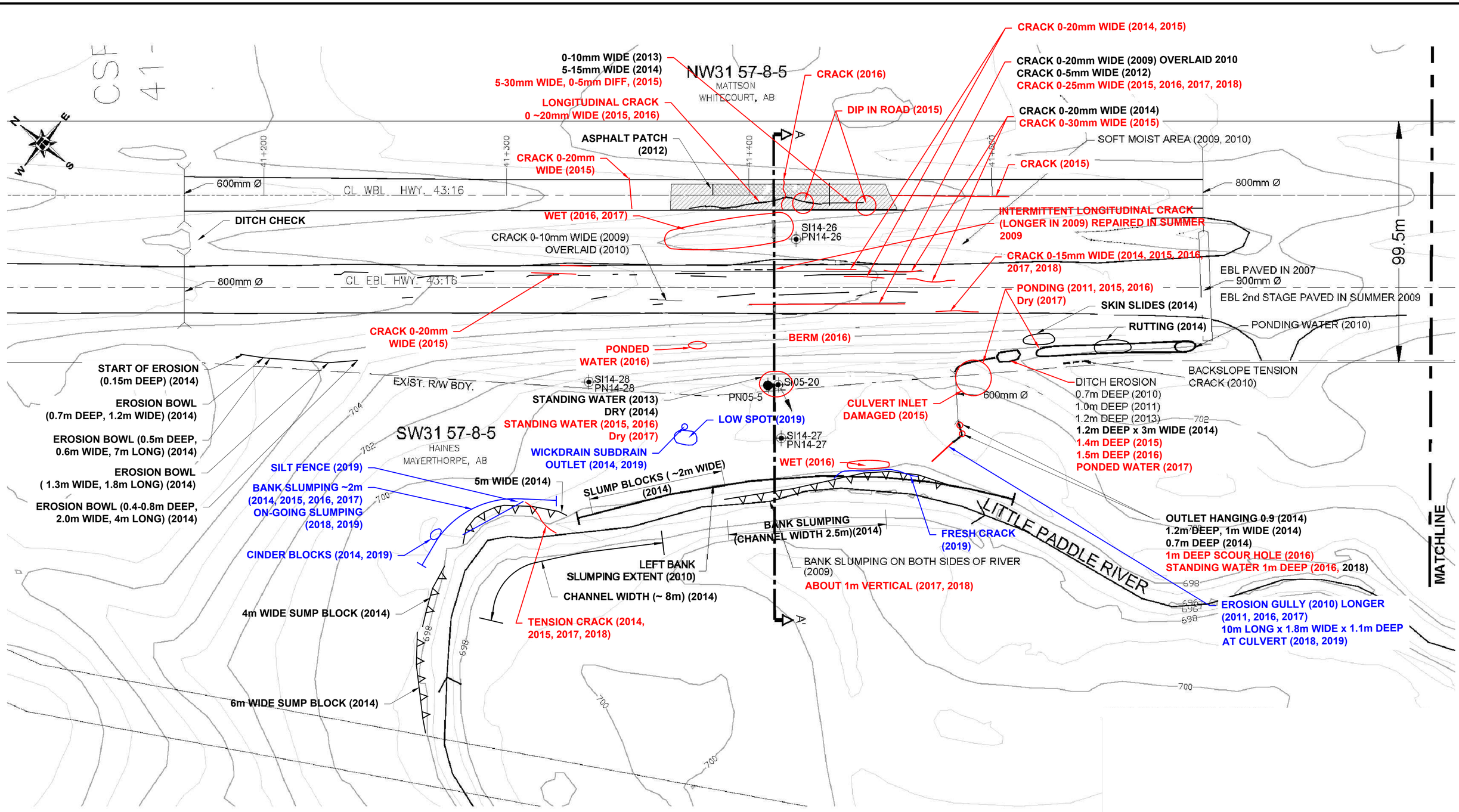
Attachment:
Figure 1 – Main Slide Site Plan
SI05-20 Slope Inclinometer Plots
SI14-26 Slope Inclinometer Plots
SI14-27 Slope Inclinometer Plots
SI14-28 Slope Inclinometer Plots
Pneumatic Piezometer Depth vs. Time Plot
Pneumatic Piezometer Elevation vs Time Plot

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature ID# 74389
Date 13-June-2022
PERMIT NUMBER: P 0258
The Association of Professional Engineers and Geoscientists of Alberta



NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. 2012 TO 2013 OBSERVATIONS FROM GOLDER ASSOCIATES FIGURE 1 (DATE SEPTEMBER 6, 2013) SHOWN IN BLACK
3. SEPTEMBER 3, 2014 OBSERVATIONS SHOWN IN BLACK
4. 2015 TO 2018 OBSERVATIONS SHOWN IN RED
5. 2019 OBSERVATIONS SHOWN IN BLUE

LEGEND

- PNEUMATIC PIEZOMETER (PN)
- SLOPE INCLINOMETER (SI)
- DIRECTION OF MOVEMENT IN SLOPE INCLINOMETER
- CULVERT SUBDRAIN INLET/OUTLET

REFERENCE

THURBER ENGINEERING LTD. PROJECT#15-16-326
ORIGINAL SCALE 1:1000 DATE AUGUST 2011.
1m CONTOURS FROM LIDAR PROVIDED BY ALBERTA TRANSPORTATION.

0 20 40 60 80 m

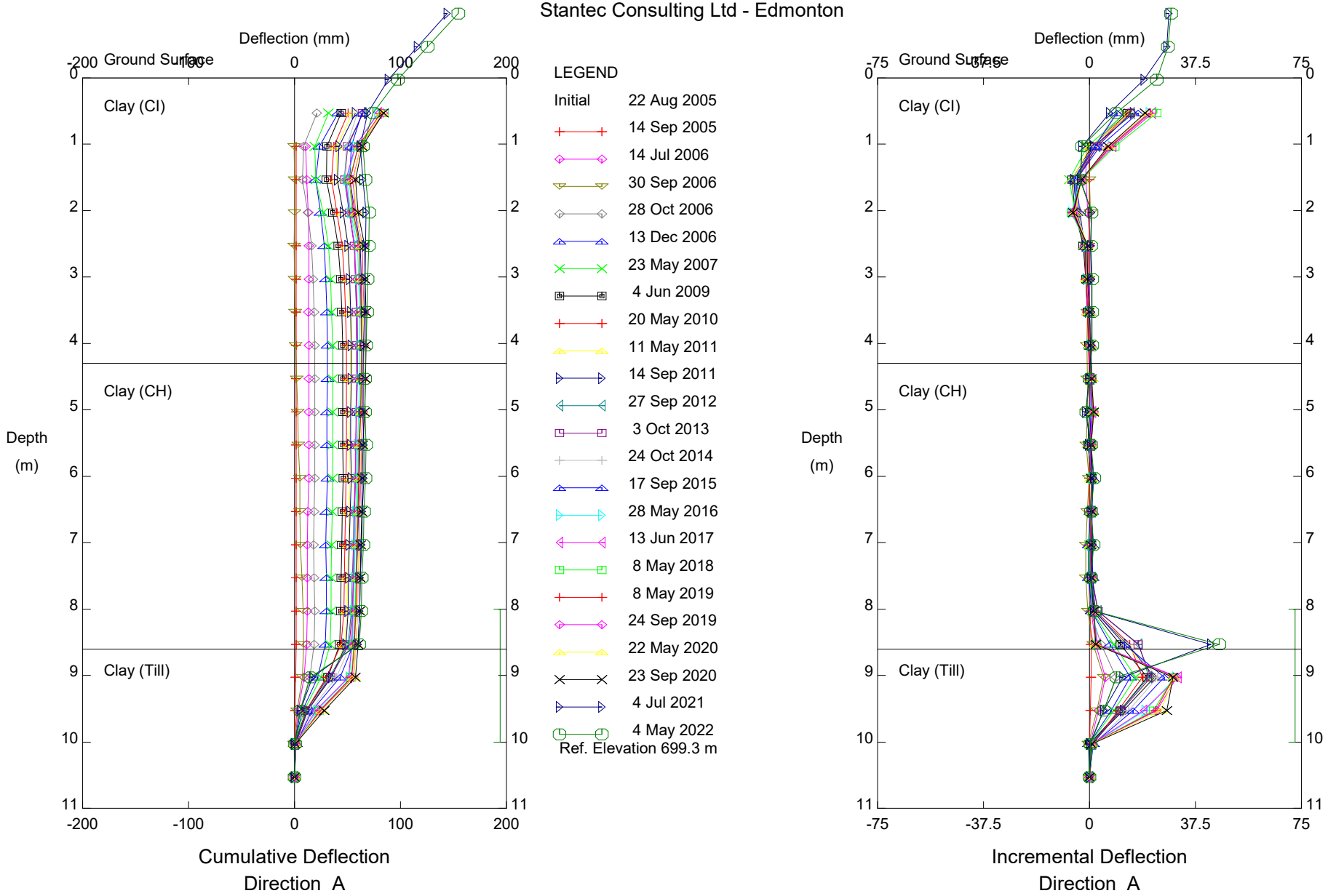
Stantec
STANTEC CONSULTING
400-10220 103 AVENUE NW
EDMONTON, ALBERTA, CANADA
T5J 0K4

ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC59 LITTLE PADDLE RIVER
MAIN SLIDE SITE PLAN

DRAWN WW / MK	CHECK XL	APPROVE LC
DATE 16 JUL 2019	SCALE AS SHOWN	PROJECT # 123315222

FIGURE - 1 -

Stantec Consulting Ltd - Edmonton



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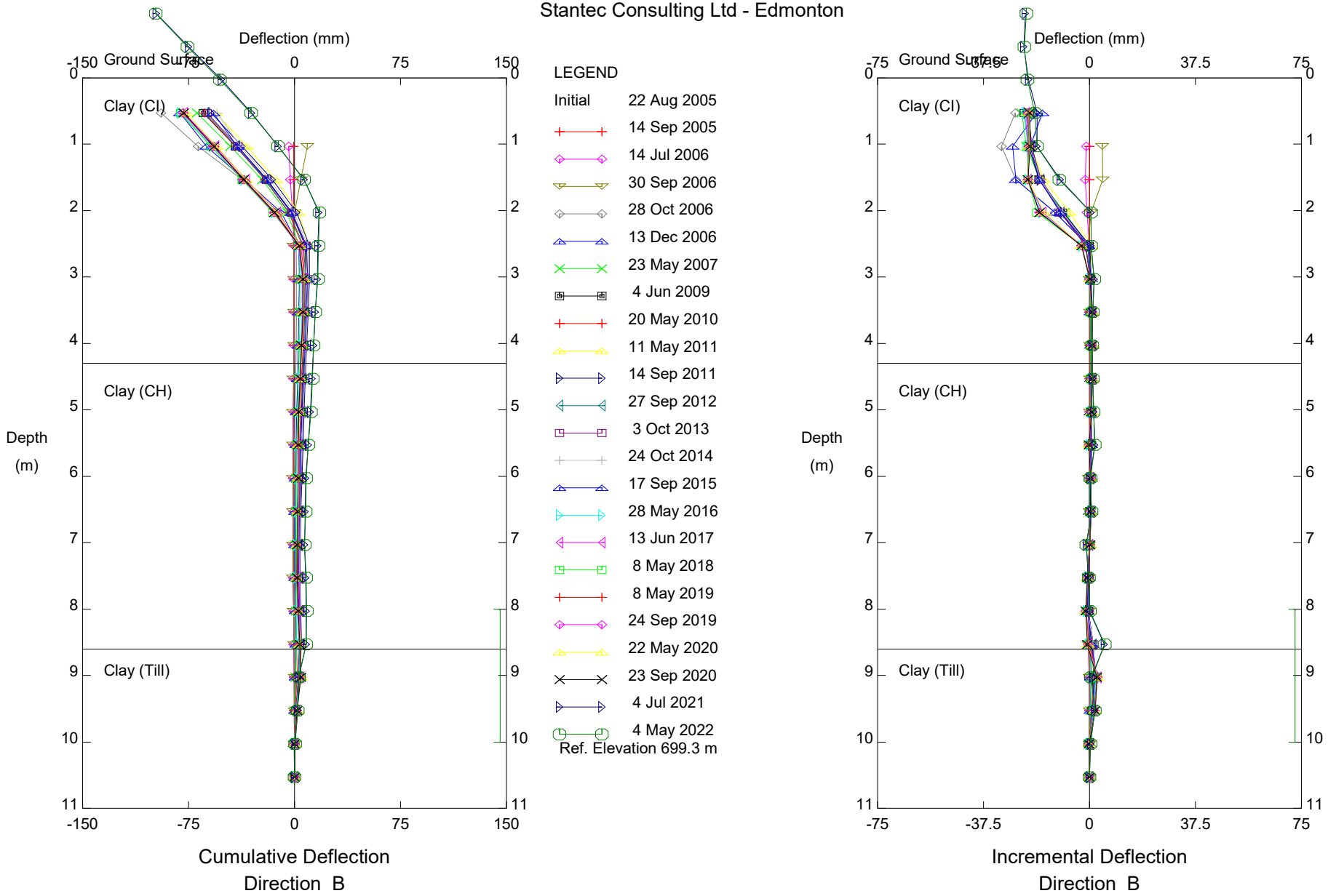

