Stantec

To:	Amy Driessen Transportation and Economic Corridors	From:	Leslie Cho and Lawrence Onwude Stantec Consulting Ltd.
File:	123315222	Date:	October 31, 2025

Reference: North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 Instrumentation Monitoring Report

1.0 OBSERVATIONS

1.1 FIELD PROGRAM AND INSTRUMENTATION STATUS

The Fall 2025 reading cycle consisted of instrument readings of two slope inclinometers (SI-1 and SI13-3), one pneumatic piezometer (PN-02), one vibrating wire piezometer (VW13-3), and one standpipe piezometer (SP13-3A). During the site visit, slope inclinometer (SI-2) was found to be cut off at 0.72 m and could not be read. The site plan is shown on **Figure 1** attached. The instrument readings were taken by Akintola Fakinlede, GIT and Adham Zahr, Geotechnical EIT and on October 3, 2025.

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. The vibrating wire piezometers (VW) were read with a Slope Indicator VW Data Recorder 52613500 readout box. Standpipe piezometers (SP) were read with Heron Instruments water tape.

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

2.0 INSTRUMENTATION READINGS

2.1 GENERAL

SI plots are attached 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 since initializing each SI are provided in **Table NC052-1** and the attachments.

The groundwater levels from PN, VWP and SP readings are plotted in the attachments and summarized in **Table NC052-2**.

2.2 ZONES OF MOVEMENT

No new zones of movement were observed in the SIs. **Table NC052-1** summarizes existing 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.

Reference: **North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 Instrumentation Monitoring Report**

2.3 MONITORING RESULTS

2.3.1 Slope Inclinometers

SI-1 shows negligible movement over the zone of movement at about 11 m depth. Total cumulative movement observed since 2006 is about 3 mm.

SI13-3 has recorded about 6 mm of cumulative movement since 2014. The recorded movement is likely related to construction activities in winter 2014. Little to no movement was observed since 2016.

2.3.2 Piezometers

In Spring 2024, **PN-01** showed a significant decrease in piezometric elevation of about 18 m (El. 810.4 m) which is close to the piezometer tip at elevation 810.2 m. The data is likely erroneous due to a leak within the pneumatic piezometer tubing. In Fall 2024, PN-01 was confirmed to be non-operational.

PN-02 had artesian conditions until 2014 when the pore pressure decreased because of remedial work to relieve pore pressures in the east slope. Current reading indicates a significant drop in piezometric elevation of about 20 m (El. 809.3 m) which is close to the piezometer tip at elevation 808.8 m. This result is likely erroneous due to a leak from the pneumatic piezometer tube related to the damage to the SI since they share the same installation location.

VW13-3 showed a decrease of 1.0 m in piezometric level since the previous reading in Spring 2025. The piezometric level in VW13-3 has been relatively stable since about 2015.

The water level in **SP13-3A** decreased by about 1.7 m after construction in winter 2014. The water level gradually increased to above pre-construction levels in May 2017. A 1.1 m drop was measured in September 2017 whereafter water levels increased again to above pre-construction levels until May 2020. Another significant drop in water levels was observed in September 2020. There appears to be a trend where water levels increase for 1-3 years followed by a sharp drop in water levels. The current measured water level decreased by 1.2 m from the previous reading cycle in Spring 2025 corresponding to a water level depth of 1.8 m bgs.

3.0 RECOMMENDATIONS

3.1 FUTURE WORK

It is recommended that all instruments be read again in Spring 2026 reading cycle.

Reference: **North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 Instrumentation Monitoring Report**

3.2 INSTRUMENTATION REPAIRS

The battery for tiltmeter TW1 should be replaced as soon as practicable. This can be done via ice access in the winter or with the use of a snooper truck. Alternatively, precise surveys of the bridge can be completed regularly to monitor its movement.

The cables connecting tiltmeters TE1 and TE2 to the datalogger have been ripped apart, likely due to drift accumulation and are likely unrepairable.

PN-01 appears to have sustained damage since the Spring 2024 cycle as it was leaking and made a hissing sound. An attempt to repair PN-01 could be made since the ability to hear the hissing sound suggests the leak is within the exposed portion of cabling. If the leak location is identified, PN-01 could potentially be repaired by splicing below the leak.

PN-02 was inferred to be leaking during the 2025 Fall reading cycle. If the leak location is identified, PN-01 could potentially be repaired by splicing below the leak.

SI-2 was found broken at 0.72 m (approximately 0.2 m from ground surface) during 2025 Fall reading cycle. The sheared portion of the SI casing could be removed and a coupler with new casing could potentially be installed to allow for continuous reading in the future.

Reference: **North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 Instrumentation Monitoring Report**

Table NC052-1: Fall 2025 Slope Inclinometer Reading Summary

Instrument Name	Date Initialized	Top of Casing Elevation (m aMSL)[1]	Coordinates [2] (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) [3]
			Northing	Easting							
SI-1	Aug. 31 2006	828	5905057	621641	3 mm over 7.4 m to 11.9 m depth in 328º direction	4 mm/year; May 2016	Operational	9-May-25	-<1	<1	-<1
SI-2	Aug. 31, 2006	833	5905016	621726	26 mm over 6.8 m to 10.3 m depth in 191° direction -16 mm over 12.8 m to 14.8 m depth in 191° direction	17 mm/yr; May 2014 9 mm/yr; Sept. 2022	Non - Operational	9-May-25	Found sheared at 0.72 m in October, 2025		
SI13-3	May 23, 2013	833	5905025	621786	6 mm over 19.2 m to 21.2 m depth in 7° direction	397 mm/yr; Nov. 2013	Operational	9-May-25	Negligible movement rate since Oct. 2016 (less than 1 mm/yr)		

Note:
(1) aMSL = Above Mean Sea Level
(2) Operational instruments were updated October 3, 2025 with approximate accuracy of ± 3 m.
(3) Negative (-) indicates decrease in rate of movement and/or change in direction of movement.

Reference: **North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 Instrumentation Monitoring Report**

Table NC052-2: Fall 2025 Pneumatic, Vibrating Wire, and Standpipe Piezometers Reading Summary

Instrument Name	Date Initialized	Top of Casing Elevation (m aMSL) (1)	Coordinates (2) (UTM 11U, NAD1983) (m)		Tip Elevation (m)	Current Status	Maximum Depth below Ground Surface [Elevation](3) (m)	Depth below Ground Surface (m)	Piezometric Elevation (m)	Change in Piezometric Level Since Previous Reading (m)
			Northing	Easting						
PN-01 (30578)	Aug 31, 2006	828.0	5905055	621640	810.2	Non-Operational	-6.7 [833.7 m] May 17, 2013	-	-	N/A
PN-02 (30579)	Aug 31, 2006	832.0	5905015	621726	809.2	Operational	-4.2 [835.9] June 5, 2012	22.5	809.3	-20.5
VW13-3 (25255)	Apr 25, 2013	834.2	5905024	621787	814.4	Operational	0.2 [832.5] May 8, 2013	3.7	829.0	-1.0
SP13-3A	May 23, 2013	834.6	5905026	621790	-	Operational	0.4 [832.4] May 20, 2020	1.8	830.9	-1.2

Note:
(1) aMSL = Above Mean Sea Level
(2) Operational instruments were updated October 3, 2025 with approximate accuracy of ± 3 m.
(3) Negative value indicates artesian condition.

Reference: **North Central Region, Stony Plain, Site NC052 - Highway 621:02 Pembina River Bridge Abutment, Fall 2025 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
October 31, 2025
ID# 139079

