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 NC018 - Highway 764:02 Pembina River Bridge (N. of Cherhill), 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 five slope inclinometers (SI7, SI8, SI9, SI22, and SI24) and three standpipes (SP2, SP96-1 and SP06-3). **Figure 1** attached provides 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 a 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. Standpipe piezometers (SP) were read with a Heron Instruments water tape.

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

2.0 INTERPRETATION

2.1 GENERAL

The SI plots are provided in the attachments and summarized in the following sections. Resultant plots in the A, B and X-direction along with rates of movement are provided for the SIs. Piezometer results are also summarized in the following sections with resultant plots attached.

2.2 ZONES OF MOVEMENT

No new zones of movement were observed in any of the operational slope inclinometers. **Table NC018-1** summarizes zones of movement, total movement, depth of movement, and the maximum rate of movement since initializing each SI. 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

Most of the SI measurements show no appreciable change in movement rates except for seasonal variations since about 2005.

SI-7, SI-8, SI-9 showed a negligible rate of movement (less than 1 mm/yr) since Fall 2017.

SI-22 does not contain any discernable movement zones. Note that during the work transfer to Stantec in 2016, a slight depth discrepancy was observed in SI-22 due to different unit of measurements used during data collection. In order to present more accurate information, data prior to 2016 has been excluded from the SI plots but the cumulative movement since initialization has been included on the SI table.

SI-24 showed a cumulative movement of about 119 mm with 5 mm/yr rate of movement within the upper 2 m. However, given that the majority of movement occurred in the B direction (i.e. perpendicular to the roadway), this movement is likely due to seasonal frost/thaw effects and lateral spreading of the road embankment. The lower shear zone is located at approximately 5 m below grade. The lower zone showed negligible movement (< 1 mm) and was similar to the previous readings since about 2011.

2.3.2 Piezometers

SP-2 shows signs of seasonal variations. The current reading shows an increase of 0.1 m since the Spring 2021 reading cycle.

SP96-1 shows an increase in water level by 1.0 m since the Spring 2021 reading cycle. The water level has been increasing since 2001 and is currently measuring the highest levels recorded since 2001 at 5.5 m below ground surface (bgs).

Plots for the piezometric levels are provided in the attachments with summaries provided in **Table NC018-2**.

3.0 RECOMMENDATIONS

3.1 FUTURE WORK

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

3.2 INSTRUMENTATION REPAIRS

No instruments require repair at this time.

Reference: **North Central Region, Edson, Site NC018 - Highway 764:02 Pembina River Bridge (N. of Cherhill), Spring 2022 Instrumentation Monitoring Report**

Table NC018-1: 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							
SI-7	Sept. 27, 1996	5978202	653008	-2 over 10.0 m to 11.0 m depth in 197º direction	9 in May 2005	Operational	July 4, 2021	< 1	< 1	< 1
SI-8	Sept. 27, 1996	5978217	653012	-2 over 3.9 m to 4.9m depth in 304º direction	9 in Oct. 2004	Operational	July 4, 2021	1	-1	1
SI-9	Sept. 27, 1997	5978201	653026	0 over 18.9 m to 20.9 m depth in 316º direction	2 in Oct. 2003	Operational	July 4, 2021	< 1	< 1	No Change
				-1 over 21.4 m to 22.9 m depth in 316º direction	3 in Oct. 2013			< 1	< 1	<1
SI-21	Aug. 27, 1997	5978067	652968	9 over 16.3 m to 17.8m depth in 89º direction	20 in Sept. 2016	Blocked	Sep 8, 2017	Found blocked at 1.2 m in Spring 2021		
SI-22	Aug. 27, 1997	5978052	652959	4 over 16.1m to 16.6m depth in 161º direction prior to 2016	14 in Sept 2017	Operational	July 4, 2021	No discernable movement from 2016 baseline		
SI-23	Aug. 27, 1997	-	-	6 over 12.5 m to 15 m depth in 259º direction	4 in Aug. 1997	Blocked	May 7, 2019	Found blocked at 2.2 m in Spring 2020		
SI-24	Sept. 25, 1996	5978213	653031	119 over 0.1m to 1.9m depth in 86º direction	39 in Oct. 2016	Operational	July 4, 2021	13	16	12
				4 over 3.8m to 8.4m depth in 86º direction	5 in Sept. 2016			<1	<1	<1

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

Reference: **North Central Region, Edson, Site NC018 - Highway 764:02 Pembina River Bridge (N. of Cherhill), Spring 2022 Instrumentation Monitoring Report**

Table NC018-2: Spring 2022 Standpipe Piezometer Reading Summary

Instrument Name	Date Initialized	Coordinates (1) (UTM 11U, NAD1983) (m)		Bottom Depth (m)	Current Status	Maximum Water Level (m bgs)	Measured Water Level Spring 2022 (m bgs)	Previous Water Level Spring 2021 (m bgs)	Change in Water Level (m)
		Northing	Easting						
SP2	Sept 27, 1996	5978211	653013	8.6	Operational	6.4 May 2016	7.9	8.0	0.1
SP96-1	Sept 27, 1996	5978074	652955	19.7	Operational	5.5 May 2022	5.5	6.5	1.0
SP06-3	N/A	-	-	13.0	Non-operational	9.9 Sept 2017	Found damaged during Spring 2021.		

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

Reference: **North Central Region, Edson, Site NC018 - Highway 764:02 Pembina River Bridge (N. of Cherhill), Spring 2022 Instrumentation Monitoring Report**

4.0 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.

PROFESSIONAL ENGINEER ALBERTA
LESLIE CHO
2022-06-12
ID# 139079

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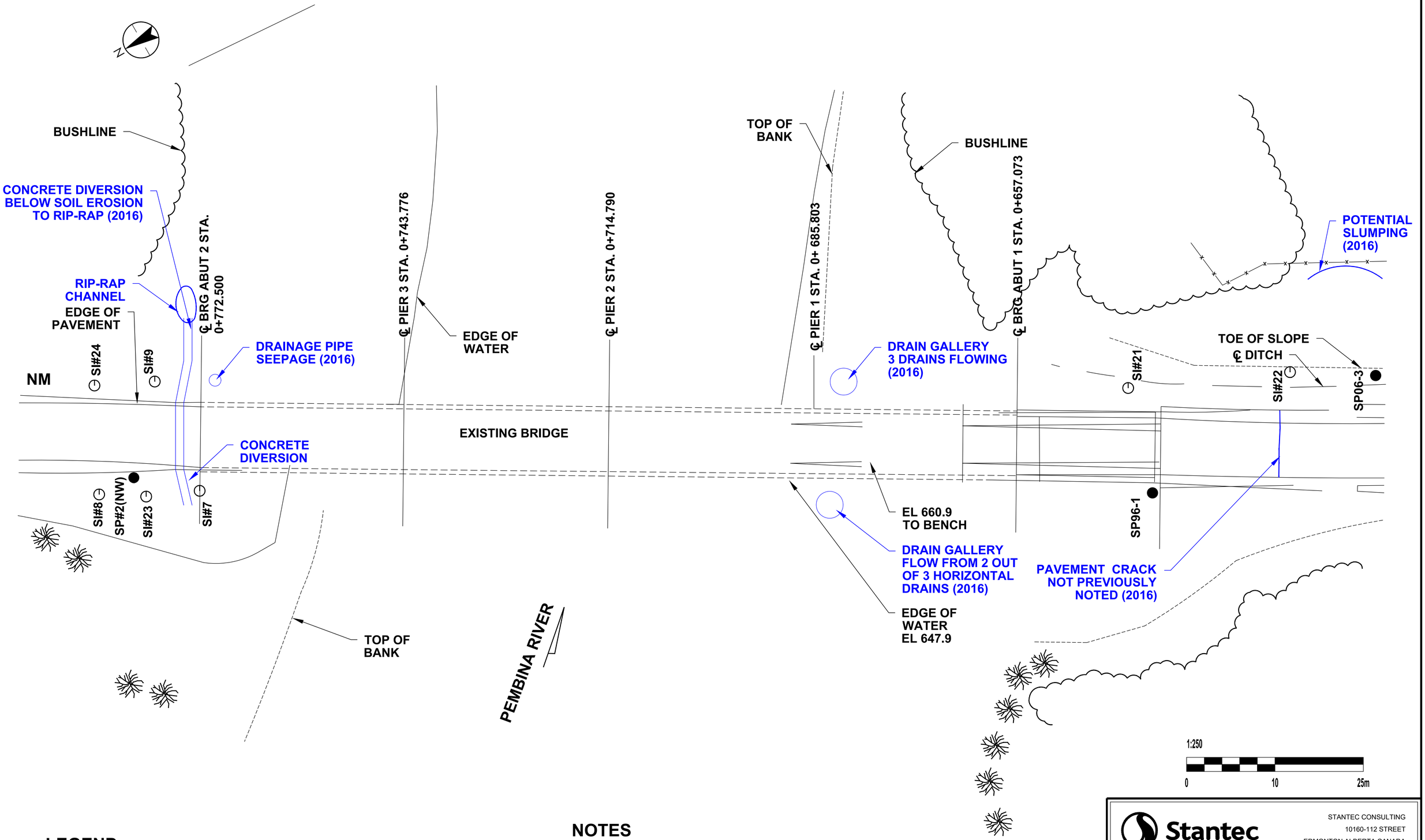
Attachment:
Figure 1 – Site Plan
SI-7 Slope Inclinometer Plots
SI-8 Slope Inclinometer Plots
SI-9 Slope Inclinometer Plots
SI-22 Slope Inclinometer Plots
SI-24 Slope Inclinometer Plots
Standpipe Piezometer Depth vs Time Plot

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



LEGEND

- APPROXIMATE LOCATION OF SLOPE INCLINOMETER (SI)
- APPROXIMATE LOCATION OF STAND PIEZOMETER (SP)

NOTES

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK
2. 2016 OBSERVATIONS SHOWN IN BLUE

REFERENCE

THURBER ENGINEERING LTD, PROJECT No.15-16-257, ORIGINAL SCALE 1:750, DATE SEPTEMBER 2011.

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STANTEC CONSULTING
10160-112 STREET
EDMONTON ALBERTA CANADA

ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC18 - HWY 764 - PEMBINA RIVER BRIDGE
SITE PLAN

DRAWN WW	CHECK LC	APPROVE CDM
DATE 04 AUG. 2016	SCALE AS SHOWN	PROJECT # 123315222

FIGURE - 1 | -

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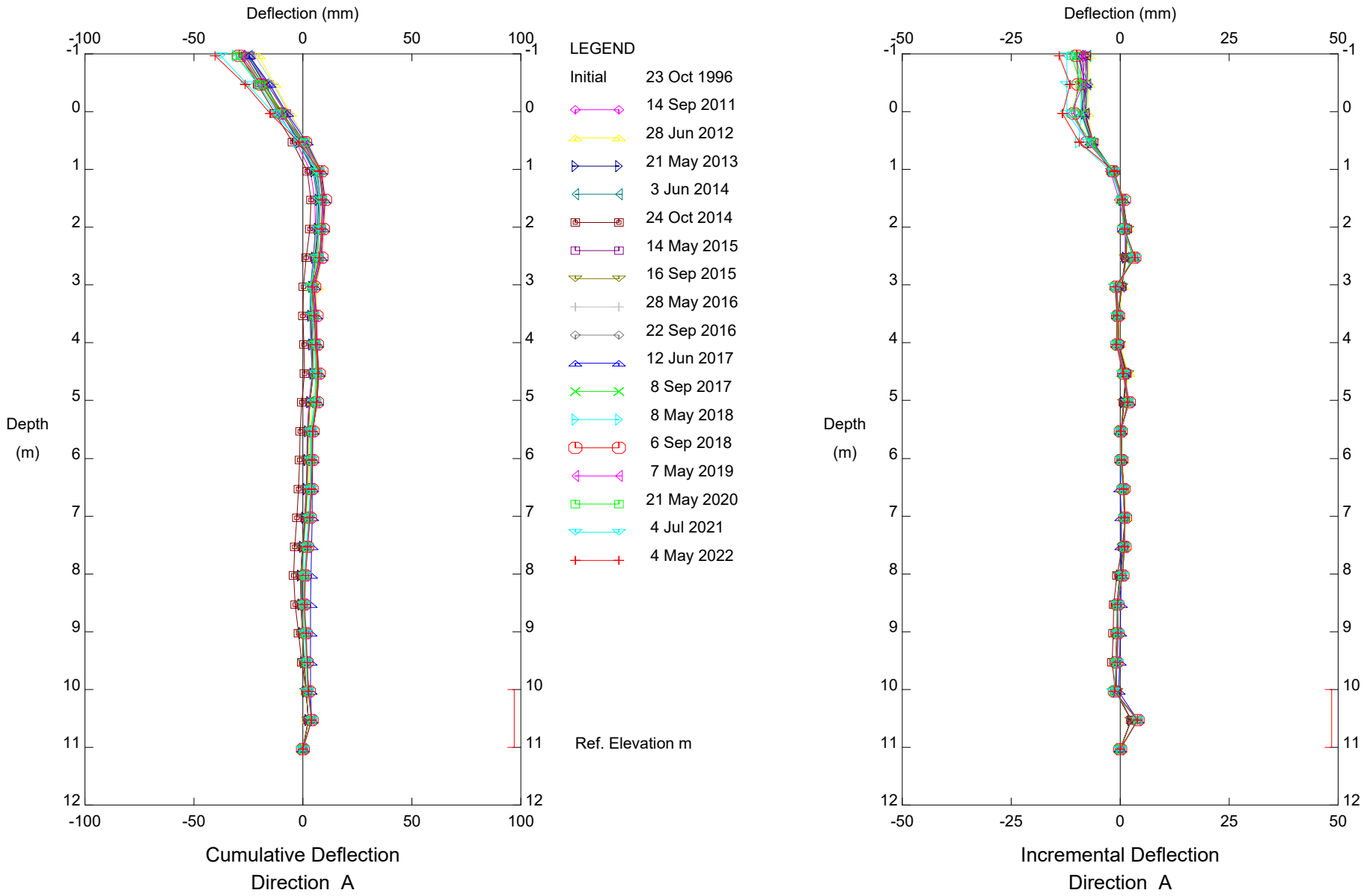