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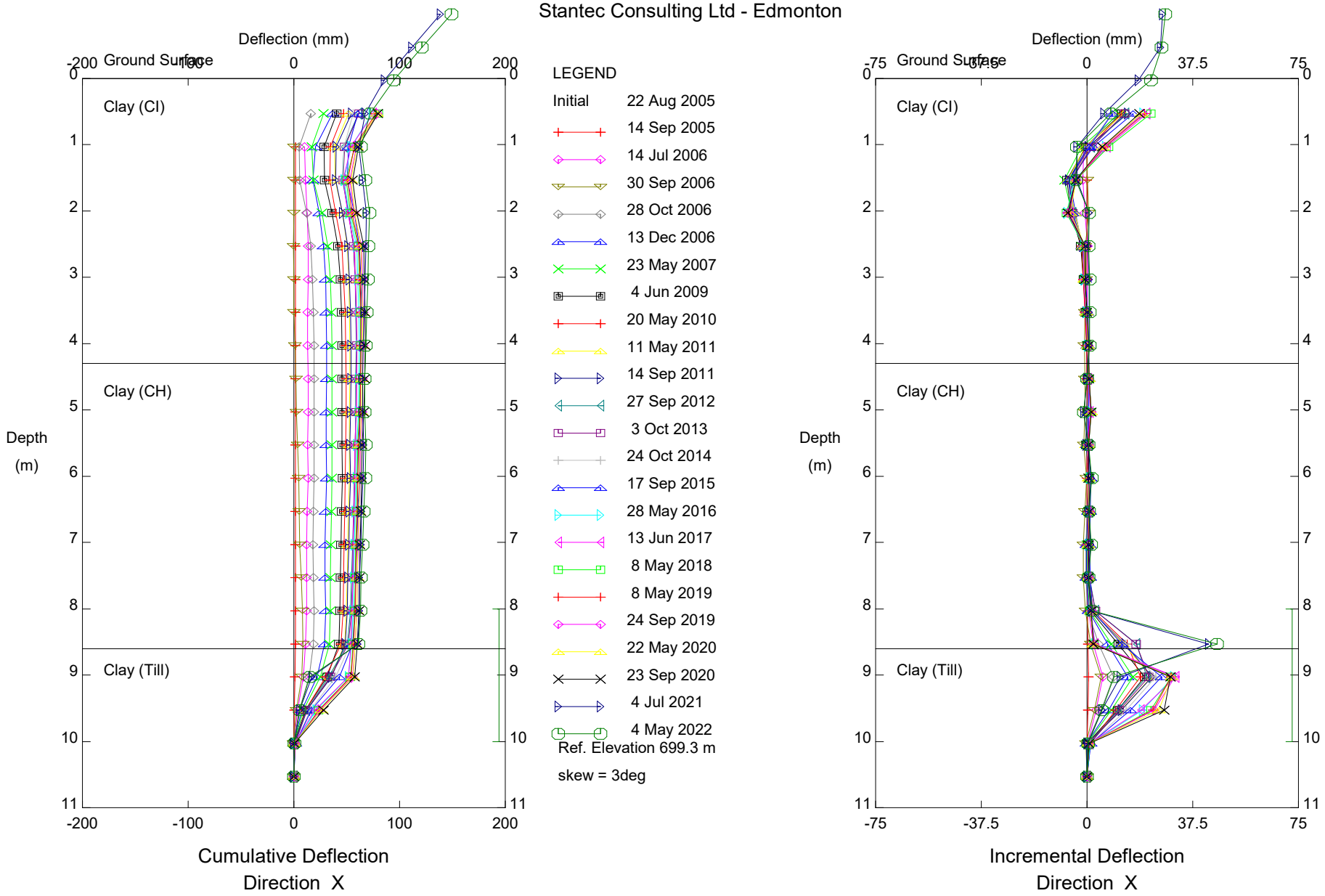

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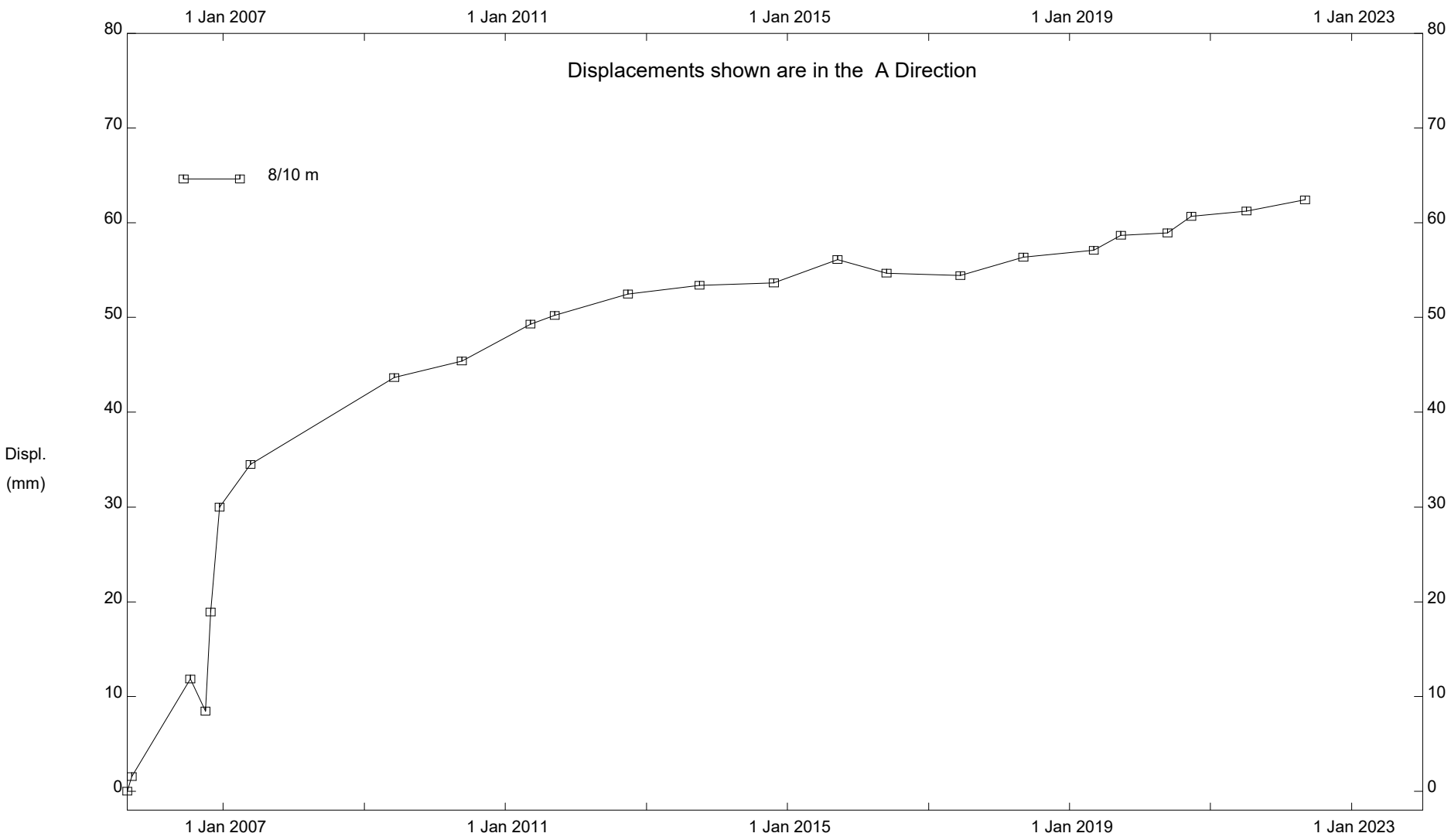

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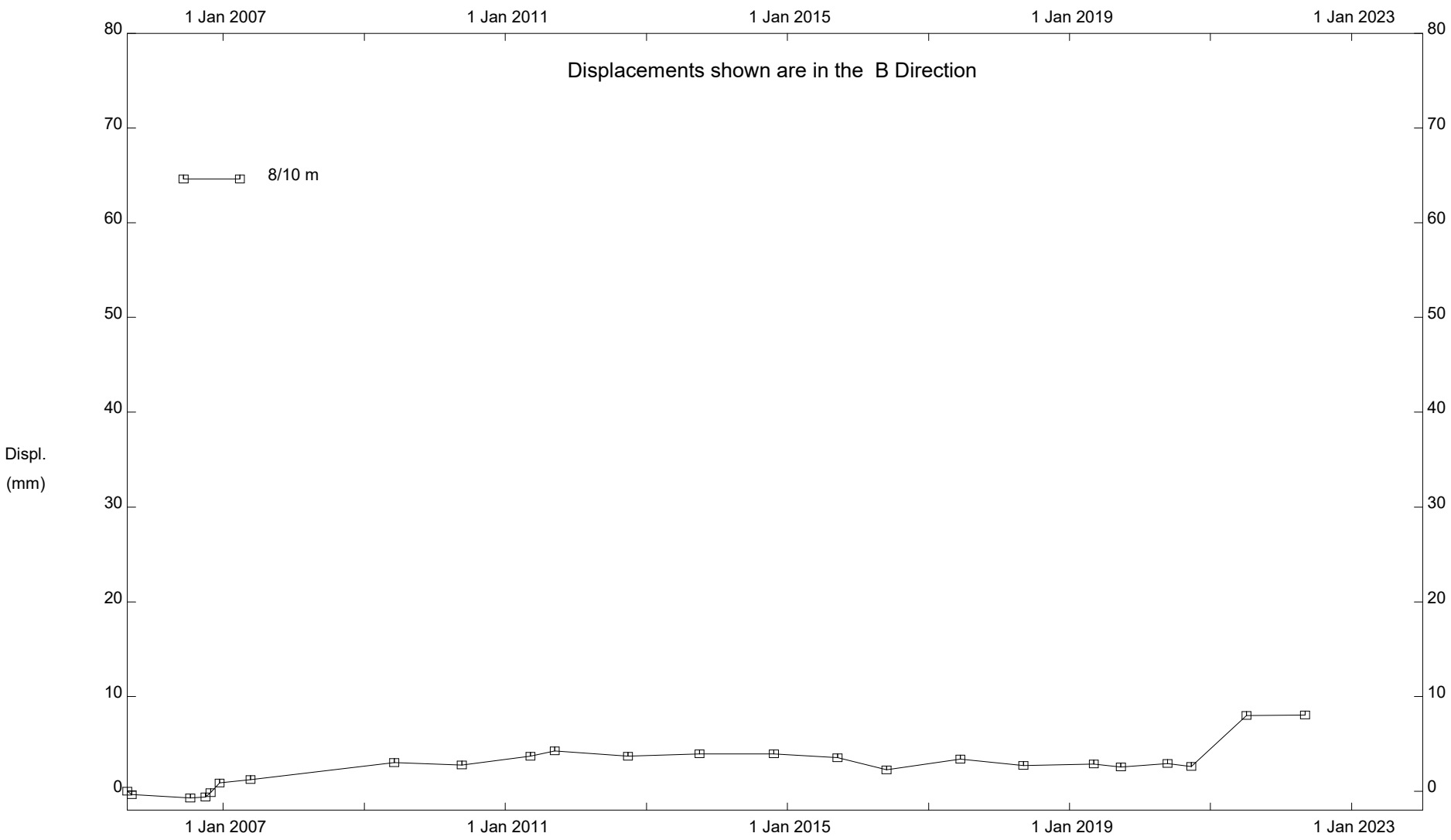