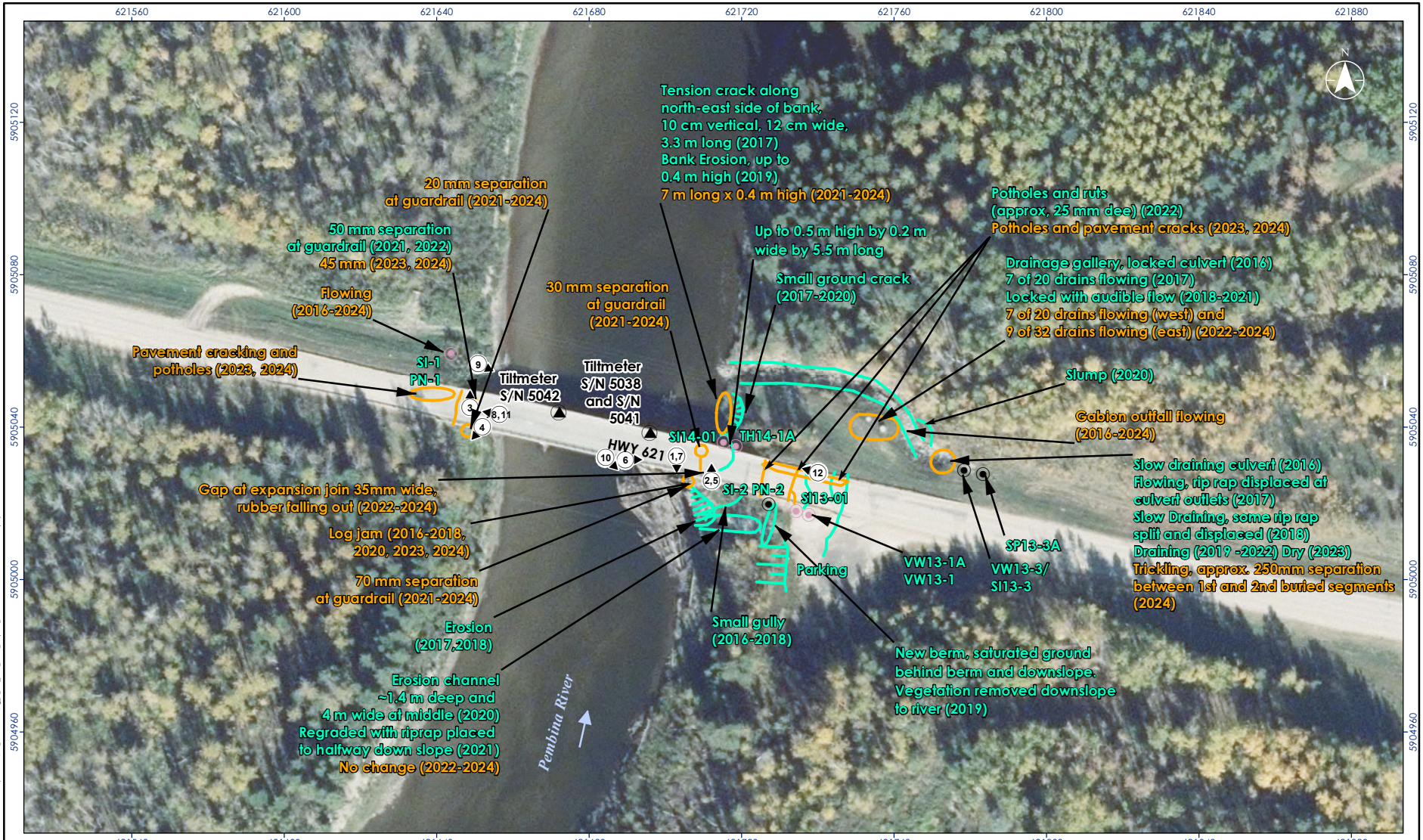
31-Oct-2025

Leslie Cho M.Eng., P.Eng.
Senior Associate, Geotechnical Engineer
Phone: 780-917-7403
leslie.cho@stantec.com

Lawrence Onwude M.Eng., P.Eng.
Senior Associate, Geotechnical Engineer
Phone: 780-969-2257
lawrence.ownude@stantec.com

Attachment:
Figure 1 – Site Plan
SI-1 Slope Inclinometer Plots
SI-2 Slope Inclinometer Plots
SI13-3 Slope Inclinometer Plots
Pneumatic Piezometer Elevation vs. Time Plot
Vibrating Wire Piezometer Elevation vs Time Plot
Standpipe Piezometer Elevation vs Time Plot
NC052 Fall 2025 Damaged Instrument Photos

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature ID# 74389
Date 6-Nov-2025
PERMIT NUMBER: P 0258
The Association of Professional Engineers and Geoscientists of Alberta



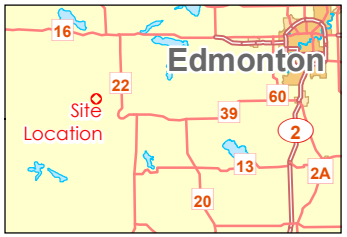


Photo Number and Direction
Non-Operational Instrument
Operational Instrument
Tiltmeter Data Logger
Previous Observation
2024 Observation

0 25 50 metres
1:1,500 (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Base features: Geogratis, ©Department of Natural Resources Canada. All rights reserved.
3. Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

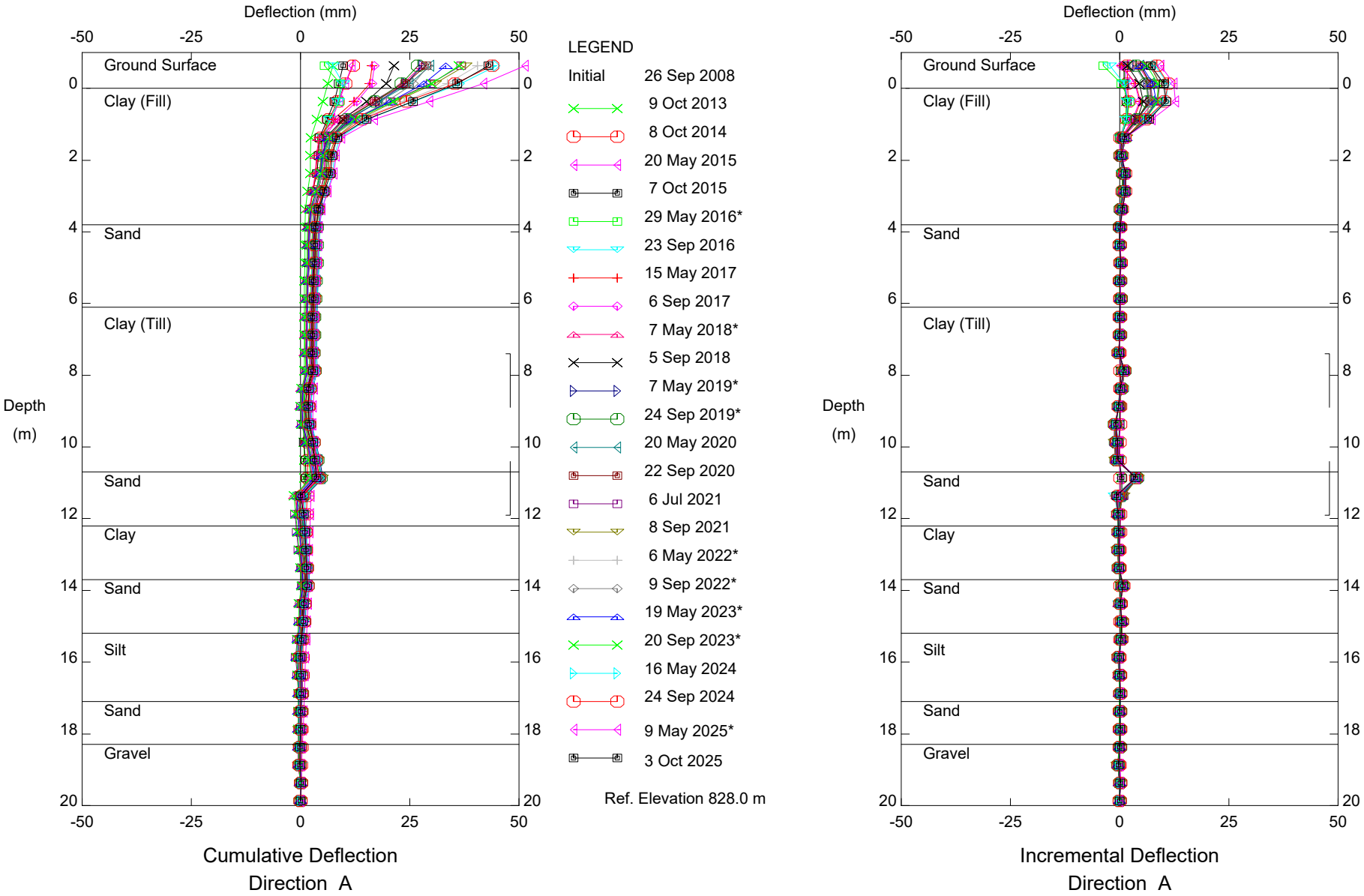
Project Location	123315222
Hwy 621:02 Alberta	Prepared by SP on 2024-10-06
	QR by LC on 2024-10-06
	IR by XL on 2024-10-06

Client/Project
Transportation and Economic Corridors
Geohazard Monitoring Program
NC52 HWY 621:02 Pembina River Bridge

Figure No.
1

Title
Site Plan

Stantec Consulting Ltd - Edmonton



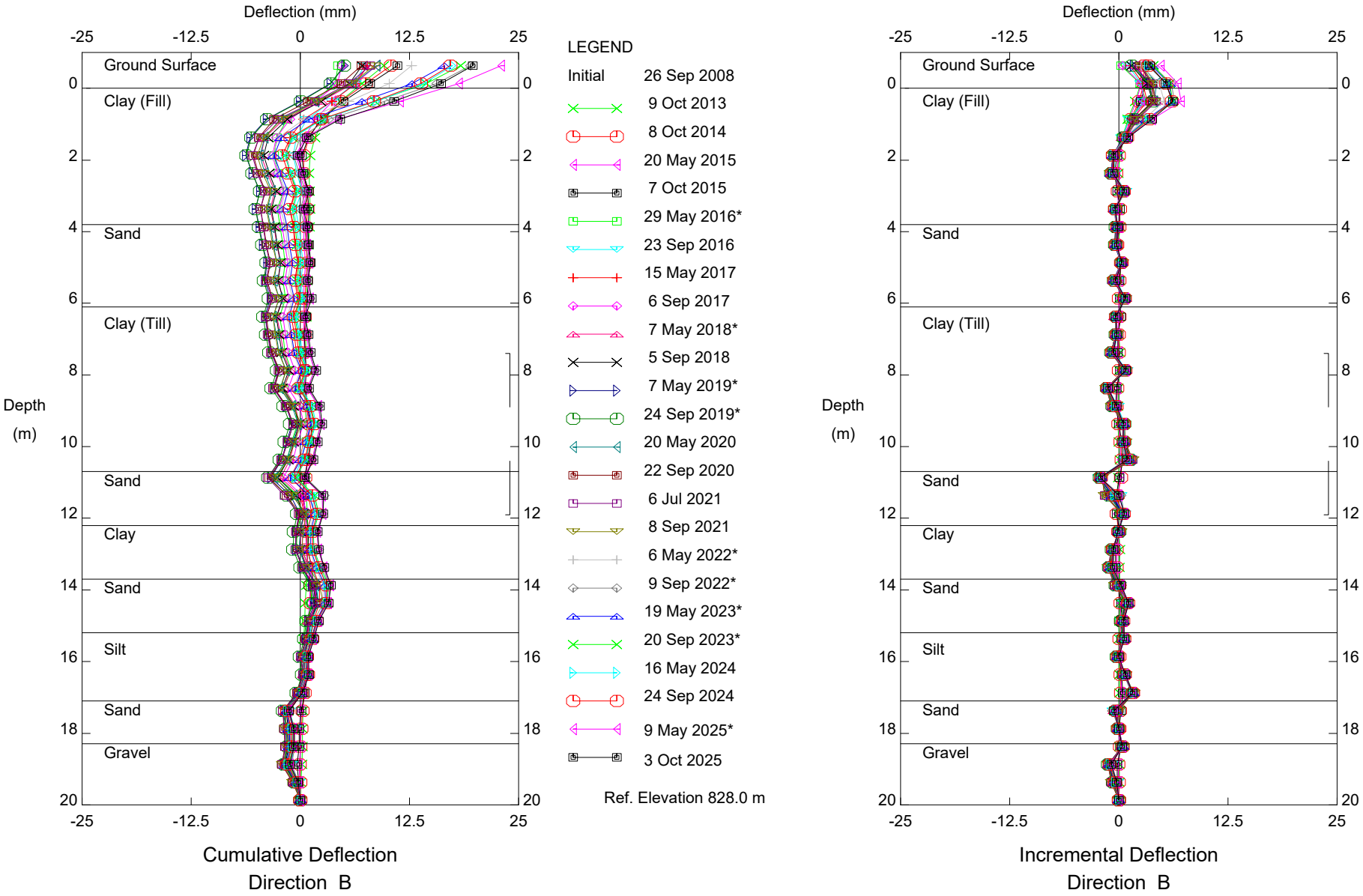
NC052, Inclinometer SI-1

Transportation & Economic Corridors

Sets marked * include zero shift and/or rotation corrections.