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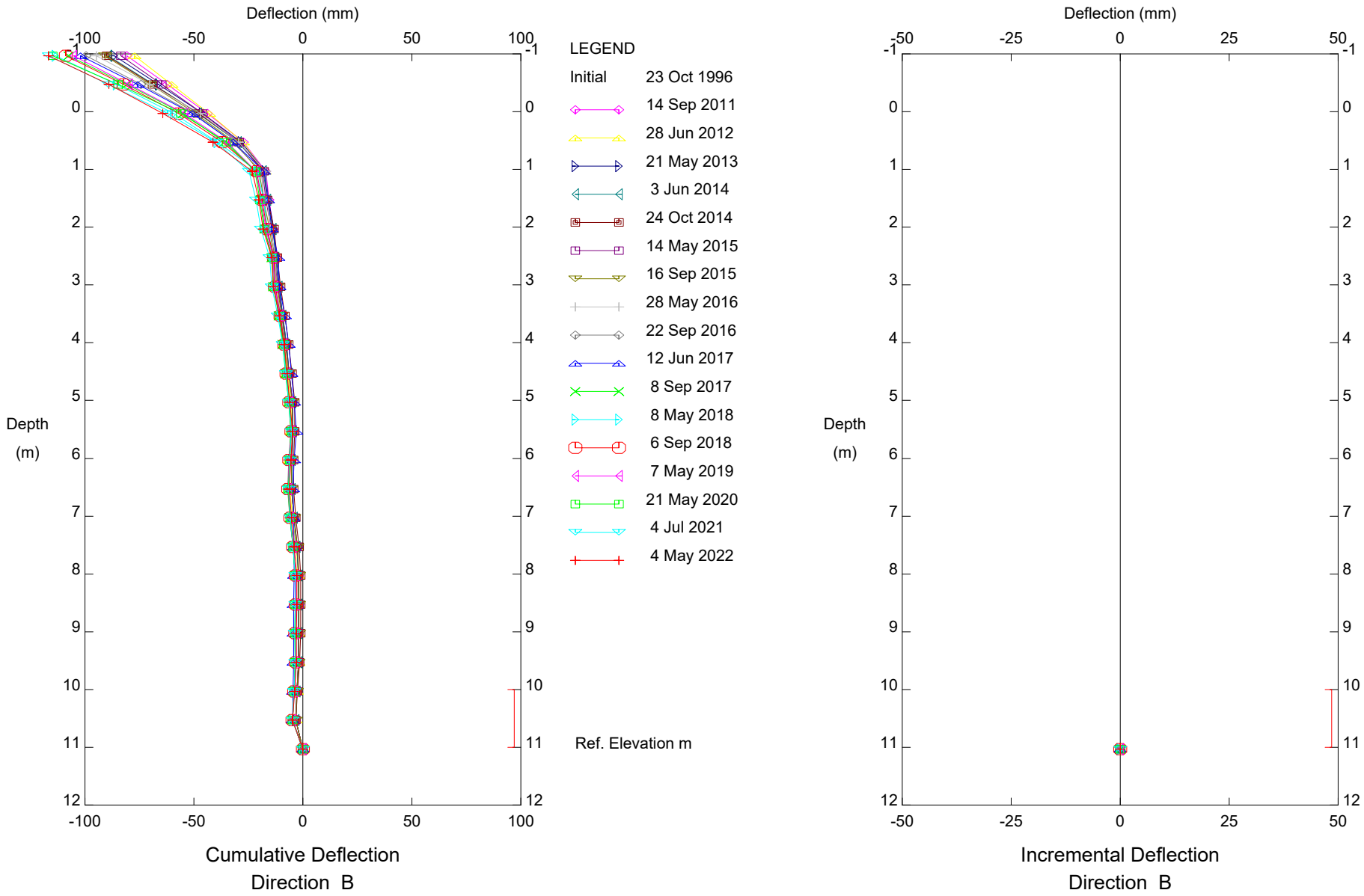

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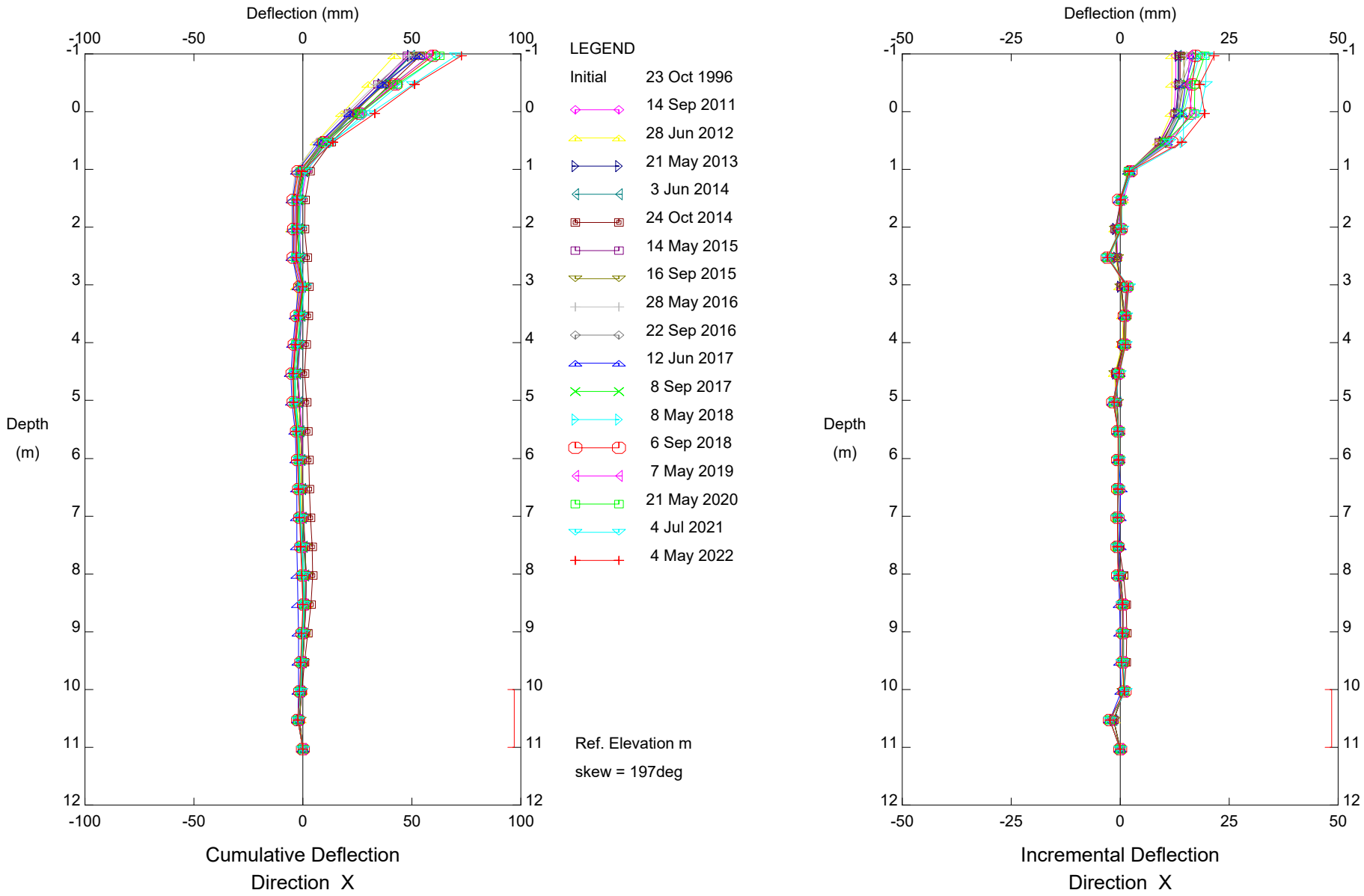

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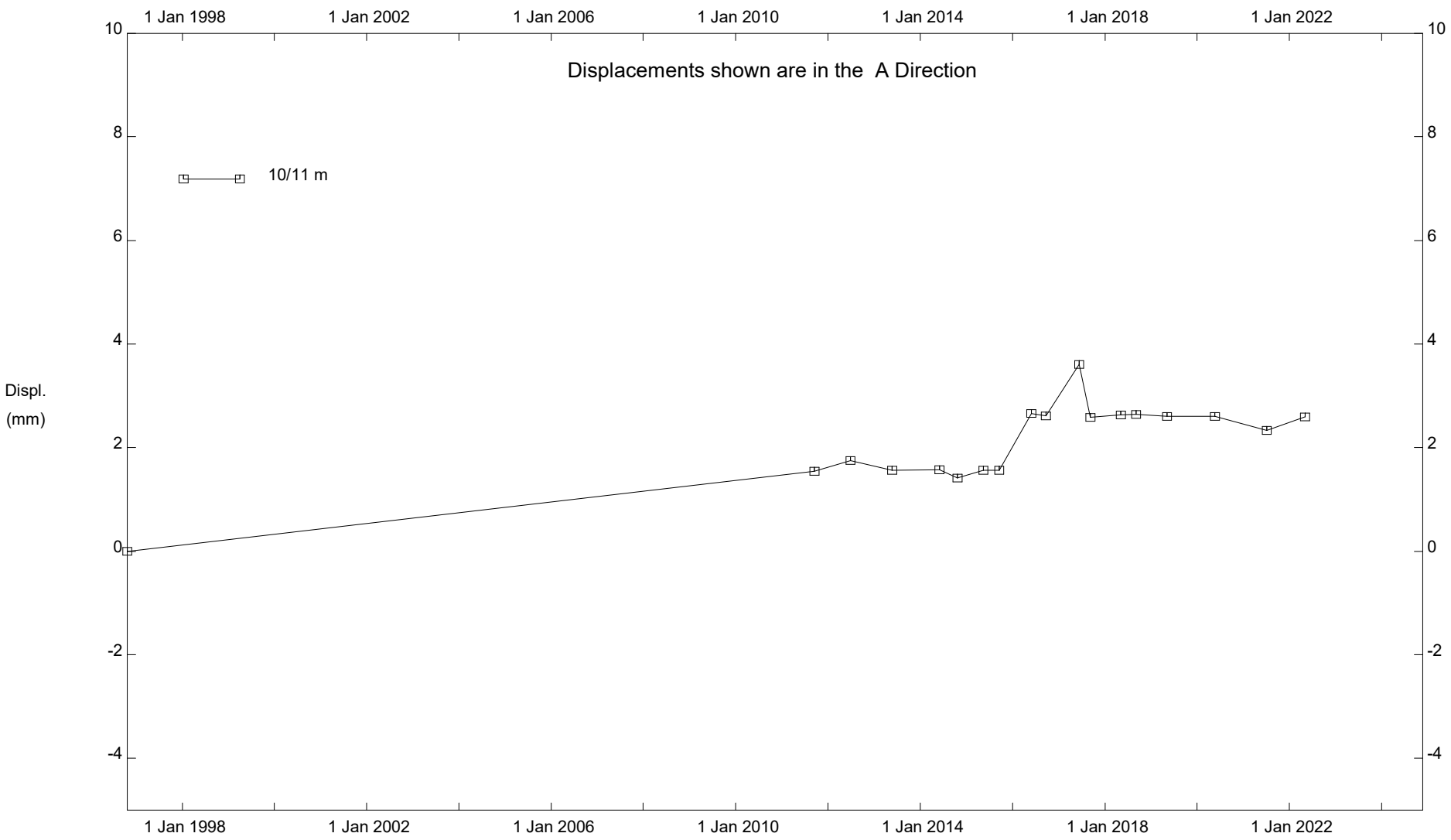

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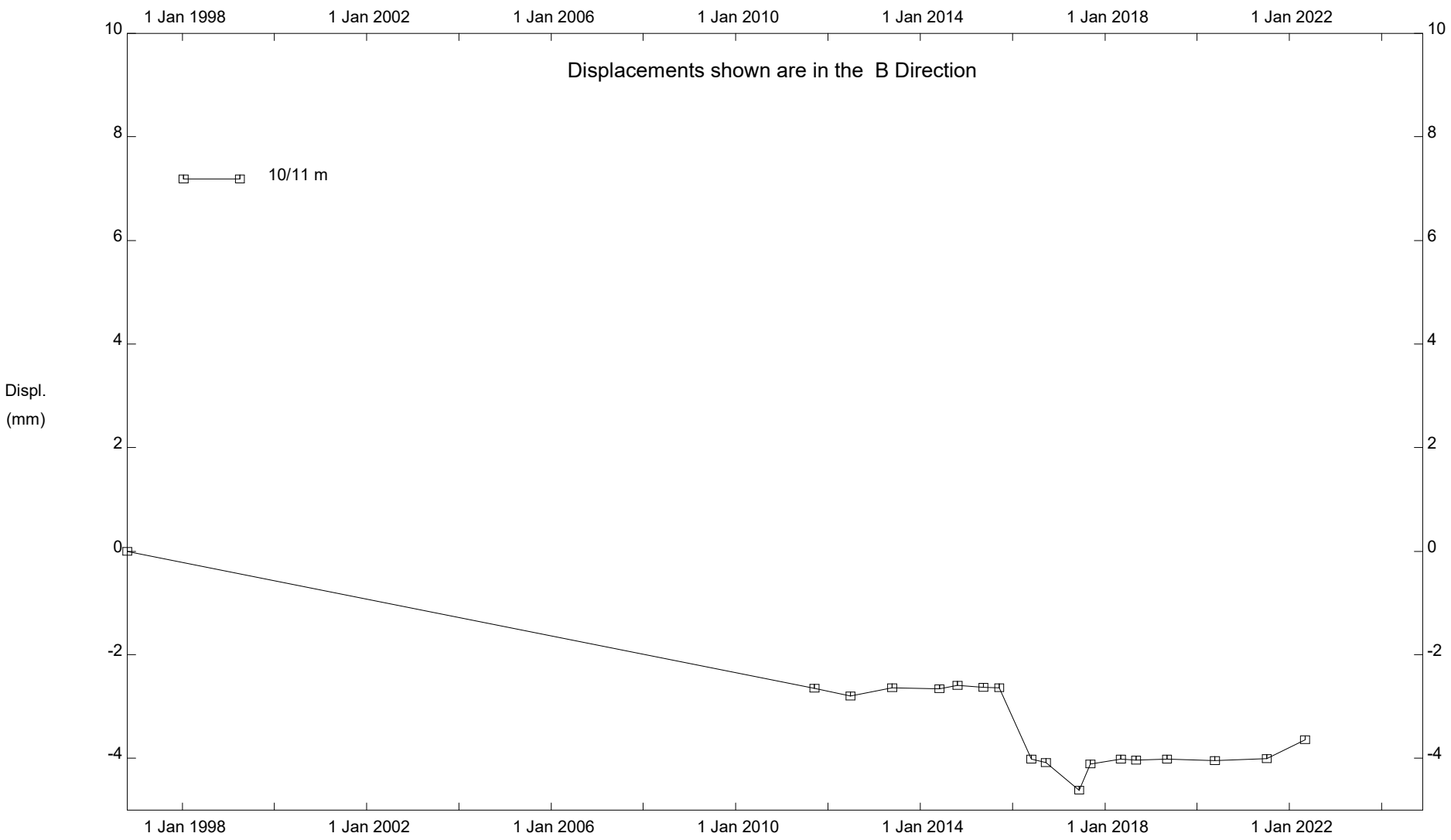