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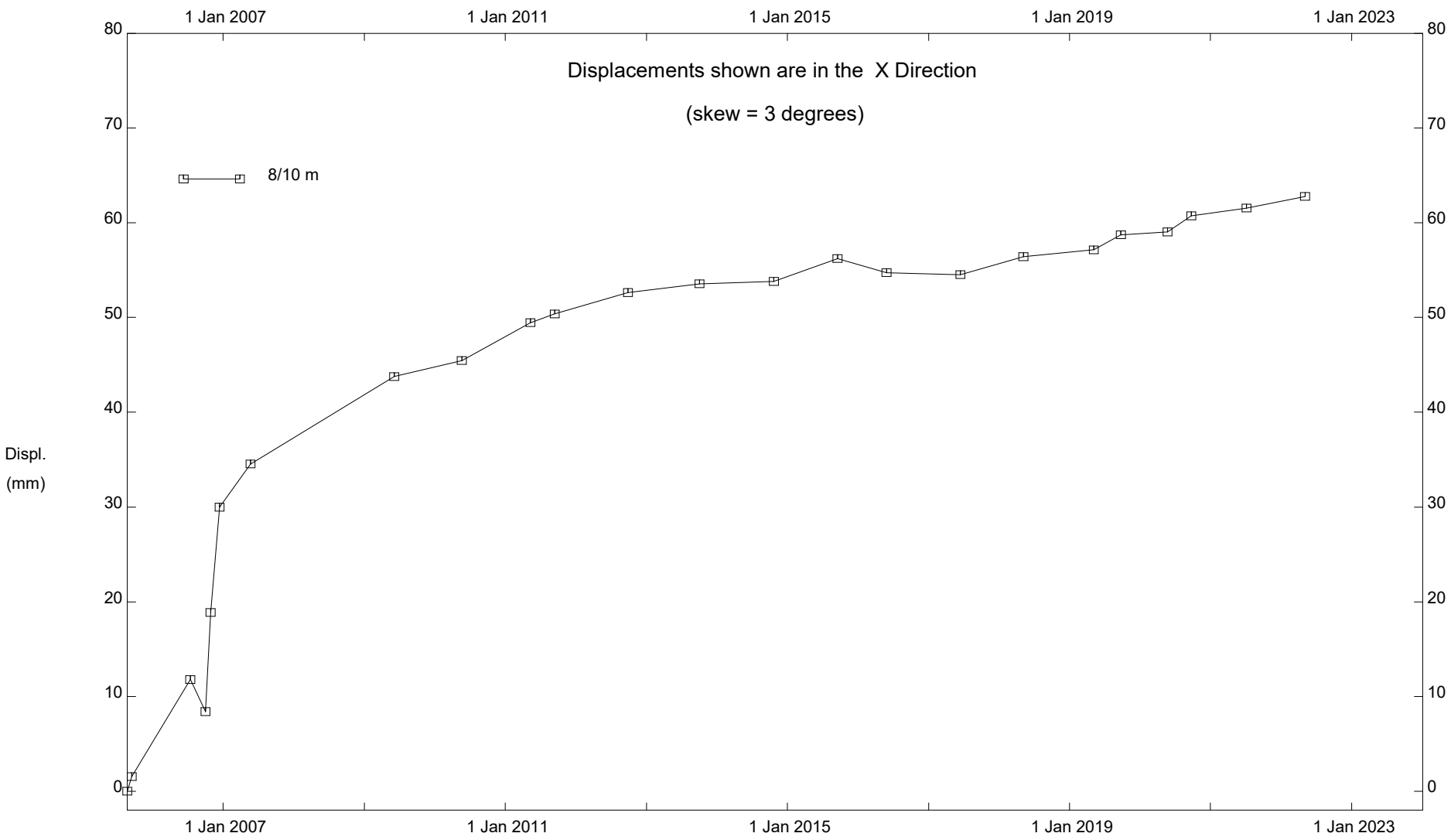

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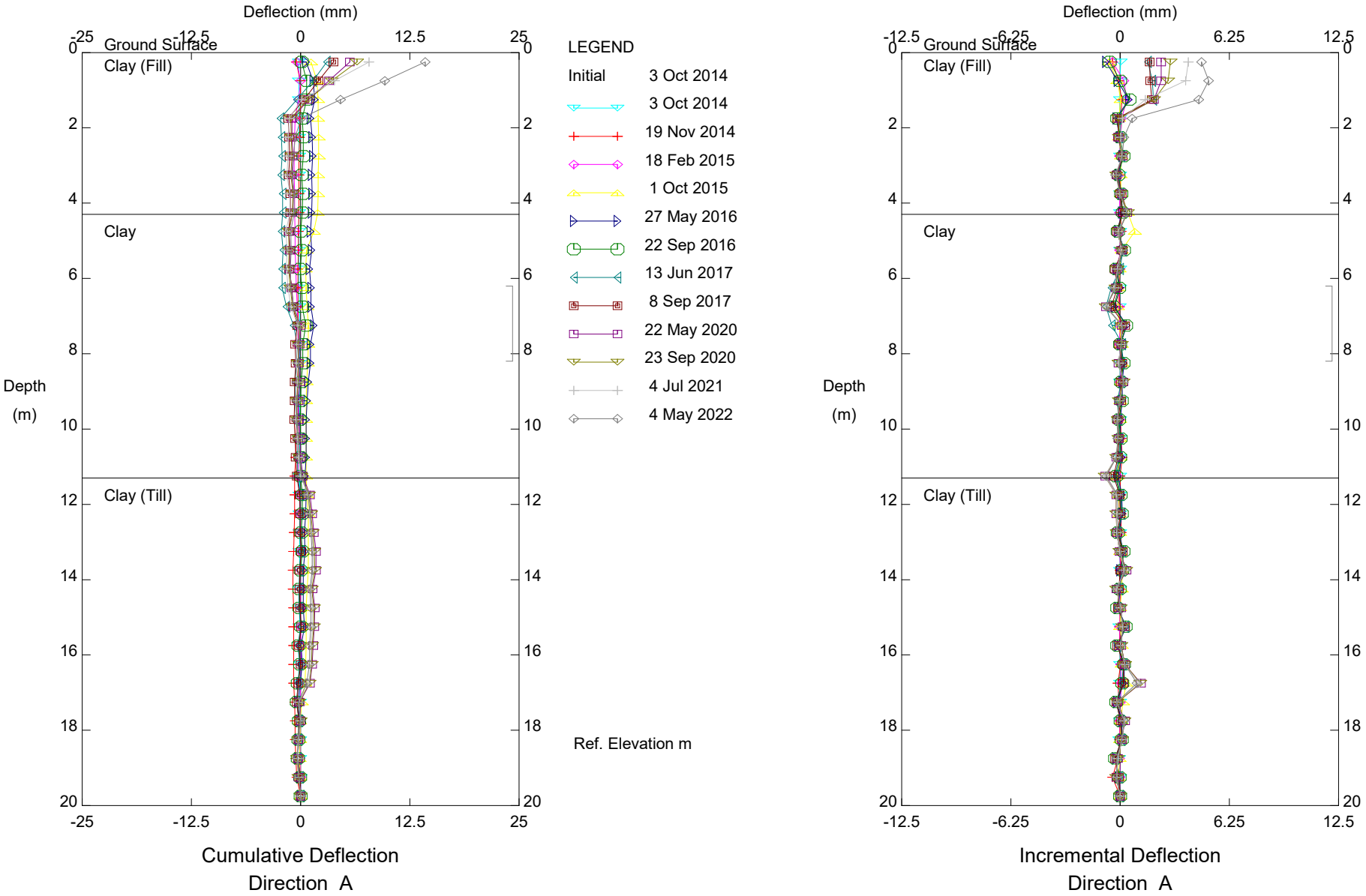

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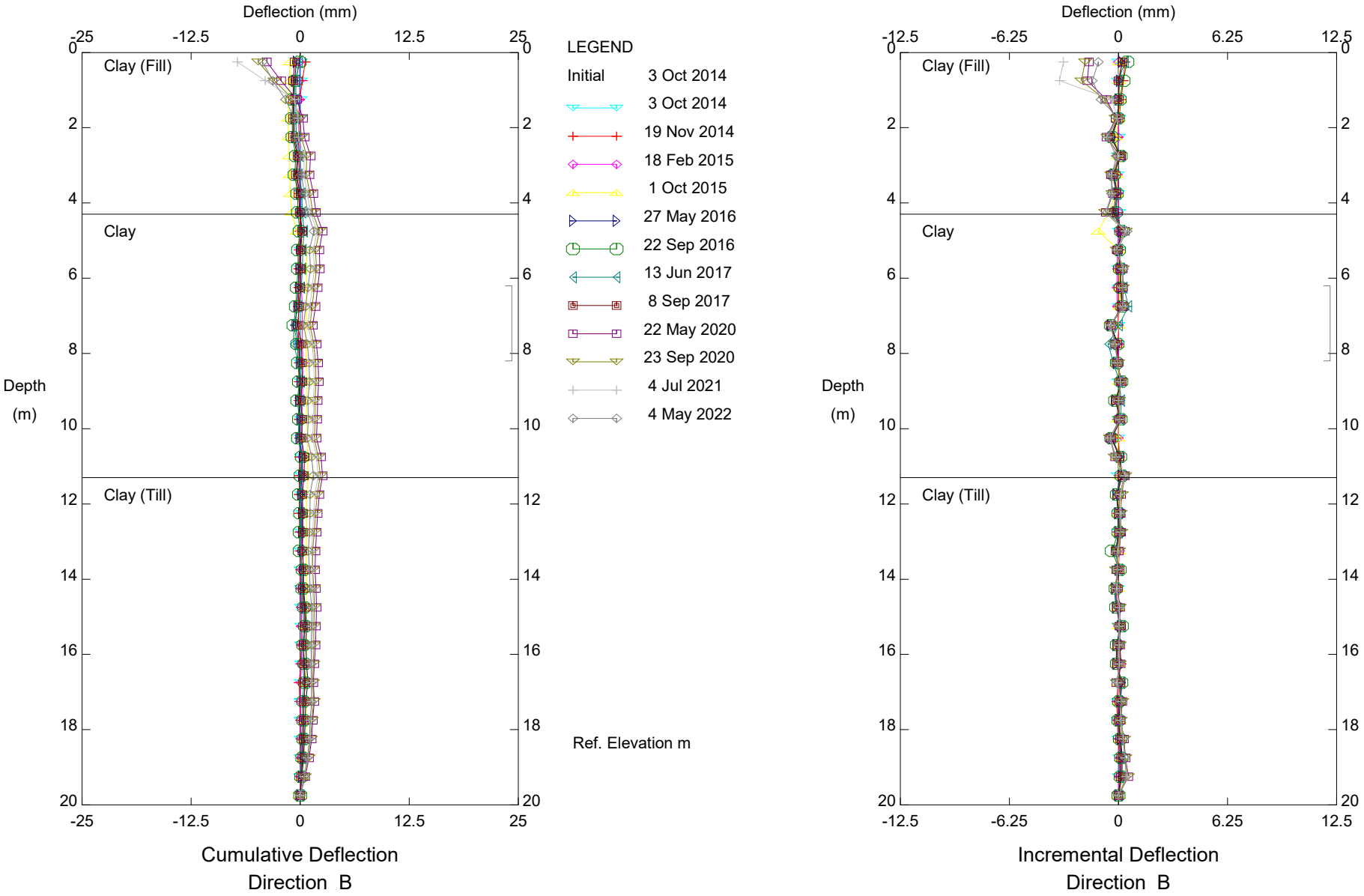