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI-1\NC052_SI-1_S2025.gtl

Stantec Consulting Ltd - Edmonton



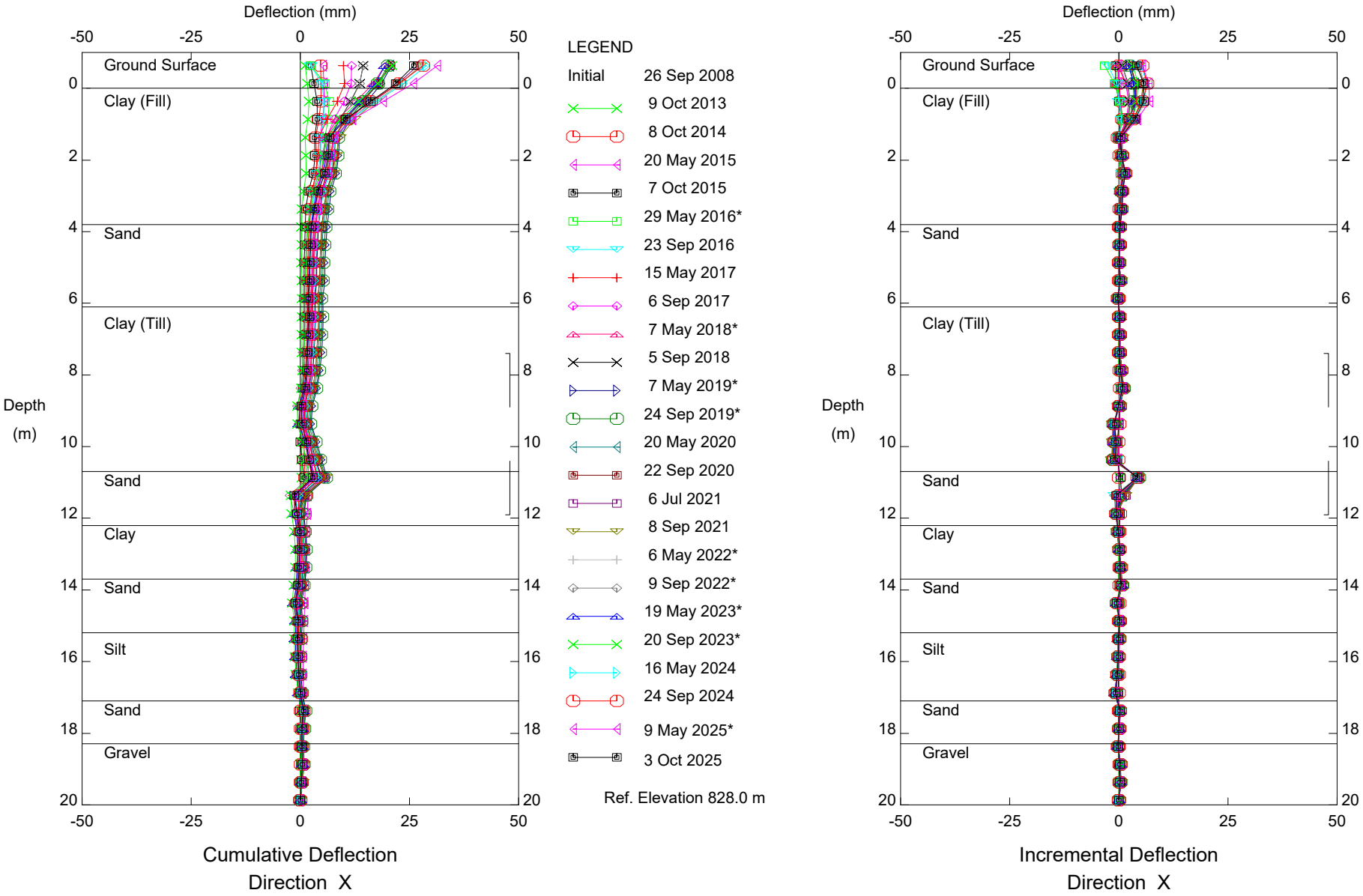
NC052, Inclinometer SI-1

Transportation & Economic Corridors

Sets marked * include zero shift and/or rotation corrections.

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI-1\NC052_SI-1_S2025.gtl

Stantec Consulting Ltd - Edmonton



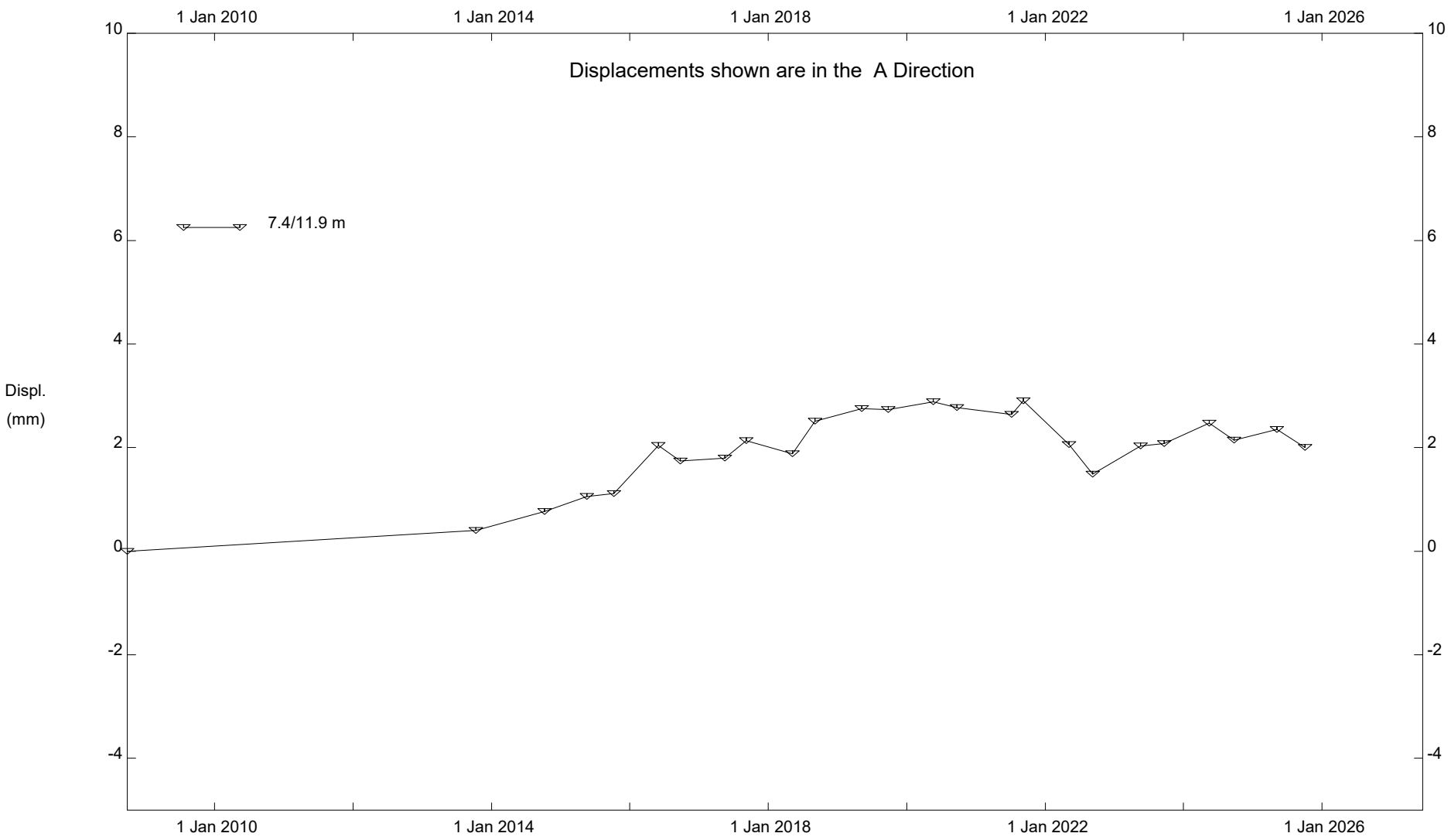
NC052, Inclinometer SI-1

Transportation & Economic Corridors

Sets marked * include zero shift and/or rotation corrections.