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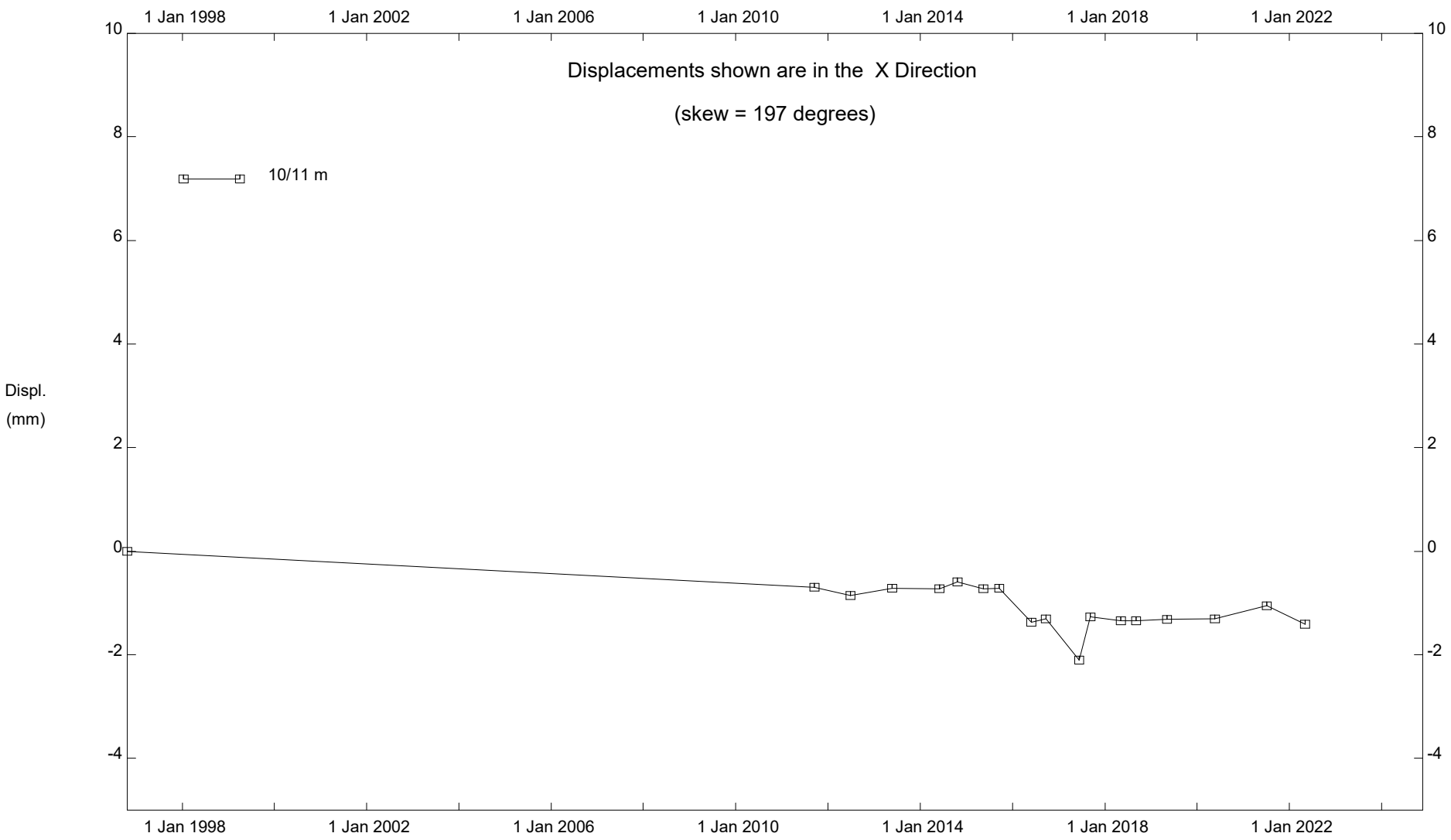

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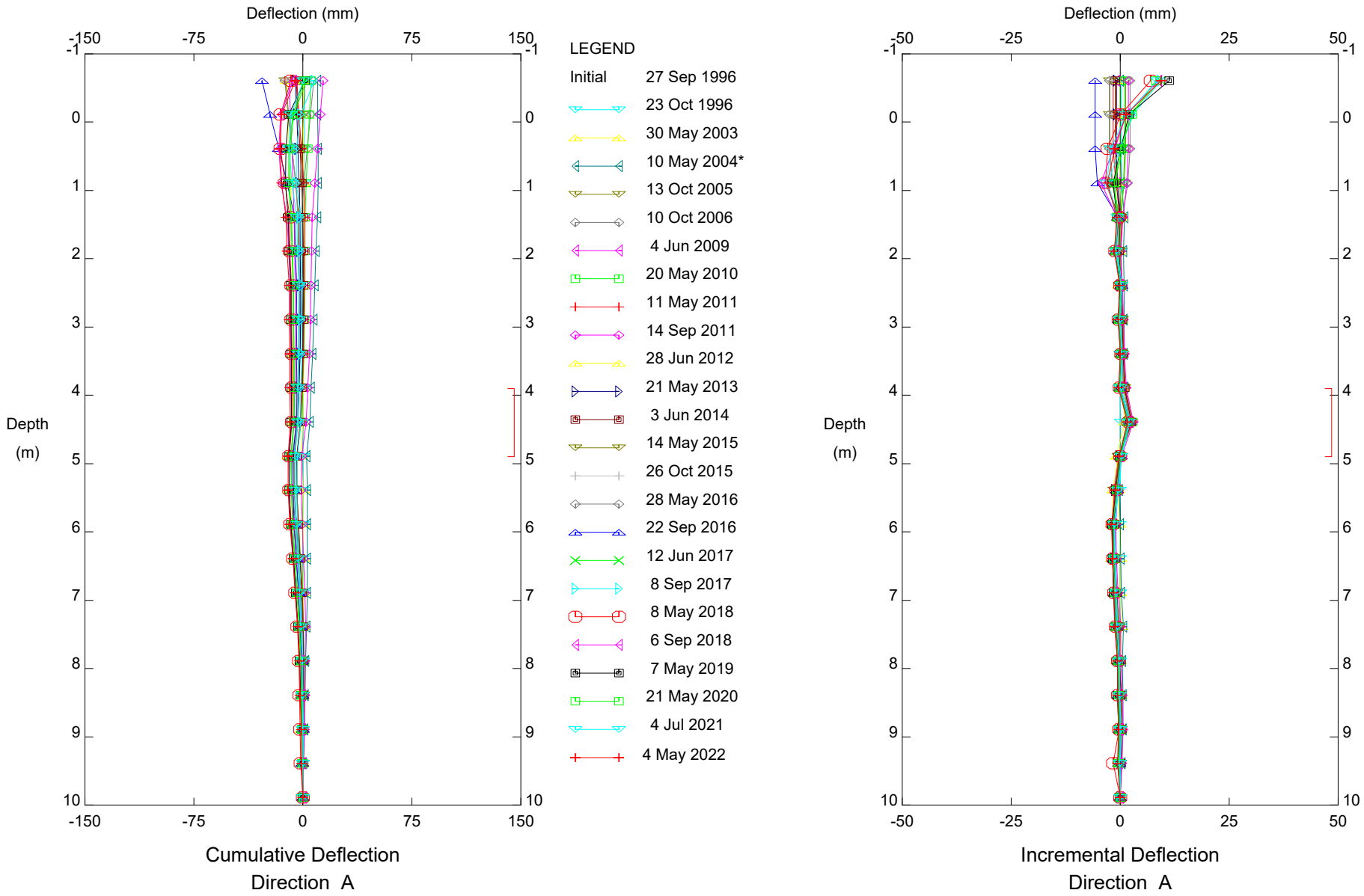

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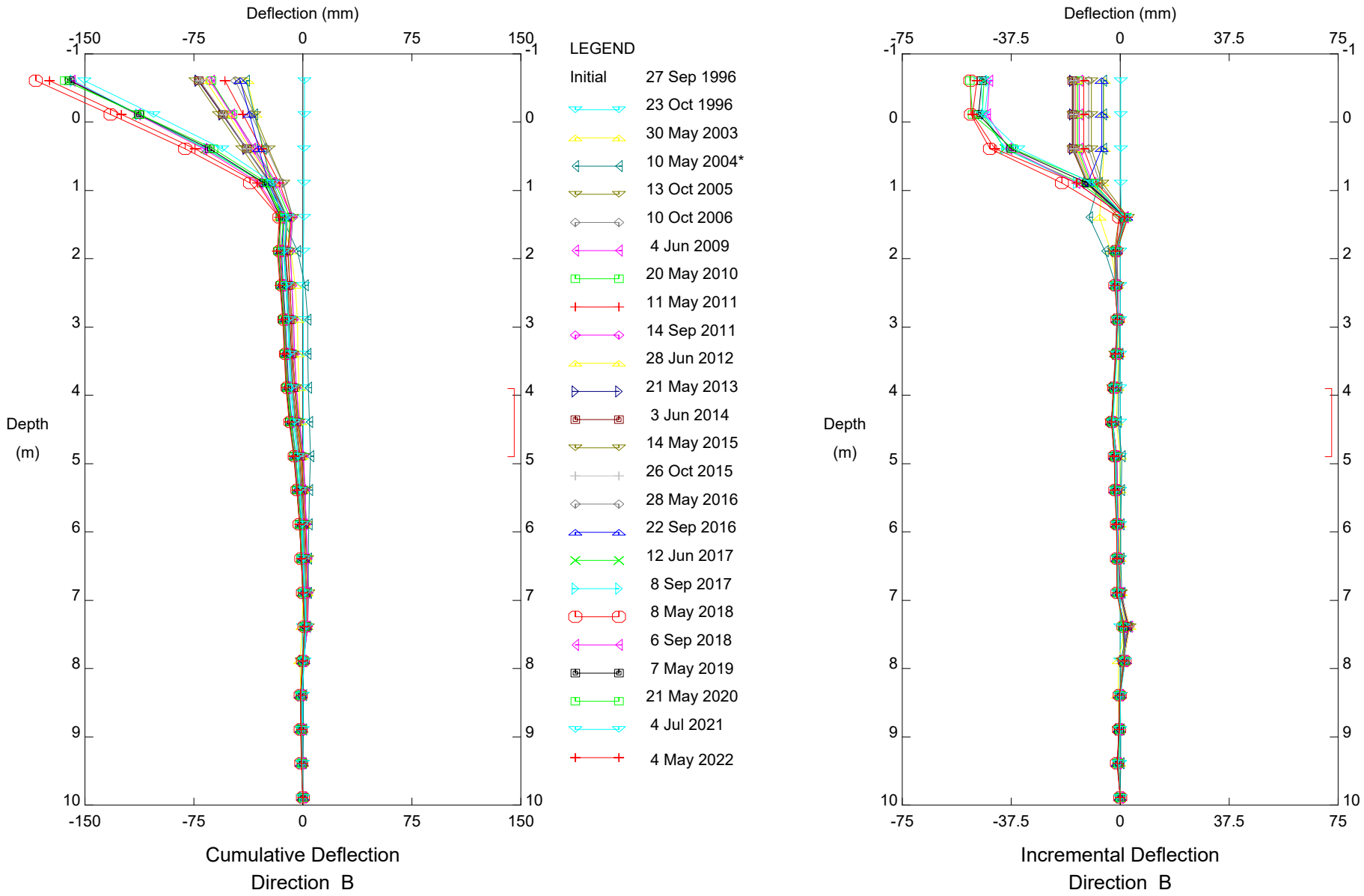

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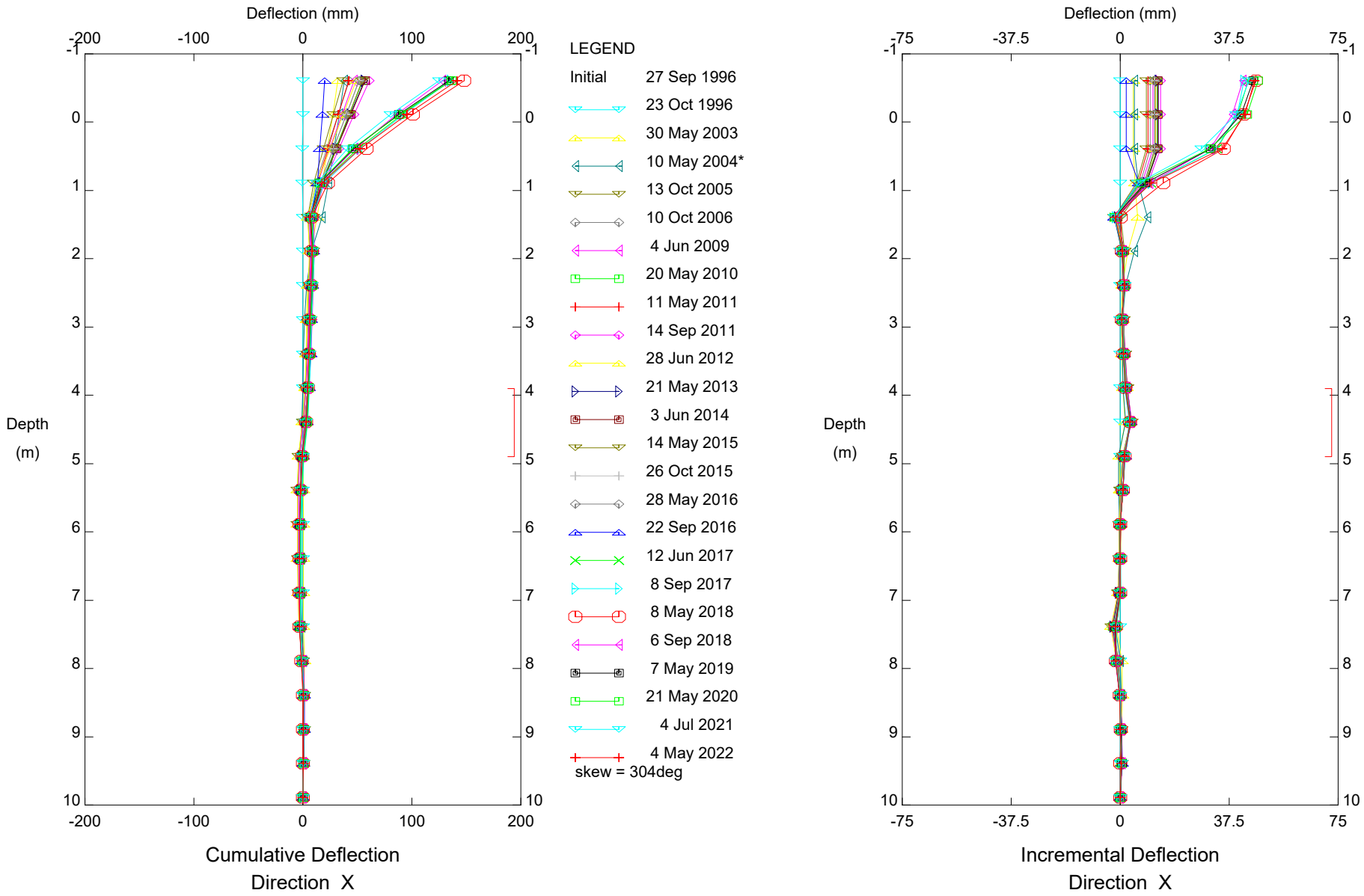