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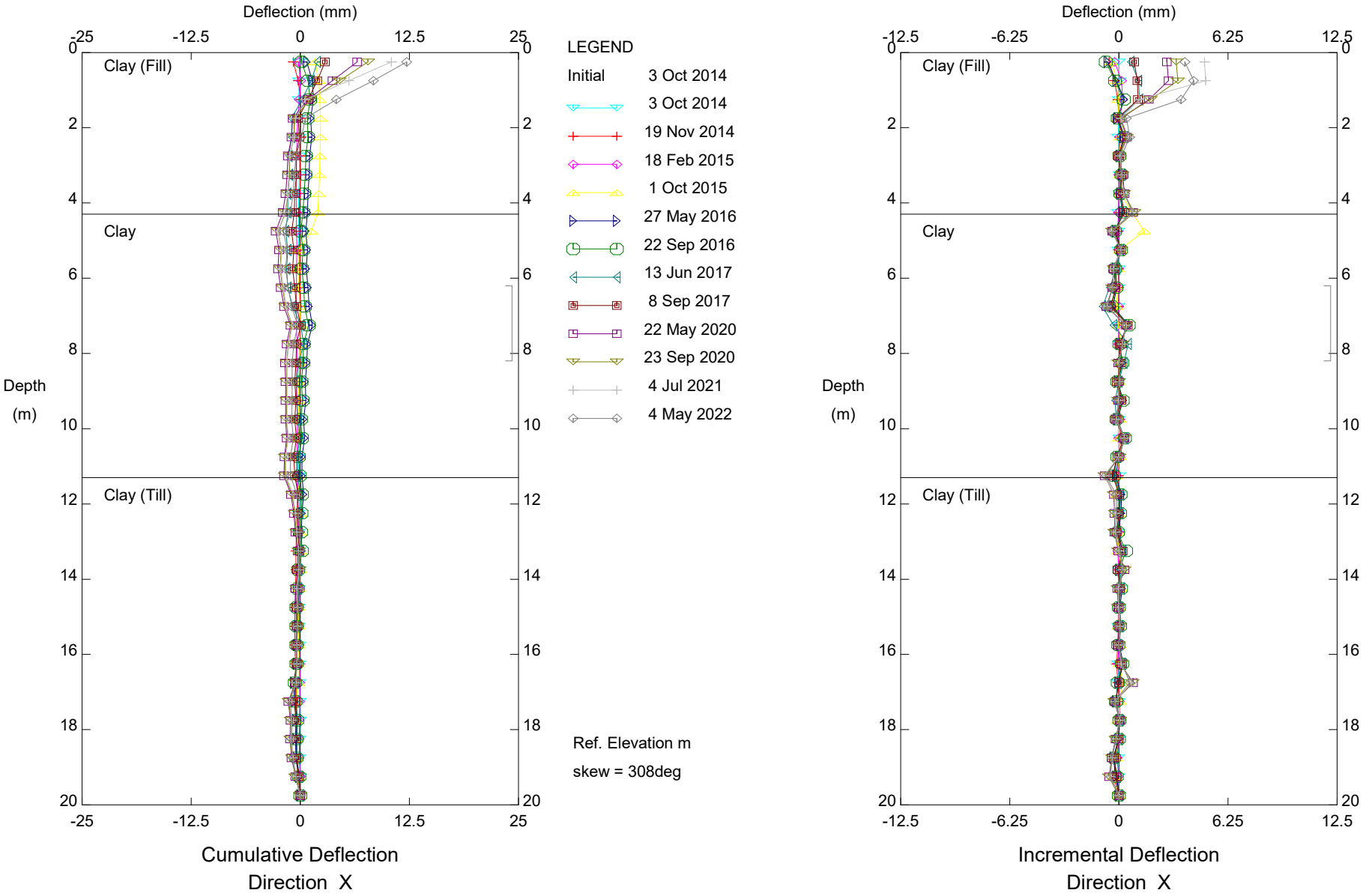

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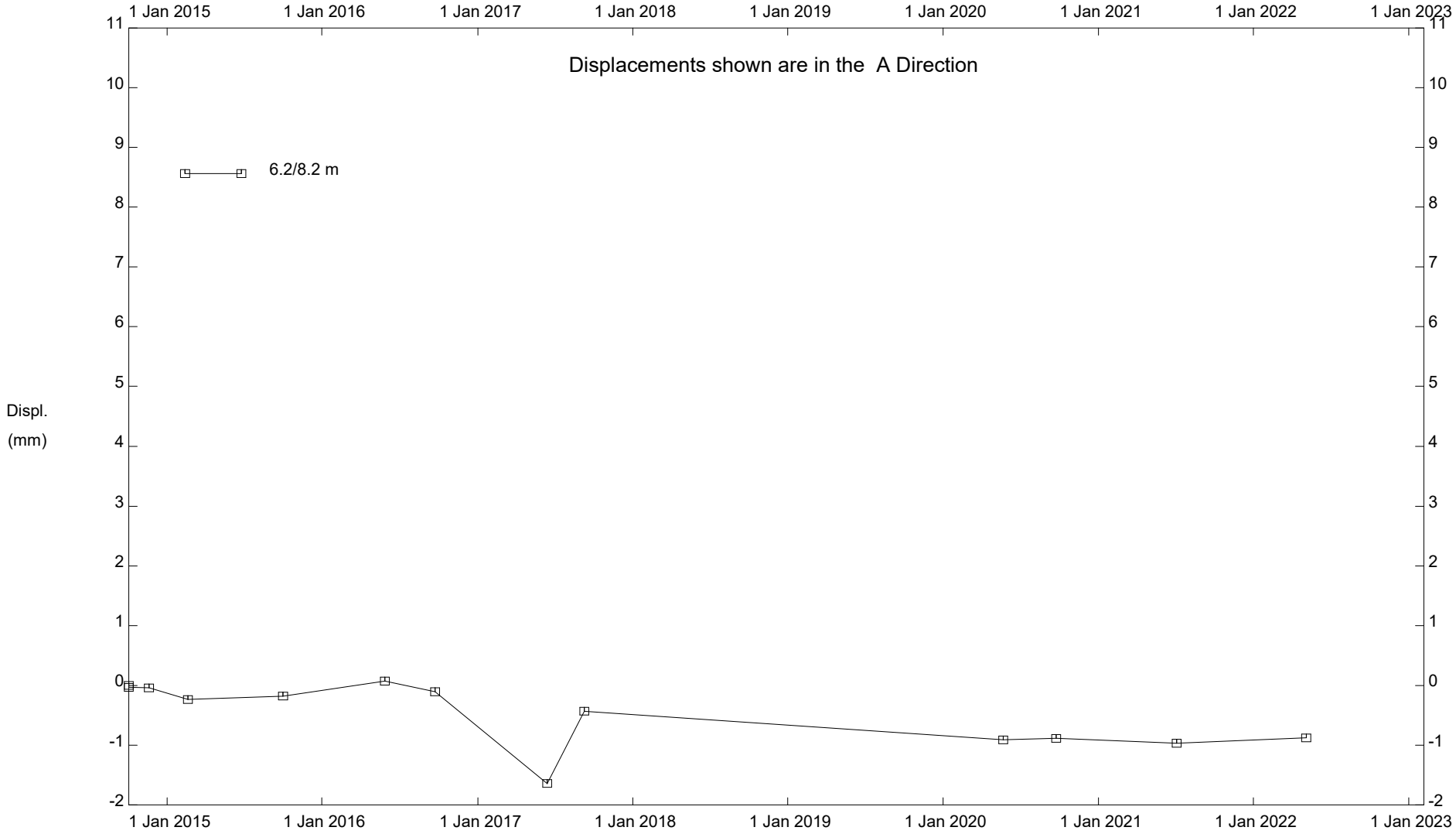

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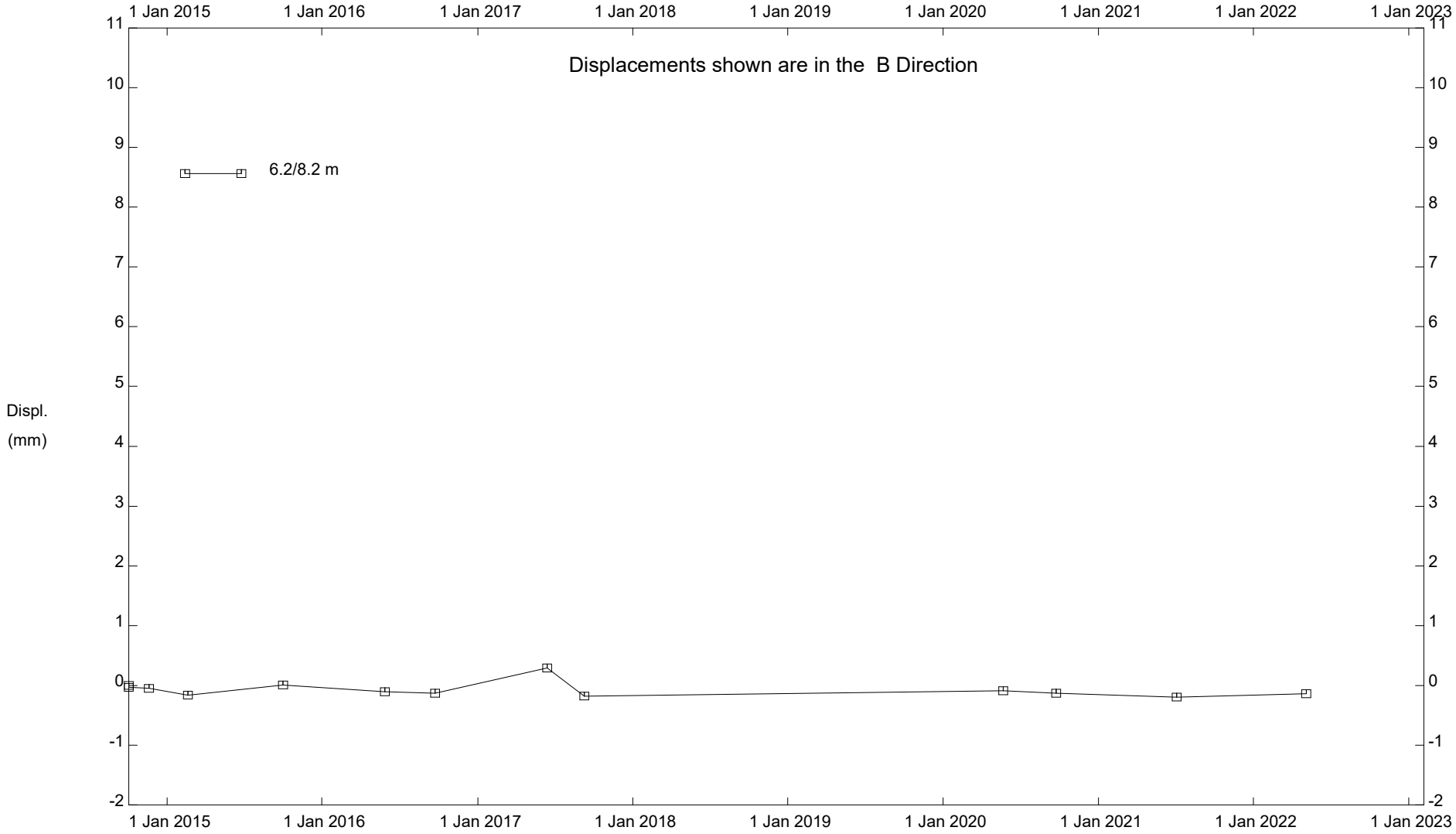