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI-1\NC052_SI-1_S2025.gtl

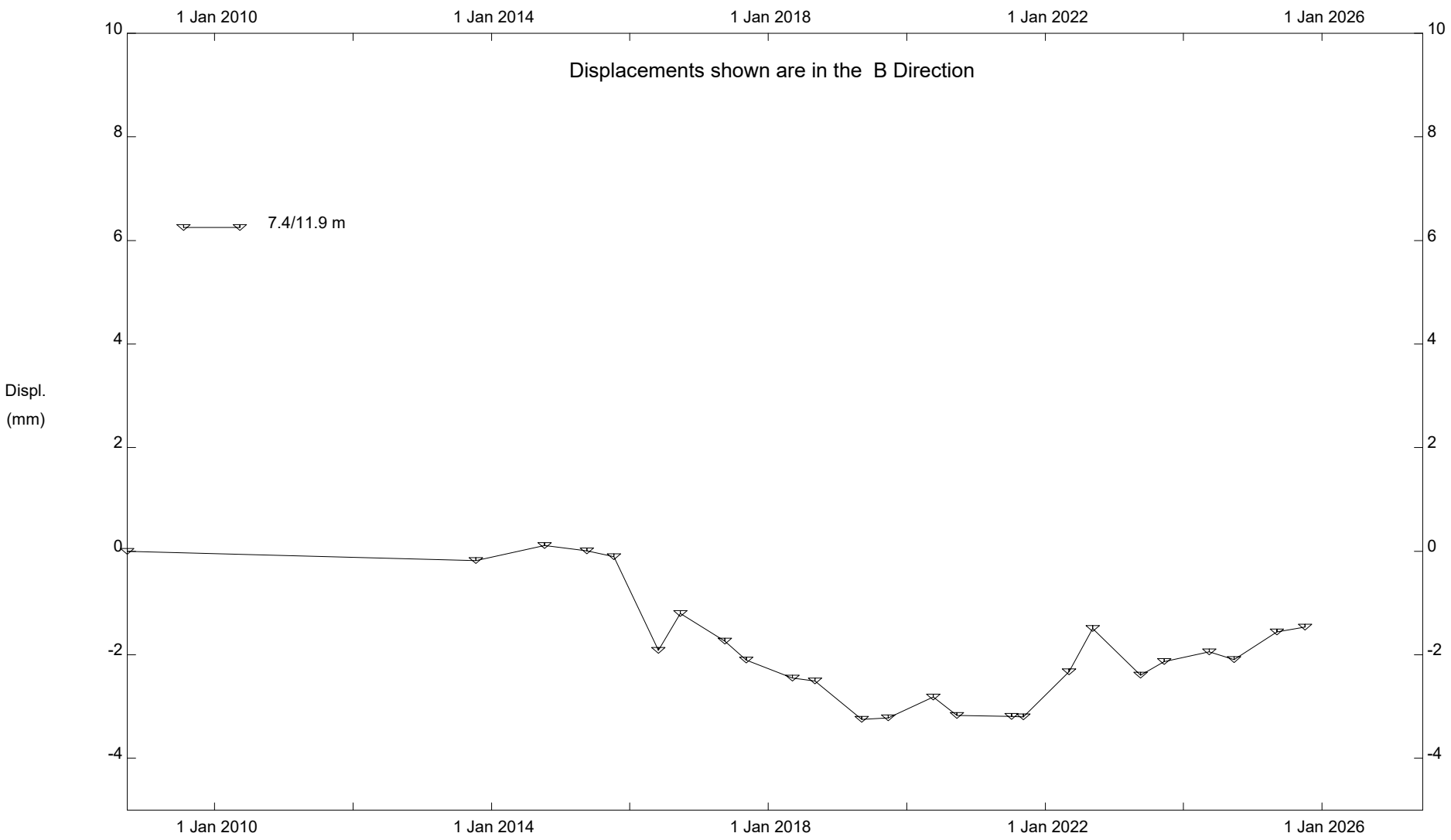
Stantec Consulting Ltd - Edmonton



NC052, Inclinometer SI-1

Transportation & Economic Corridors

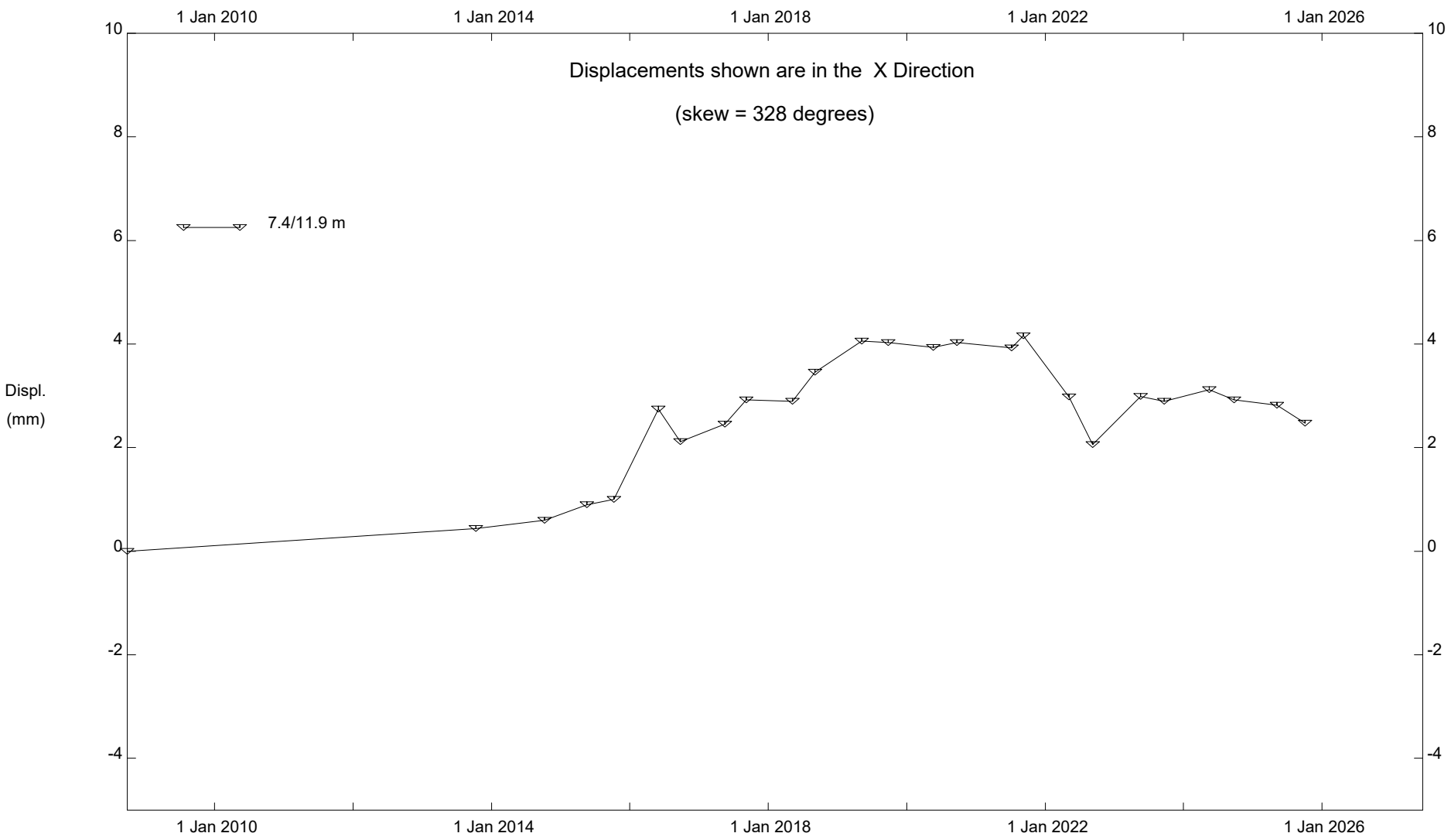
Stantec Consulting Ltd - Edmonton



NC052, Inclinometer SI-1

Transportation & Economic Corridors

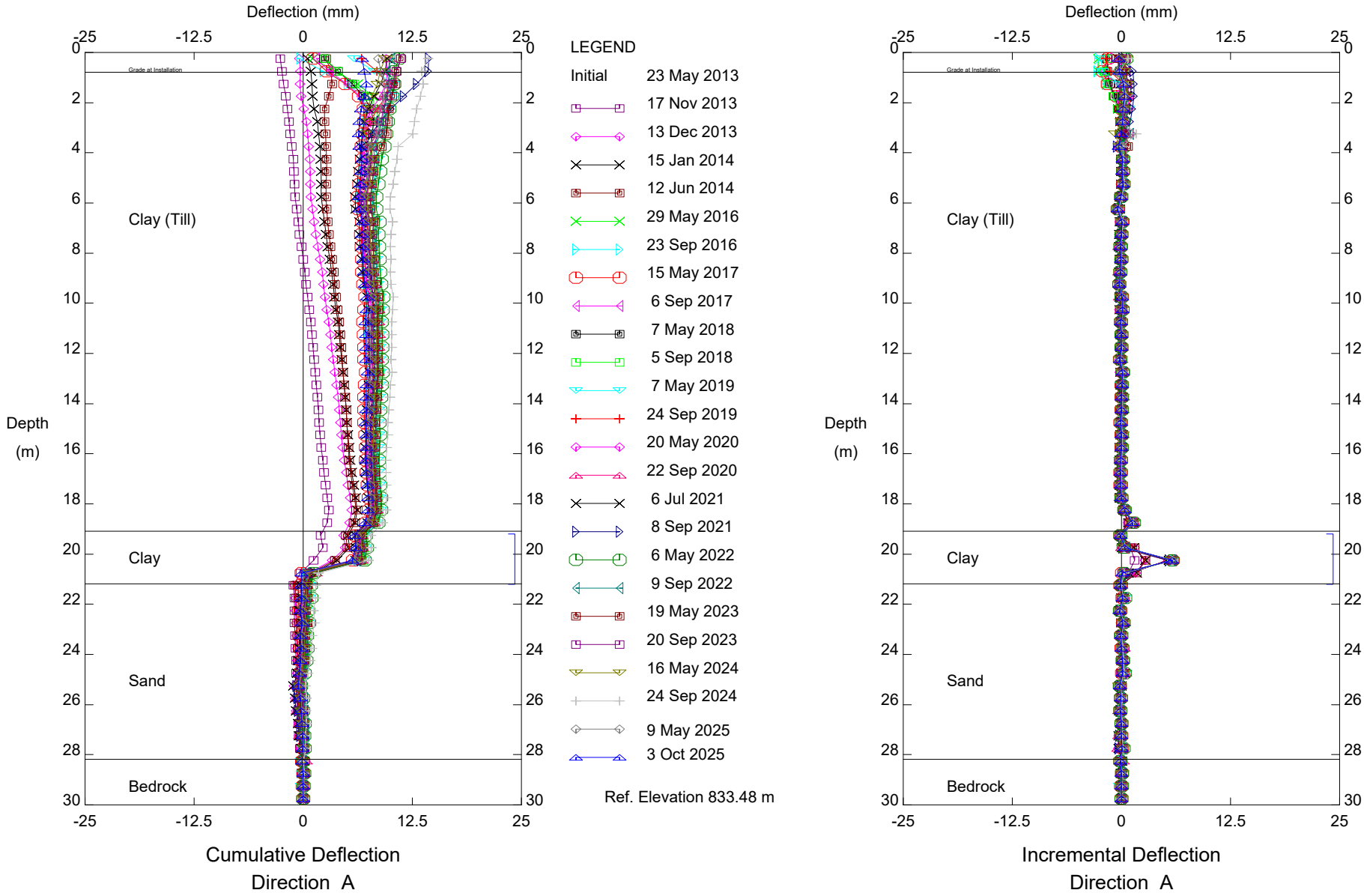
Stantec Consulting Ltd - Edmonton



NC052, Inclinometer SI-1