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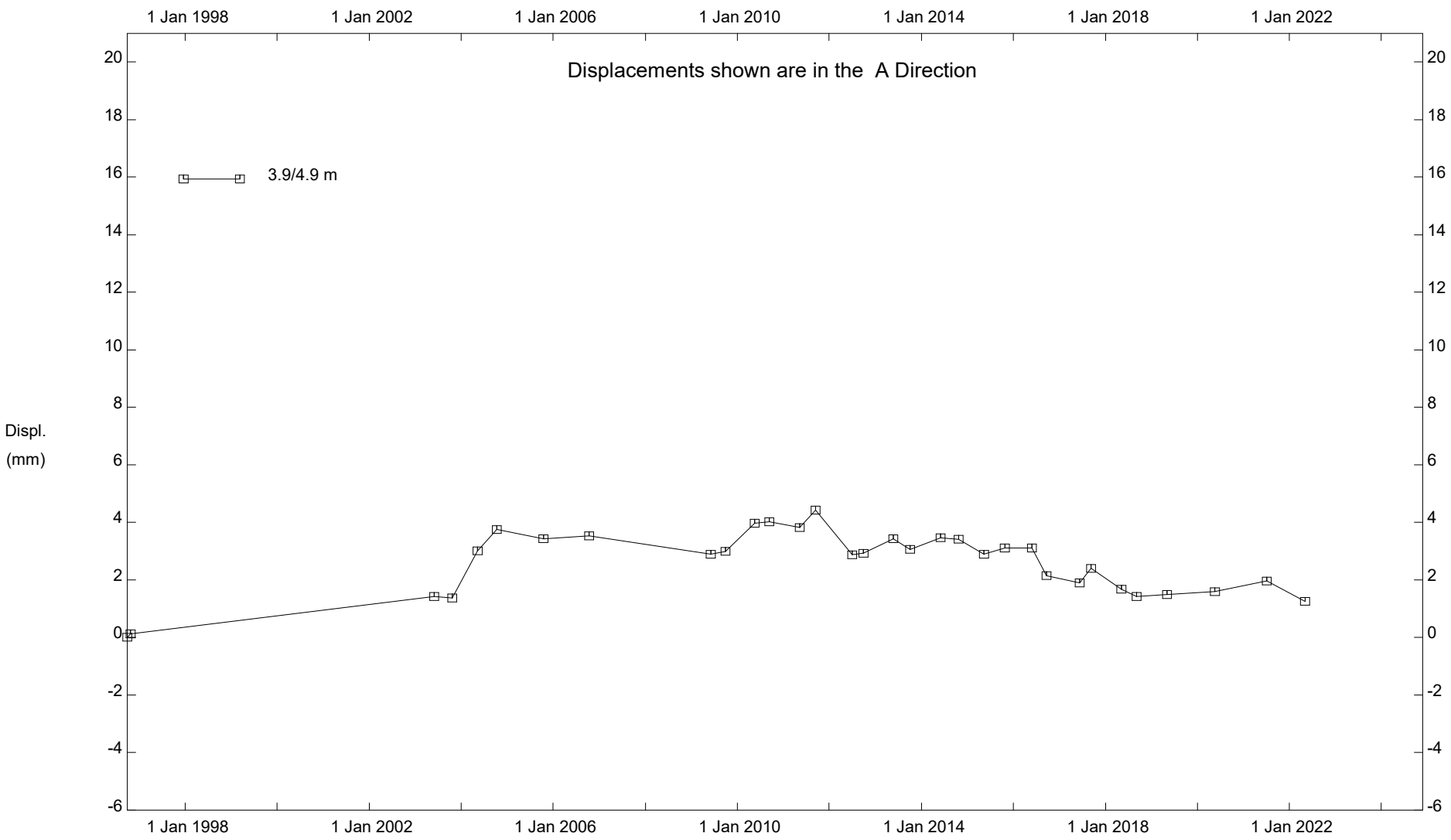

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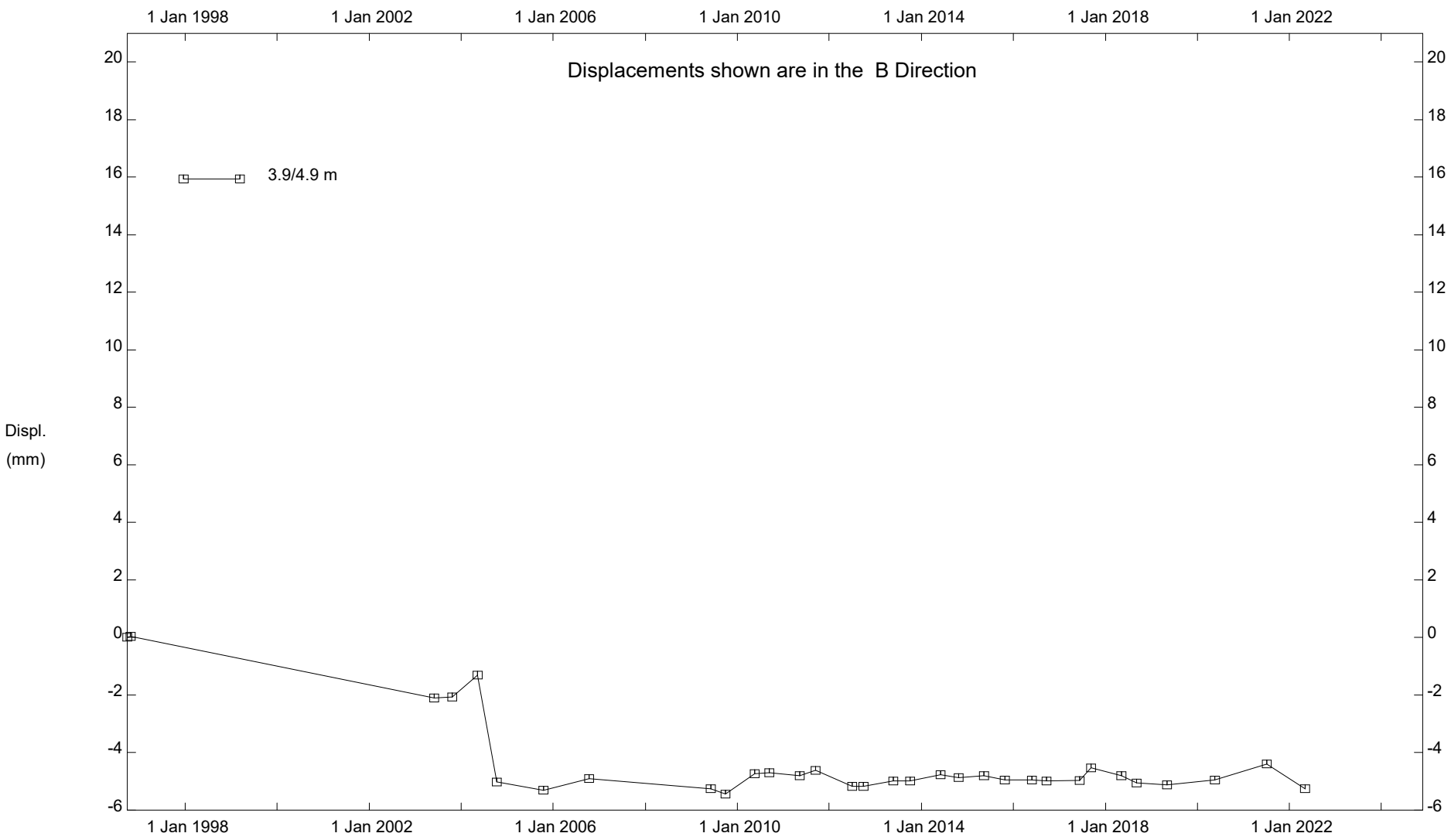

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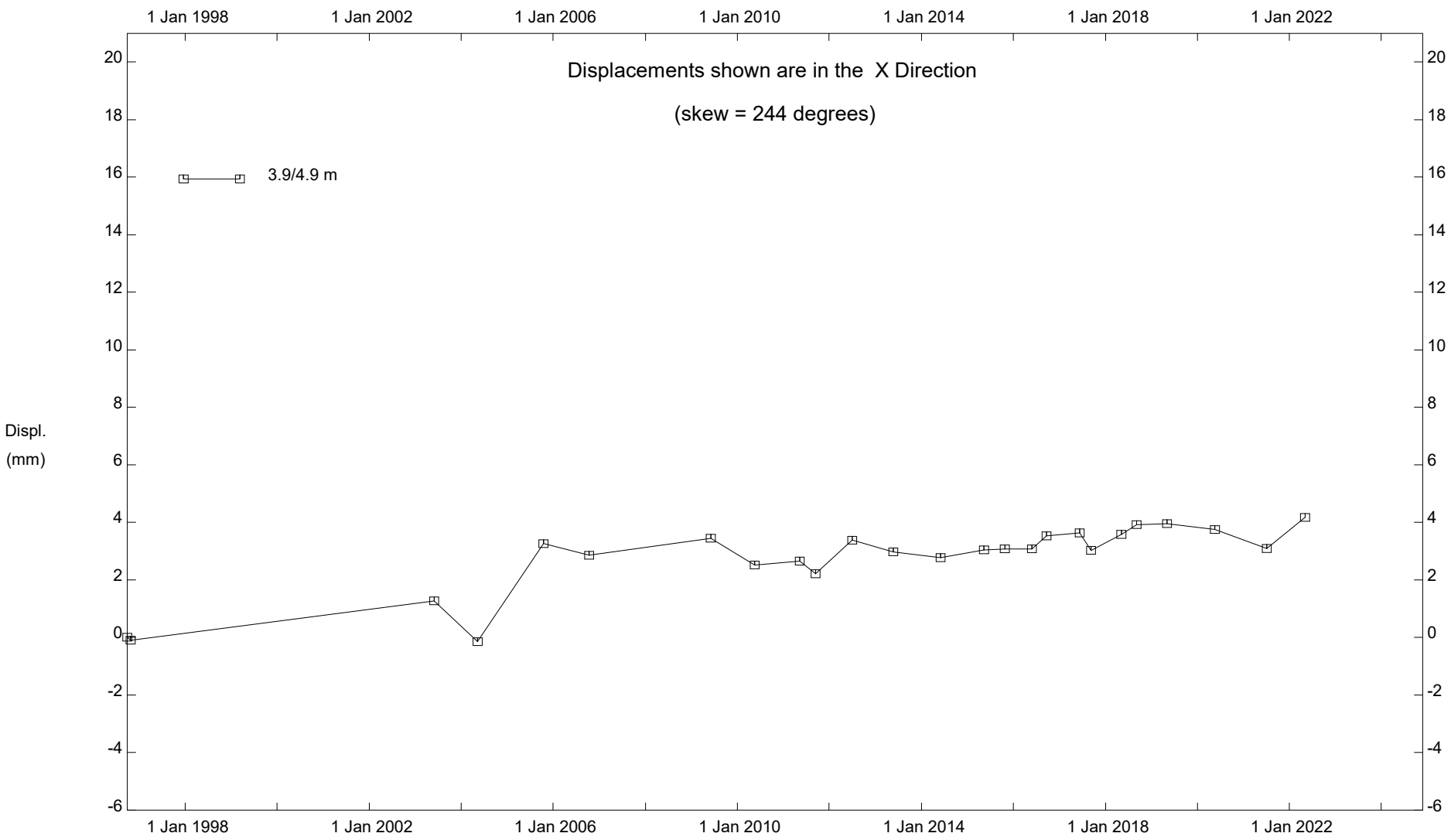

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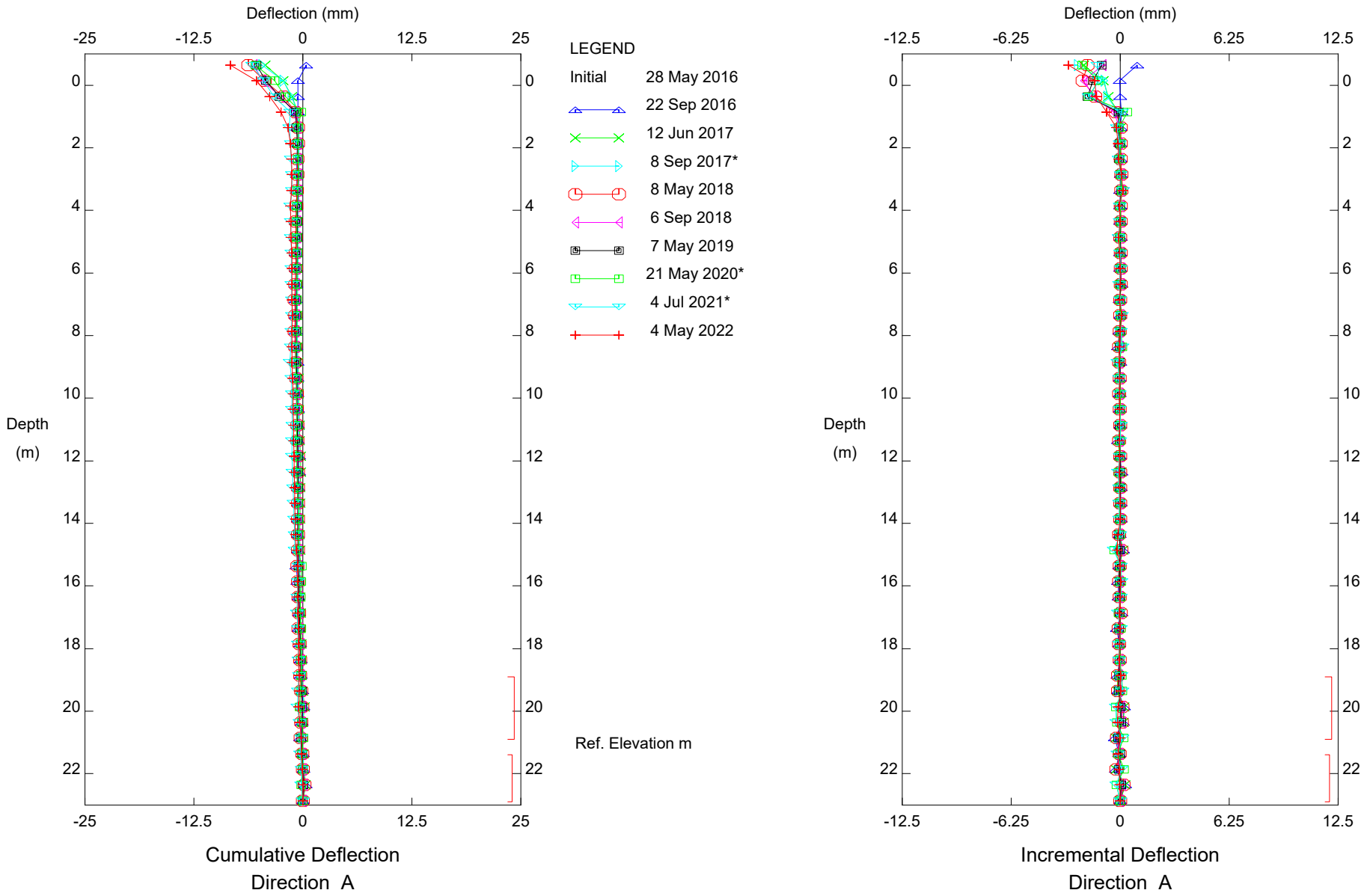