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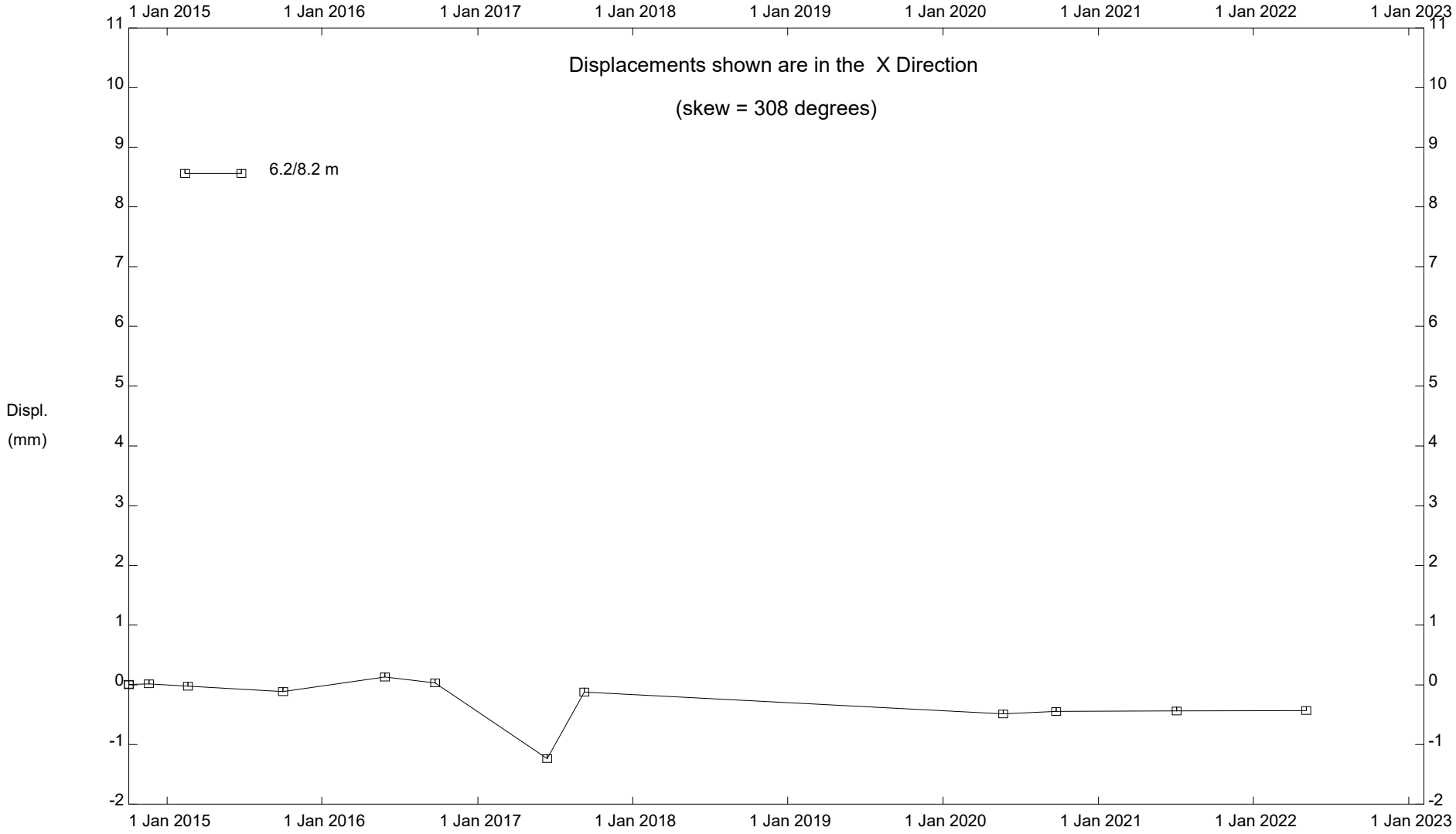

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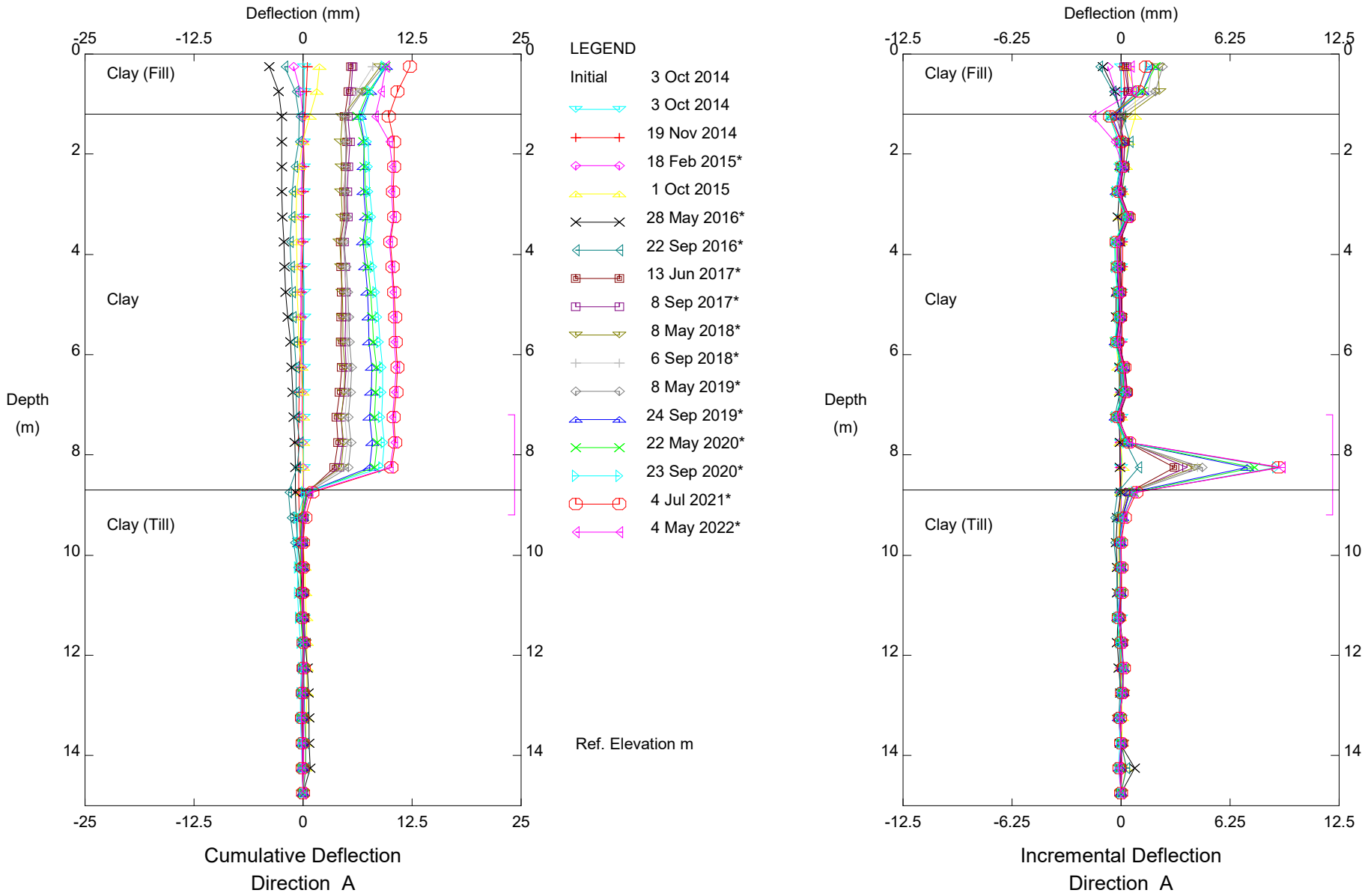

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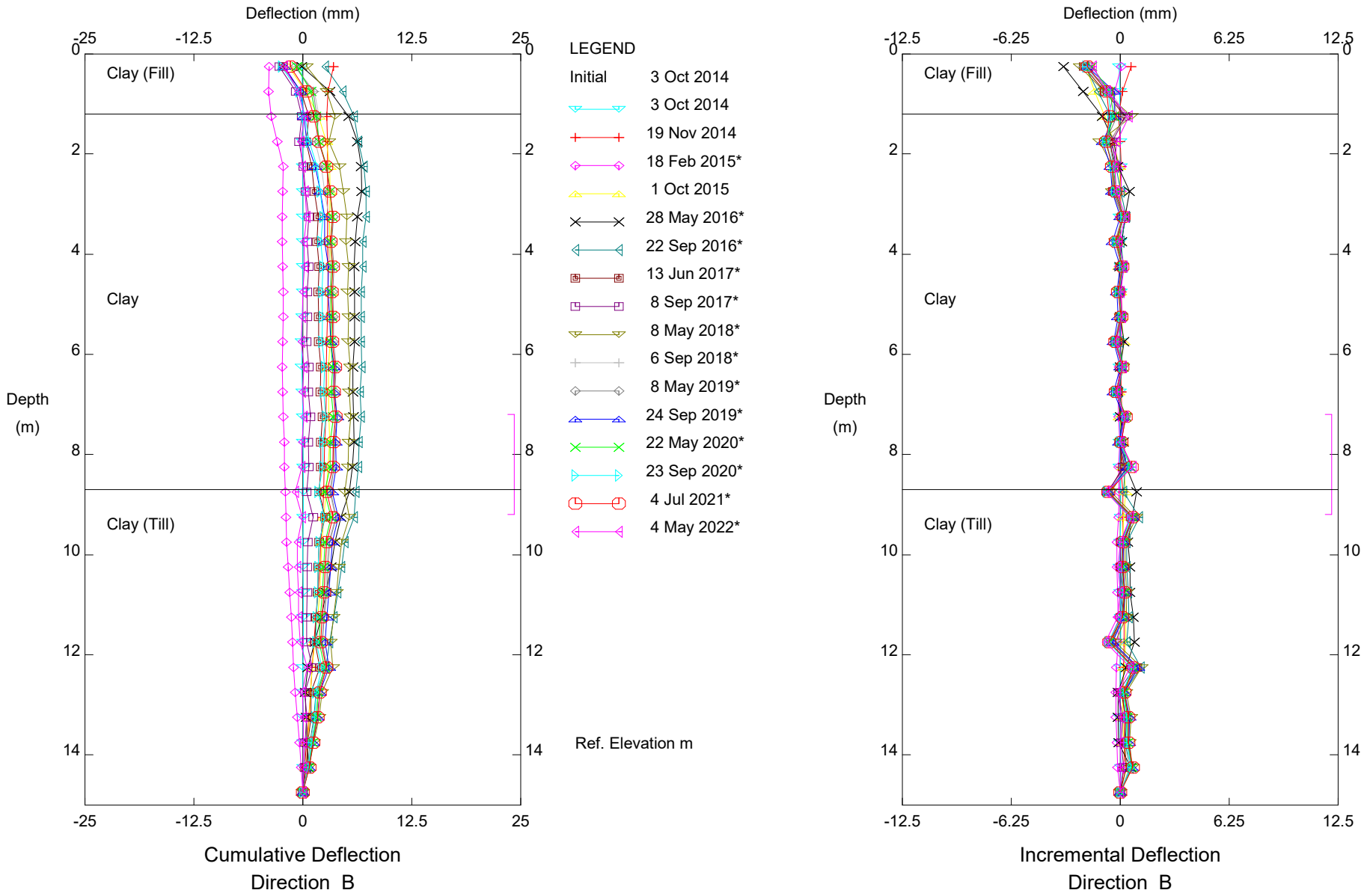