Transportation & Economic Corridors

Stantec Consulting Ltd - Edmonton

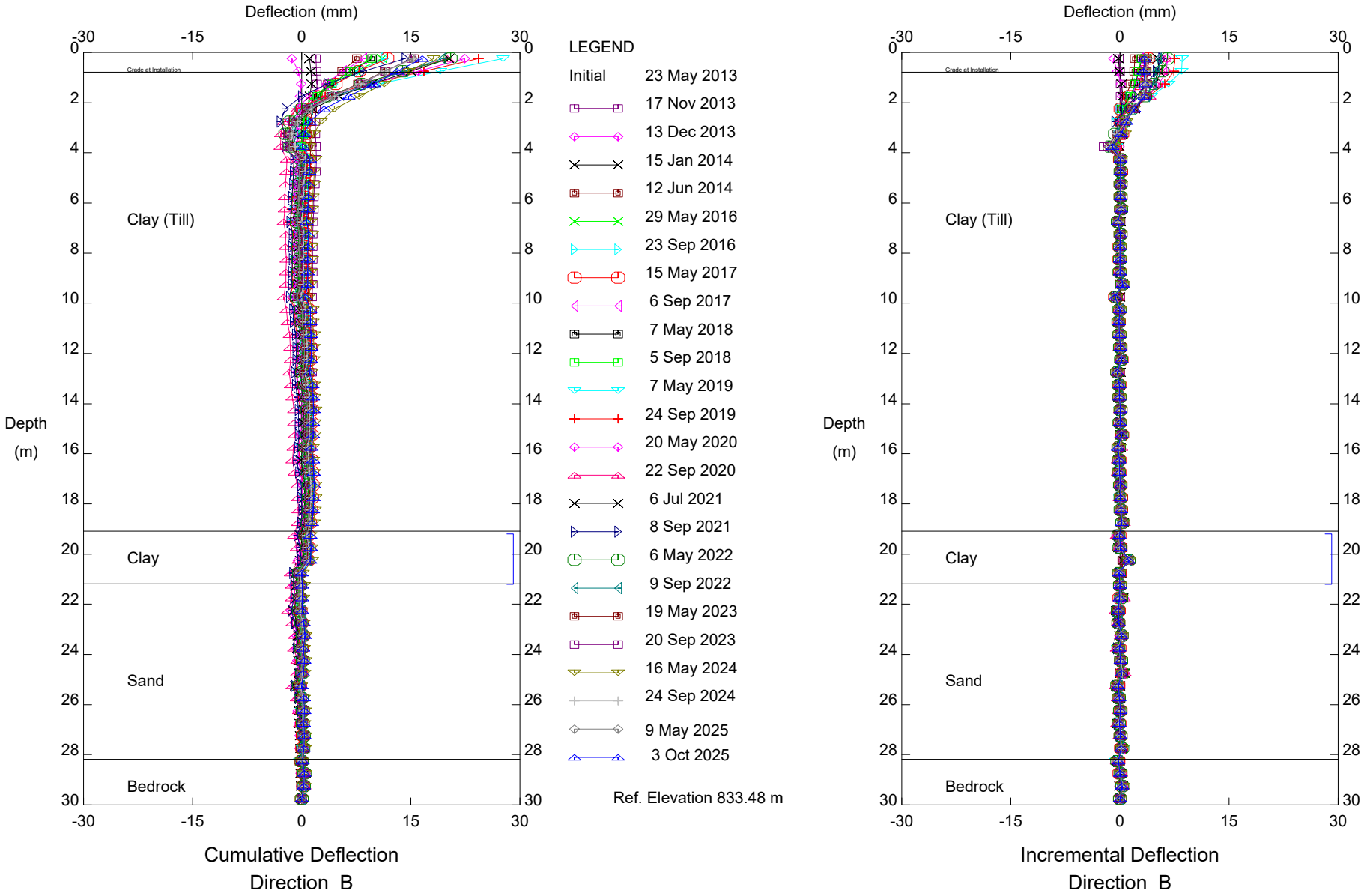


NC052, Inclinometer SI13-3

Transportation & Economic Corridors

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI13-3\NC052_SI13-3_S2025.gtl

Stantec Consulting Ltd - Edmonton

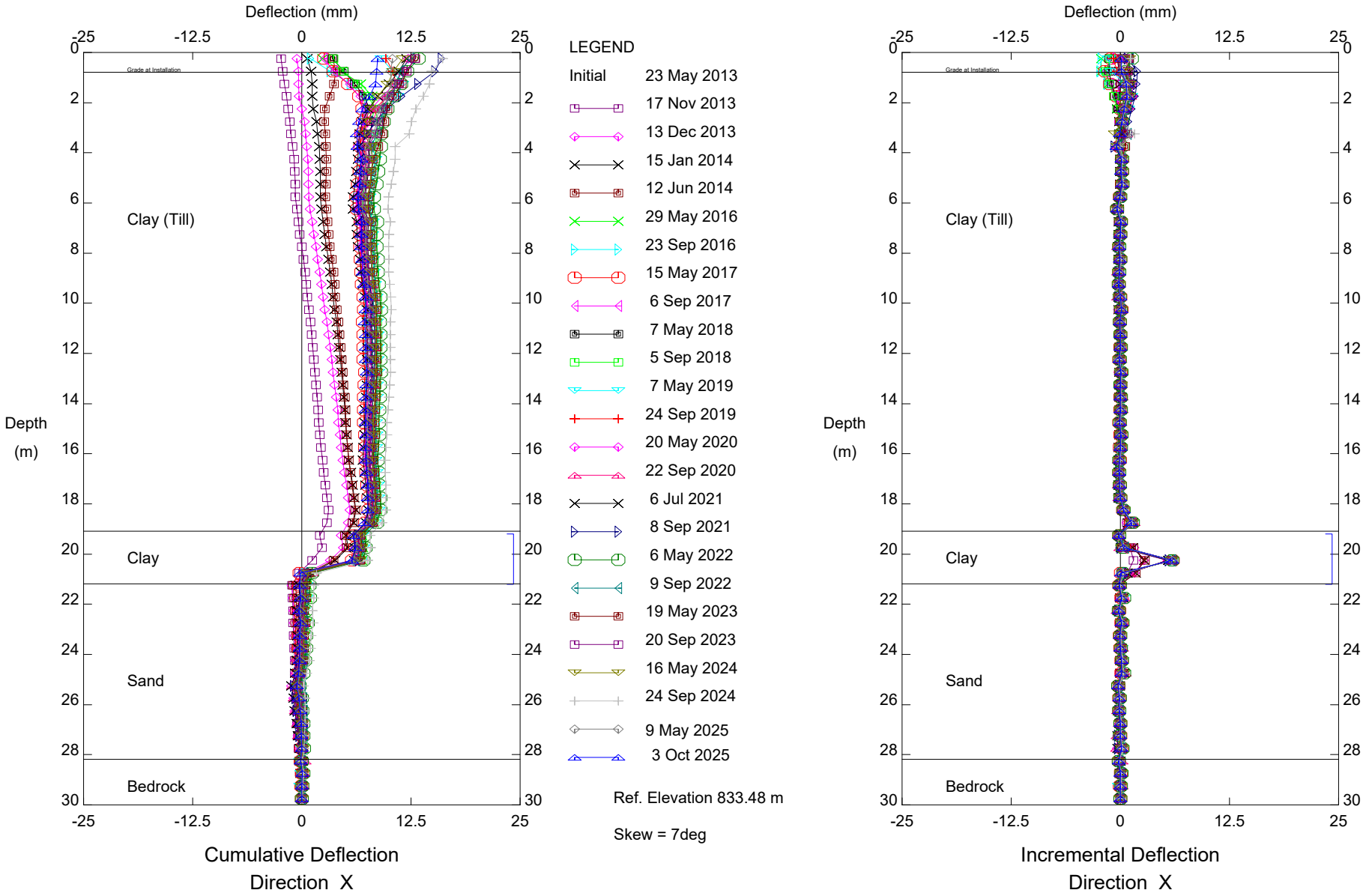


NC052, Inclinometer SI13-3

Transportation & Economic Corridors

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI13-3\NC052_SI13-3_S2025.gtl

