THURBER ENGINEERING LTD.

November 6, 2023 File No.: 32121

Alberta Transportation and Economic Corridors
Provincial Building
9621-96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Max Shannon

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS – FALL 2023

SECTION C

SITE PH009: OLD HWY 2:02 SHOP SLIDE

Dear Mr. Shannon:

This report provides the results of the bi-annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation and Economic Corridor's Geohazard Risk Management Program (GRMP) for Peace Region – Peace River District (CON0022164).

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. FIELD PROGRAM AND INSTRUMENTATION STATUS

Five slope inclinometers (SI05-1, SI09-3, SI09-4, SI11-1, and SI19-5), eight standpipe piezometers (SP11-06, SP05-1, SP05-4, SP05-5, SP09-8 to SP09-10 and SP19-3), one pneumatic piezometer (PN19-5B) and two vibrating wire piezometers (VW09-3 and VW09-4) were monitored at the Old Hwy 2:02 Shop Slide site on October 10, 2023, by Mr. Niraj Regmi, G.I.T., and Mr. Nixson Mationg, both of Thurber.

The SIs were read using a RST Digital Inclinometer probe with a 2 feet wheelbase and a RST Pocket PC readout. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. A DGSI dipmeter was used to read the standpipe piezometers. The vibrating wire piezometers were read using a GEOKON GK-404 vibrating wire readout. The pneumatic piezometers were read using a RST C108 pneumatic piezometer readout.

Construction of landslide stabilization measures at this site was completed in June 2022. The site was remediated with a 250 m-long pile wall consisting of cast-in-place concrete piles and a concrete waler with 30 m-long tie-backs installed in the north portion. Embedded steel H-piles in the waler were installed to support a timber lagging retaining structure for the upper 3 m to 4 m of the wall. Downslope of the wall, up to 6.5 m of soil was removed and new rip-rap drainage channels installed to control surface runoff. Other grading improvements were also done in the vicinity such as repair of the upslope ditch and of the sinkhole over the 760 mm SWSP culvert.

The Type 1 and Type 2 wall sections used 1.2 m diameter tangent piles and 1 row of tie-backs. The Type 3 wall used 1.5 m diameter slightly-spaced cantilever piles. Slope offloading resulted in a bench level located at about 6.5 m, 4.5 m and 3 m for Type 1, 2, and 3, respectively, below the top of the lagged wall section.

Three shape accelerometer arrays (SAAs) and strain gauges were installed in one representative pile in each of the three wall sections (Type 1, Type 2, and Type 3). Load cells were installed on five of the tie-back anchors. The SAAs, stain gauges and load cells were wired to a Campbell Scientific CR6 datalogger which was programmed to take readings every 6 hours. The datalogger was also connected to a modem to allow for remote downloading of data via Loggernet software.

2. DATA PRESENTATION

2.1 General

SI and SAA plots for A and B directions are included in in Appendix A. Where movement has been recorded, the resultant plot (X direction, if applicable) and rate of movement have also been provided. Piezometer, strain gauge and load cell reading plots are also included in Appendix A.

The SAAs were read manually during construction. Before the SAAs were wired to the datalogger at the end of construction, the top portion of each instrument was unintentionally unlocked by the Contractor, and the SAAs had to be reset in their respective piles. As a result, the manual SAA readings were plotted separately from the data collected by the datalogger (plots of movement prior to the datalogger were provided in the Spring 2023 report and are not included in this report). The SAA readings from the datalogger, taken after May 27, 2022, are provided in Appendix A.

Slope inclinometer and piezometer reading summary tables are provided below.

2.2 Zones of Movement

No new zones of movement were observed in the SIs since the spring of 2023 readings. Zones of movement in the SAAs were defined over the length of their respective piles.

Zones of movements are summarized in Tables PH009-1 (SIs) and PH009-2 (SAAs) below. Tables PH009-1 and PH009-2 also provide a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred in the SIs and SAAs since initialization.

SIs that are no longer active at the site are also summarized in Table PH009-1A for reference.

It should be noted that the ground elevations and stickups of several of the SIs (SI09-4, SI11-1, and SI19-5) were affected by the grading work during construction, and the reported zones of movement have been adjusted to reflect these changes.

Table PH009-1I: Fall 2023 – Old Hwy 2:02 Shop Slide Slope Inclinometer Instrumentation Reading Summary

Date Monitored: October 10, 2023

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI05-1	Jun.6, 2005	33.5 mm over 0.0 m to 3.0 m depth in 56° direction	21.0 mm/yr between Sept. 2010 and May 2011	Operational	June 13, 2023	No discernible movement	N/A	-1.6
SI09-3	August 20, 2009	No discernible movement	N/A	Operational	June 13, 2023	N/A	N/A	N/A
SI09-4	June 13, 2020 (Reinitialized)	6.0 mm over 8.6 m to 10.5 m depth in 54° direction	6.9 mm/yr in October 2021	Operational	June 13, 2023	No discernible movement	N/A	-0.3
		3.6 mm over 11.7 m to 13.5 m depth in 54° direction	13.0 mm/yr in October 2021			<0.1	0.3	-0.1
SI11-01	May 21, 2015	16.5 mm over 13.9 m to 16.3 m depth in 81° direction	34.3 mm/yr in June 14, 2022	Operational	June 13, 2023	0.8	2.6	-1.6
SI19-5	June 25, 2019	7.9 mm over 8.2 m to 11.2 m depth in 111° direction	8.8 mm/yr in September 2023	Operational	June 13, 2023	No discernible movement	N/A	-0.6
		9.6 mm over 17.9 m to 19.7 m depth in 111° direction	12.4 mm/yr in July 2021			No discernible movement	N/A	-2.2

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Table PH009-1A: Fall 2023 – Old Hwy 2:02 Shop Slide Slope Inclinometer Instrumentation Reading Summary (Inactive Instruments)

Date Monitored: Not monitored

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI05-2	*Jun. 6, 2005*	*70.6 mm over 0.2 m to 11.8 m depth in 20° direction*	*33.9 mm/yr between Oct. 2007 and May 2008*	*Sheared at 10.7 m depth*	*May 27, 2009*	*N/A*	*N/A*	*N/A*
		73.0 mm over 8.7 m to 11.8 m depth in 20° direction	*36.4 mm/yr between May and Oct. 2007*			*N/A*	*N/A*	*N/A*
SI05-3	*Jun. 6, 2005*	*3.8 mm over 0.2 m to 2 m depth in 15° direction*	*9.2 mm/yr between May 2009 and Sept. 2009*	*Sheared at 17.5 m depth*	*September 23, 2009*	*N/A*	*N/A*	*N/A*
		8.0 mm over 8.1m to 10 m depth in 15° direction	*6.1 mm/yr between May and Oct. 2007*			*N/A*	*N/A*	*N/A*
		11.2 mm over 11.8 m to 14.2 m depth in 15° direction	*9.1 mm/yr between May and Oct. 2007*			*N/A*	*N/A*	*N/A*
		23.8 mm over 15.5 m to 17.9 m depth in 15° direction	*11.6 mm/yr between May and Oct. 2007*			*N/A*	*N/A*	*N/A*
		4.2 mm over 19.7 m to 22.2 m depth in 15° direction	*2.7 mm/yr between Jun. and Aug. 2005*			*N/A*	*N/A*	*N/A*

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Table PH009-1A – Continued…Fall 2023 – Old Hwy 2:02 Shop Slide Slope Inclinometer Instrumentation Reading Summary (Inactive Instruments)

Date Monitored: Not monitored

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI05-4	*Jun. 6, 2005*	*53.8 mm over 5.2 m to 8.3 m depth in 47° direction*	*21 mm/yr between May and Oct. 2007*	*Sheared at 6.7 m depth*	*June 9, 2012*	*N/A*	*N/A*	*N/A*
SI09-1	*August 20, 2009*	*152.1 mm over 0.3 m to 2.2 m depth in 50° direction*	*215.6 mm/yr in May 2011*	*Sheared at 1.8 m depth*	*June 1, 2011*	*N/A*	*N/A*	*N/A*
		3.4 mm over 7.1 m to 8.3 m depth in 50° direction	*5.8 mm/yr in September 2009*			*N/A*	*N/A*	*N/A*
		10.6 mm over 11.9 m to 13.8 m depth in 50° direction	*29.0 mm/yr in September 2009*			*N/A*	*N/A*	*N/A*
SI09-2	*August 20, 2009*	*156.4 mm over 0.1 m to 3.8 m depth in 25° direction*	*270.4 mm between May 2009 and September 2010*	*Destroyed*	*September 21, 2010*	*N/A*	*N/A*	*N/A*

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Table PH009-2: Fall 2023 – Old Hwy 2:02 Shop Slide Shape Accelerometer Array Instrumentation Reading Summary

Date Monitored: October 10, 2023

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	AVERAGE RATE OF MOVEMENT[1, 2] (mm/yr)	CHANGE IN AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
Manual Readings November 24, 2021 – April 13, 2022[1]							
SAA-P34	November 24, 2021	13.0 over 1.8 m to 20.8 m depth	Operational	April 13, 2022	N/A	33.8	N/A
SAA-P77	November 24, 2021	18.4 over 1.8 m to 20.8 m depth	Operational	January 19, 2022[2]	N/A	119.7	N/A
SAA-P113	February 2, 2022	3.9 over 1.4 m to 25.9 m depth	Operational	April 13, 2022	N/A	20.1	N/A
Datalogger Readings May 27, 2022 - Current[2]							
SAA-P34	May 27, 2022	6.8 over 1.8 m to 20.8 m depth	Operational	June 13, 2023	0.8	2.5	-2.5
SAA-P77	May 27, 2022	2.4 over 1.8 m to 20.8 m depth	Operational	June 13, 2023	0.8	2.4	1.9
SAA-P113	May 27, 2022	11.6 over 1.4 m to 25.9 m depth	Operational	June 13, 2023	2.2	6.8	1.6

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Notes:

1) Average rate of movement for manual readings is the average movement rate for entire monitoring period from November 24, 2021 to April 13, 2022.
2) The average movement rate for the data logger readings is the average movement rate between June 13, 2023, and October 10, 2023.

Table PH009-3: Fall 2023 – Old Hwy 2:02 Shop Slide Vibrating Wire Strain Gauge Instrumentation Reading Summary

Date Monitored: October 10, 2023

DEPTH FROM TOP OF PILE (m)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)
PILE P34								
UPSLOPE PILE FACE					DOWNSLOPE PILE FACE			
1.2	SR1854	-47.4	-9.8	10.9	SR1853	-4.79	-29.3	10.6
2.0	SE1017 (2 Tapes)**	34.8	-12.1	10.1	SE1017 (3 Tapes)**	-92.4	-13.2	10.5
3.3	SR1851	-76.6	-3.6	10.2	SR1849	21.2	7.9	10.2
4.1	SE1017 (0 Tapes)**	-84.7	0.6	9.8	SE1017 (1 Tape)**	-4.5	14.6	10.1
5.1	SR1846	-53.8	3.7	9.1	SR1845	0.2	21.1	9.4
7.2	SR1843	54.9	9.2	7.9	SR1842	-112.1	6.5	8.1
9.3	SR1841	130.2	8.8	7.6	SR1840	-206.1	-4	7.5
11.1	SR1839	114.7	7.4	7.6	SR1838	-133.9	-3.9	7.5
13.2	SR1837	52.4	4.1	7.7	SR1835	-64.0	-2.4	7.6
15.0	SR1834	14.6	2.6	7.8	SR1832	-40.7	-1.3	7.7
17.2	SR1831	0.7	1.7	7.7	SR1829	-12.9	1.3	7.7

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

***** Previous readings on June 13, 2023

**Tapes were used to identify separate strain gauges with same serial number

Table PH009-3 – Continued…Fall 2023 – Old Hwy 2:02 Shop Slide Vibrating Wire Strain Gauge Instrumentation Reading Summary

Date Monitored: October 10, 2023

DEPTH FROM TOP OF PILE (m)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)
PILE P77								
UPSLOPE PILE FACE					DOWNSLOPE PILE FACE			
1.00	SR1865	-10.8	4.7	10.7	SR1861	-45.8	1.5	10.5
2.85	SR1857	-4.1	6.8	9.7	SR1856	-37.2	20.2	10.0
5.00	SR1855	-26.0	4.2	8.4	SR1852	-85.6	14.2	8.5
7.10	SR1850	4.4	7.8	7.5	SR1848	-134.8	0.9	7.6
8.95	SR1847	6.3	8.8	7.4	SR1844	-133.8	-4.7	7.4
11.05	SR1836	-24.8	5.2	7.6	SR1833	-102.1	-3.5	7.5
12.90	SR1830	-34.9	2.8	7.7	SR1828	-81.0	-2.5	7.6
15.00	SR1827	-23.9	0.6	7.7	SR1826	-51.3	0.2	7.6
17.10	SR1825	-31.0	0.4	7.6	SR1824	-43.9	0.5	7.6

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

***** Previous readings on June 13, 2023

Table PH009-3 – Continued…Fall 2023 – Old Hwy 2:02 Shop Slide Vibrating Wire Strain Gauge Instrumentation Reading Summary

Date Monitored: October 10, 2023

DEPTH FROM TOP OF PILE (m)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)	GAUGE #	TOTAL MICROSTRAIN (με)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READINGS* (με)	MEASURED TEMPERATURE (°c)
PILE P113								
UPSLOPE PILE FACE					**DOWNSLOPE PILE FACE**			
1.0	SR1820	*Not functioning*	*N/A*	*N/A*	SR1821	-61.6	7.5	10.9
2.8	SR1822	-6.2	11.4	9.4	SR1823	-79.1	13.3	9.4
4.9	SR1806	-22.6	11.4	7.9	SR1807	-68.8	7.5	8.1
6.9	SR1808	-19.1	4.4	7.1	SR1809	-61.4	-1.1	7.4
9.0	SR1810	-22.5	2.5	7.5	SR1811	*Not functioning*	*N/A*	*N/A*
11.2	SR1812	-4.3	3.5	7.7	SR1813	-70.1	-3.2	7.6
13.3	SR1814	34.0	4.1	7.8	SR1815	-66.2	-1.5	7.8
15.3	SR1816	79.3	6.2	7.9	SR1817	-81.5	-2.6	7.9
17.0	SR1818	13.5	10.8	7.8	SR1819	-97.2	-4.3	7.8
19.0	SR1858	-16.7	7.9	7.7	SR1859	-123.0	-4.0	7.6
21.2	SR1860	-60.0	3.3	7.5	SR1862	-103.7	-3.6	7.6
23.2	SR1863	50.1	0.5	7.2	SR1864	-11.7	2.3	7.3

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

***** Previous readings on June 13, 2023

Table PH009-4: Fall 2023 – Old Hwy 2:02 Shop Slide Vibrating Wire Load Cell Instrumentation Reading Summary

Date Monitored: October 10, 2023

ANCHOR NUMBER	LOAD CELL SERIAL #	WALL SECTION	SLS DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD (1) (Oct. 10, 2023) (kN)	PREVIOUS RECORDED LOAD (1) (JUNE 13, 2023) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
A19	VC2340	1	202/100	220.37 on July 9, 2023	211.73	215.38	-3.65
A34	VC2341	1	202/100	229.54 on April 7, 2023	200.32	202.51	-2.19
A51	VC2342	1	202/100	206.49 on April 1, 2023	161.50	166.02	-4.52
A67	VC2343	2	160/100	134.22 on April 1, 2023	121.93	126.39	-4.46
A77	VC2344	2	160/100	221.71 on October 8, 2023	219.47	194.34	25.13

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate locations of the monitoring instrumentation for this site.

***** Previous readings on June 13, 2023

Table PH009-5: Fall 2023 – Old Hwy 2:02 Shop Slide Standpipe Piezometer Instrumentation Reading Summary

Date Monitored: October 10, 2023

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM MEASURED WATER LEVEL BGS (m)	MEASURED WATER LEVEL BGS (m)	PREVIOUS READING (June 13, 2023) BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP11-06	May 21, 2015	12.98	-	Active	8.31 on June 15, 2018	DRY	DRY	N/A
SP05-1	Jun. 6, 2005	9.91	N/A	Active	1.56 on June 9, 2012	8.10	7.65	-0.45
SP05-4	Jun. 6, 2005	9.91	N/A	Active	4.80 on May 18, 2008	5.56	5.80	0.24
SP05-5	Jun. 6, 2005	12.04	N/A	Active	2.55 on May 18, 2007	2.84	2.94	0.10
SP09-8	August 20, 2009	23.77	393.778	Active	N/A	DRY	DRY	N/A
SP09-9	August 20, 2009	11.28	361.294	Active	N/A	DRY	DRY	N/A
SP09-10	August 17, 2009	21.03	379.506	Active	7.05 on June 15, 2018	8.82	8.34	-0.48
SP19-3	February 7, 2019	9.25	393.650	Active	3.44 on June 13, 2020	4.06	4.40	0.34

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Table PH009-6: Fall 2023 – Old Hwy 2:02 Shop Slide Vibrating Wire Piezometer Instrumentation Reading Summary

Date Monitored: October 10, 2023

INSTRUMENT	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL ELEVATION (Depth, mBGS)	CURRENT GROUNDWATER ELEVATION (m) (DEPTH, (mBGS))	PREVIOUS (June 13, 2023) GROUNDWATER ELEVATION (m) (DEPTH, (mBGS))	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
VW09-3 (10022)	August 18, 2009	356.40	361.73	Operational	359.86 m on August 18, 2009 (1.87)	DRY	DRY	N/A
VW09-4 (10021)	August 17, 2009	361.19	379.58	Operational	373.29 m on August 17, 2009 (7.26)	365.65 (13.93)	365.65 (13.93)	0.00

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Note: BGS = Below Ground Surface

Table PH009-7: Fall 2023 – Old Hwy 2:02 Shop Slide Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: October 10, 2023

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER ELEVATION (m) (Depth, mBGS)	PREVIOUS (June 13, 2023) GROUNDWATER ELEVATION (m) (Depth, mBGS)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN19-5A	*February 14, 2019*	*9.30*	*372.11*	*Damaged*	*365.55 on February 14, 2019*	*N/A*	*N/A*	*362.90 (9.21)*	*N/A*
PN19-5B	February 14, 2019	19.25	372.11	Active	367.41 on August 18, 2021	137.7	366.90 (5.22)	366.64 (5.48)	0.26

Drawings 32121-PH009-1 through 32121-PH009-3 in Appendix A provide a sketch of the approximate location of the monitoring instrumentation for this site

Note: BGS = Below Ground Surface

3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometer SI05-1 showed no discernible movement over 0.0 m to 3.0 m depth since the spring of 2023 readings. The slight incremental deflection at about 20 m in SI05-1 appears to be an artifact from one reading as there has been no further displacement at that depth. SI09-3 continued to show no discernible movement. SI09-4 showed no discernible movement over 8.6 m to 10.5 m depth and 0.3 mm/yr over 8.6 m to 10.5 m depth and 11.7 m to 13.5 m depth, respectively, since the spring of 2023 readings. These movement zones were first observed in 2021 during construction and displacement has been gradually levelling off with each subsequent set of readings. Inclinometer SI09-4 was slightly damaged during construction but was repaired at the completion of grading. SI11-01 had a rate of movement of 2.6 mm/yr over 13.9 m to 16.3 m depth. SI11-01 had a maximum rate of movement of 34.3 mm/yr over this zone in June 14, 2022, near the end of construction; however, the movement rate has decreased for three consecutive readings cycles indicating it may be approaching a stable state. SI19-5 showed no discernible movement over 8.2 m to 11.2 m depth over 17.9 m to 19.7 m depth. The overall movement in SI19-5 has slowed significantly since slope offloading and the completion of construction.

It is anticipated that the concrete pile wall and associated lower slope offloading and flattening will eventually reach a new equilibrium so there should be a further reduction in the rates of movement in the inclinometers at this site. However, SI11-01 is located just beyond the north limits of the wall and will need to be watched carefully to see if additional slope stabilization measures are warranted.

SAA-P34 has shown an average rate of movement of 2.5 mm/yr in the downslope direction since the spring of 2023 readings, with a current pile head deflection of 6.8 mm since datalogger readings began for this instrument on May 27, 2022. SAA-P34 had a maximum pile head deflection of close to 10 mm in April 2023 after which it dropped off to 5.9 mm at the end of May, 2023. This movement is attributed to seasonal freezing of groundwater pushing on the back of the wall. Since then, the movement has been relatively steady but at a slower rate. The total pile head deflection to date, combining the data before and after resetting the SAA has been at least 19.8 mm.