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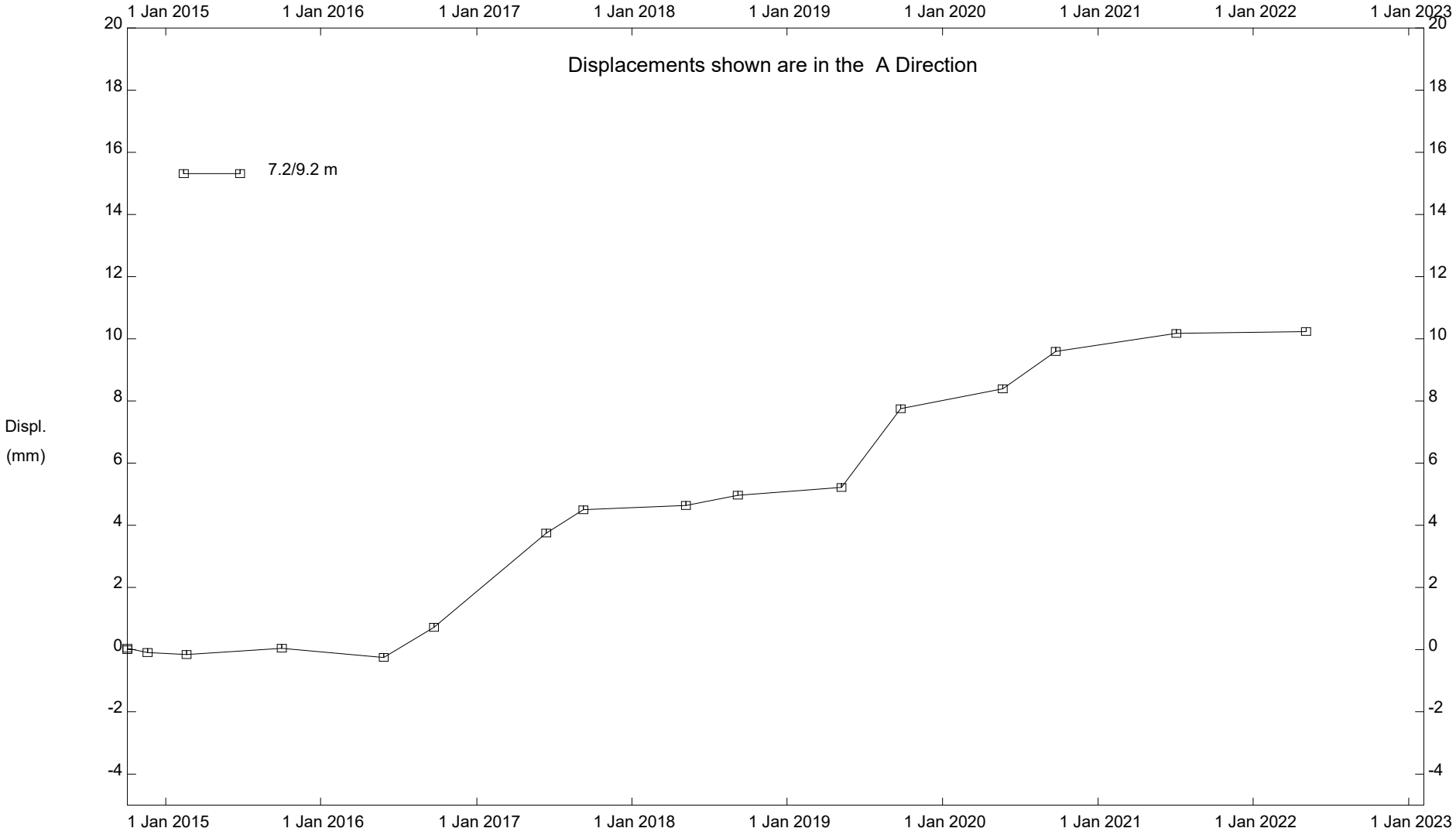

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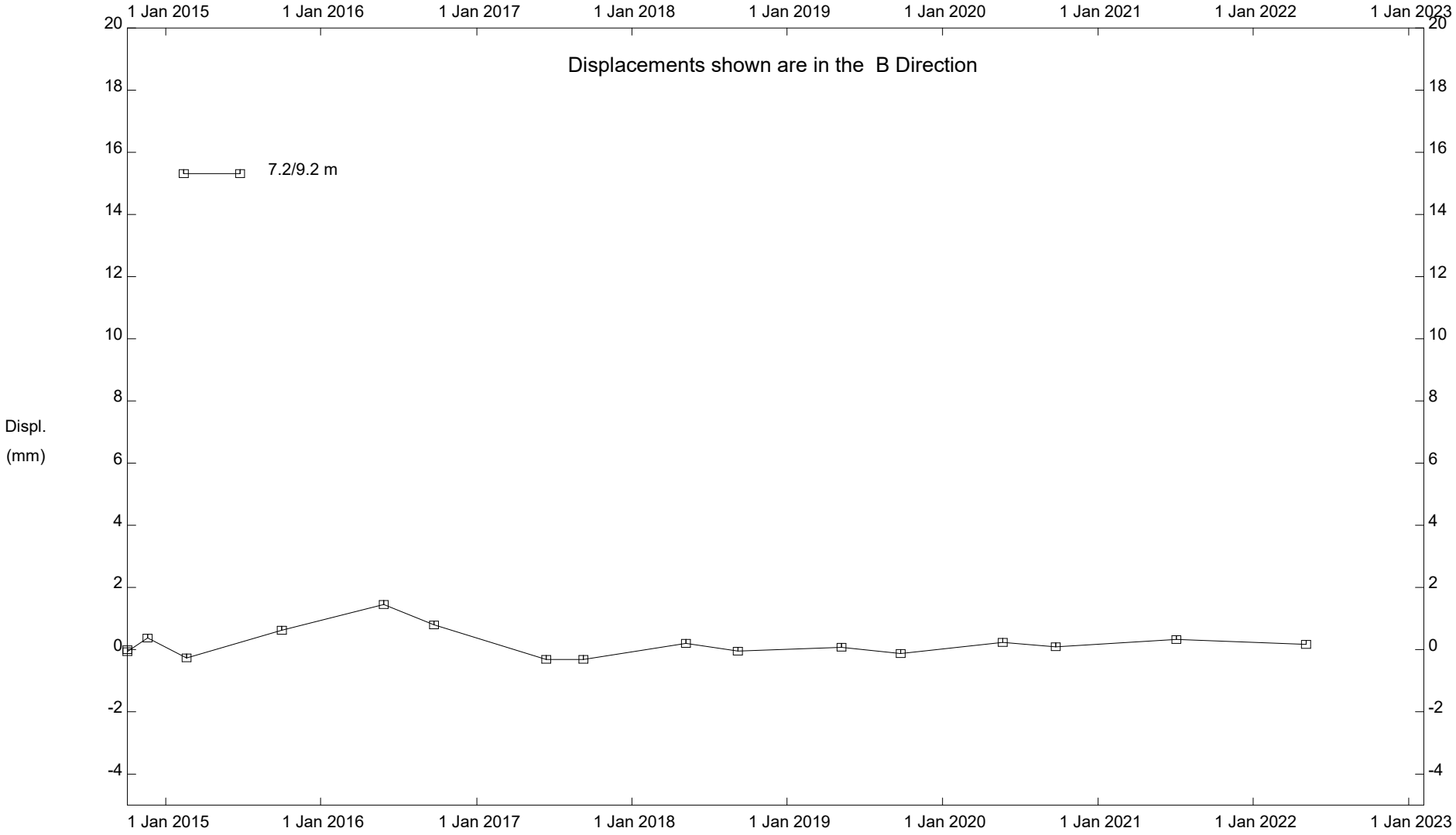

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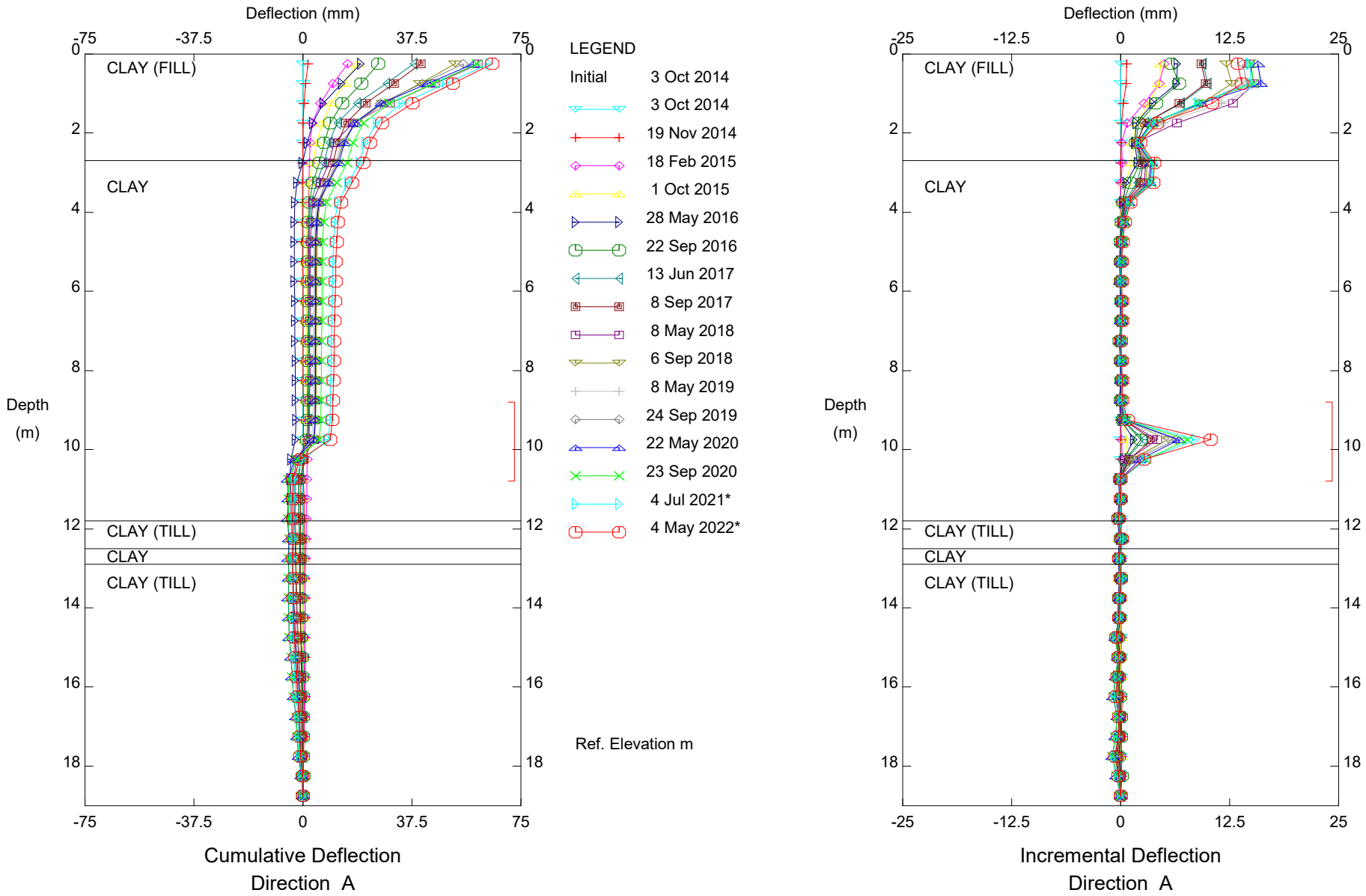