Stantec Consulting Ltd - Edmonton

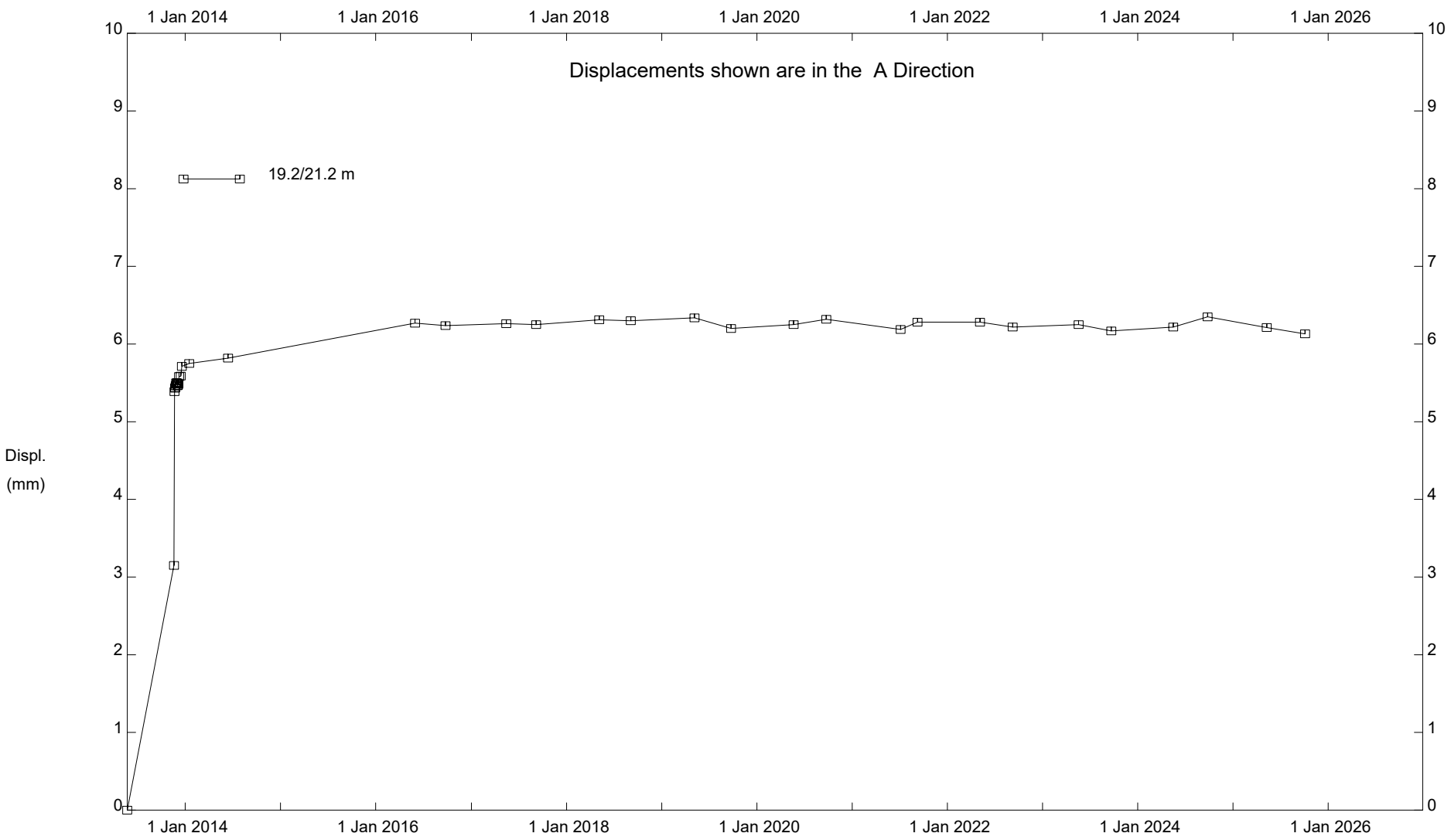


NC052, Inclinometer SI13-3

Transportation & Economic Corridors

V:\1233\active\123315222\03_data\field\instrumentation\NC052\SI data\2025_fall\SI13-3\NC052_SI13-3_S2025.gtl