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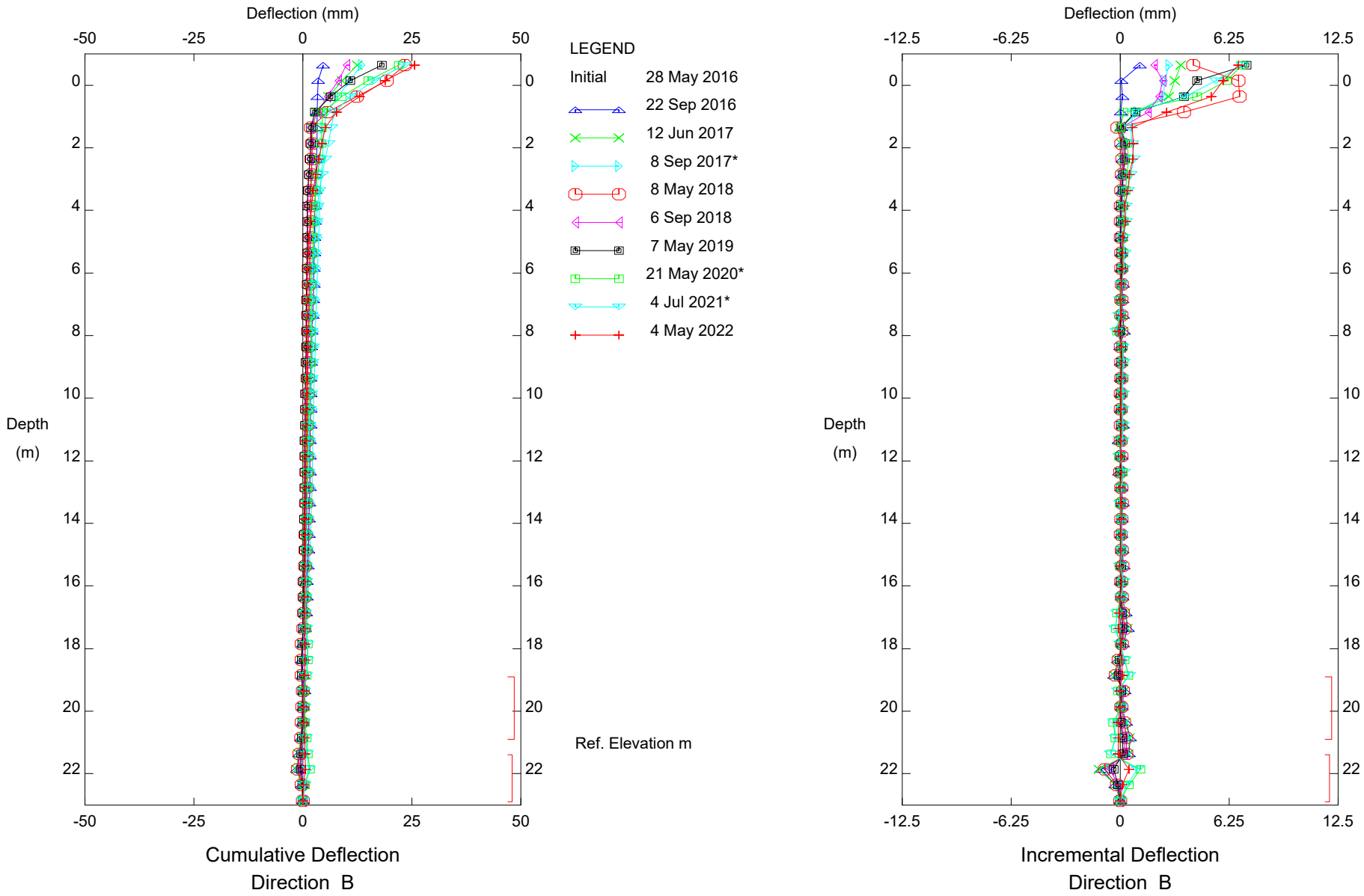

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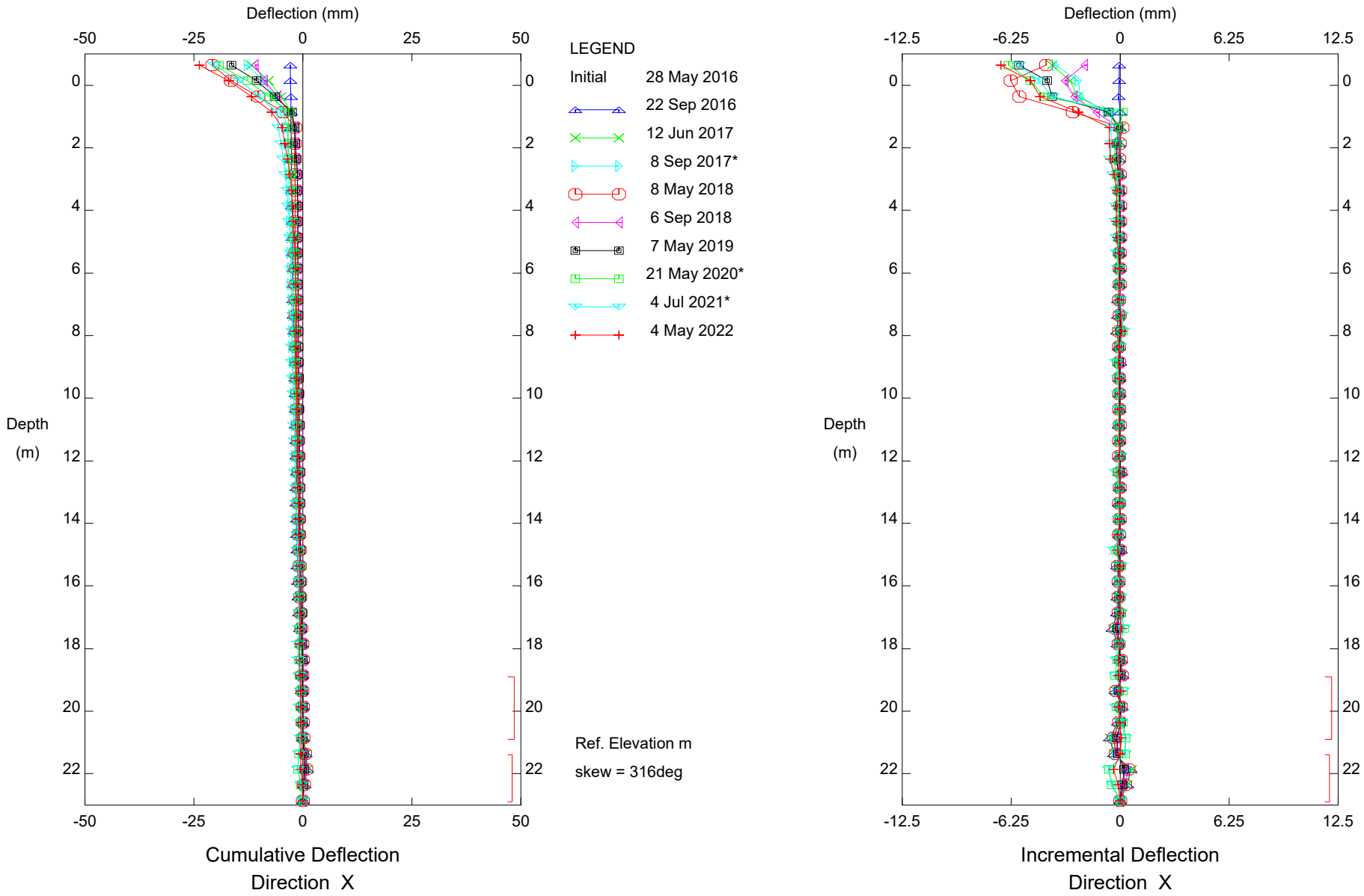

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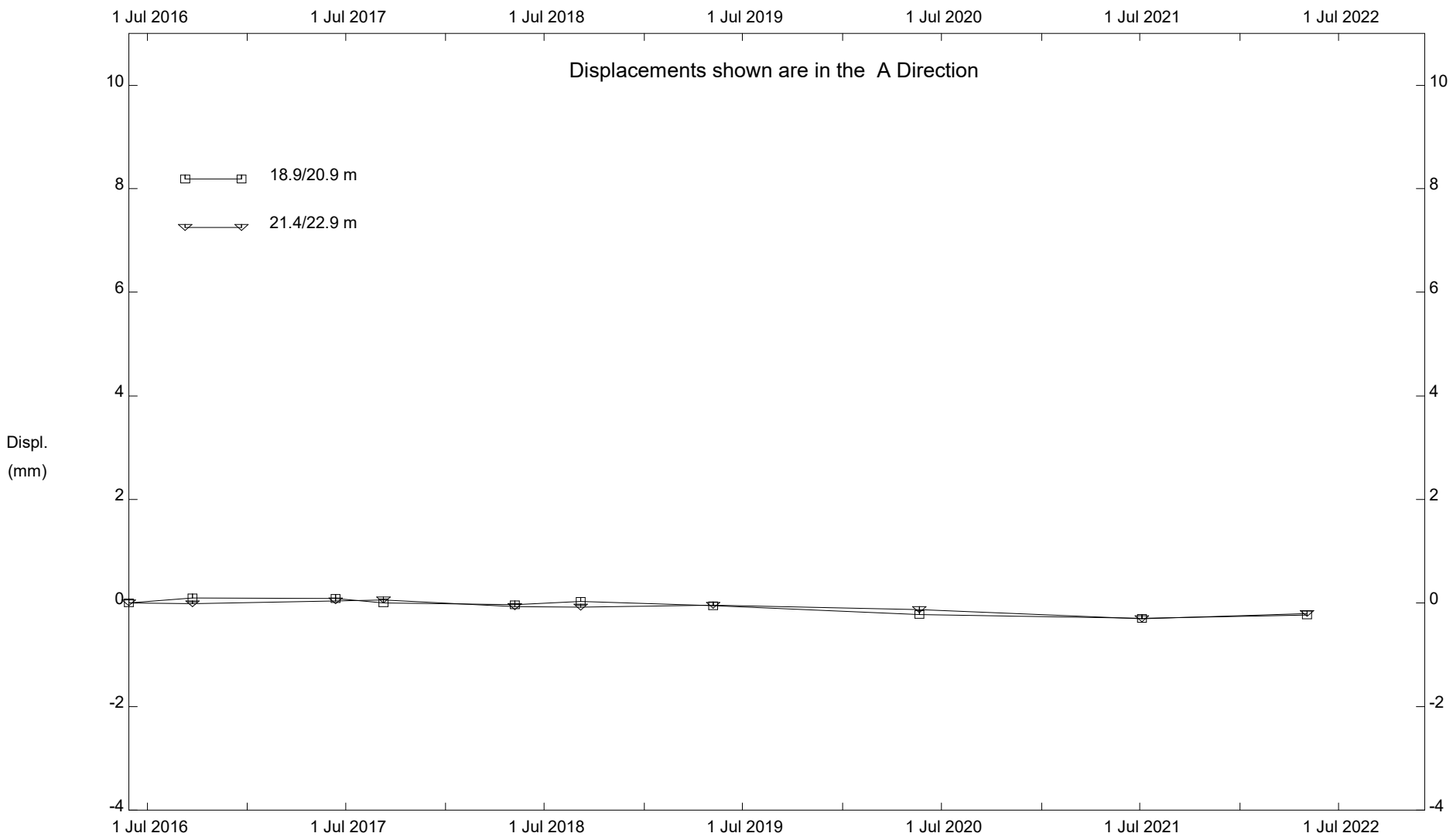

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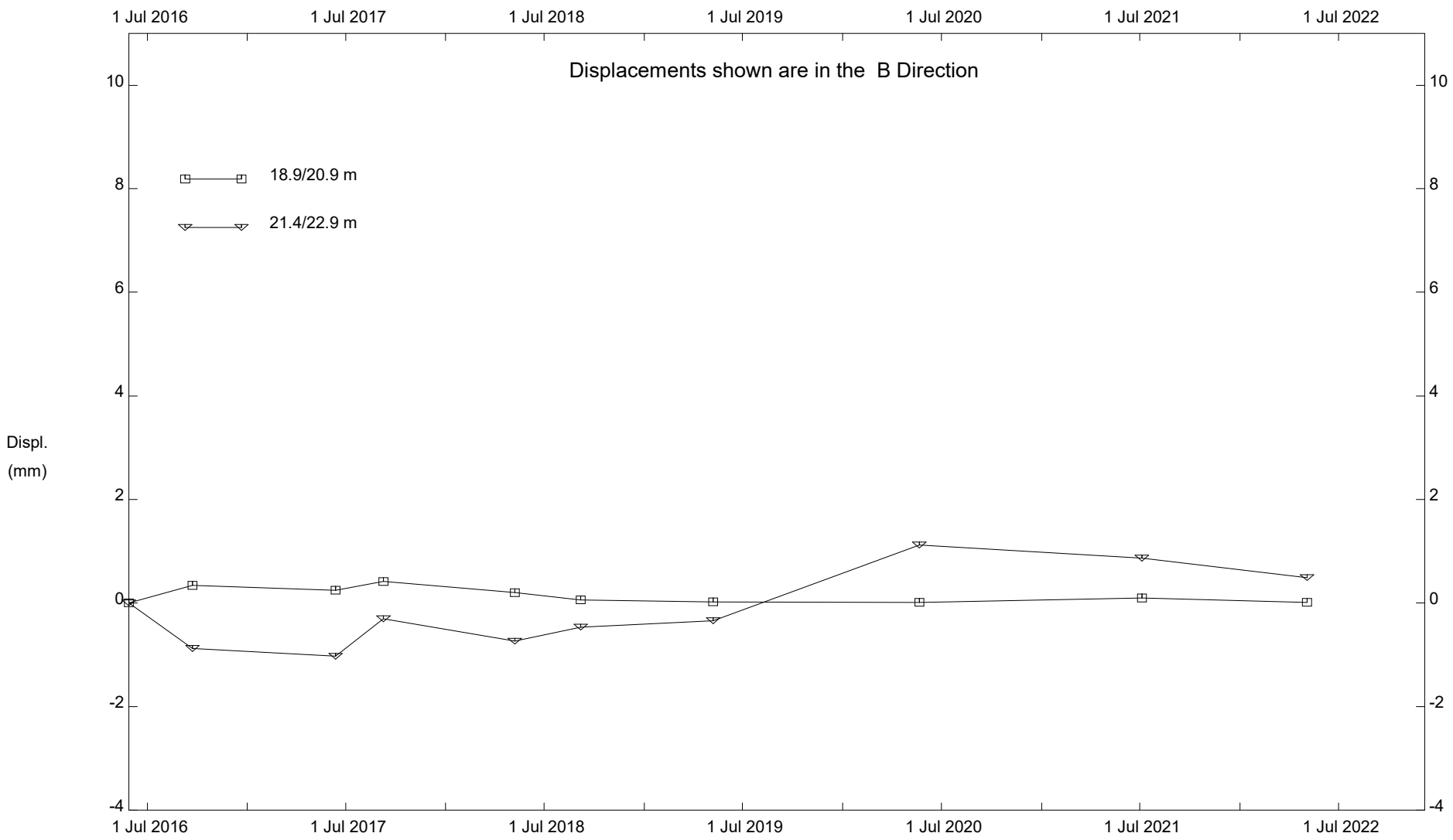