SAA-P77 showed a rate of movement of 2.4 mm/yr since the spring of 2023 readings. SAA-P77 has shown a total pile head movement of 2.4 mm since datalogger readings began on May 27, 2022. SAA-P77 had a maximum pile head deflection of about 2.4 mm in March 2023 before dropping off to 1.5 mm in May 2023, as was observed at SAA-P34. The rate of movement has been similar to that observed before the April 2023 drop. The total pile head

deflection to date, combining the data before and after resetting the SAA, has been at least 20.8 mm.

SAA-P113 has shown an average rate of movement of 6.8 mm/yr in the downslope direction since the spring of 2023 readings, with a total pile head deflection of 11.6 mm since datalogger readings began on May 27, 2022. The higher observed movement in SAA-P113 can be attributed to the fact that the pile wall at this location is cantilevered rather than tied-back like the other portions of the wall. The movement rate measured in the instrument has stayed fairly steady since the spring of 2023 readings with only a slight decrease in rate observed when the other two SAA had a noticeable drop. The total pile head deflection to date, combining the data before and after resetting the SAA has been at least 15.5 mm.

The vibrating wire strain gauges are summarized in Table PH009-3. The strain gauges are primarily RST VW5000-15 sister-bar style strain gauges; however, there are also 4 RST VWSG-E embedment style strain gauges installed in P34 in pairs at 2.0 m depth and 4.1 m depth. After completion of construction, it was noted that the datalogger program was programed to read the VWSG-E gauges at the wrong frequency sweep range, which caused erroneous data to be collected for these instruments before November 24, 2022. As such, the strain gauge plots for P34 are missing readings for these 4 strain gauges prior to this date.

The strain gauges in P34 show their maximum positive (tension) strain (130.2 microstrain) on the upslope pile face at 9.3 m depth, with a corresponding trend of negative (compression) strain (-206.1 microstrain) on the downslope pile face at the same depth. This seems to correspond to the observed deflection of the pile in the downslope direction noted in the SAA above 9 m depth.

The strain gauges on the downslope side of P77 indicate a maximum negative strain of -134.8 microstrain at a depth of 7.1 m. P77 does not show as clear of a trend of strain in the upslope pile strain gauges compared to P34.

The maximum negative strain for P113, of -123.0 microstrain, was measured on the downslope side at 19.0 m depth. The depth of the main slip surface of the deep-seated landslide at this location, as indicated by former SI05-3, was at 17.5 m below original ground prior to wall construction. The strain gauges are plotted on Figures PH009-1 through PH009-12 in Appendix A.

The load cell readings are summarized in Table PH009-4. Load Cells VC2340 (anchor A19), VC2341 (anchor A34), VC2342 (anchor A51), and VC2343 (anchor A67) show a decrease in measured load of 3.65 kN, 2.19 kN, 4.52 kN, and 4.46 kN, respectively, compared to the spring of 2023 readings. Load cell VC2344 (anchor A77) showed an increase in measured load of

25.13 kN. Load cell VC2340 registered the highest maximum recorded load of 220.37 kN on July 9, 2023, and load cell VC2344 registered the highest maximum recorded load of 221.71 kN on October 8, 2023.

Load cells VC2431 (anchor A34), VC2342 (anchor VC2342), and VC2343 (anchor A67) all recorded their maximum loads during the late winter months of 2023 before relaxing during the spring thaw. This is attributed to frost pressures on the back of the wall. Load cell VC2340 (anchor A19) measured its highest load after the spring thaw in July 2023, before relaxing slightly. Load cell VC2344 (anchor A77) has continued showing an overall trend of increasing load without the post-winter relaxation seen in the other anchors. However, within the last month of monitoring the load in this anchor shows potential signs of levelling off. Overall, the anchor loads have risen significantly since they were locked off, and anchor A19 and anchor A77 are currently above their SLS design loads. The load cells will need to be closely monitored to see if the increased movement trend continues. The load cell readings are plotted on Figure PH009-13 in Appendix A.

Pile head deflections measured by the SAA are within an acceptable range. More deflection is noted in the cantilever section of the wall (SAA-P113) which would be expected. The additional deflection in SAA-P34 may be due to the deeper amount of cut as compared to the slope below SAA-P77. The March-April 2023 drop in deflection corresponds with a drop in the loads carried by some of the anchors (A34, A51, and A67 and to a lesser extent at A19) which could indicate a post-winter shifting of the slope. Interestingly, there was not a drop off in the load carried by Anchor A77 despite the drop in the pile head deflection. This will require additional readings and analysis to interpret and will be considered as part of the ongoing development of threshold criteria for this pile wall.

Standpipe piezometers SP05-1 and SP09-10 showed decreases in groundwater level of 0.45 m, and 0.48 m respectively, since the spring of 2023 readings. Standpipe piezometers SP05-4, SP05-5 and SP19-3 showed increases in groundwater level of 0.24 m, 0.10 m, and 0.34 m, respectively, since the spring of 2023 readings. SP11-06, SP09-8, and SP09-9 continued to be dry (SP09-8 and SP09-9 have been dry since installation). The water levels measured in the standpipes have not demonstrated a trend.

The results of the standpipe piezometers are summarized in Table PH009-5, and are plotted in Figure PH009-14 in Appendix A.

VW09-4 showed no change in groundwater level since the spring of 2023 readings; the groundwater levels have been trending downward since 2012. VW09-3 has been dry since

August 2009. Vibrating wire piezometer results are summarized in Table PH009-6, and are plotted in Figure PH009-15 in Appendix A.

Pneumatic piezometer PN19-5B showed a slight increase in groundwater level of 0.26 m since the spring of 2023 readings and has had a slight increasing trend overall since installation (February 2019). Pneumatic piezometer results are summarized in Table PH009-7, and are plotted in Figure PH009-16 in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

The instruments should be read again in the spring of 2024. The movement rates in the slope inclinometers should be closely monitored to see if movements begin to decelerate following the completion of the pile wall. The movement rate in SI11-01 should be monitored carefully as it is beyond the north extent of the wall.

The instruments at the pile wall, particularly for the load cells, will need to be frequently monitored to see if the movement rates increase. At the moment, the loads, strain, and deflections are within acceptable limits based on the modeling done during detailed design of the wall.

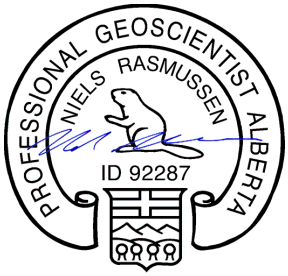
4.2 Instrumentation Repairs

No current repairs are required.

5. CLOSURE

We trust this report meets your requirements at present. If you have any questions, please contact the undersigned at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, M.Eng., P. Eng.
Partner | Senior Geotechnical Engineer



November 10, 2023

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: November 15, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Niels Rasmussen, P.Geo.
Geologist
/ak

Attachments:

- Statement of Limitations and Conditions
- Appendix A
  - Field Inspector's report
  - Site Plan Showing Approximate Instrument Locations (Drawings No. 32121-PH009-1, 32121-PH009-2, and 32121-PH009-3)
  - SI Reading Plots
  - SAA Reading Plots
  - Figures PH009-1 through PH009-12 (Vibrating Wire Strain Gauge Readings)
  - Figure PH009-13 (Vibrating Wire Load Cell Readings)
  - Figure PH009-14 (Standpipe Piezometer Readings)
  - Figure PH009-15 (Vibrating Wire Piezometer Readings)
  - Figure PH009-16 (Pneumatic Piezometer Readings)

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

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The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

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5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS

FALL 2023

APPENDIX A
DATA PRESENTATION

SITE PH009: OLD HWY 2:02 SHOP SLIDE

ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH009)
FALL 2023

Location: Shop Slide (Old Hwy 2:02 km 0.000 to 0.365)
File Number: 32121
Probe: RST SI SET 8R
Cable: RST SI SET 8R
Readout: DGSI Dipmeter,GK404 SN364, RST PN C108 Unit 4
Casing size: 3.34/2.75
Temp degree C: 16
Read by: NRM/NKR

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of Casing (ft)	Azimuth of A+ Groove (Mag N)	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI05-1	480320.97	6232126.34	10-Oct-23	0.65	69 to 3	20°	-273	156	371	-377	8R/8R	Casing size 2.75"
SI09-3	480391.11	6232279.95	10-Oct-23	1.10	53 to 3	355°	-481	-480	198	197	8R/8R	Casing size 2.75"
SI09-4	480373.71	6232136.12	10-Oct-23	0.20	72 to 2	23°	-924	936	239	-248	8R/8R	Casing size 2.27" inside 3.34"
SI11-1	480200.11	6232265.25	10-Oct-23	1.08	98 to 2	75°	-362	371	105	-113	8R/8R	Casing size 2.75"
SI19-5	480323.02	6232243.91	10-Oct-23	0.68	82 to 2	75°	353	-344	-592	586	8R/8R	*

STANDPIPE PIEZOMETER (SP) READINGS

SP#	GPS Location (UTM 11)		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Easting (m)	Northing (m)				
SP11-06	480372.32	6232387.56	10-Oct-23	1.02	Dry	13.05
SP05-1	480320.97	6232126.34	10-Oct-23	0.94	9.04	11.05
SP05-4	480345.06	6232200.36	10-Oct-23	0.97	6.53	9.70
SP05-5	480425.01	6232237.50	10-Oct-23	0.81	3.65	12.94
SP09-8	480224.19	6232191.23	10-Oct-23	0.96	DRY	24.73
SP09-9	480375.12	6232308.07	10-Oct-23	0.83	DRY	12.11
SP09-10	480402.11	6232110.94	10-Oct-23	1.13	9.95	21.78
SP19-3	480211	6232232	10-Oct-23	0.89	4.95	10.14

PNEUMATIC PIEZOMETER (PN) READINGS

PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN19-5B	Attached to SI19-5		10-Oct-23	137.7	38157

VIBRATING WIRE PIEZOMETER (VW) READINGS

VW #	GPS Location (UTM 11)		Date	Reading (Dg/^{0}C)	Identification
	Easting (m)	Northing (m)			
VW09-3	480391.11	6232279.95	10-Oct-23	9006.3/7.6	10022
VW09-4	480373.71	6232136.12	10-Oct-23	8789.7/7.1	10021

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SP09-8
OLD HWY 2 R/W
SI05-1
TH05-1
REMOVED AND REINSTATED SIGN POST
800 mm Ø CSP
SP19-3
300 mm DIA 1/2 CULVERT
TH19-4
INSTALLED W-BEAM TERMINAL AS PER RDG-BI-5
REPLACED ASPHALT PAVEMENT
CONSTRUCTED CONCRETE DRAIN TROUGH
INSTALLED SALVAGED AND NEW W BEAM GUARDRAIL
HIGHWAY 2 OFFRAMP
SEWER MAIN
WATERMAIN
SP19-2 (DAMAGED)
SP19-1
OLD HWY 2
DATALOGGER
SAA-P113
SI11-01
W-BEAM GUARDRAIL
(DAMAGED) BH13/SP09-11
SP09-10
SI09-4/VW09-4
SI05-3 (SHEARED)
SP05-3
SP05-2/SI05-2 (SHEARED)
VC2344 SAA-P77
VC2343
VC2342
VC2341 SAA-P34
VC2340
SP09-7 (DAMAGED)
INSTALLED 14 m LONG 600 mm Ø CSP UNDER PATH
≈21%
OLD HWY 2 R/W
≈26%
S.W. 1/4 SEC. 31-83-21-5
≈25%
CONCRETE SWALE
SI09-2/VW09-2 (DESTROYED)
TRM
CLASS 1M RIPRAP
SP09-6 (DAMAGED)
CLASS 1M RIPRAP
INSTALLED NEW PATH ALIGNMENT (SEE SHEET 22 FOR DETAILS)
CONSTRUCTED DRAINAGE SWALE
RIPRAP LINED DISSIPATION BOWL
TRM
INSTALLED 150 mm DIA PERFORATED SUBDRAINS (SURROUNDED BY FILTER MATERIAL ENVELOPED IN NON-WOVEN GEOTEXTILE) TO DRAIN GRAVEL LAYER INTO DRAINAGE CHANNEL. SHOWN LOCATION IS APPROXIMATE AND TO BE FIELD FIT TO PLACE DRAINS IN AREA OF HIGHEST SEEPAGE AS DIRECTED BY THE CONSULTANT
SI19-5/PN19-5A/B
SI09-1/VW09-1 (SHEARED)
SP09-5
SP05-4/SI05-4
CNR R/W
ECSB TYPE B (TYP)
DRAINAGE CHANNEL
CLASS 1 RIPRAP
600 mm Ø CSP
800 mm Ø CSP
SP05-5
SI09-3/VW09-3
SP09-9
760 STEEL CASING (1979)
400 STEEL CASING (1979)
SI8

LEGEND

- ASPHALT CEMENT PAVEMENT
- ASPHALT CEMENT SLOPE PROTECTION (40 mm THICK)
- EROSION CONTROL SOIL COVERING (TYPE B)
- PERMANENT RECP (TRM TYPE B, COMPLETE WITH SYNTHETIC PERMEABLE DITCH BARRIERS AT 15 m INTERVALS ALONG SWALE)
- CLASS 1M RIPRAP (0.4 m THICK)
- CLASS 1 RIPRAP (0.8 m THICK)
- FIBRE ROLL
- GUARDRAIL
- TELUS LINE (BURIED)
- GAS LINE
- POWER LINE AND POWER POLE
- GUY WIRE
- RAIL LINE
- ROW BOUNDARY
- SIGN POST
- TELUS UNDERGROUND VAULT
- DATALOGGER ENCLOSURE
- INSTRUMENT LOCATION
- NON-OPERATIONAL
- SI SLOPE INCLINOMETER
- VW VIBRATING WIRE PIEZOMETER
- SP STANDPIPE PIEZOMETER
- PN PNEUMATIC PIEZOMETER

0 10 20 30 40 50 60m
SCALE 1:500

Alberta

PEACE REGION (PEACE RIVER DISTRICT)

PH009: OLD HWY 2:02 SHOP SLIDE
SITE PLAN SHOWING INSTRUMENT LOCATIONS

DWG No. 32121-PH009-1

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:1500
DATE	JUNE 2023
FILE No.	32121

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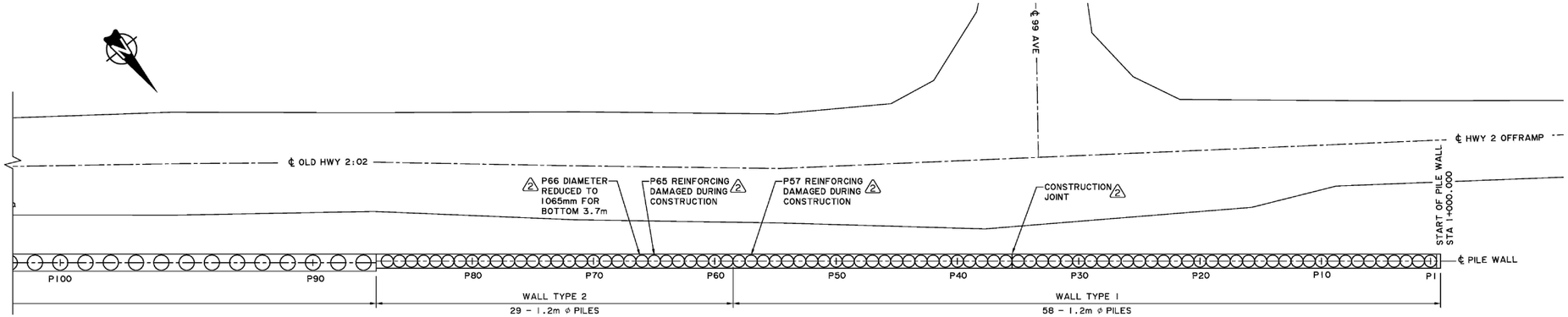
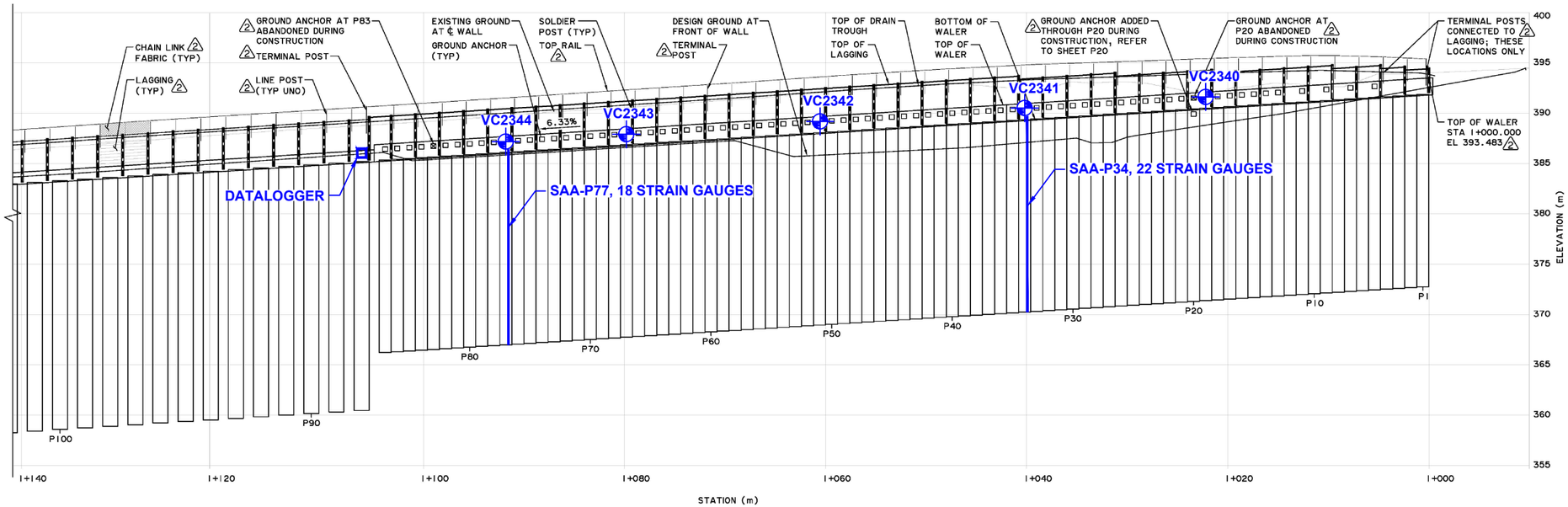


SITE PLAN
1:200



ELEVATION – PILE WALL

LEGEND

- INSTRUMENT LOCATION
- DATALOGGER ENCLOSURE

0 5 10 15 20 25 30m
SCALE 1:500

Alberta

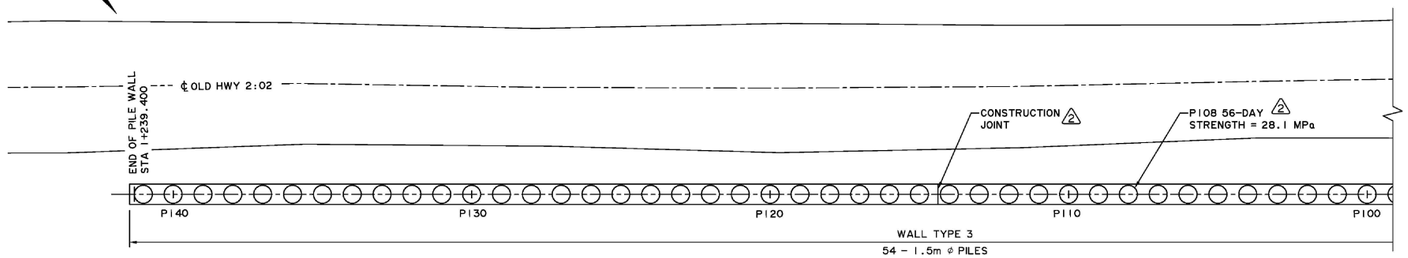
PEACE REGION (PEACE RIVER DISTRICT)