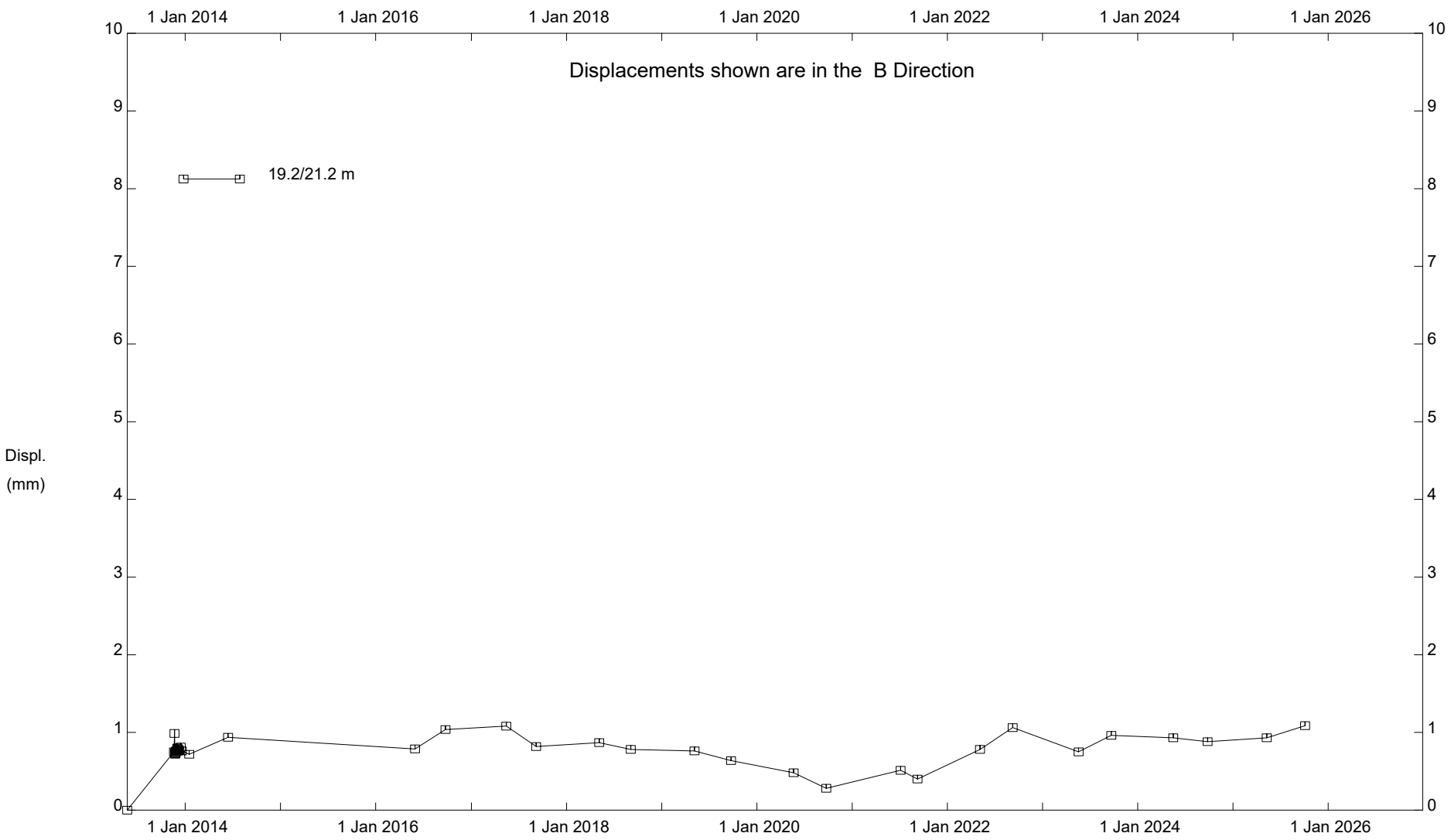
Stantec Consulting Ltd - Edmonton



NC052, Inclinometer SI13-3

Transportation & Economic Corridors

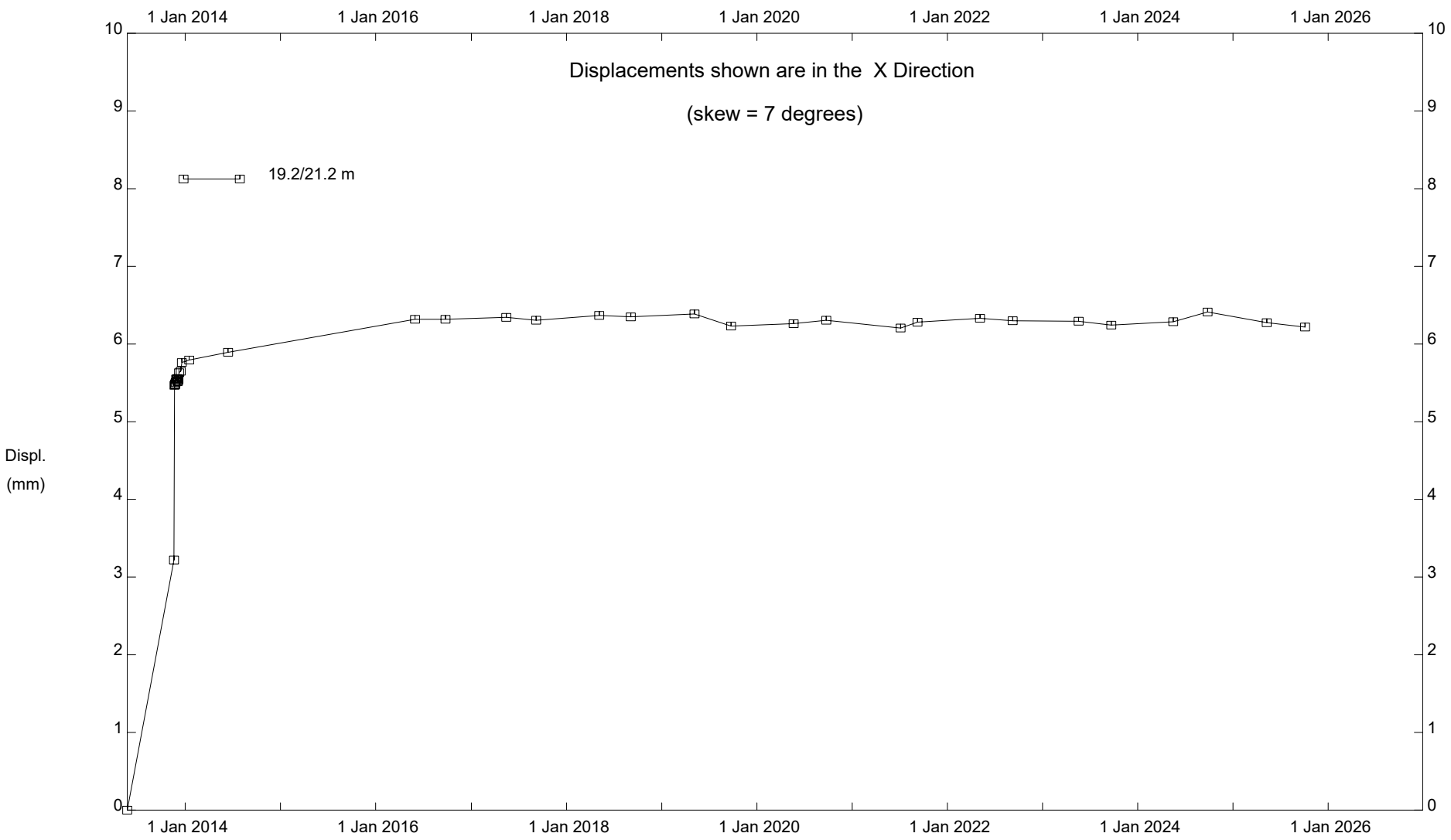
Stantec Consulting Ltd - Edmonton



NC052, Inclinometer SI13-3

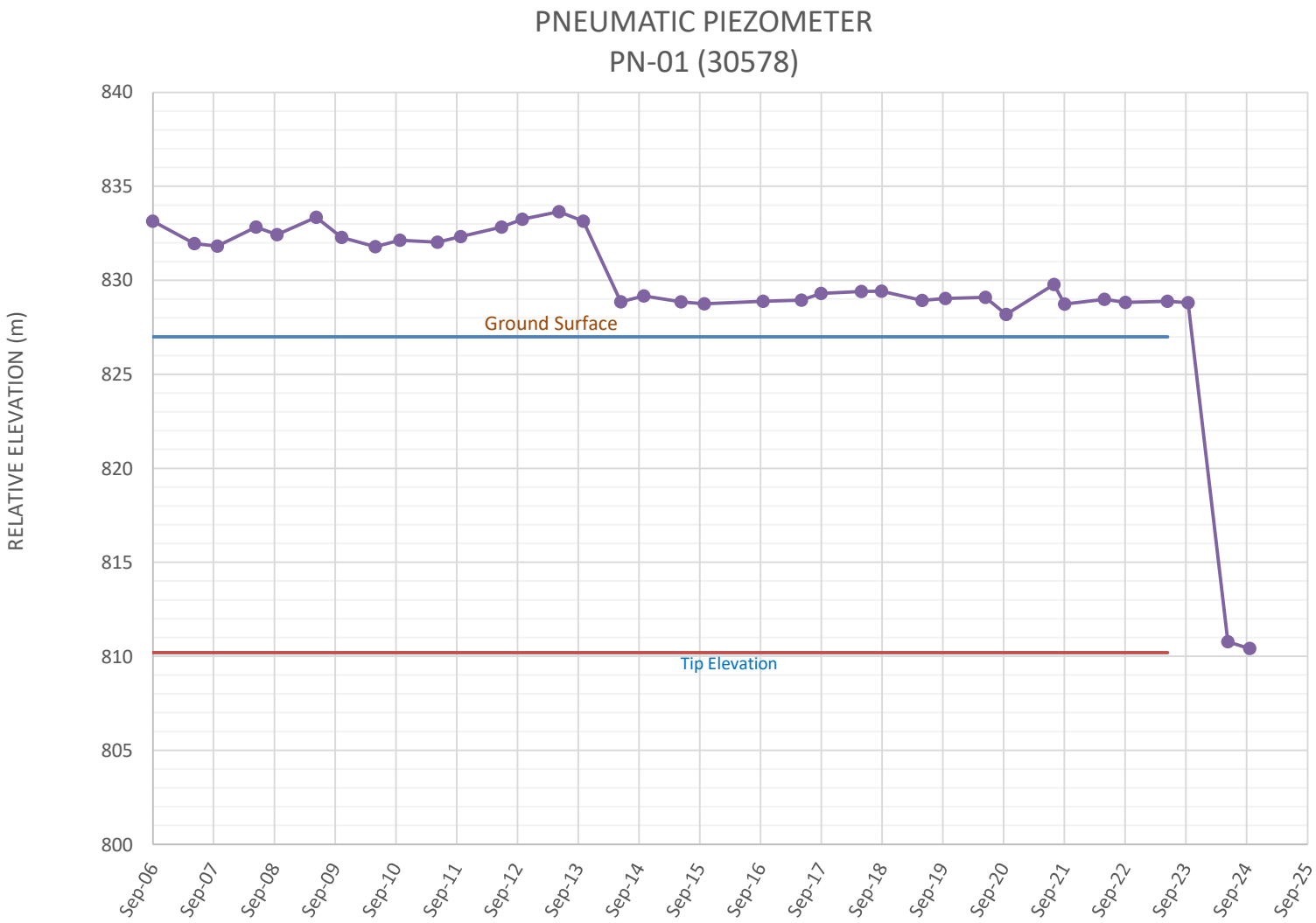
Transportation & Economic Corridors

Stantec Consulting Ltd - Edmonton

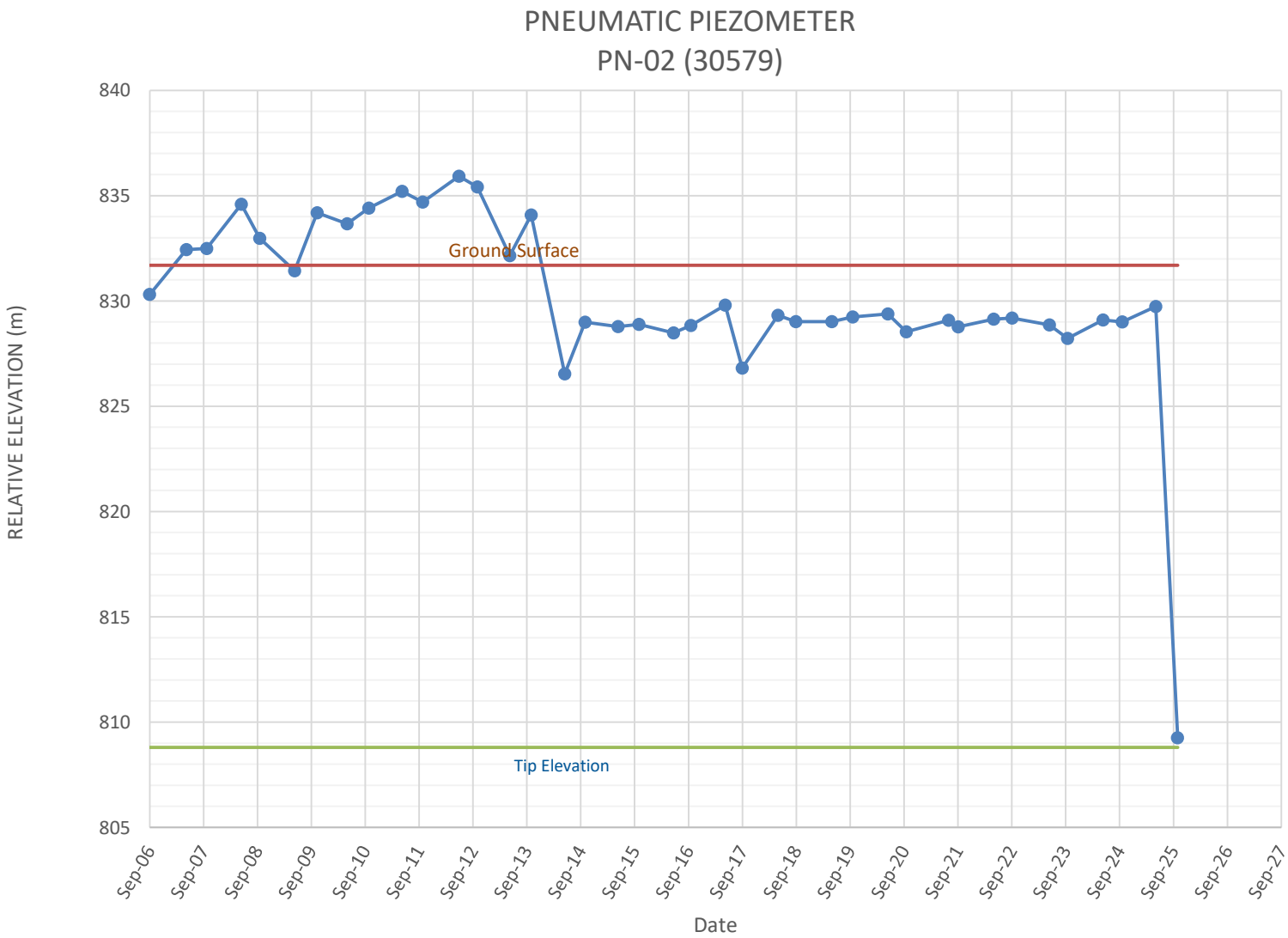


NC052, Inclinometer SI13-3

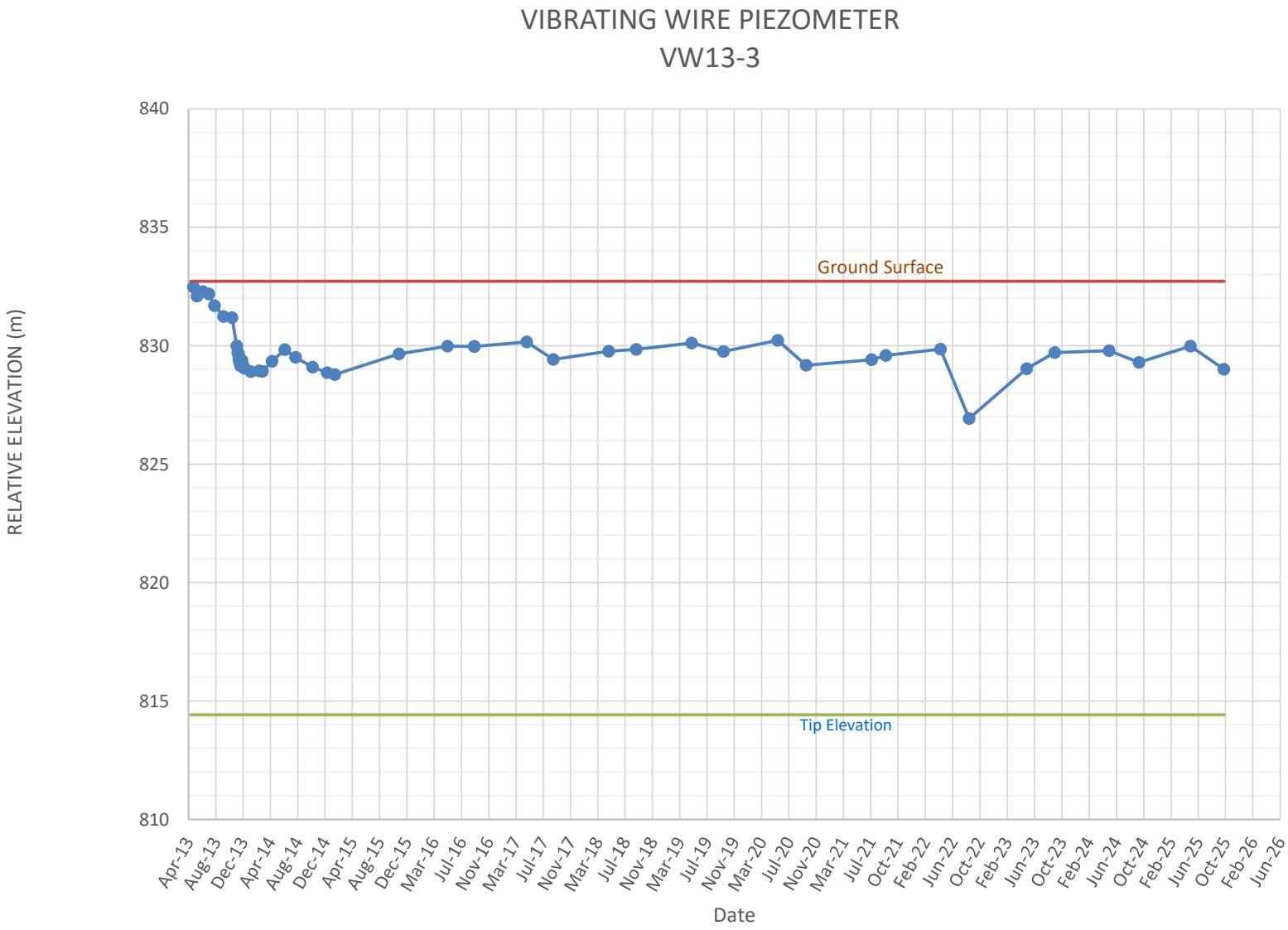
Transportation & Economic Corridors


PNEUMATIC PIEZOMETER
PN-01 (30578)
RELATIVE ELEVATION (m)
840
835
830
825
820
815
810
805
800
Ground Surface
Tip Elevation
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
Sep-22
Sep-23
Sep-24
Sep-25

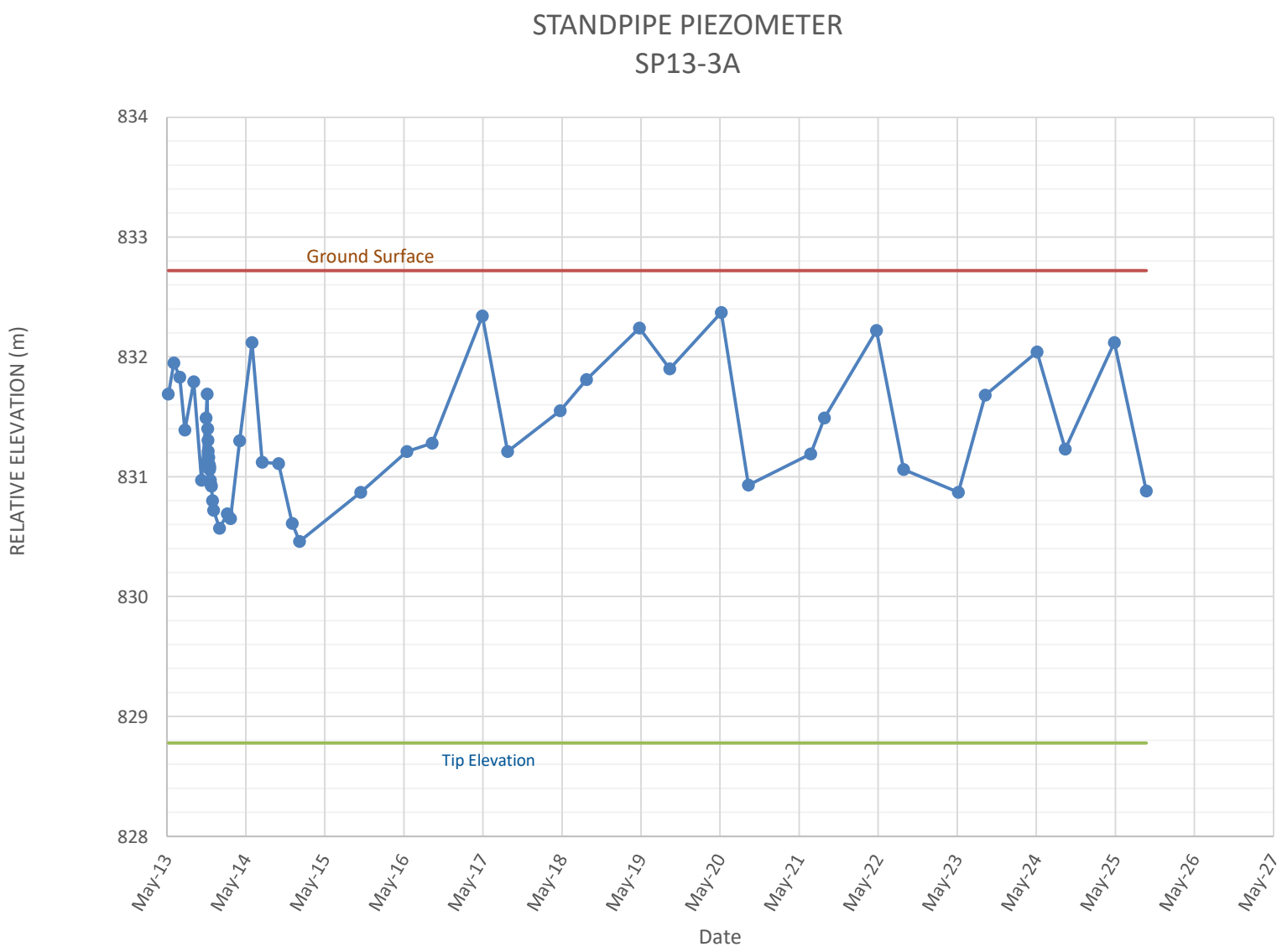
Stantec


PNEUMATIC PIEZOMETER
PN-02 (30579)
RELATIVE ELEVATION (m)
840
835
830
825
820
815
810
805
Ground Surface
Tip Elevation