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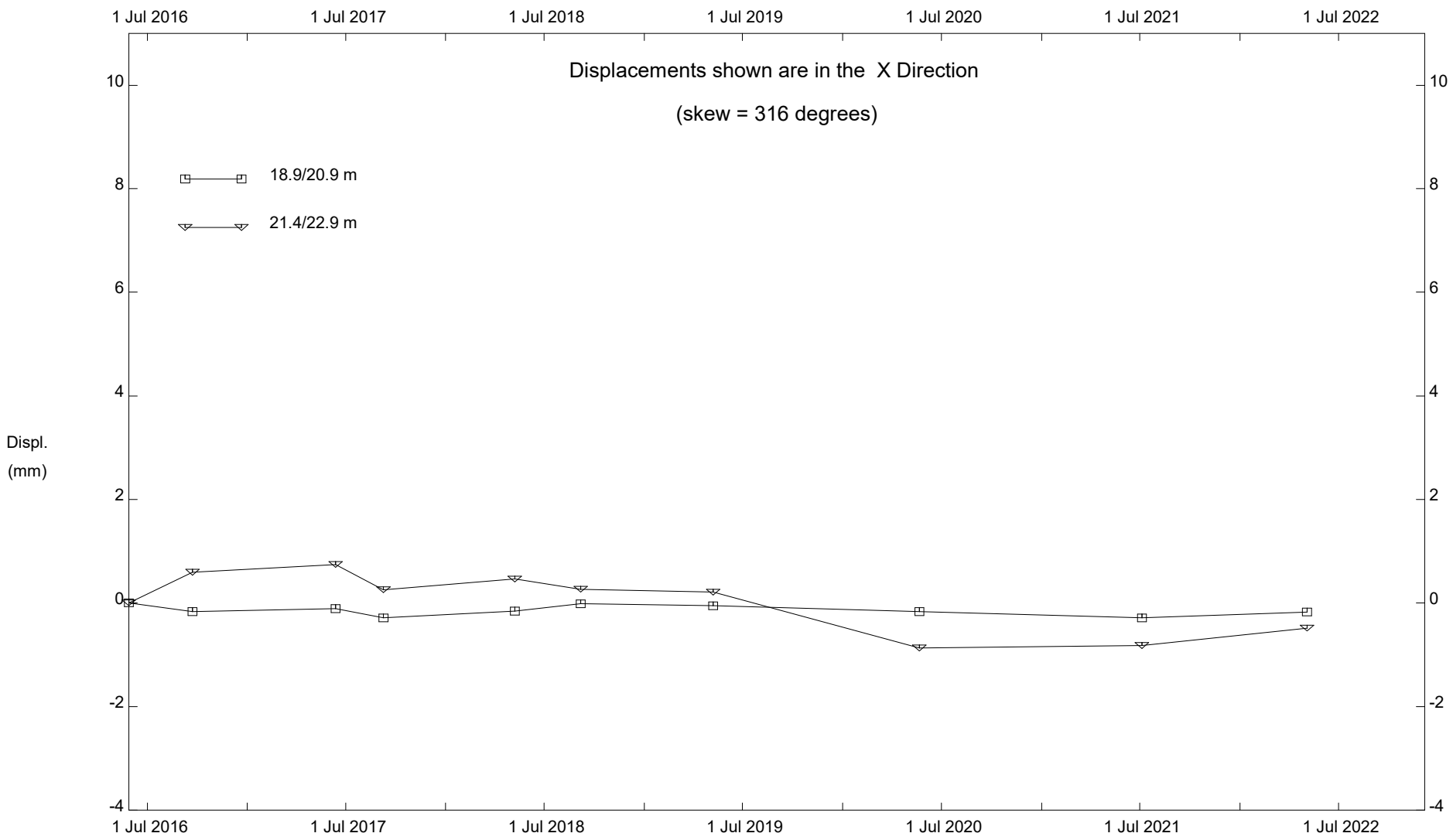

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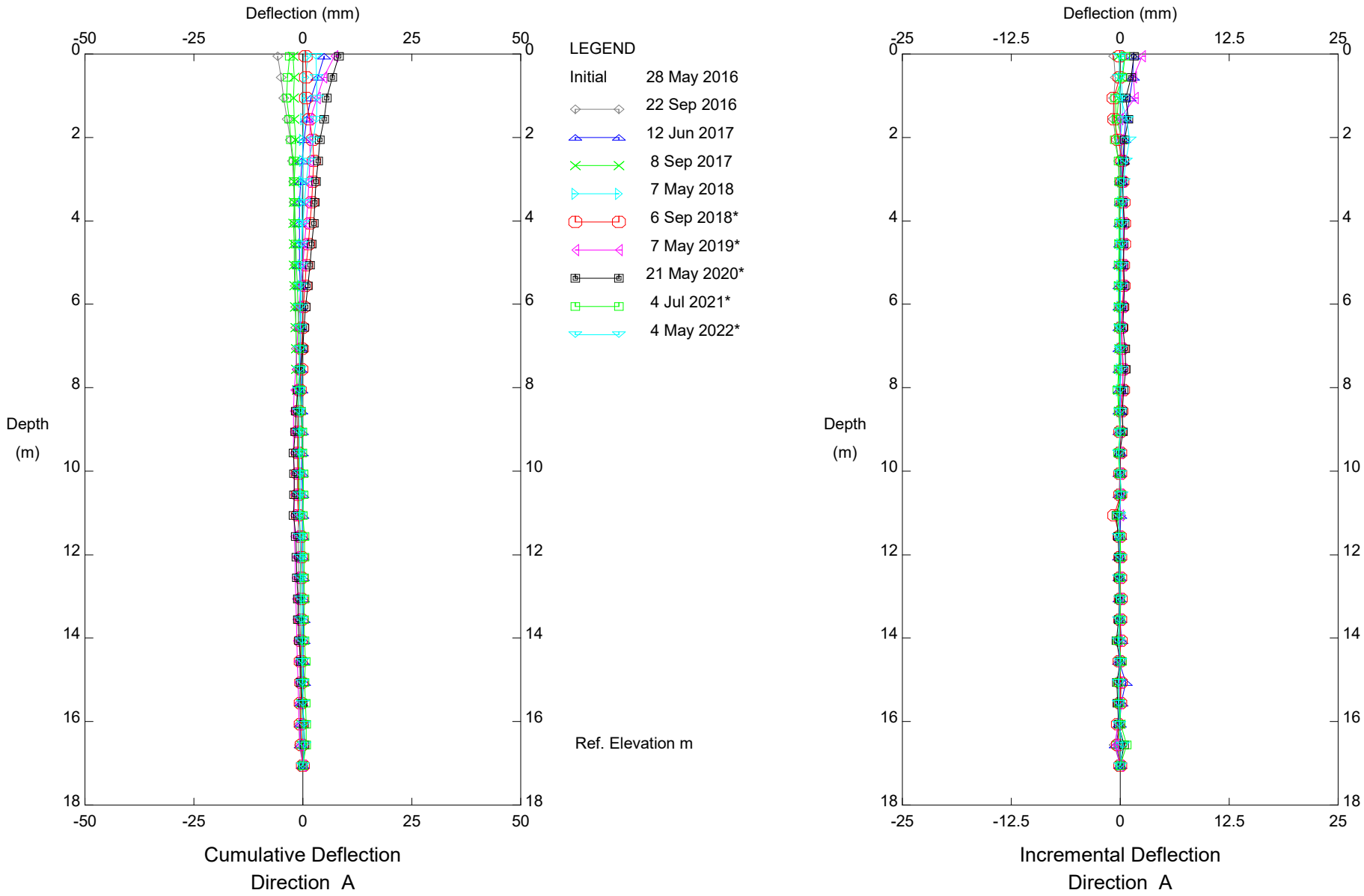

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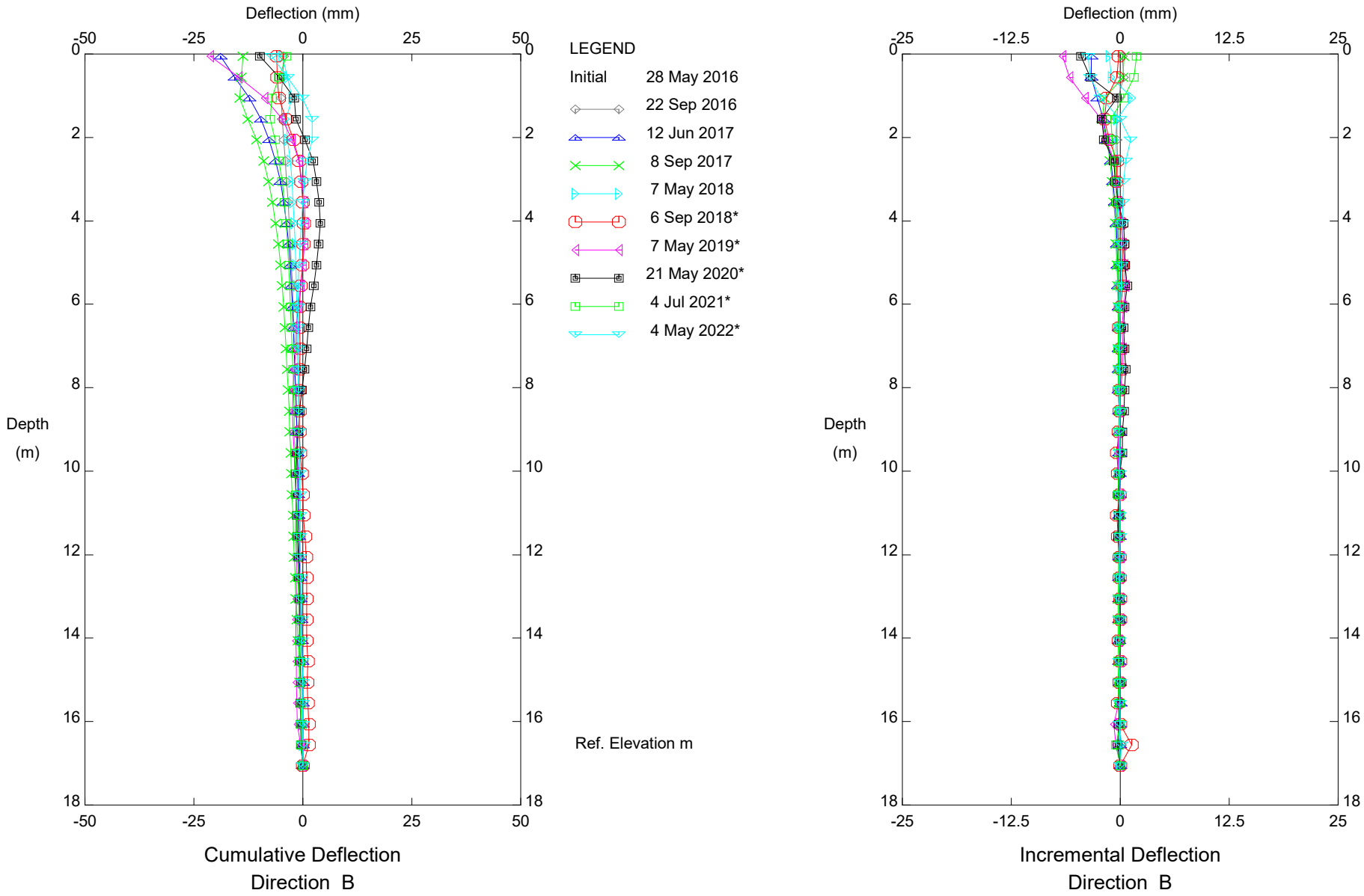