PH009: OLD HWY 2:02 SHOP SLIDE
PILE WALL GENERAL LAYOUT 2

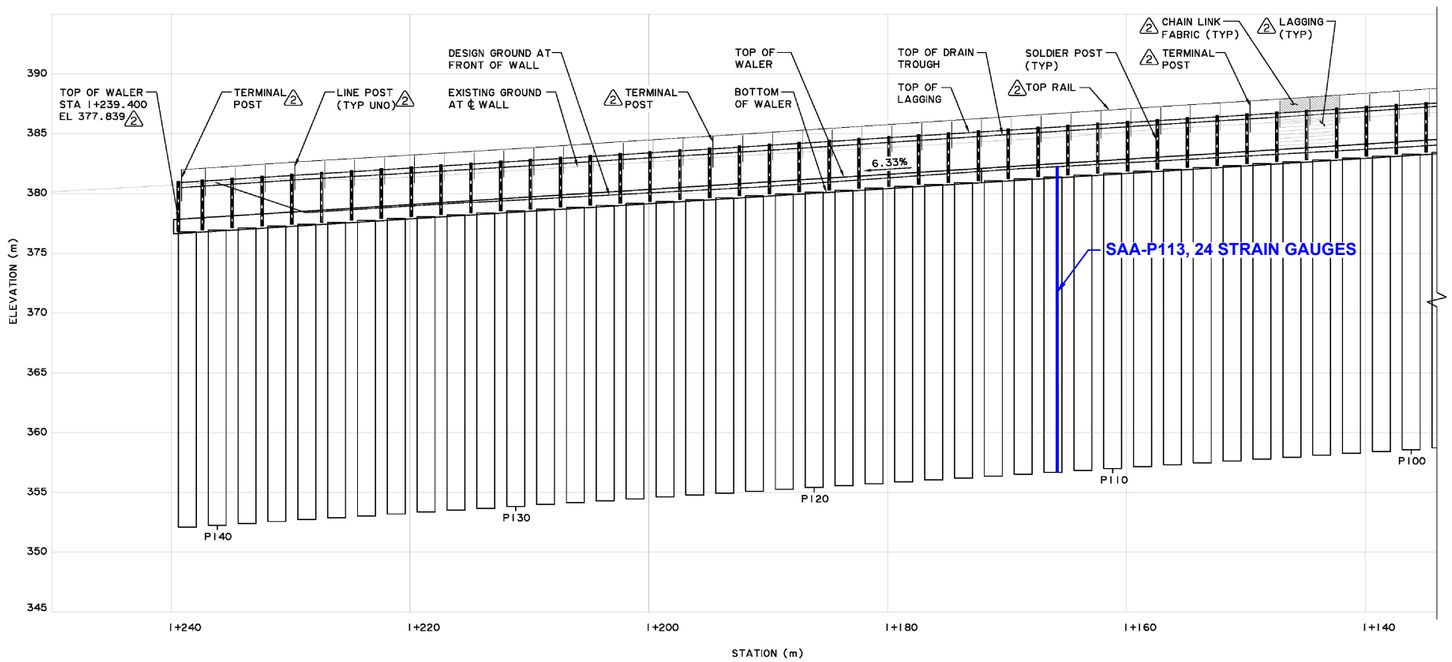
DWG No. 32121-PH009-2

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:500
DATE	JUNE 2023
FILE No.	32121

THURBER ENGINEERING LTD.



SITE PLAN
1:200



ELEVATION – PILE WALL

0 5 10 15 20 25 30m
SCALE 1:500

Alberta

PEACE REGION (PEACE RIVER DISTRICT)

PH009: OLD HWY 2:02 SHOP SLIDE
PILE WALL GENERAL LAYOUT 1

DWG No. 32121-PH009-3

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:500
DATE	JUNE 2023
FILE No.	32121

THURBER ENGINEERING LTD.

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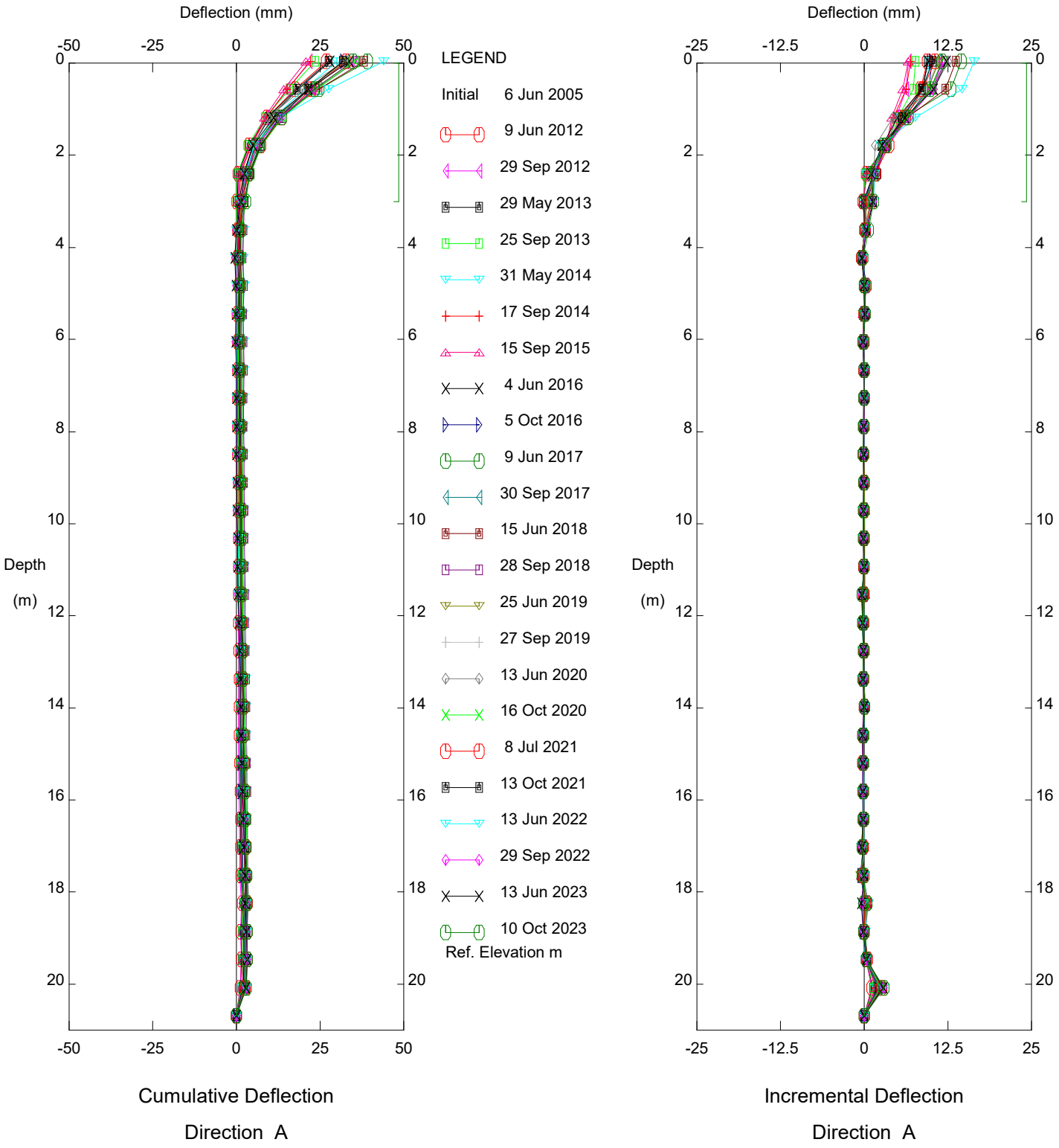

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI05-1

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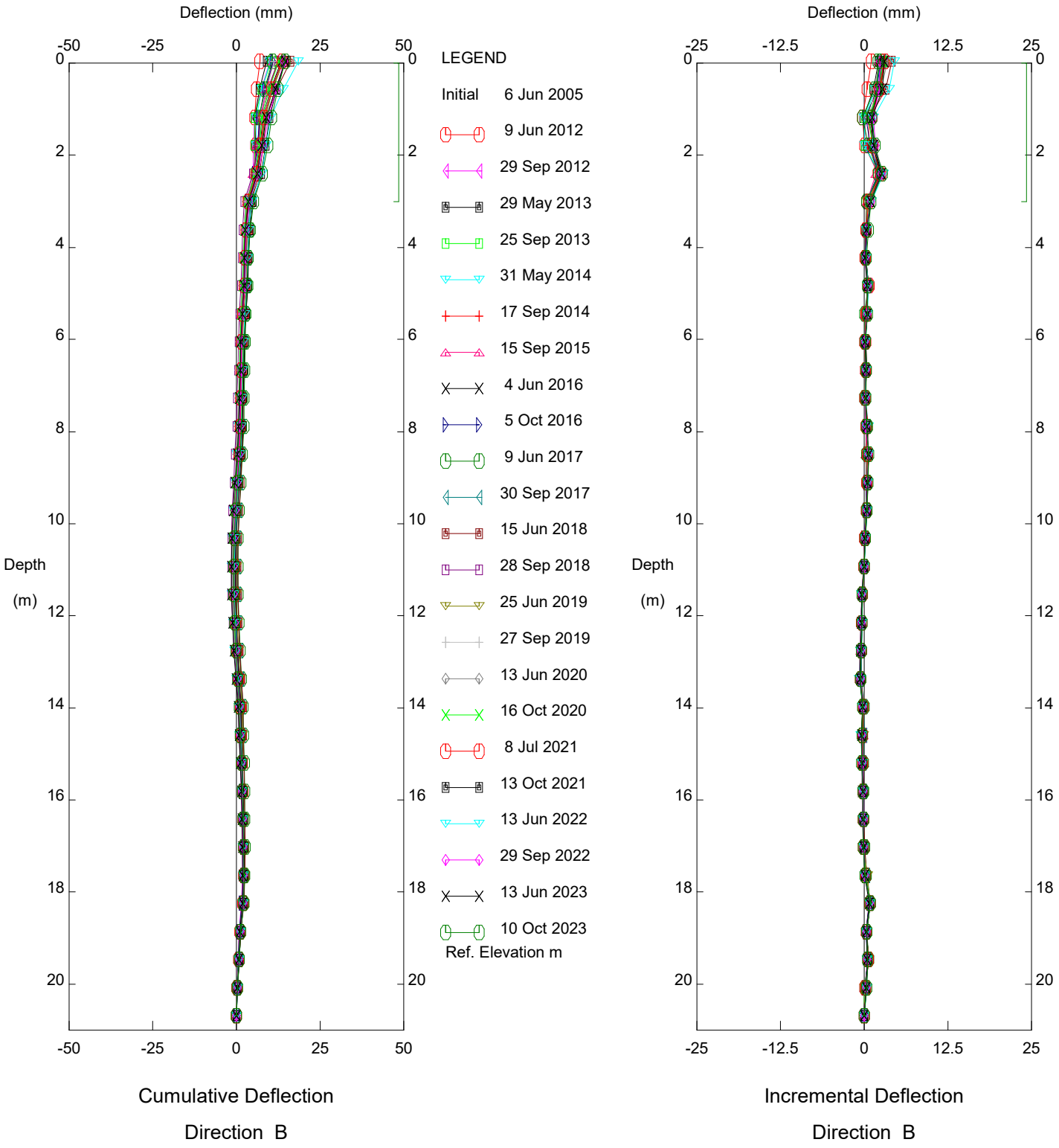

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI05-1

Alberta Transportation

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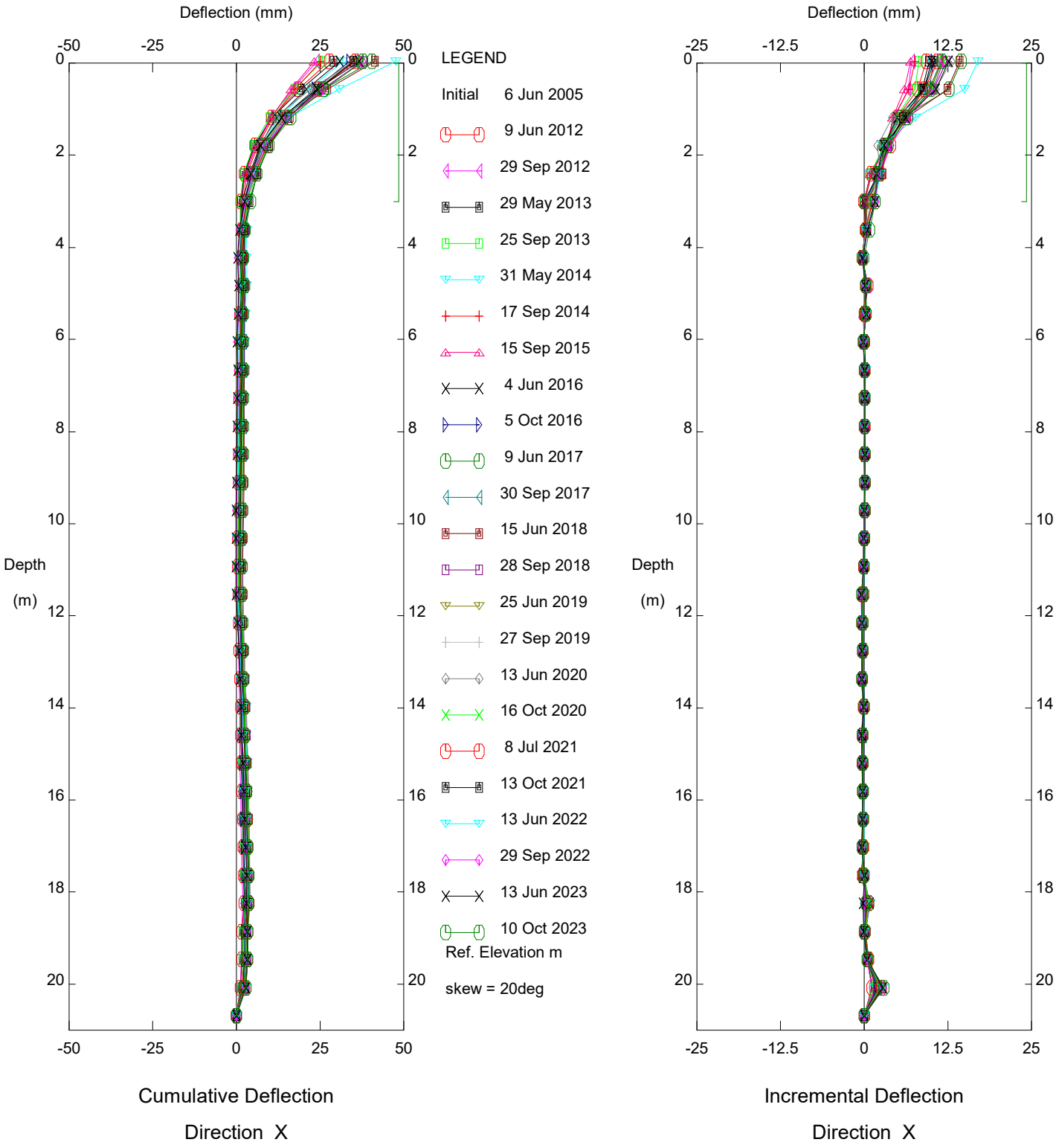
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI05-1

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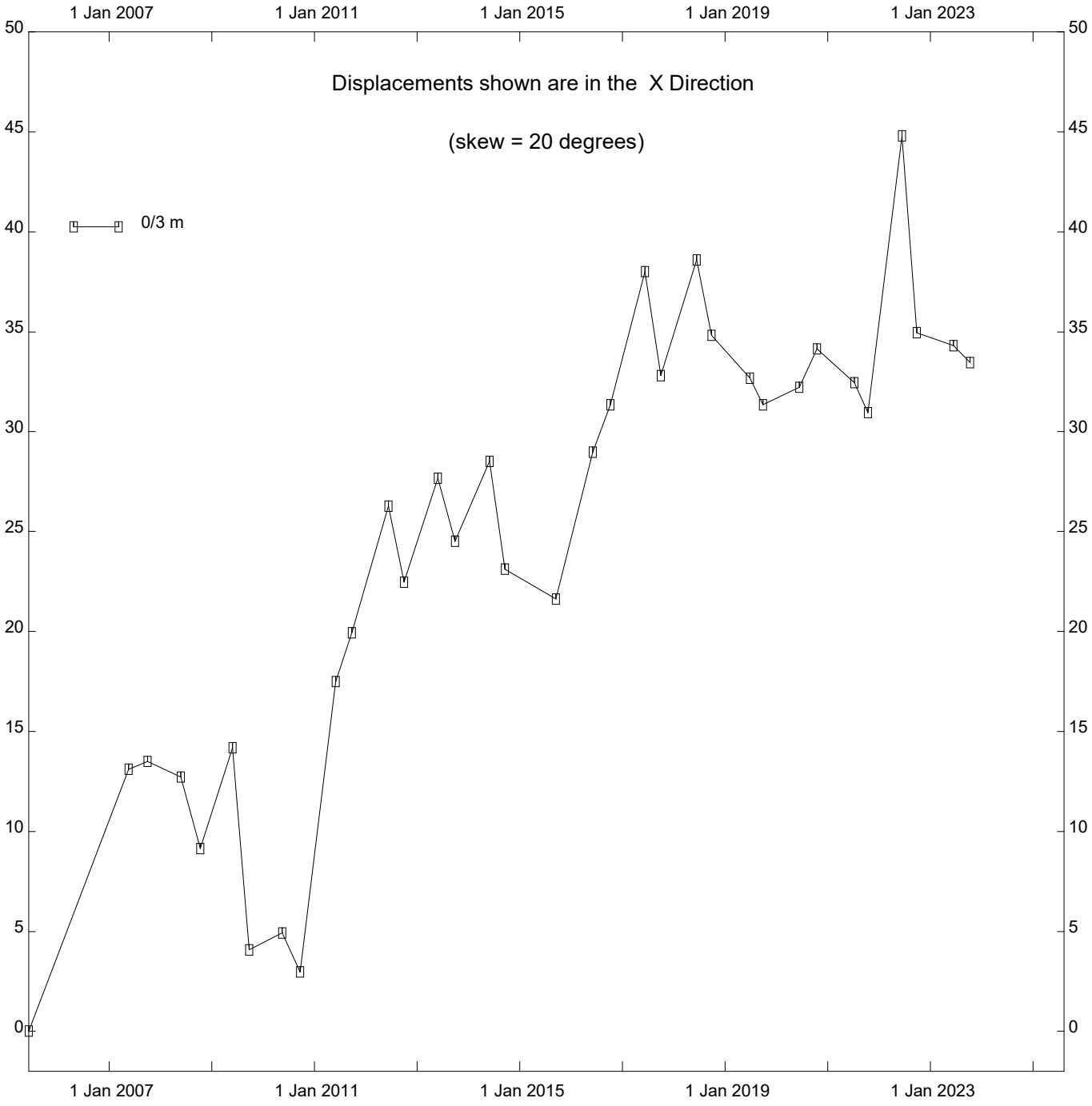
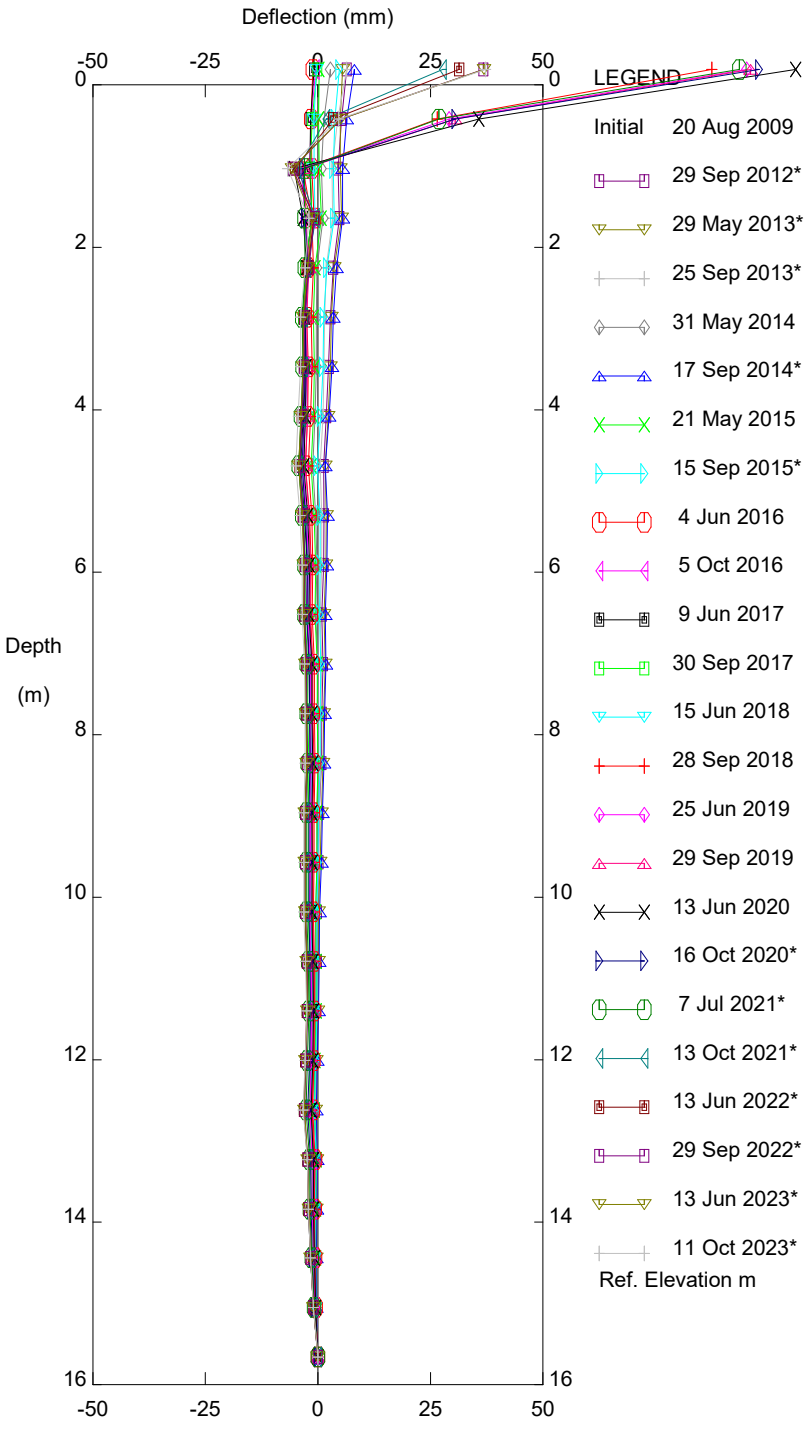
Thurber Engineering Ltd.



PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI05-1

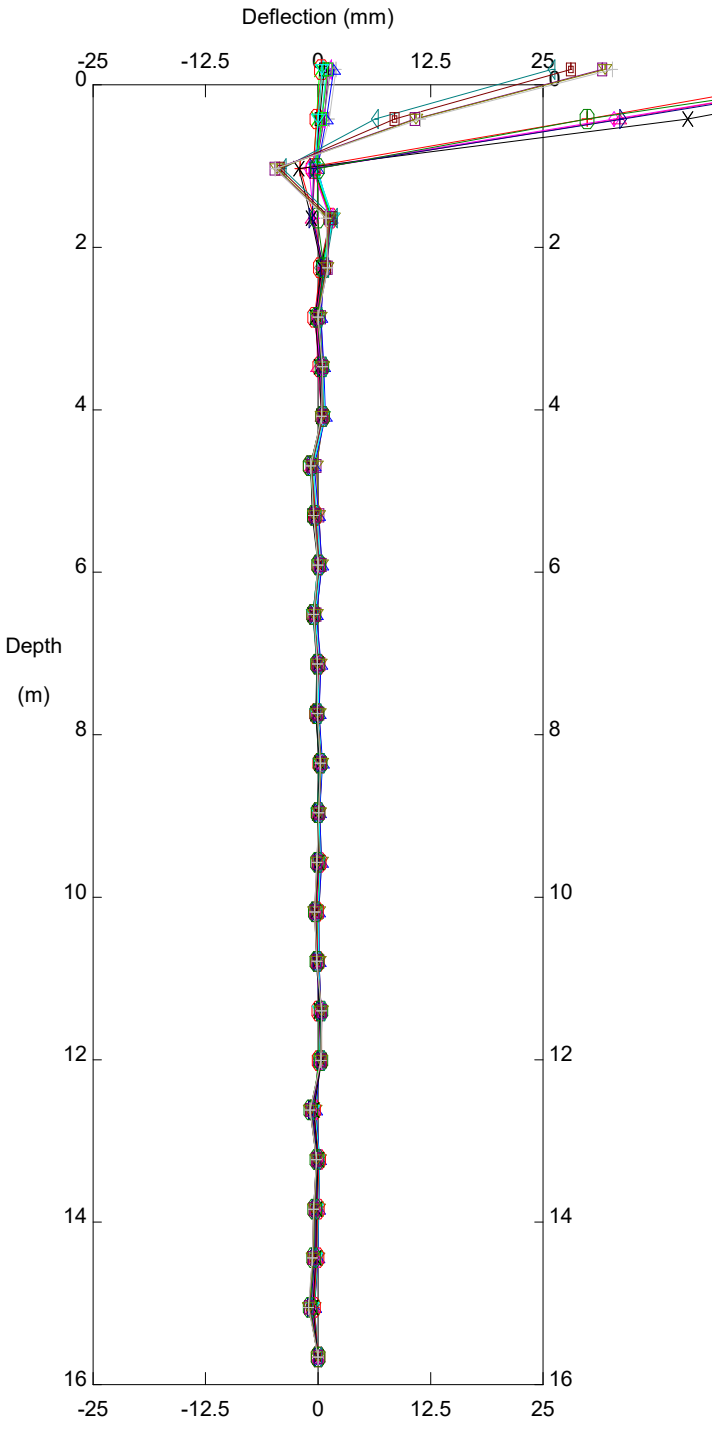
Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A



Incremental Deflection

Direction A

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-3

Alberta Transportation

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

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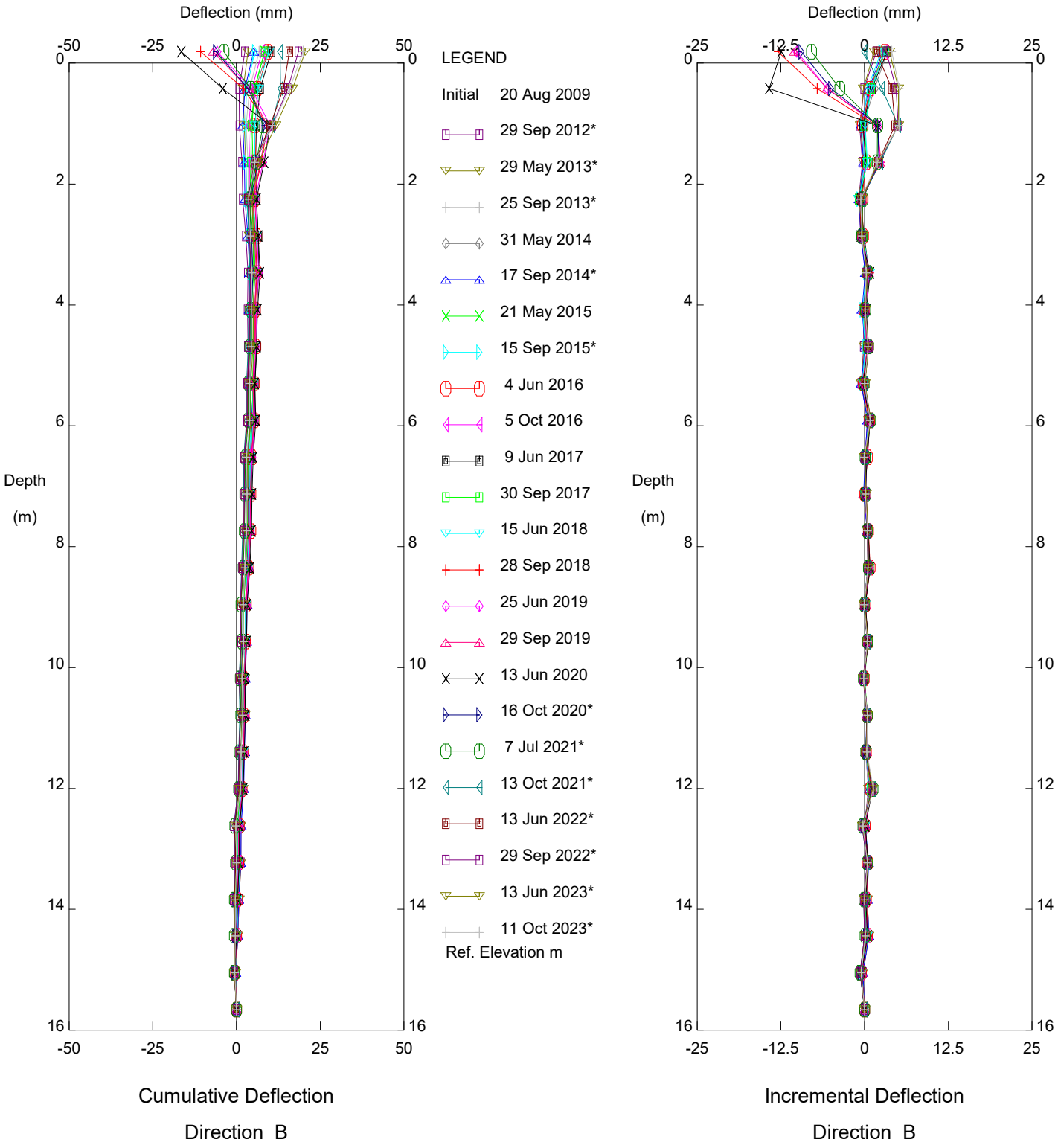
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-3

Alberta Transportation

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

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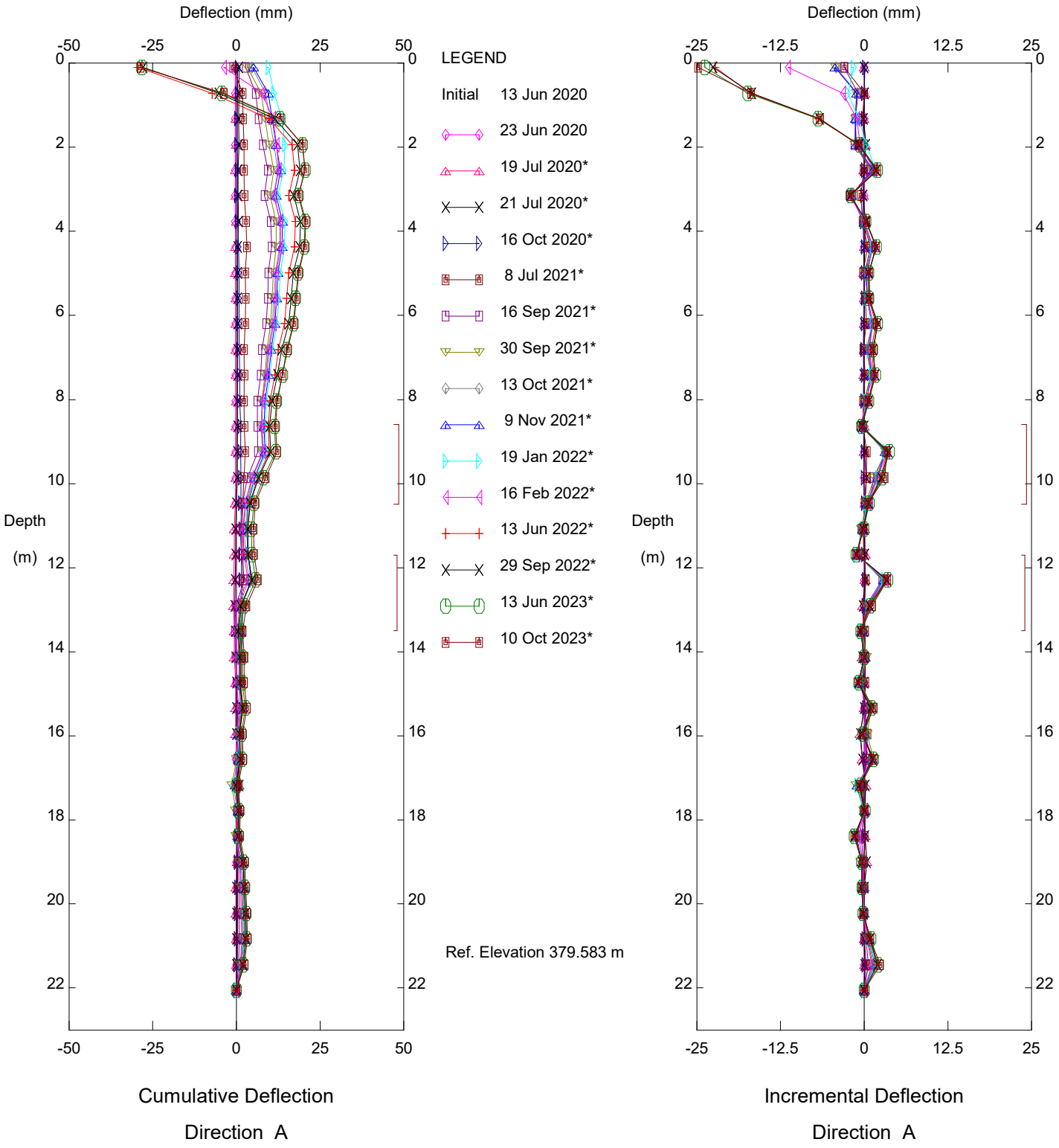
Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-4

Alberta Transportation

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

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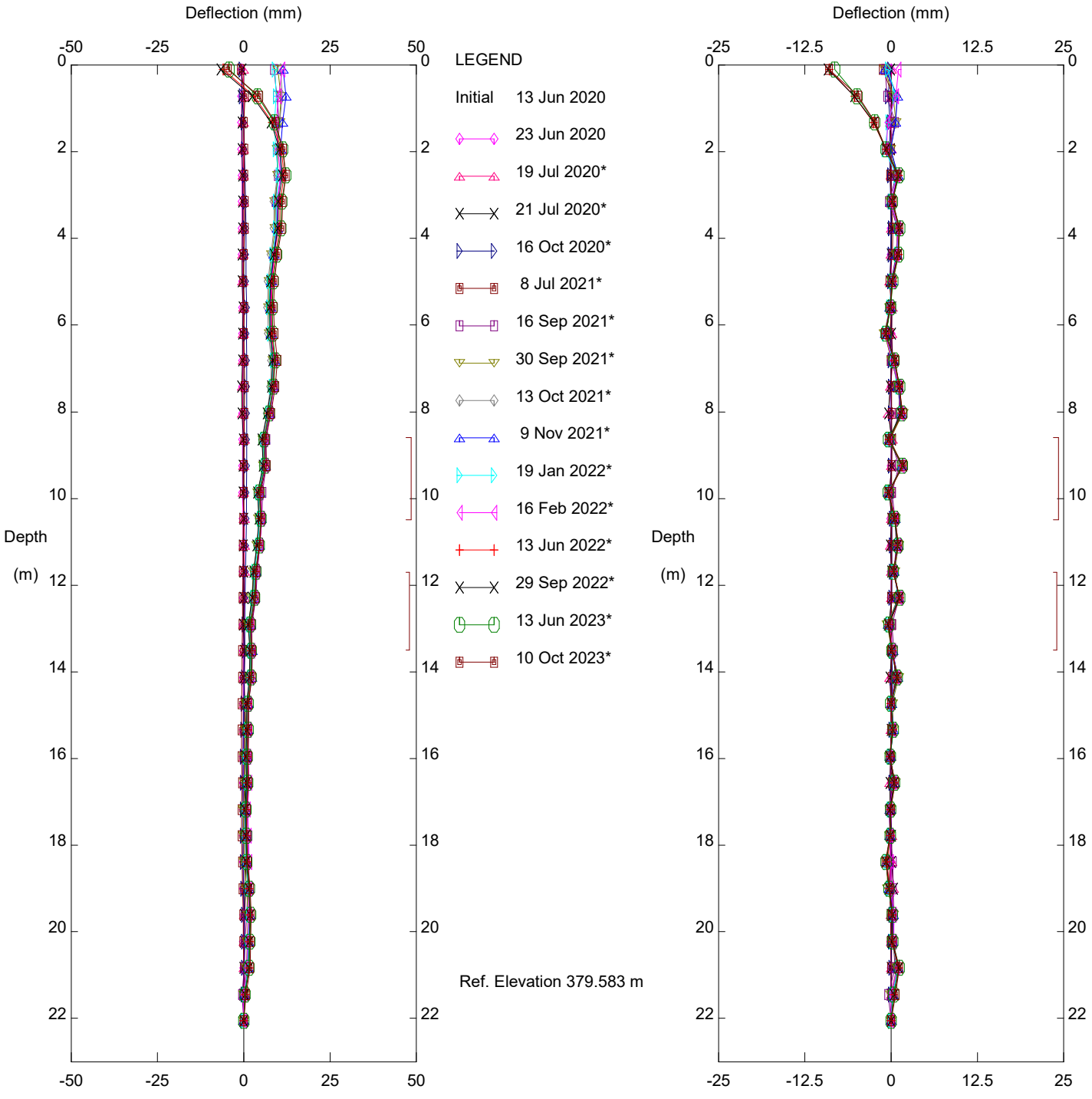
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-4

Alberta Transportation

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

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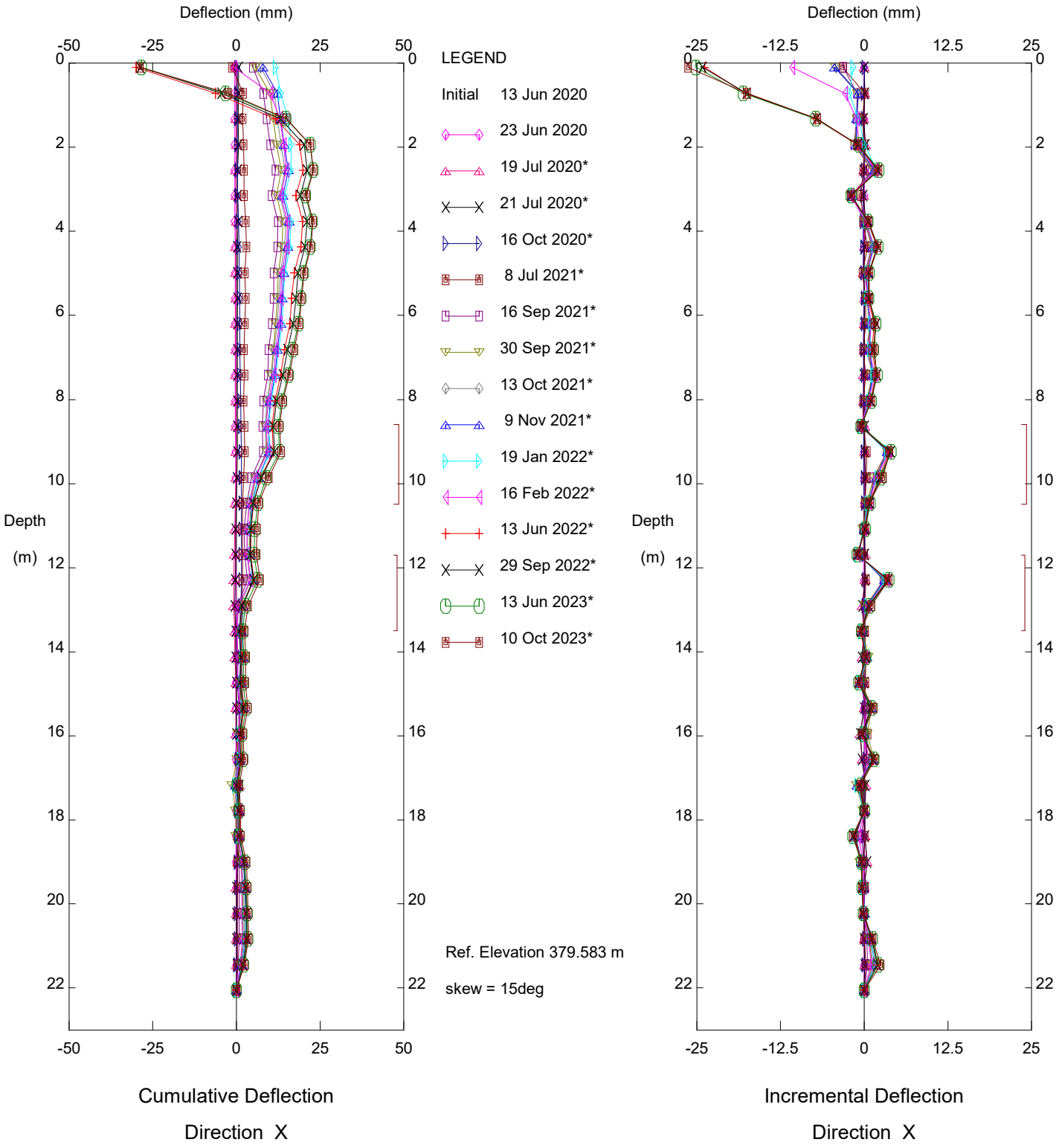
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-4