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
Sep-22
Sep-23
Sep-24
Sep-25
Sep-26
Sep-27
Date

Stantec


VIBRATING WIRE PIEZOMETER
VW13-3
RELATIVE ELEVATION (m)
840
835
830
825
820
815
810
Ground Surface
Tip Elevation
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Mar-16
Jul-16
Nov-16
Mar-17
Jul-17
Nov-17
Mar-18
Jul-18
Nov-18
Mar-19
Jul-19
Nov-19
Mar-20
Jul-20
Nov-20
Mar-21
Jul-21
Oct-21
Feb-22
Jun-22
Oct-22
Feb-23
Jun-23
Oct-23
Feb-24
Jun-24
Oct-24
Feb-25
Jun-25
Oct-25
Feb-26
Jun-26
Date

Stantec


STANDPIPE PIEZOMETER
SP13-3A
RELATIVE ELEVATION (m)
834
833
832
831
830
829
828
Ground Surface
Tip Elevation
May-13
May-14
May-15
May-16
May-17
May-18
May-19
May-20
May-21
May-22
May-23
May-24
May-25
May-26
May-27
Date

Stantec

2025 Fall Damaged Instrument NC052

Photo 1: SI 2 sheared at approximately 0.72 m.

Photo 2: Broken part of SI 2 on the ground surface.