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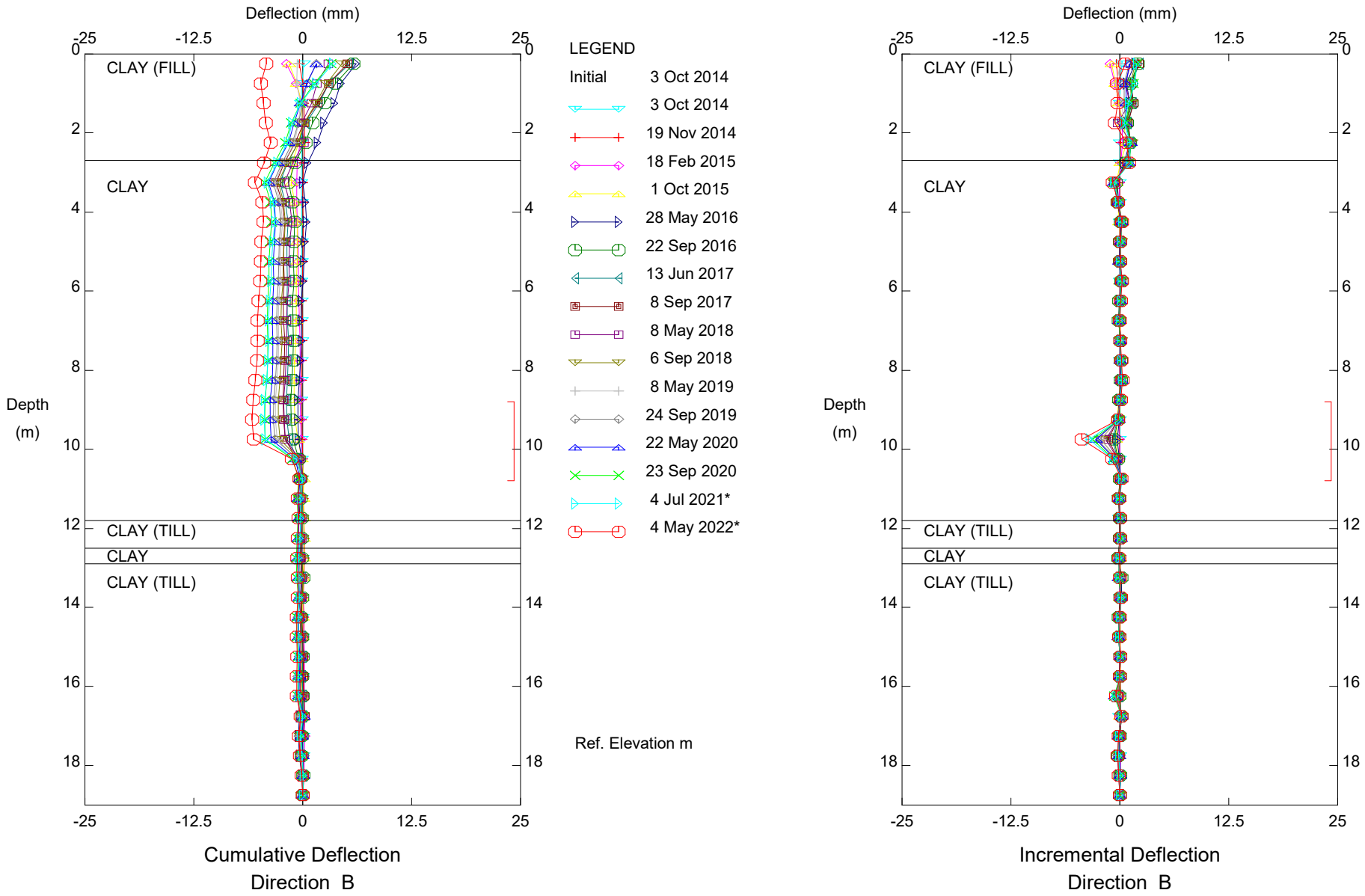

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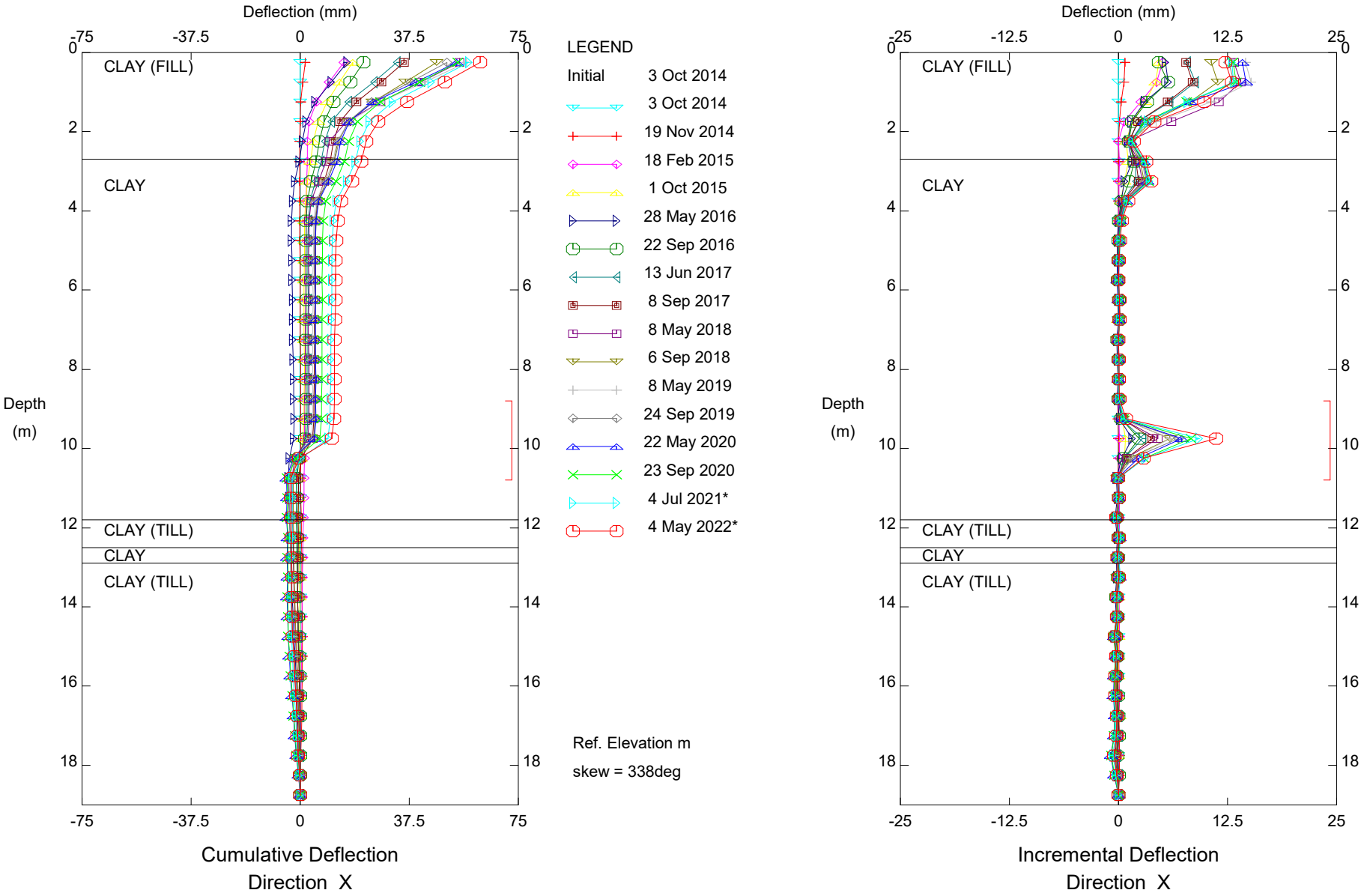

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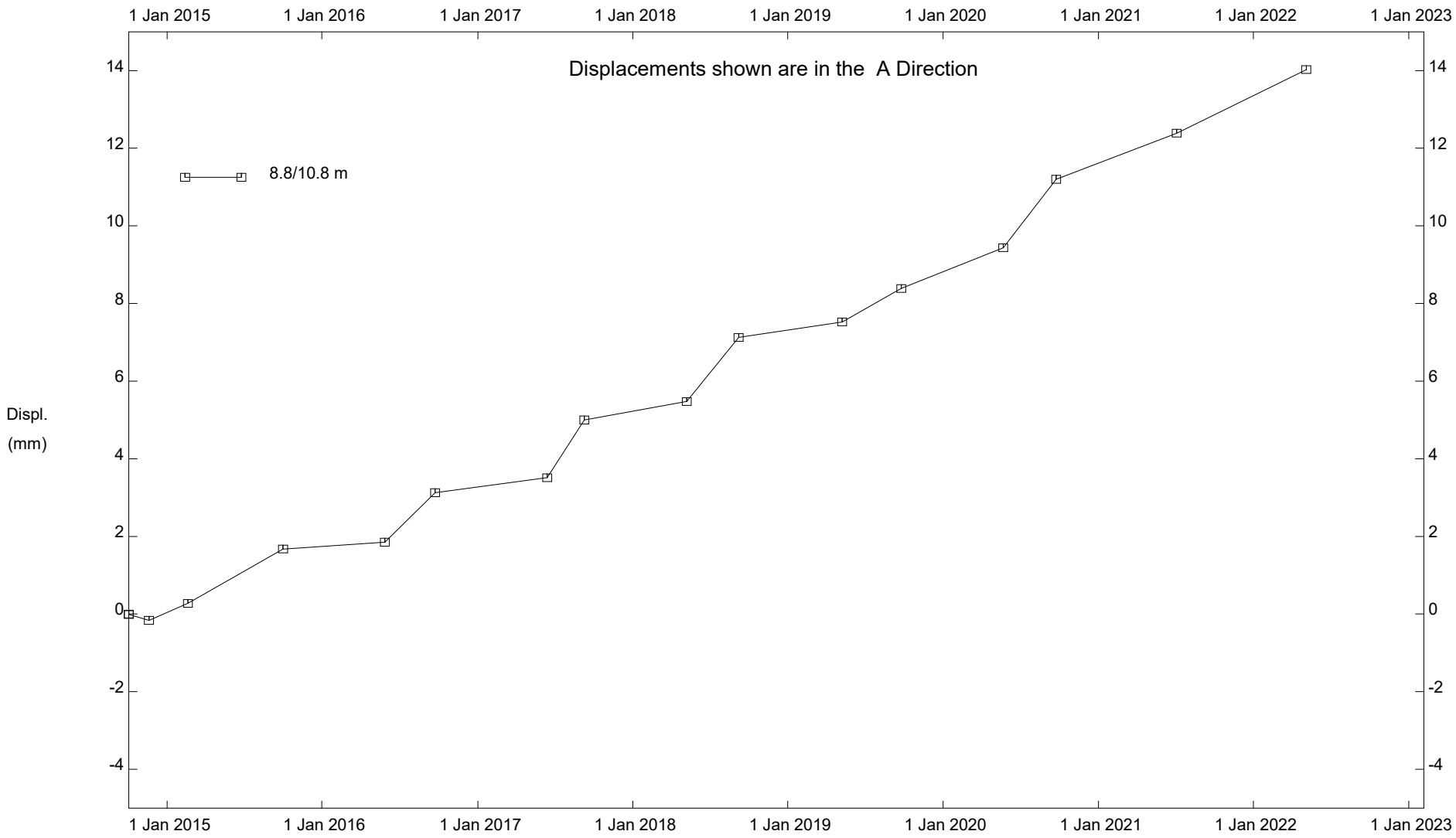