Alberta Transportation

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

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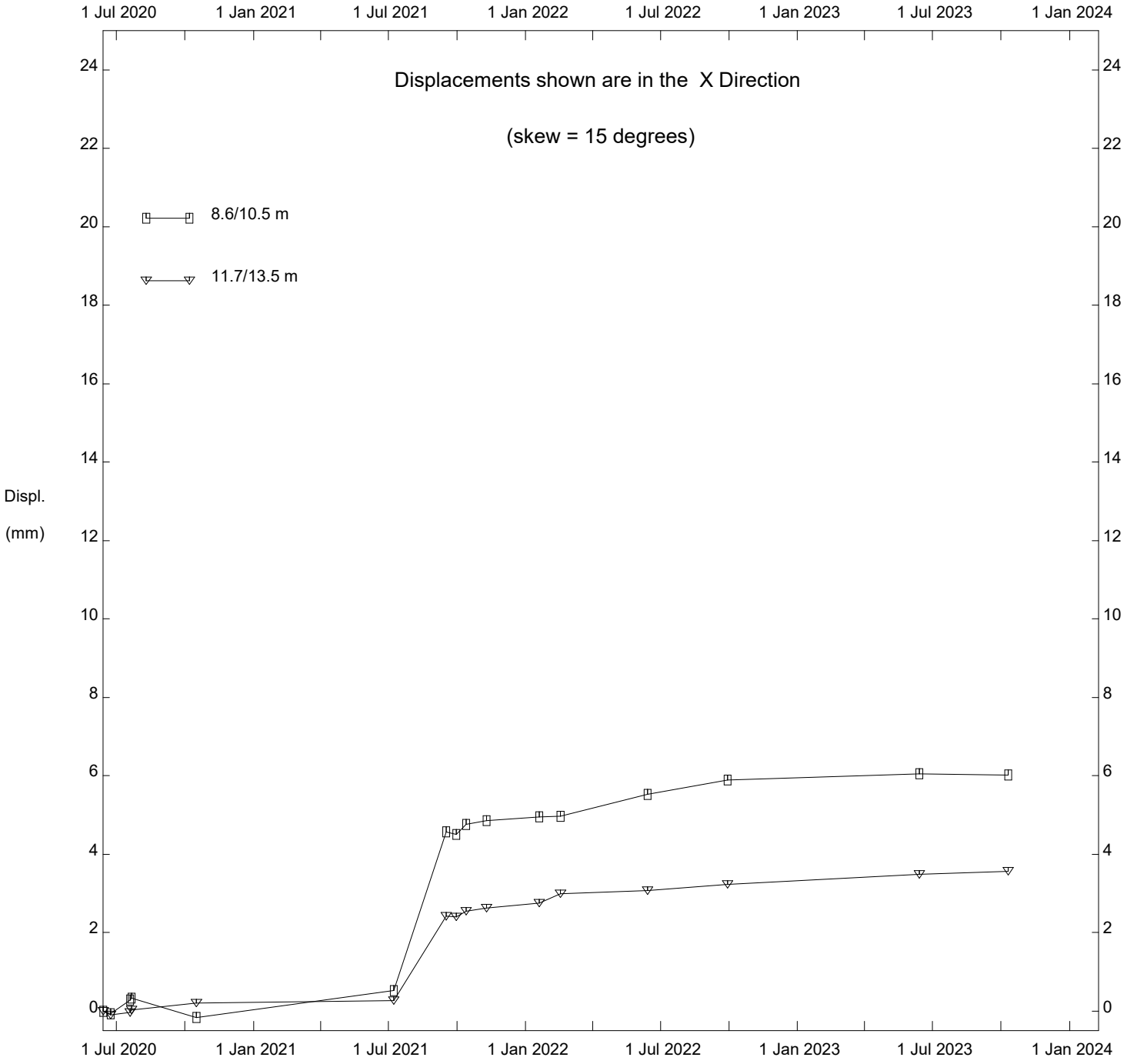
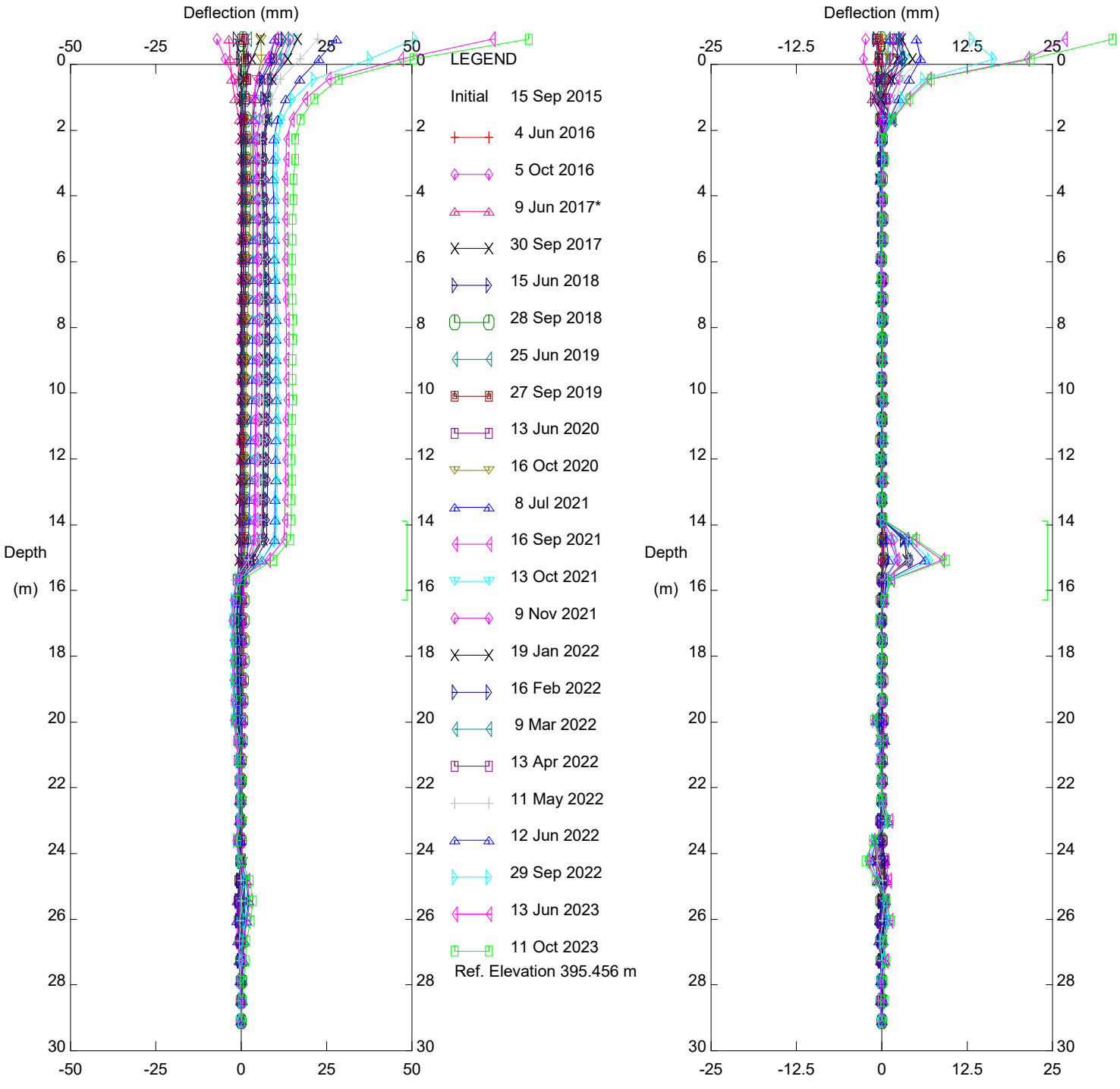
Thurber Engineering Ltd.



PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI09-4

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI11-01

Alberta Transportation

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

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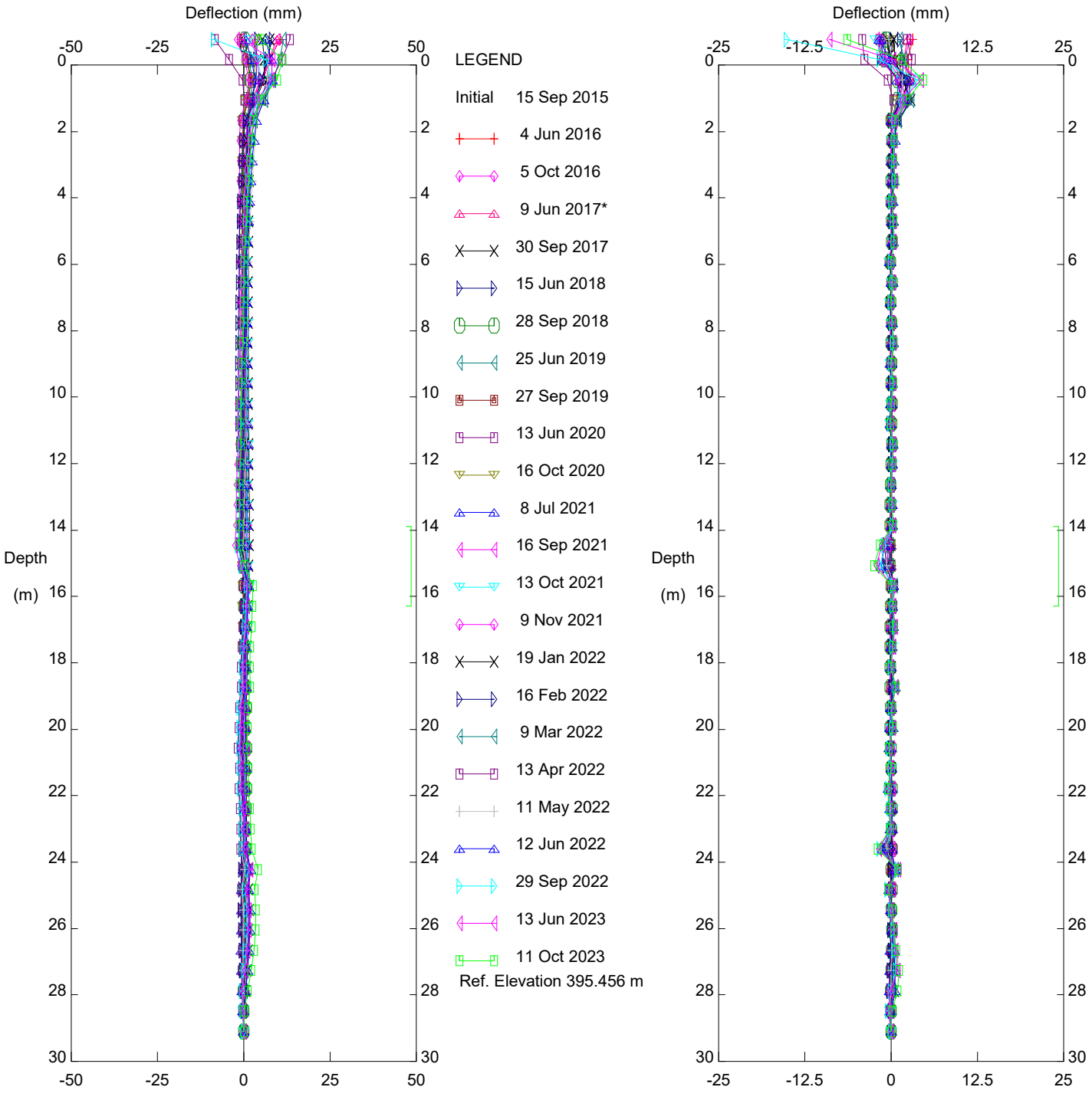
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI11-01

Alberta Transportation

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

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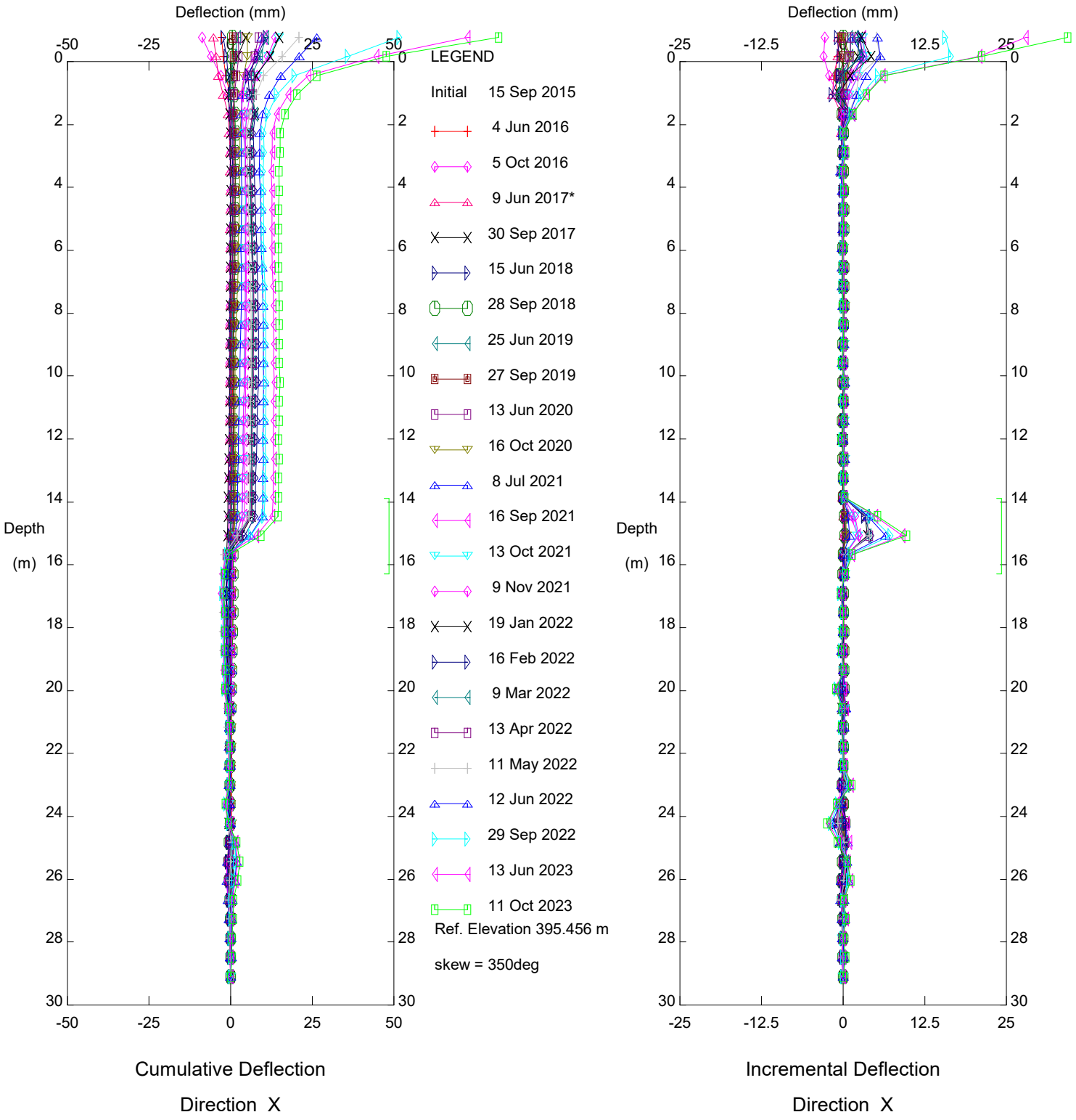
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI11-01

Alberta Transportation

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

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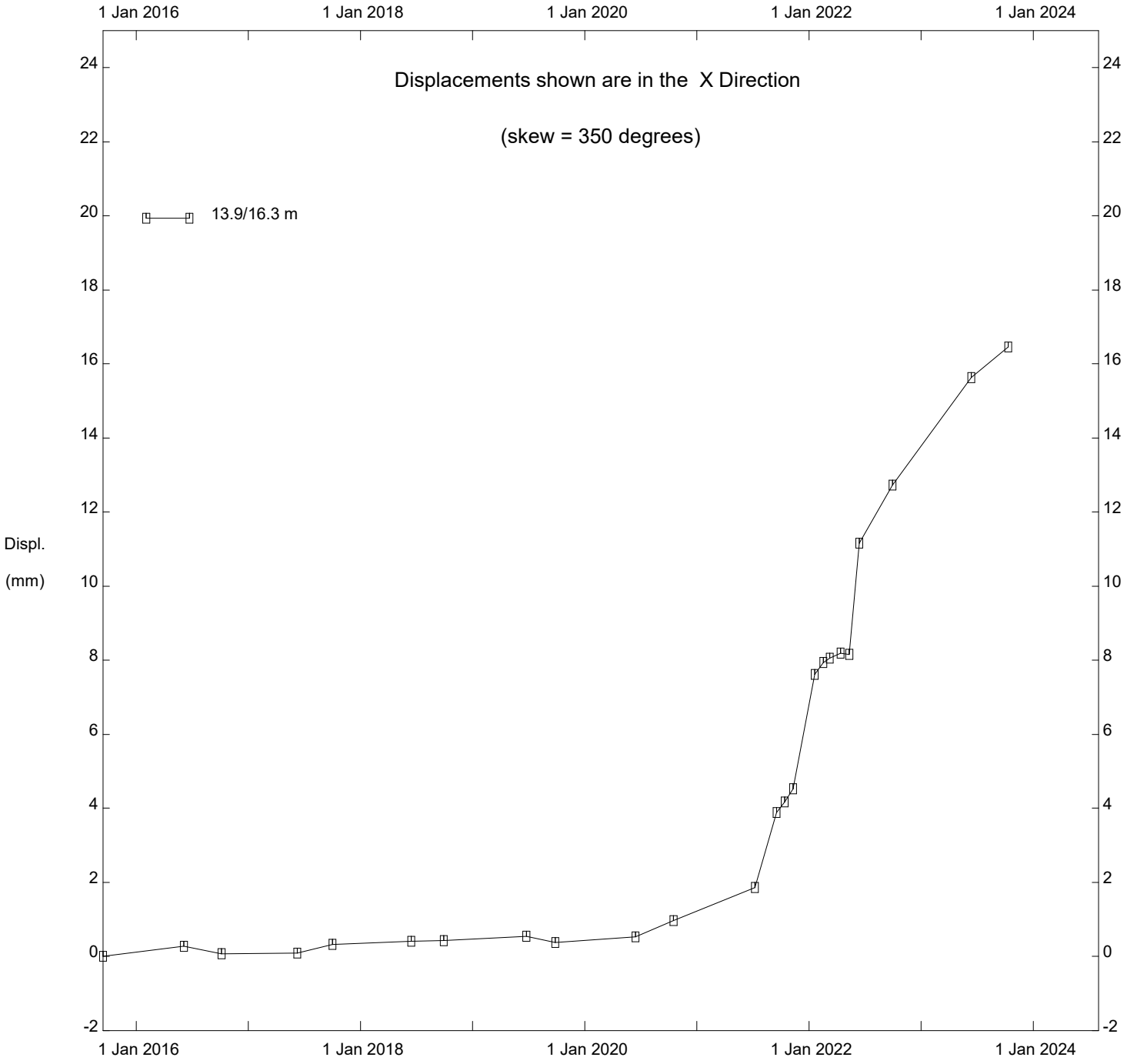
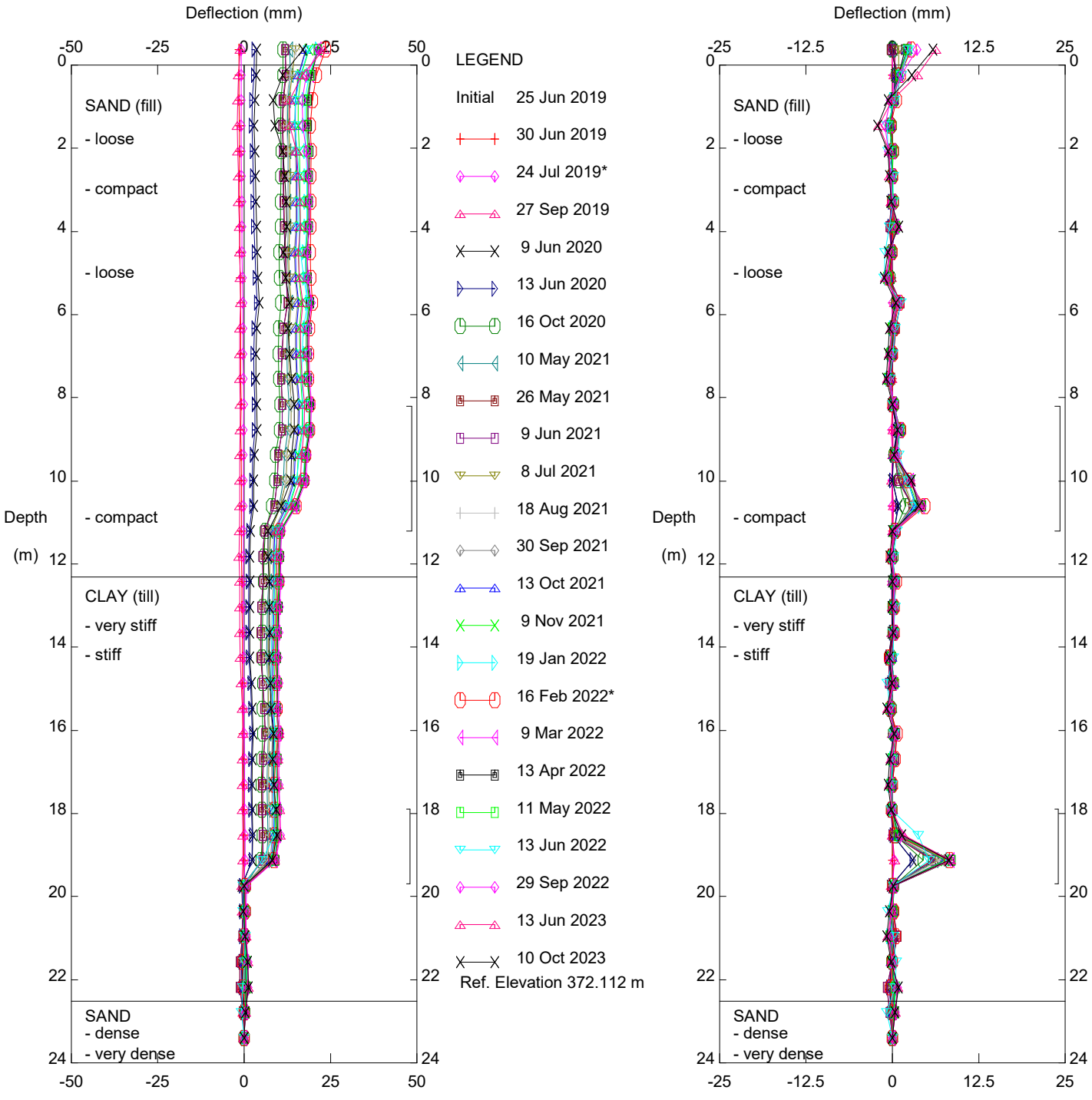
Thurber Engineering Ltd.



PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI11-01

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

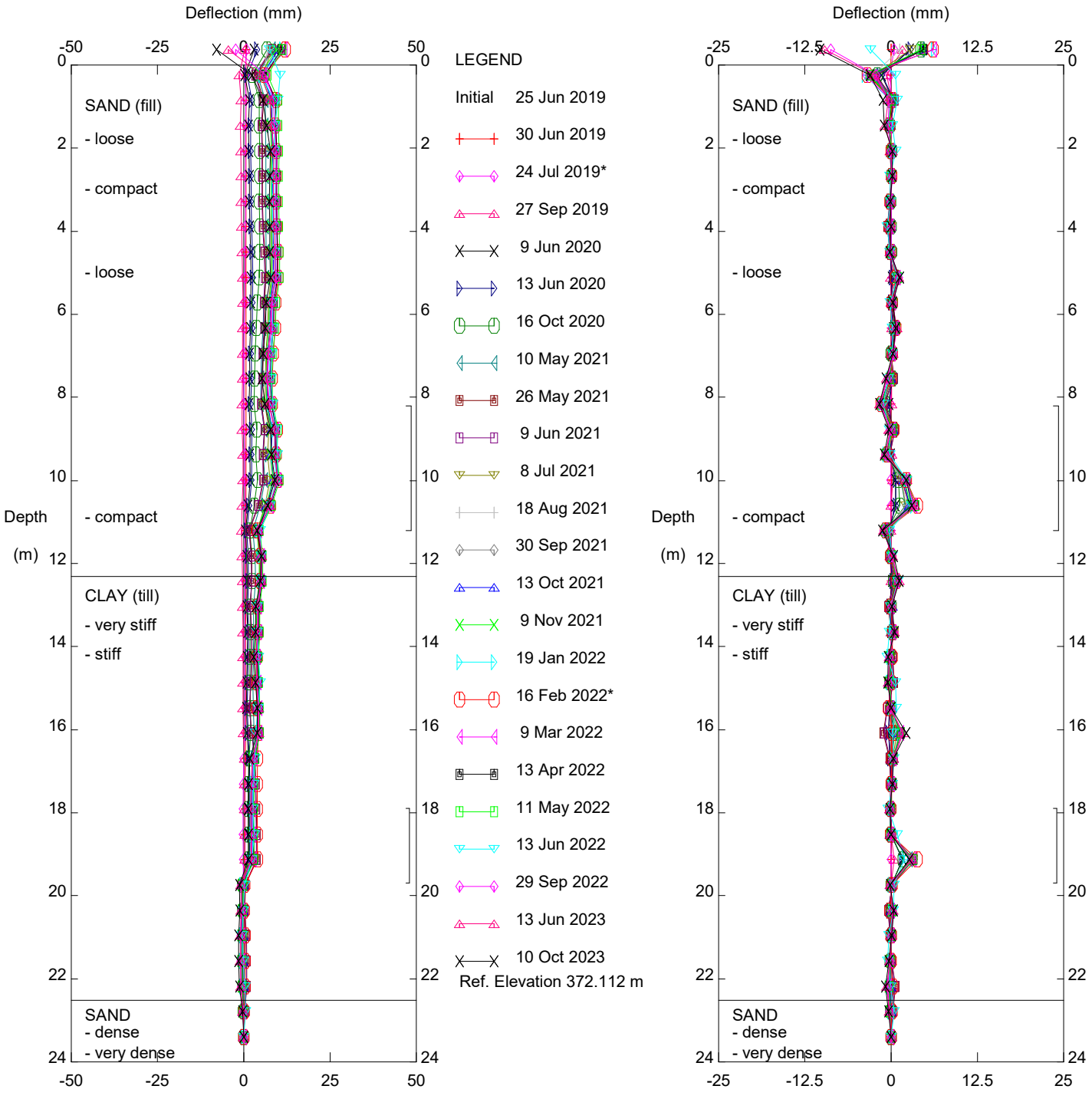
PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI19-5

Alberta Transportation

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

H:\32000\32121 AT GRMP Peace River District 2021-2025\Section C\2023B-Fall\SI Readings\PH009\SI19-5_48 mm casing_shortened 4'.gtl

Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI19-5

Alberta Transportation

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

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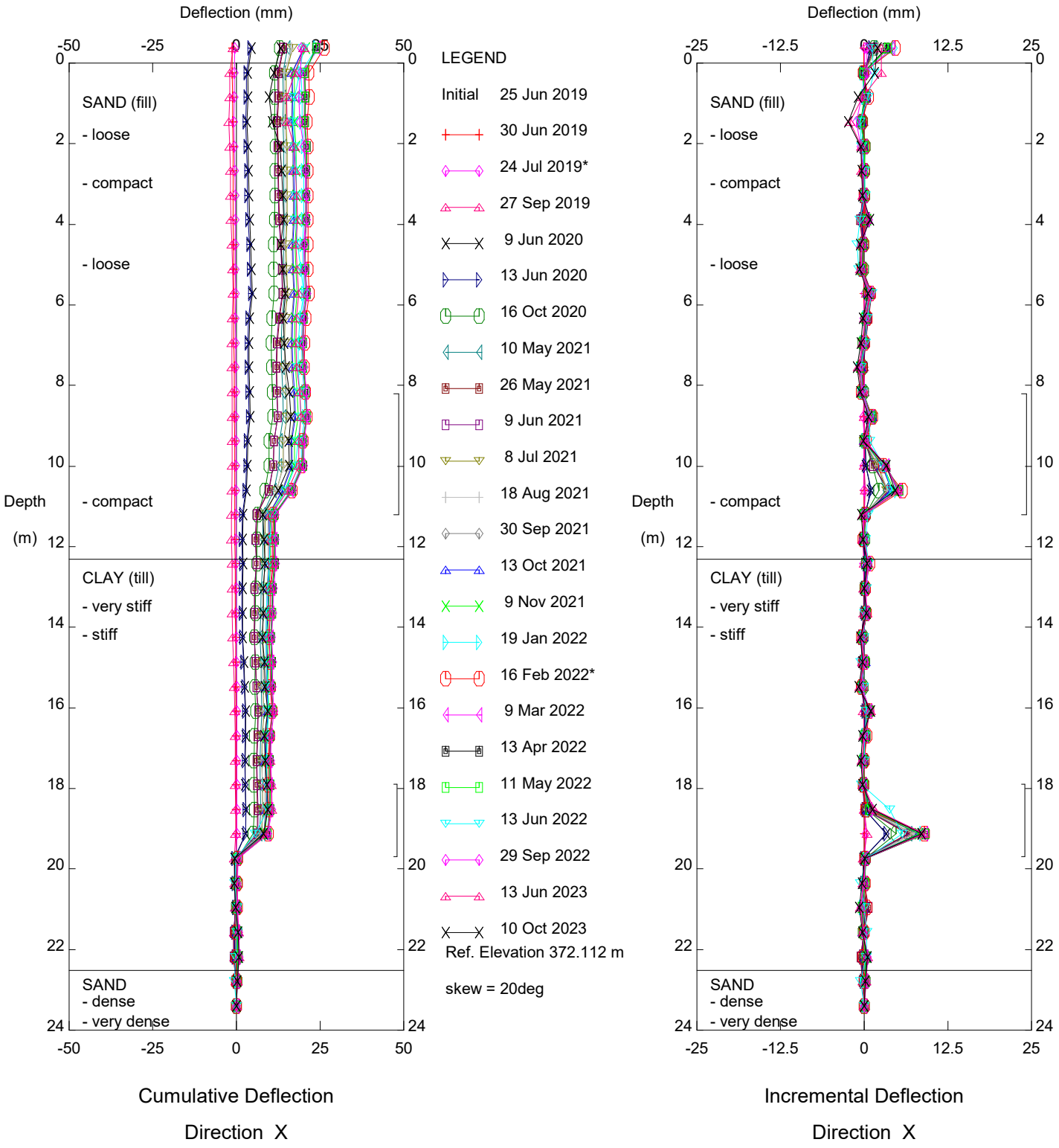
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI19-5

Alberta Transportation

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

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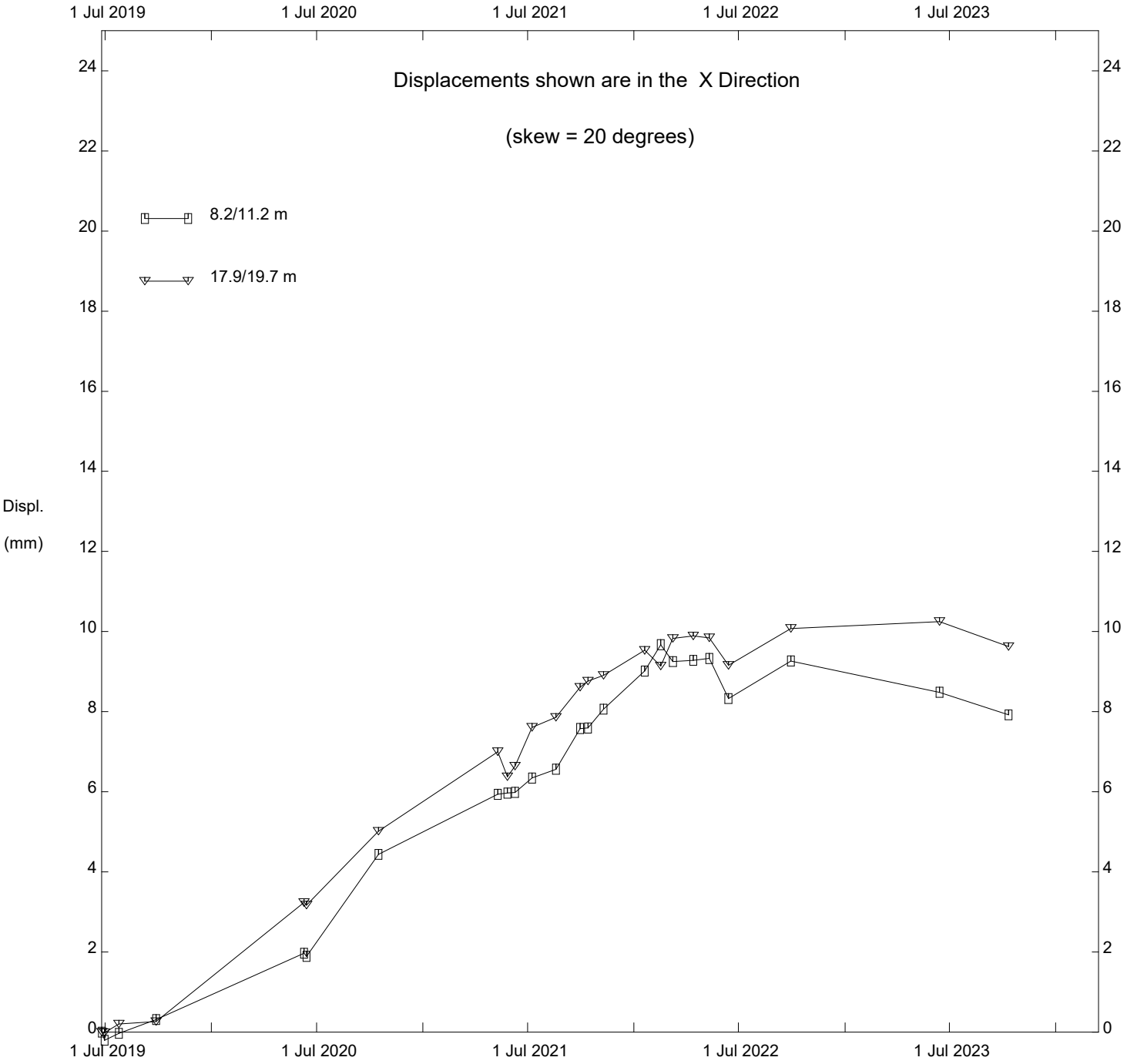
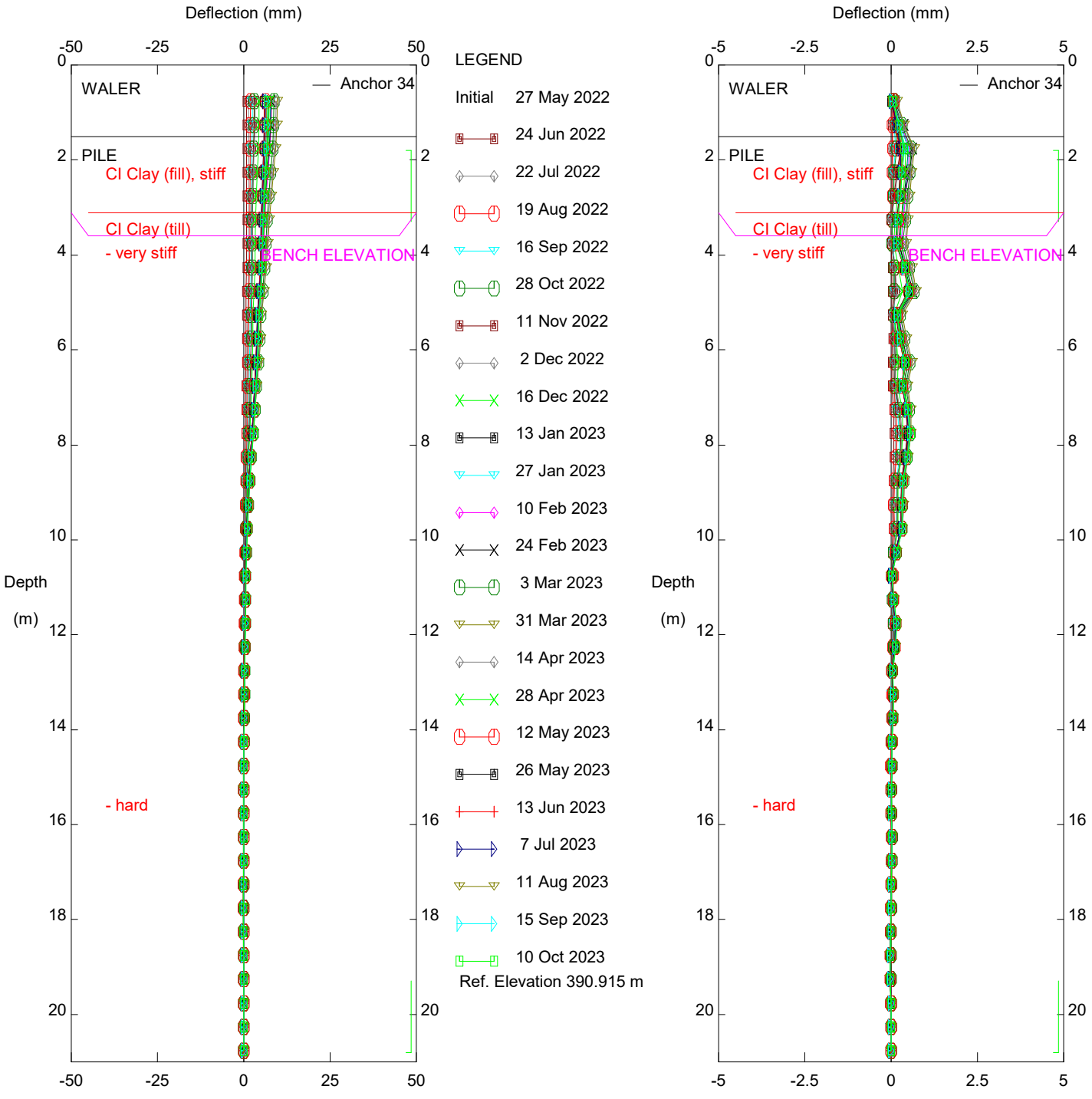
Thurber Engineering Ltd.