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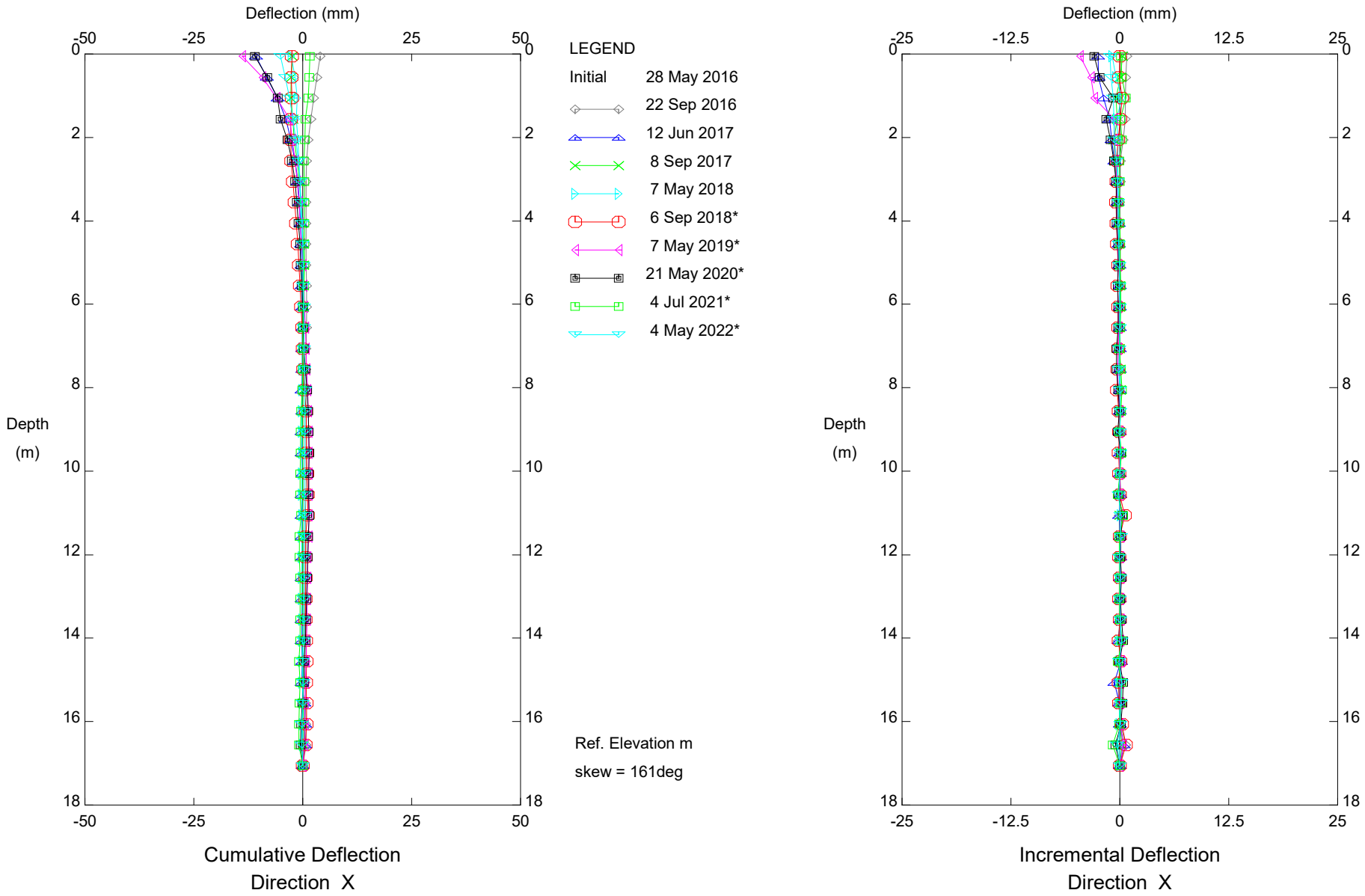

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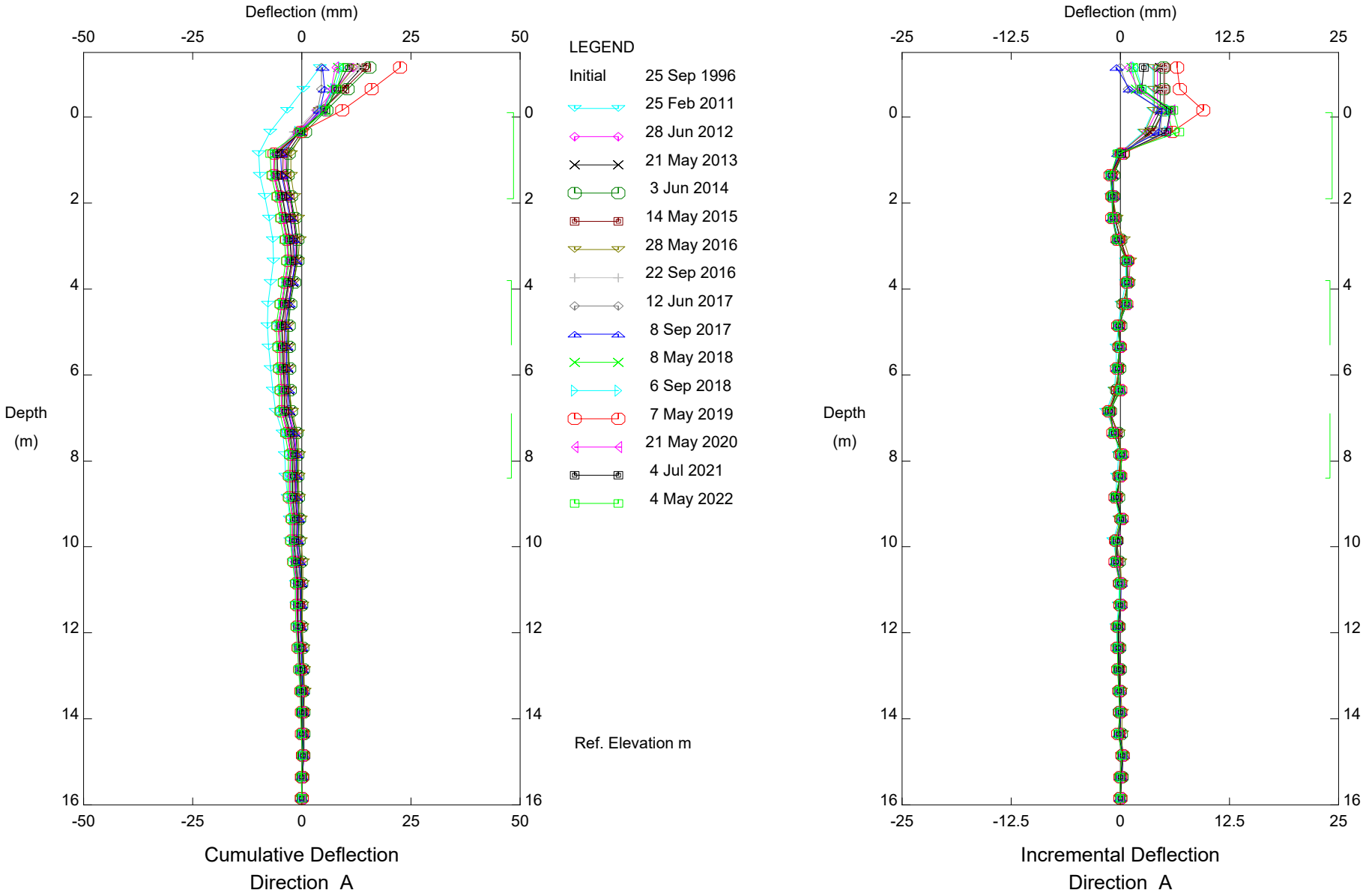

HWY764:02 Pembina River (NC018), Inclinometer SI-24

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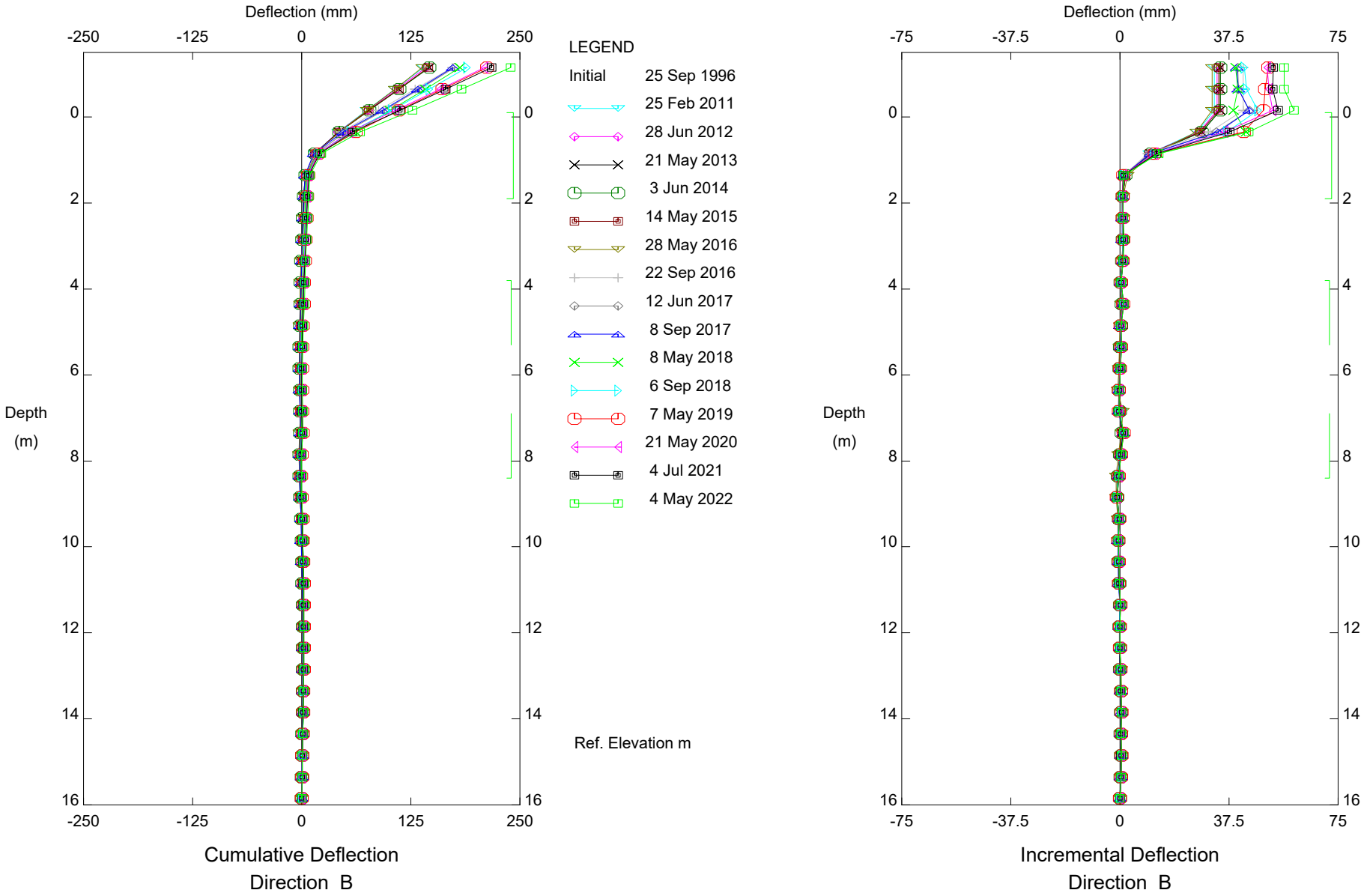

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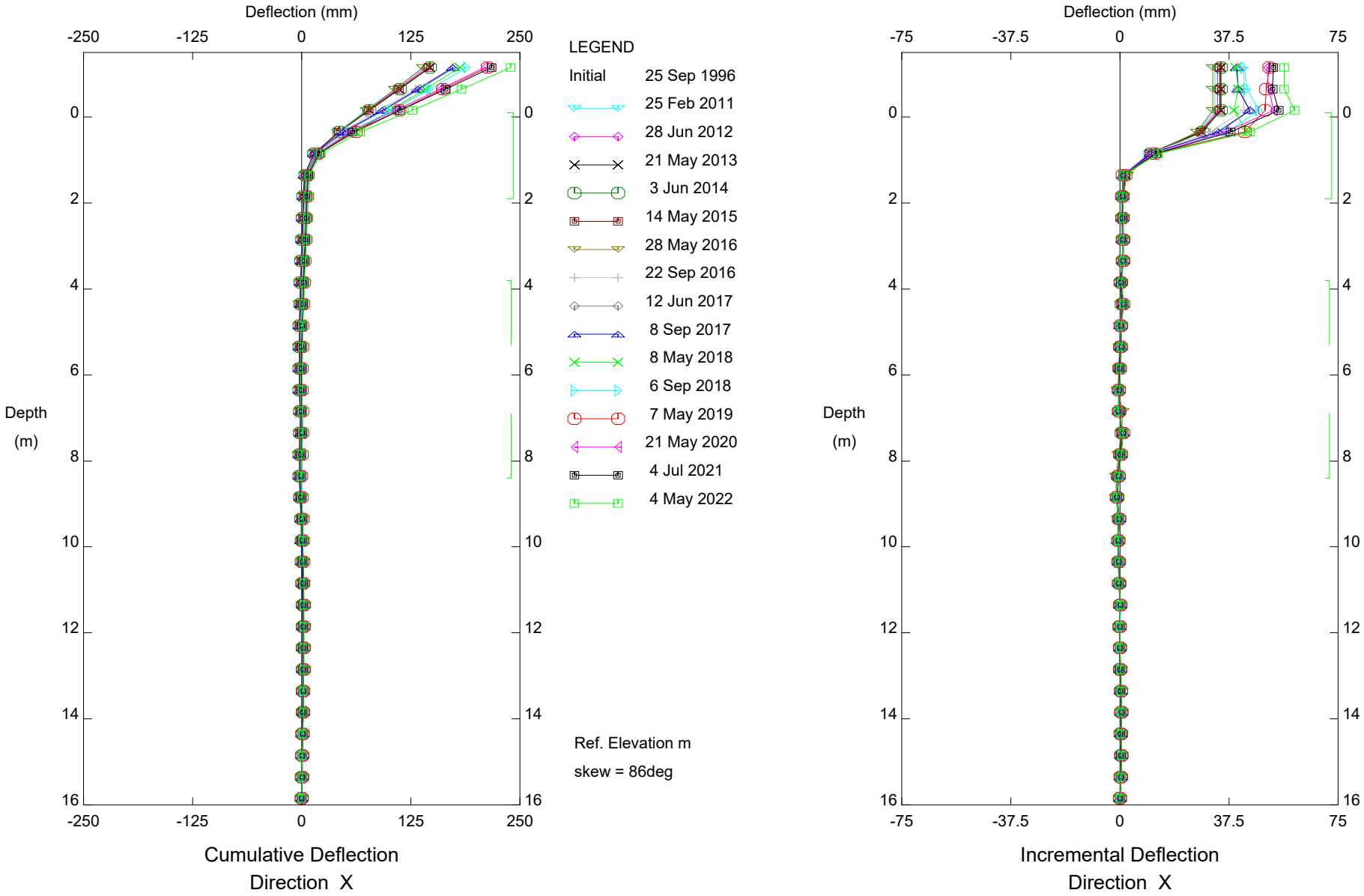