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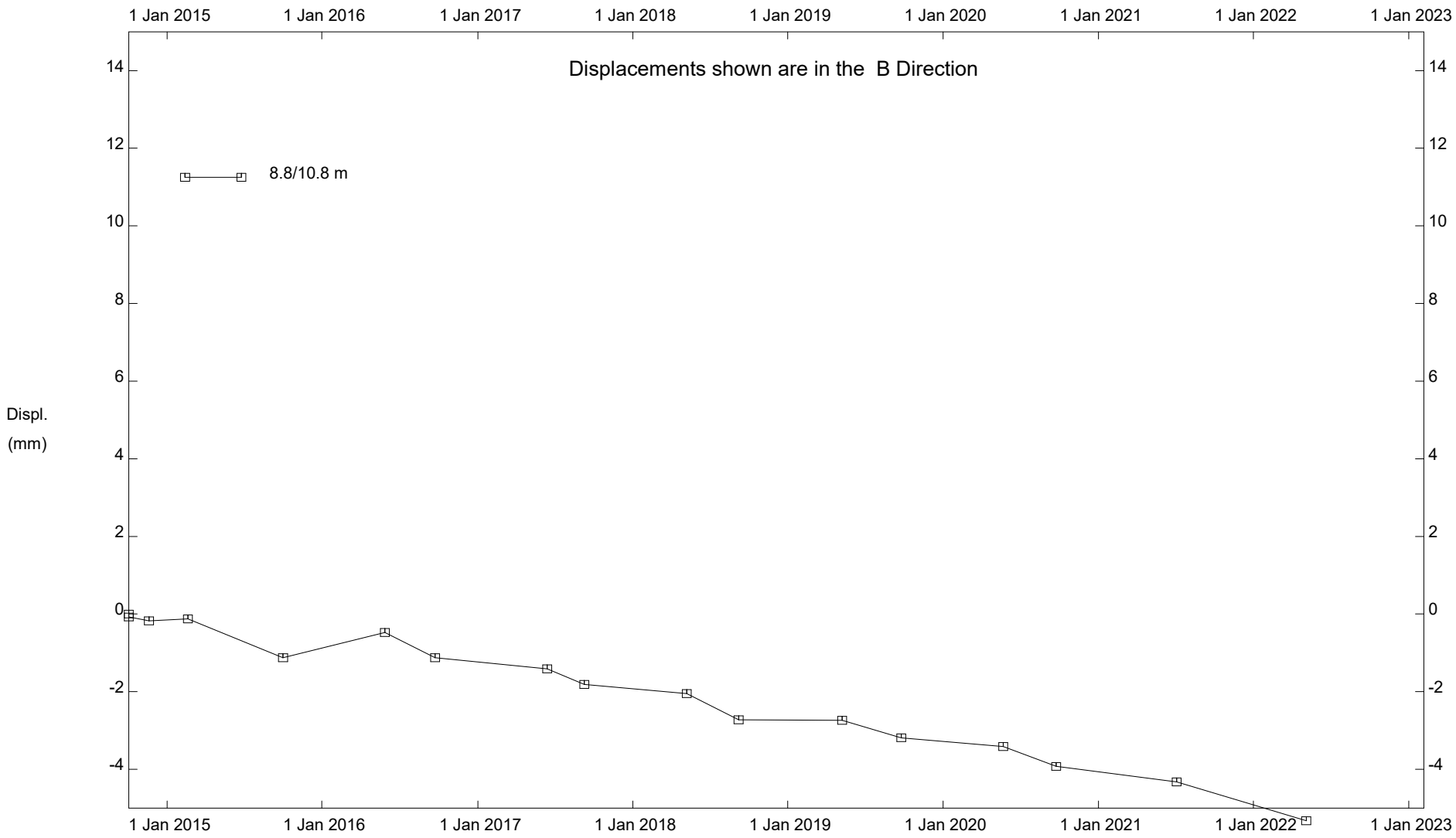

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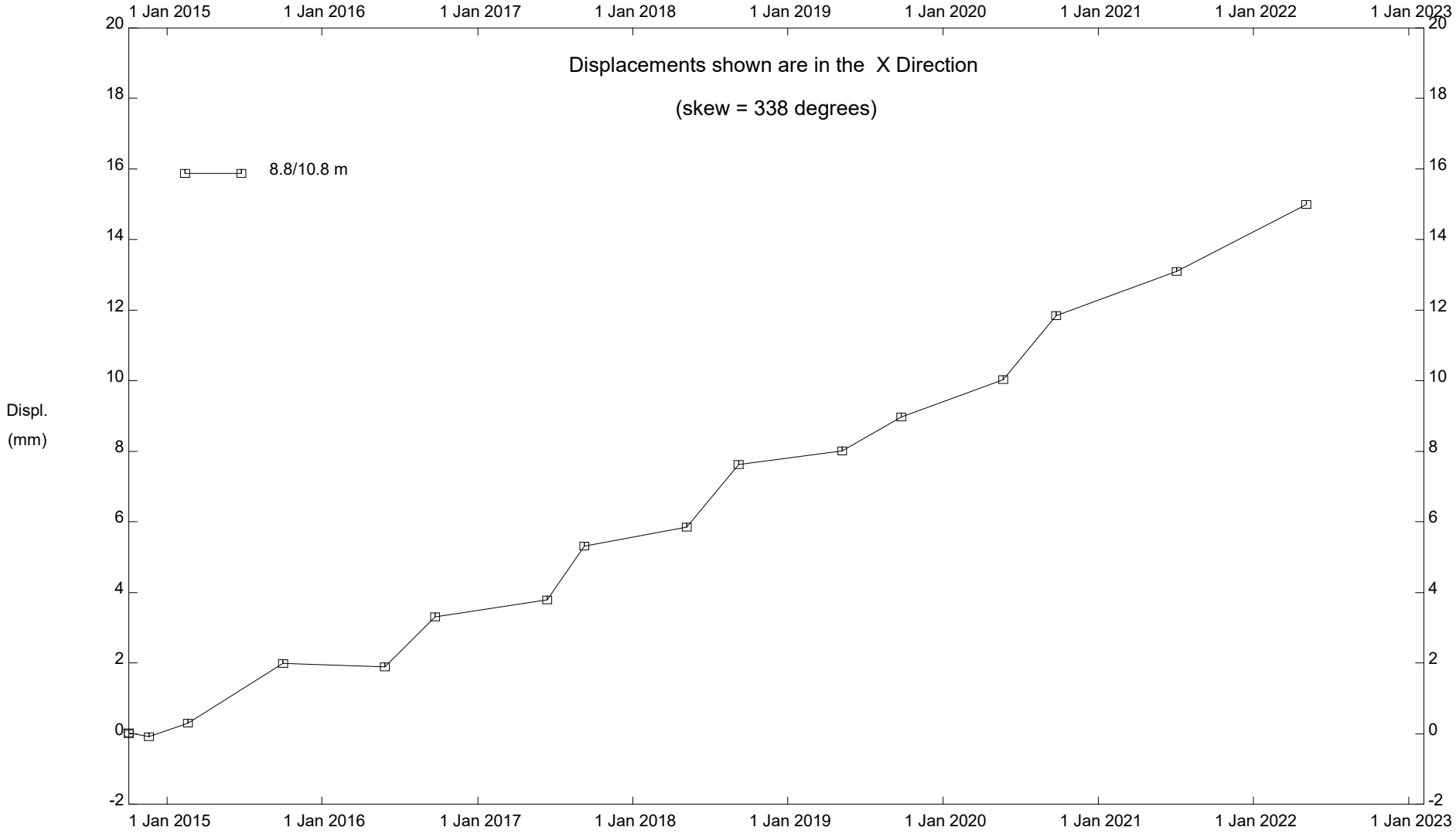

Hwy 43:16 Little Paddle River (NC059), Inclinometer SI14-28

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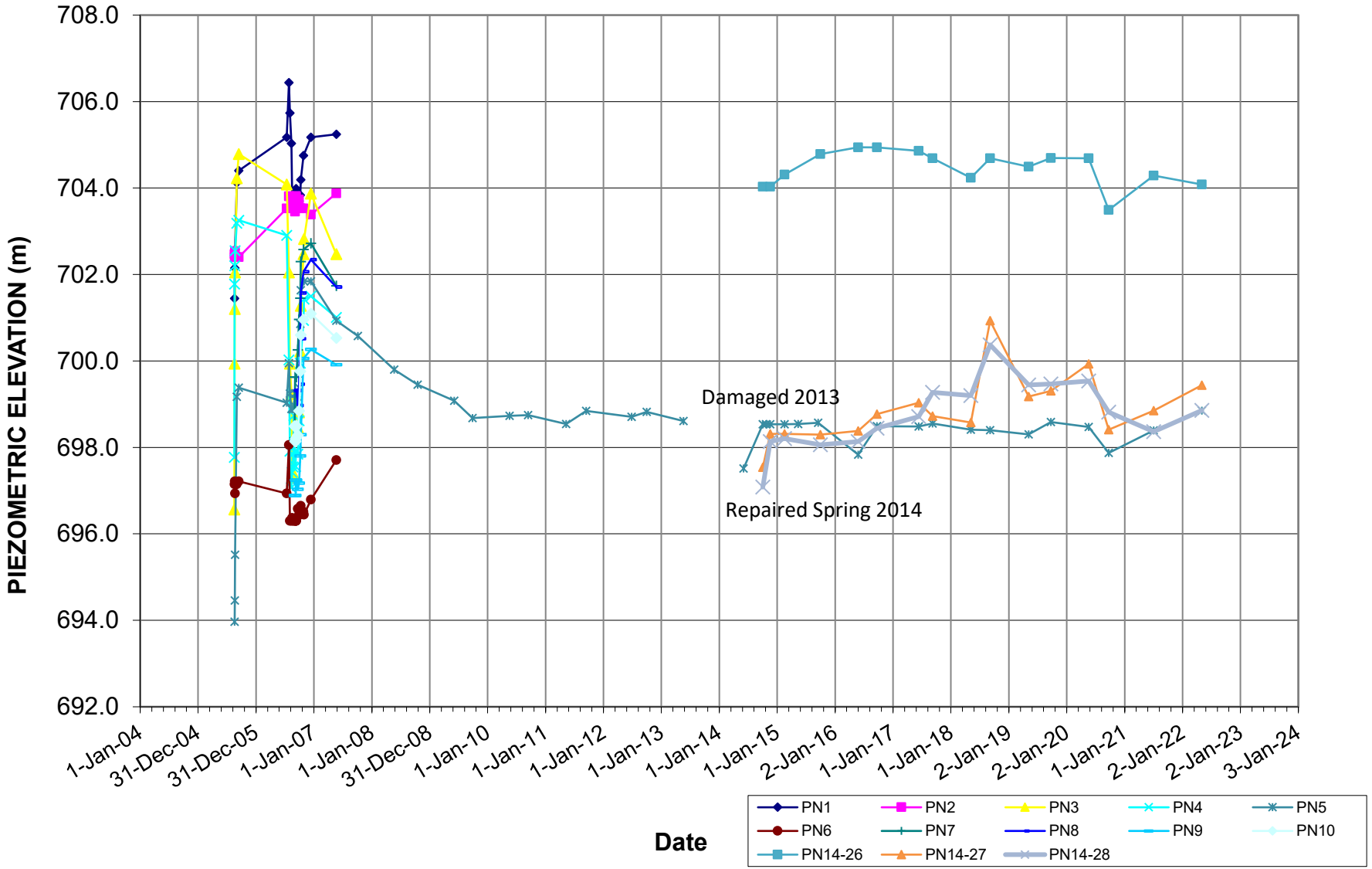
PNEUMATIC PIEZOMETER DATA
NC059: HWY 43:16, Little Paddle River Slide



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PNEUMATIC PIEZOMETER DATA
NC059: HWY 43:16, Little Paddle River Slide