PH009 Old Hwy 2:02 Shop Slide, Inclinometer SI19-5

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Dates of Note:

July 31, 2021 - P34 poured, SAA installed
February 8-April 20, 2022 - wall backfilled to top of waler
April 20, 2022 - Anchor A34 locked off
April 20-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Type 1 Wall Section, Inclinometer SAA-P34

Alberta Transportation

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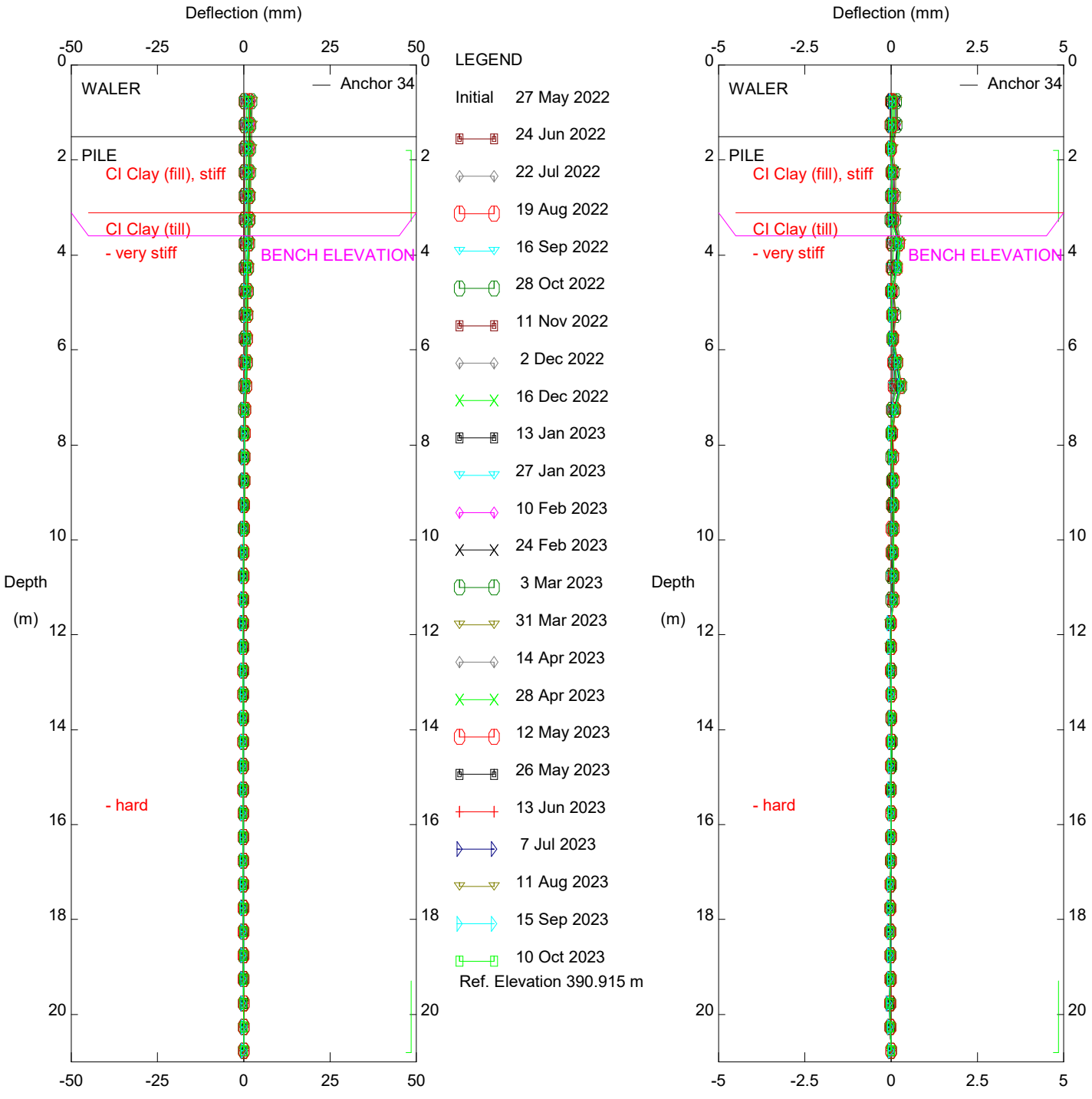
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Dates of Note:

July 31, 2021 - P34 poured, SAA installed
February 8-April 20, 2022 - wall backfilled to top of waler
April 20, 2022 - Anchor A34 locked off
April 20-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Type 1 Wall Section, Inclinometer SAA-P34

Alberta Transportation

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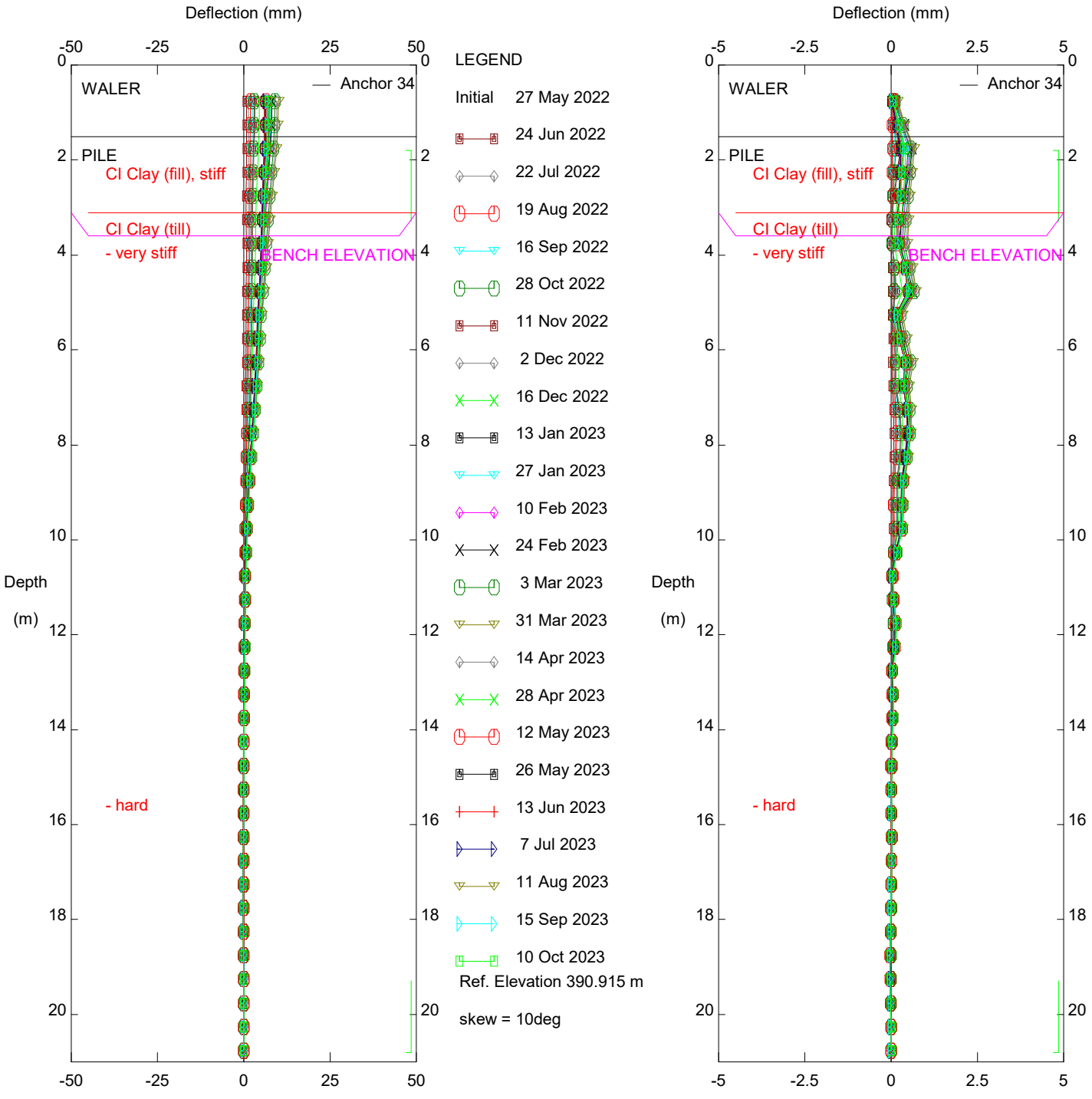

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

Dates of Note:

July 31, 2021 - P34 poured, SAA installed
February 8-April 20, 2022 - wall backfilled to top of waler
April 20, 2022 - Anchor A34 locked off
April 20-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Type 1 Wall Section, Inclinometer SAA-P34

Alberta Transportation

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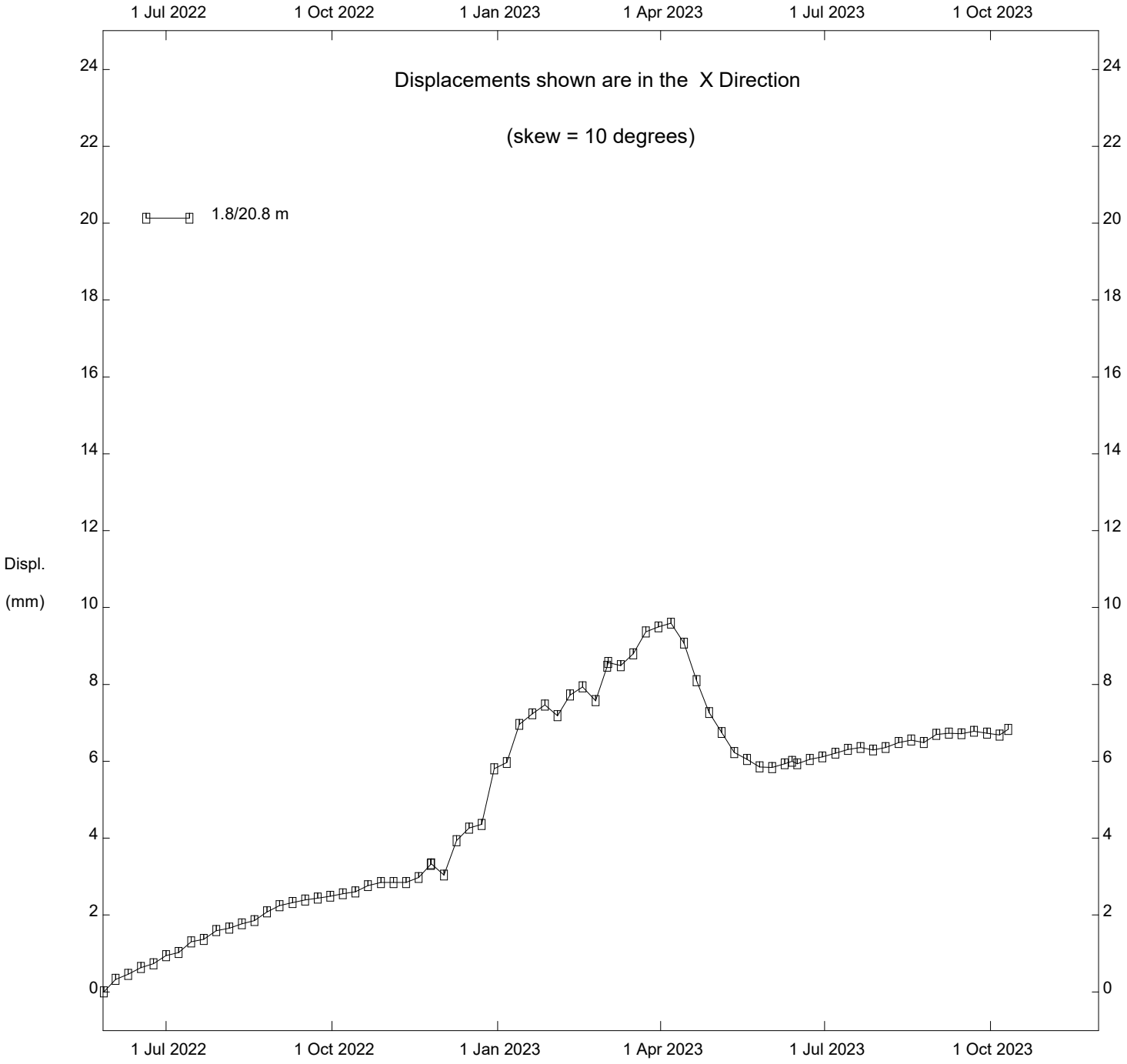
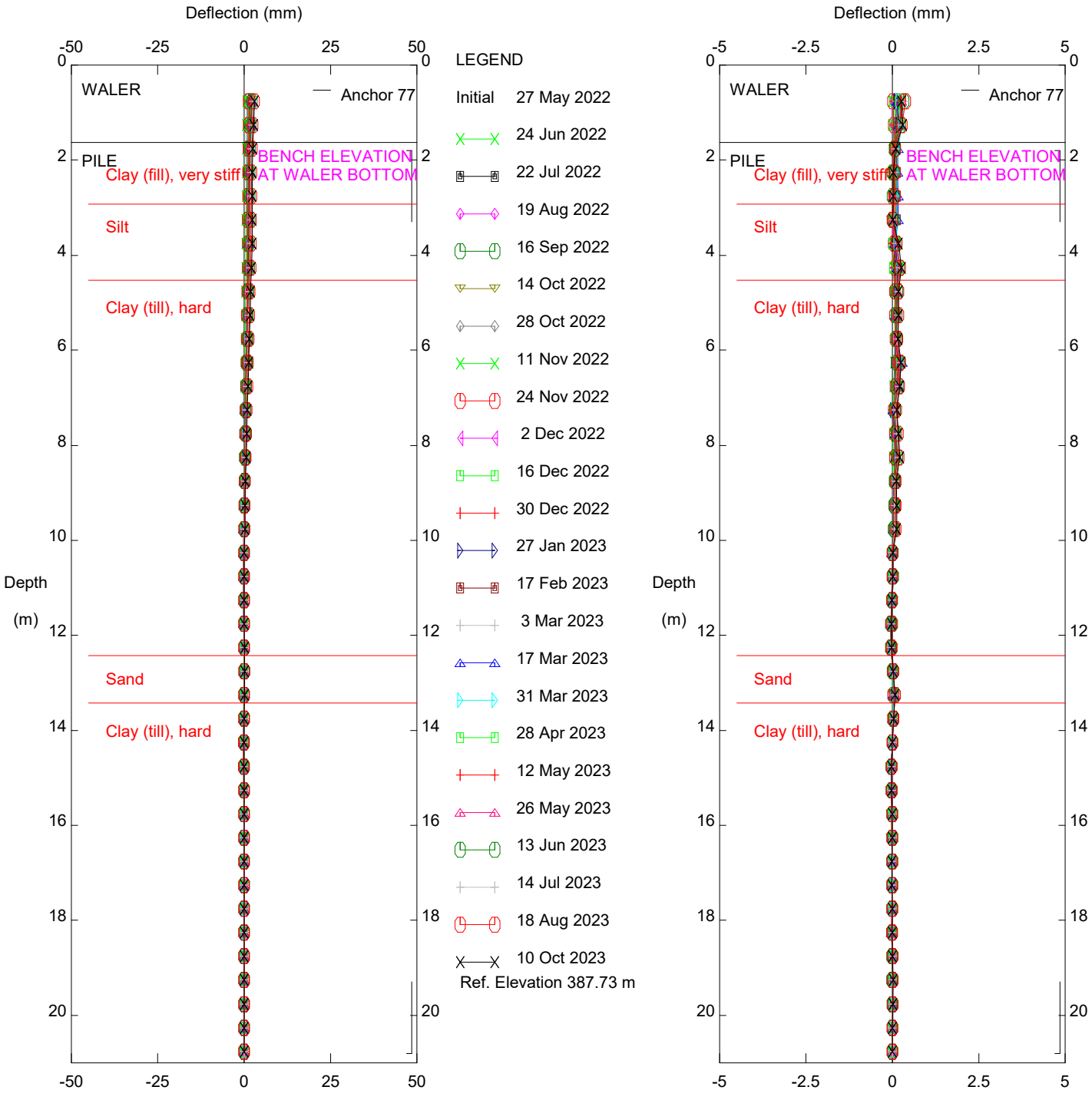


Shop Slide Type 1 Wall Section, Inclinometer SAA-P34

Alberta Transportation

Dates of Note:
July 31, 2021 - P34 Poured, SAA Installed
February 8-April 20, 2022 - Wall backfilled to top of waler
April 20, 2022- Anchor A34 Locked off
April 20-May 31, 2022 - Wall backfilled to top of lagging and road level
May 3-June 27,2022 - Grading downslope of pile wall

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Dates of Note:

July 15, 2021 - P77 poured, SAA installed
February 8-April 1, 2022 - wall backfilled to top of waler
April 1, 2022 - Anchor A77 locked off
April 1-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Wall Type 2 Section, Inclinometer SAA-P77

Alberta Transportation

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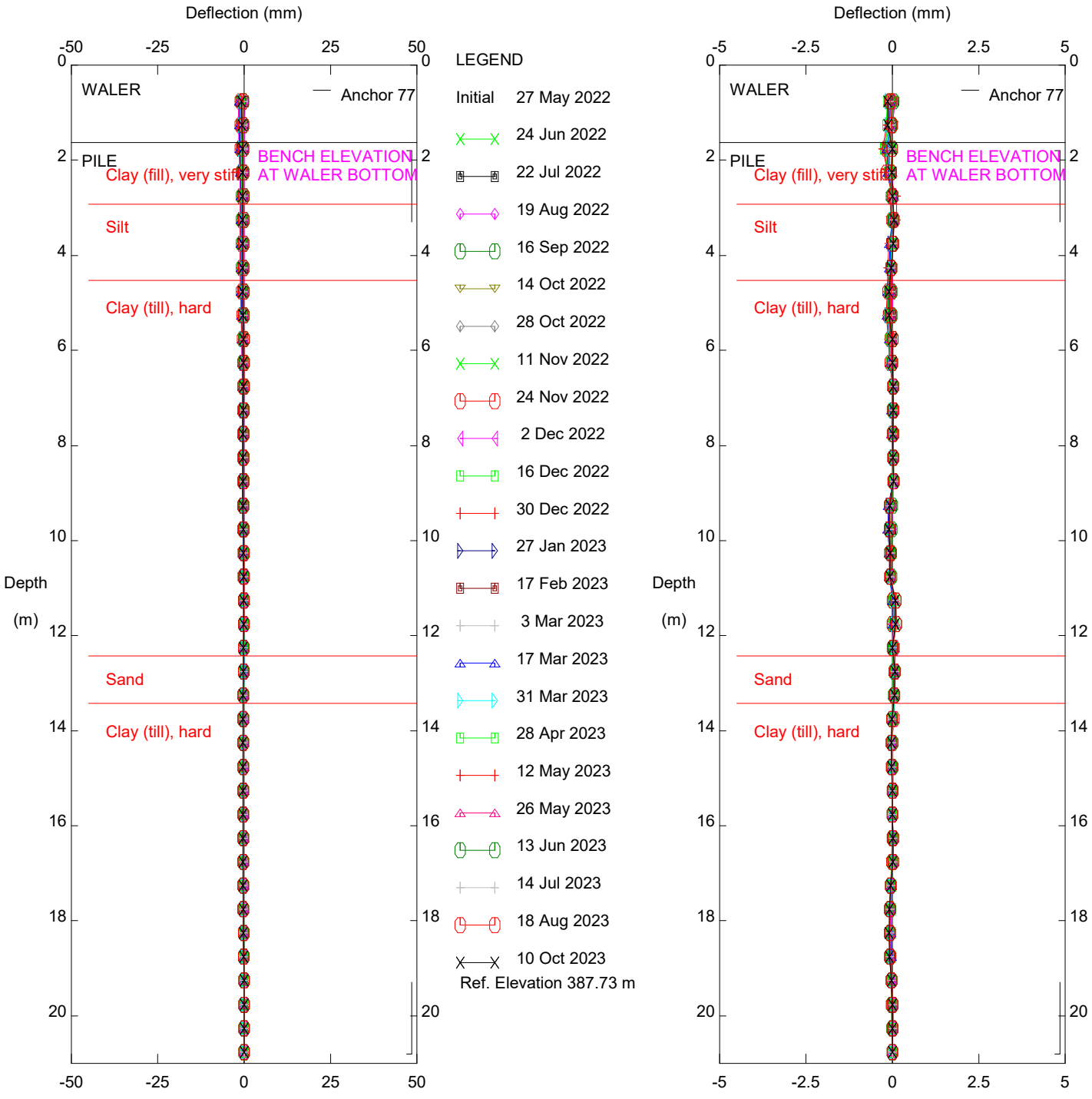
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Dates of Note:

July 15, 2021 - P77 poured, SAA installed
February 8-April 1, 2022 - wall backfilled to top of waler
April 1, 2022 - Anchor A77 locked off
April 1-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Wall Type 2 Section, Inclinometer SAA-P77