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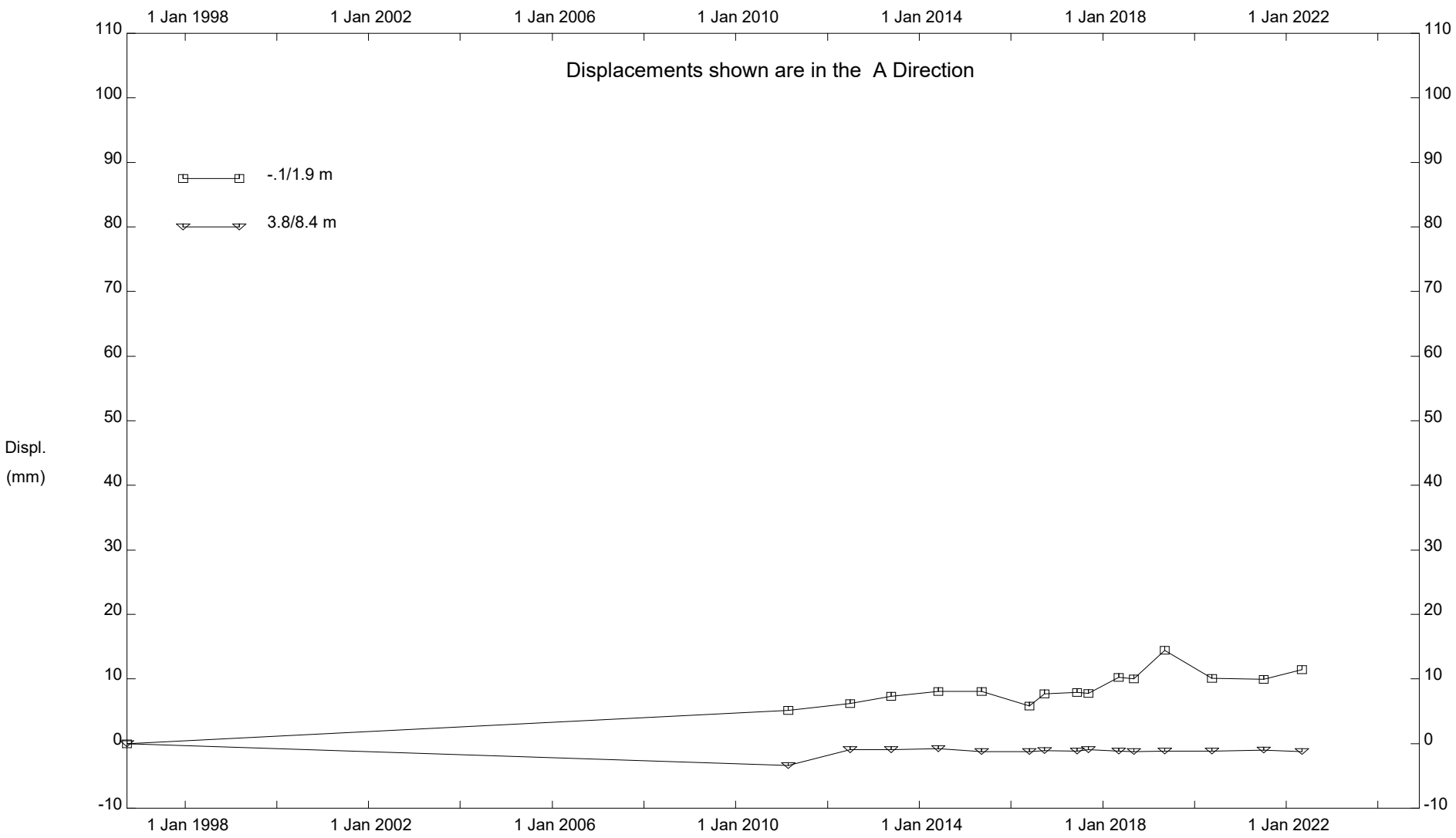

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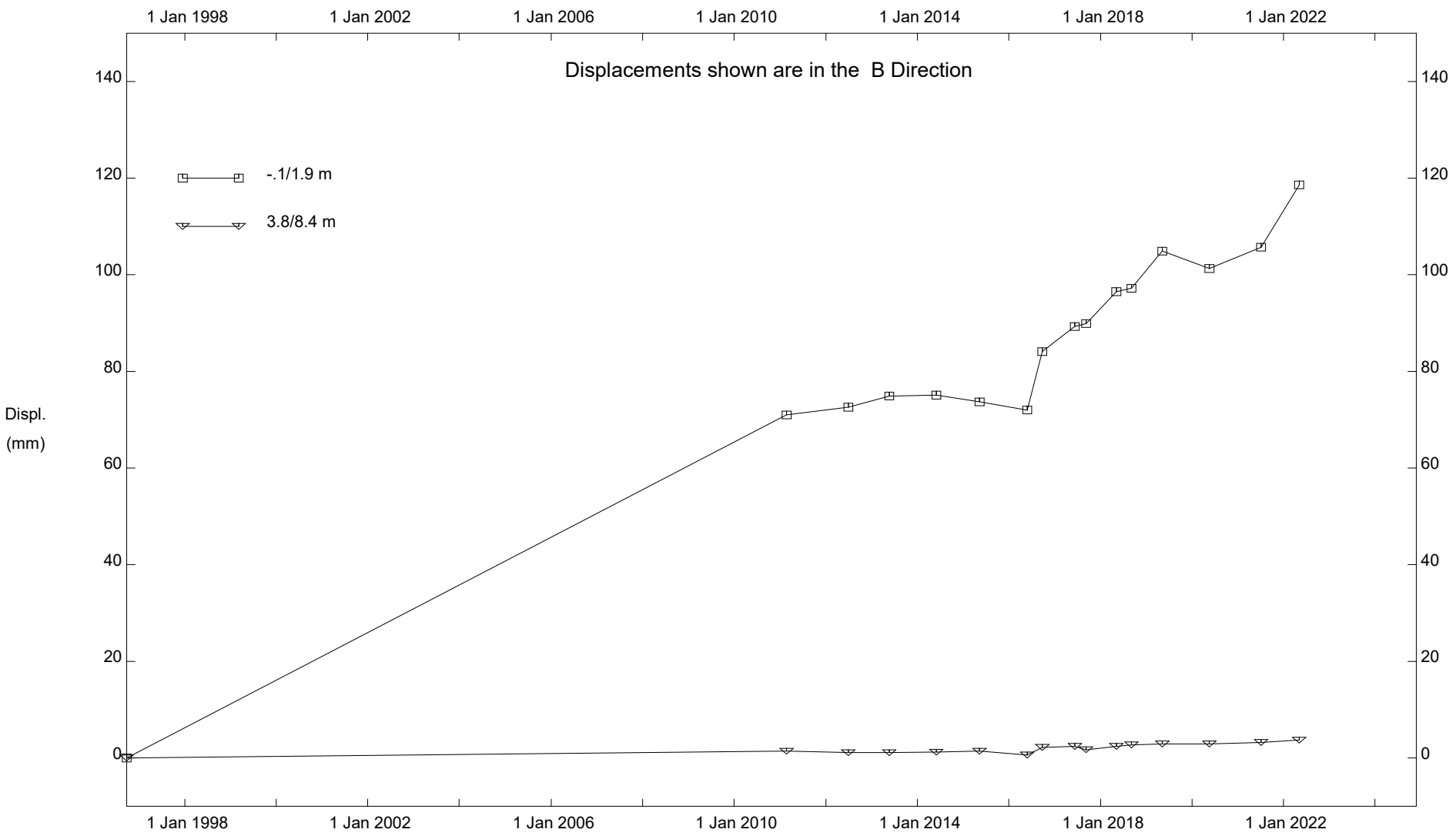

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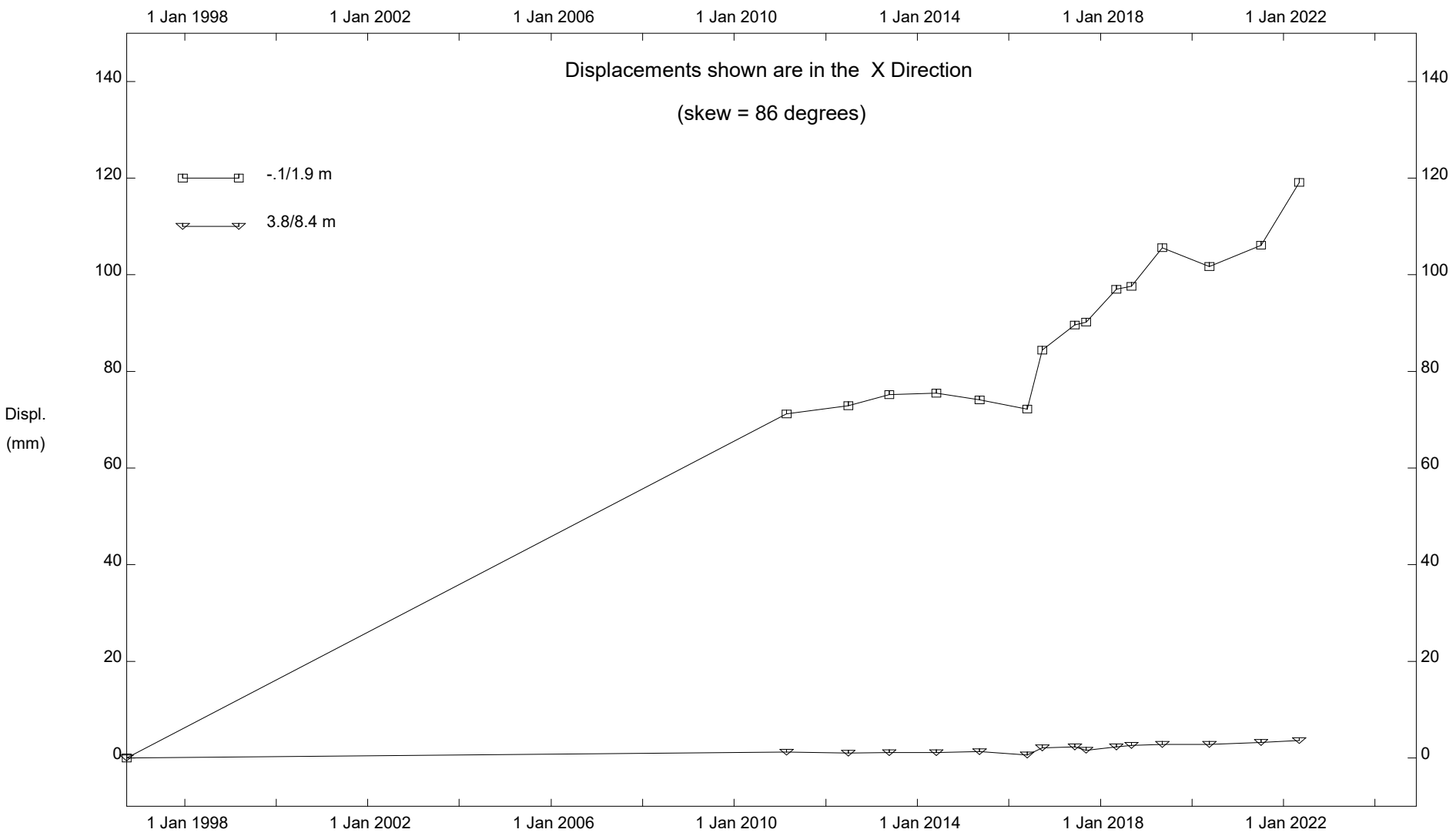

HWY764:02 Pembina River (NC018), Inclinometer SI-24

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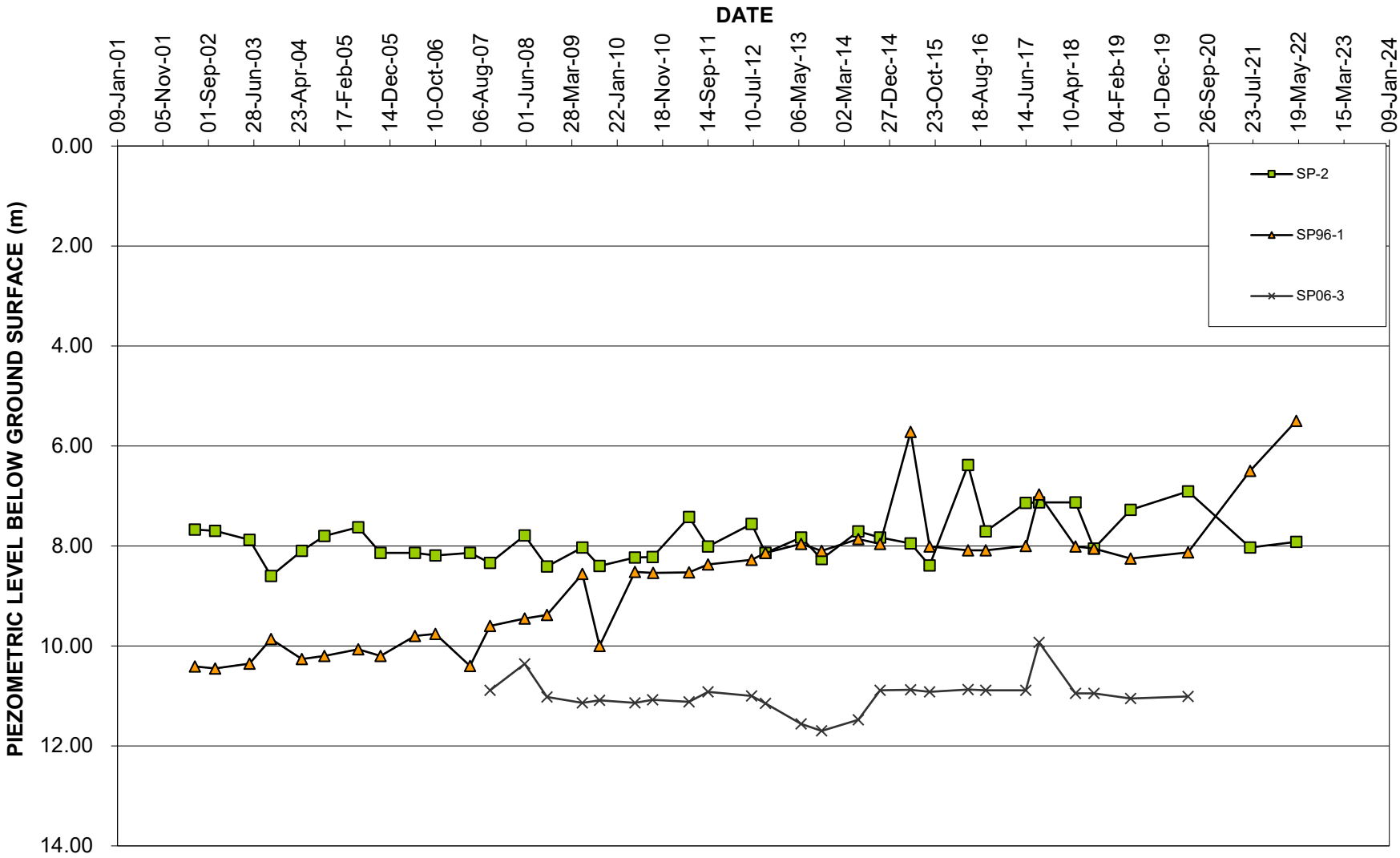
STANDPIPE PIEZOMETER DATA
NC018: HWY 764:02 Pembina River Bridge



Stantec