Alberta Transportation

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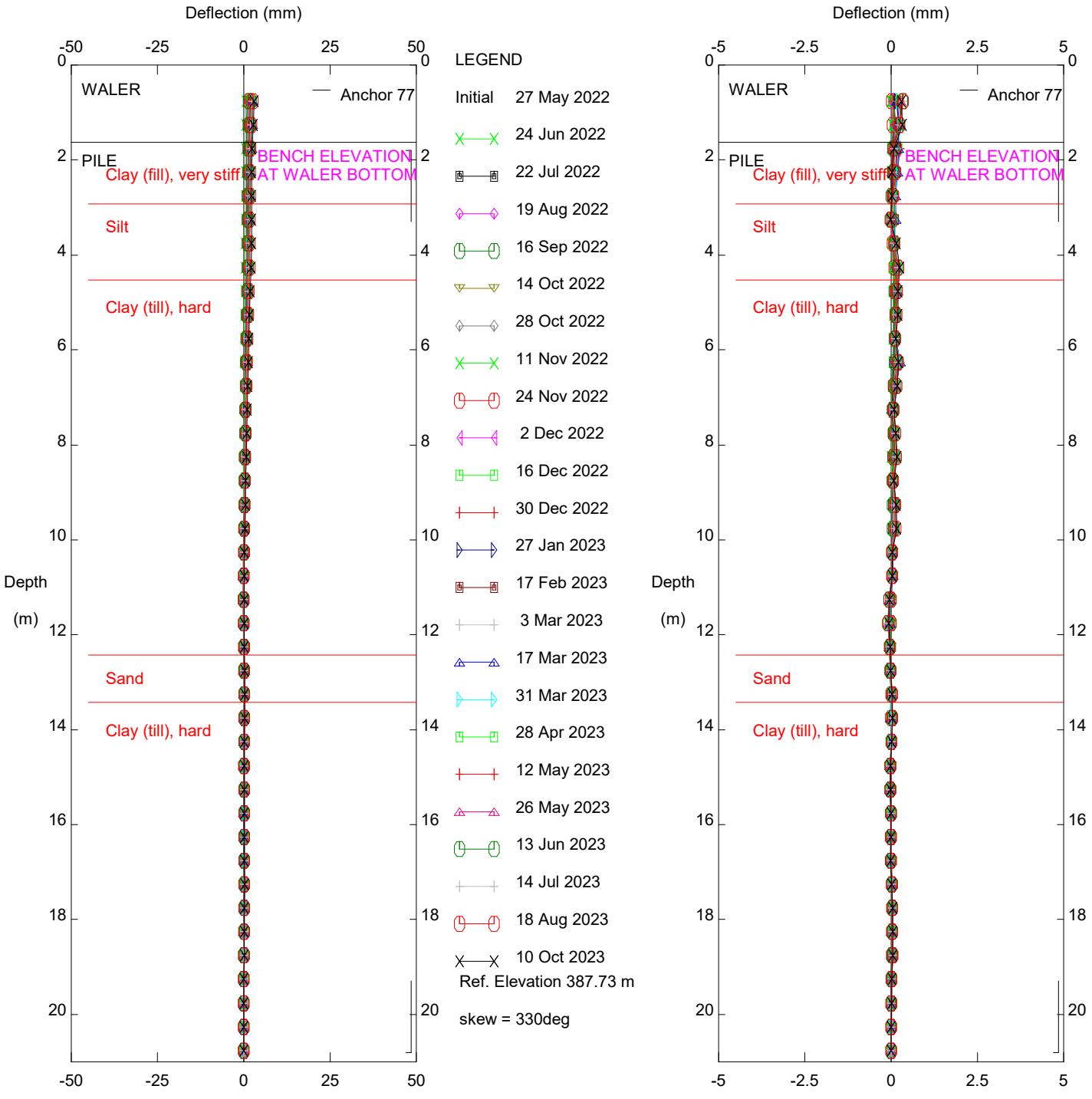

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

Dates of Note:

July 15, 2021 - P77 poured, SAA installed
February 8-April 1, 2022 - wall backfilled to top of waler
April 1, 2022 - Anchor A77 locked off
April 1-May 31, 2022 - wall backfilled to top of lagging and road level
May 3-June 27, 2022 - Grading downslope of pile wall

Shop Slide Wall Type 2 Section, Inclinometer SAA-P77

Alberta Transportation

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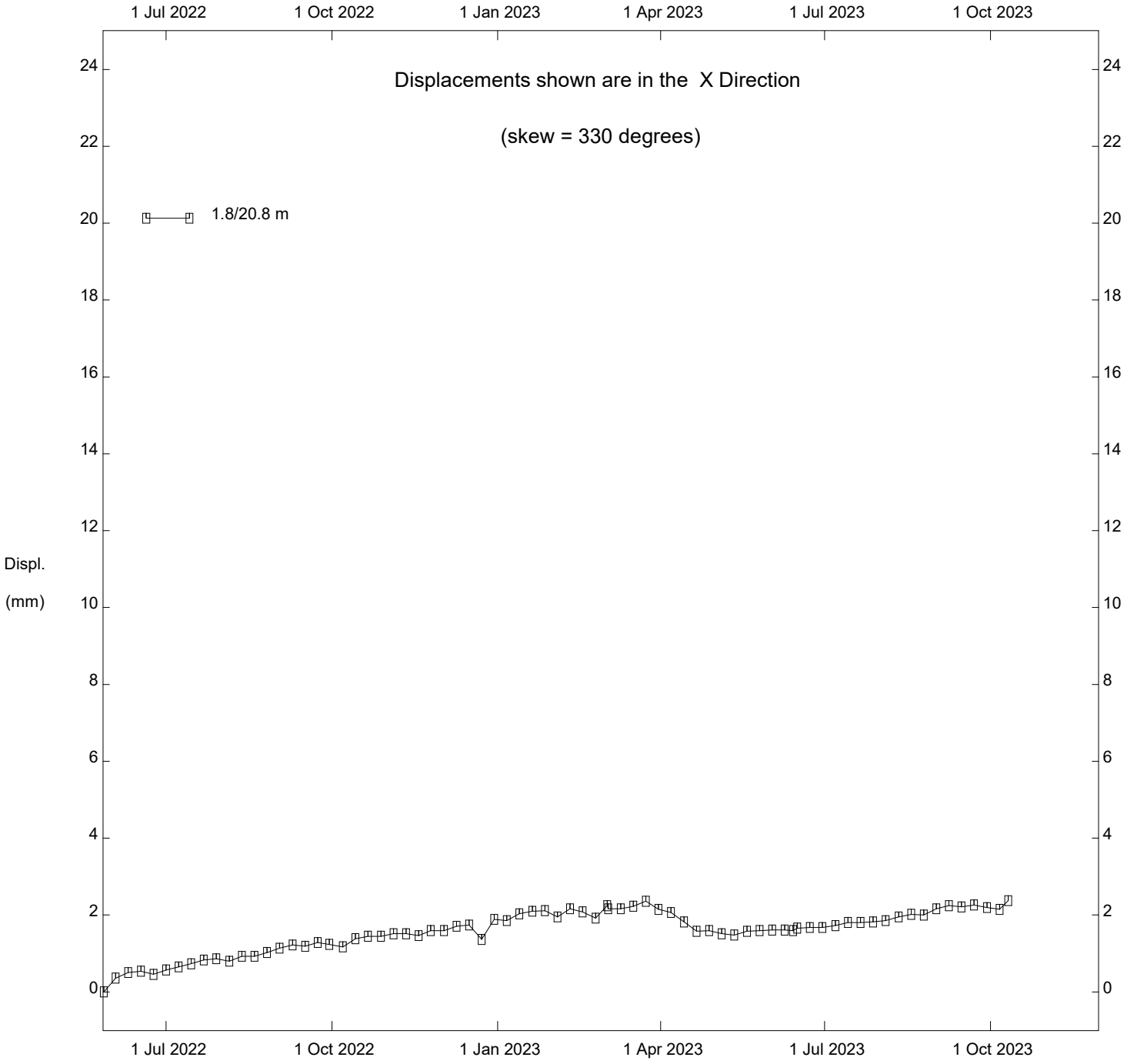
Thurber Engineering Ltd.

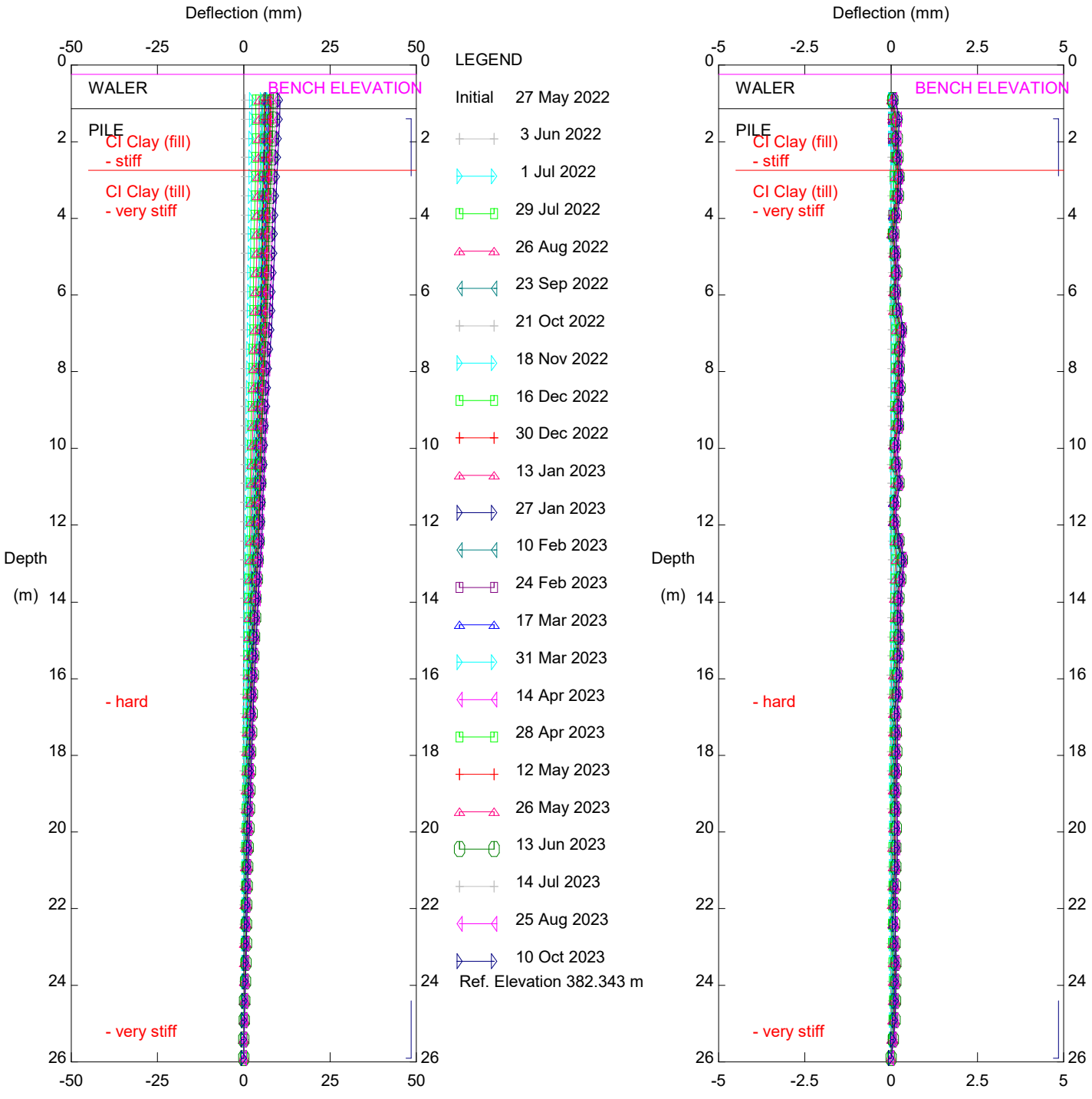


Dates of Note:
July 15, 2021 - P77 Poured, SAA Installed
February 8-April 1, 2022 - Wall backfilled to top of waler
April 1, 2022- Anchor A77 Locked off
April 20-May 31, 2022 - Wall backfilled to top of lagging and road level
May 3-June 27,2022 - Grading downslope of pile wall

Shop Slide Wall Type 2 Section, Inclinometer SAA-P77

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

Dates of Note:
Sep. 23, 2022 - P113 poured, SAA installed
February 8-May 31, 2022 - backfill completed above waler
May 3-June 27, 2022 - grading downslope of pile wall

Shop Slide Wall Type 3, Inclinometer SAA-P113

Alberta Transportation

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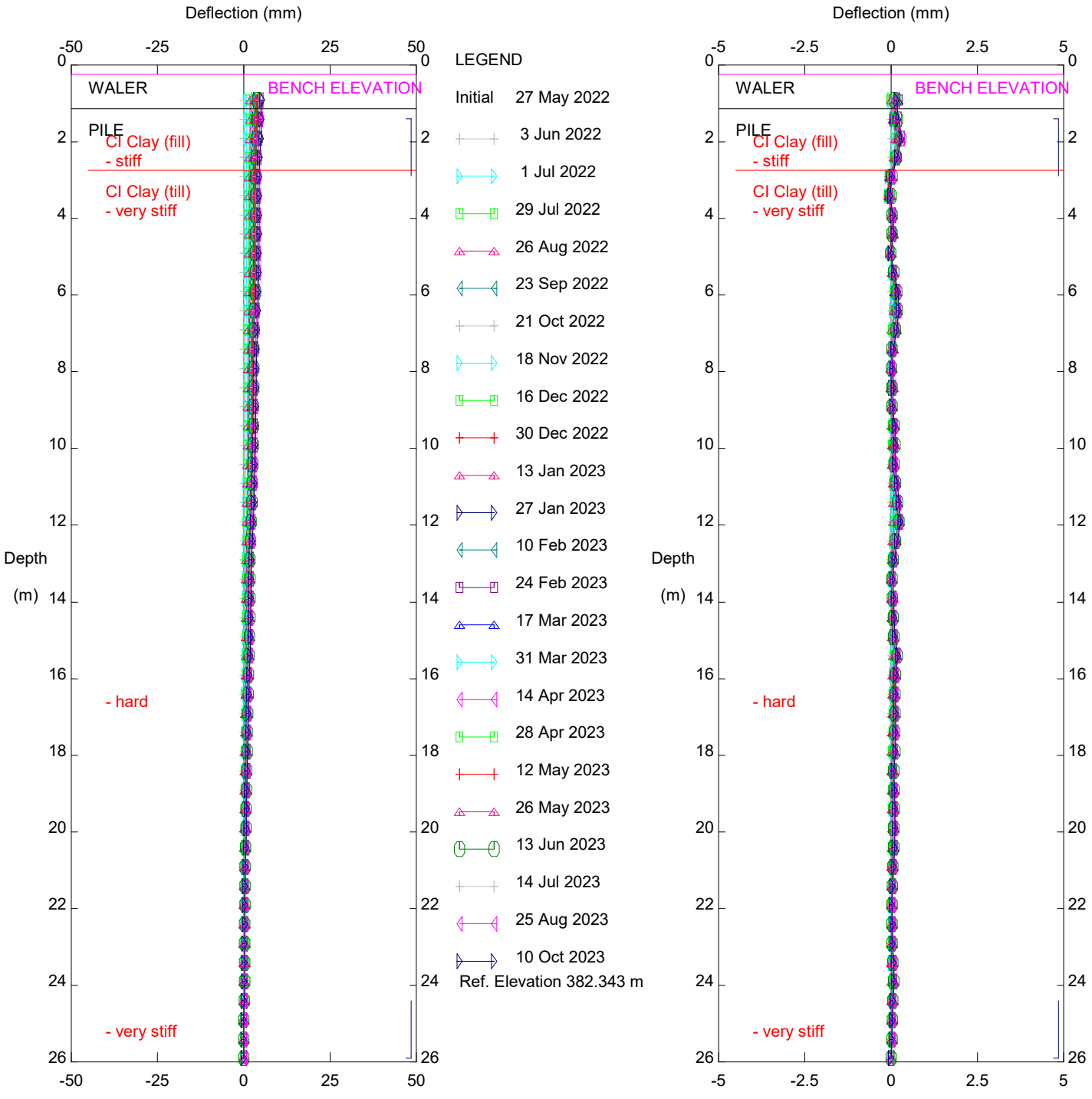
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

Dates of Note:
Sep. 23, 2022 - P113 poured, SAA installed
February 8-May 31, 2022 - backfill completed above waler
May 3-June 27, 2022 - grading downslope of pile wall

Shop Slide Wall Type 3, Inclinometer SAA-P113

Alberta Transportation

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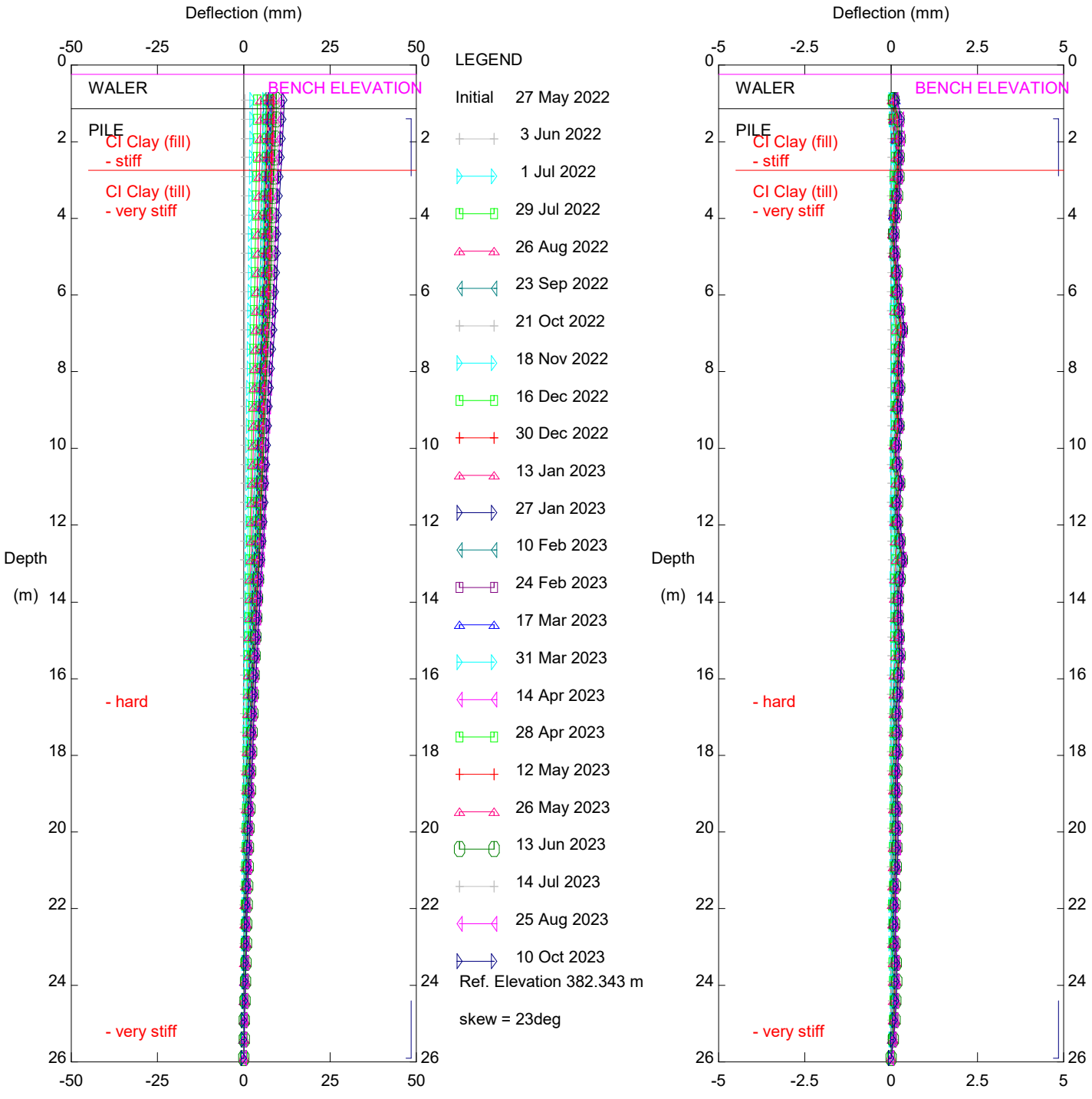
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

Dates of Note:
Sep. 23, 2022 - P113 poured, SAA installed
February 8-May 31, 2022 - backfill completed above waler
May 3-June 27, 2022 - grading downslope of pile wall

Shop Slide Wall Type 3, Inclinometer SAA-P113

Alberta Transportation

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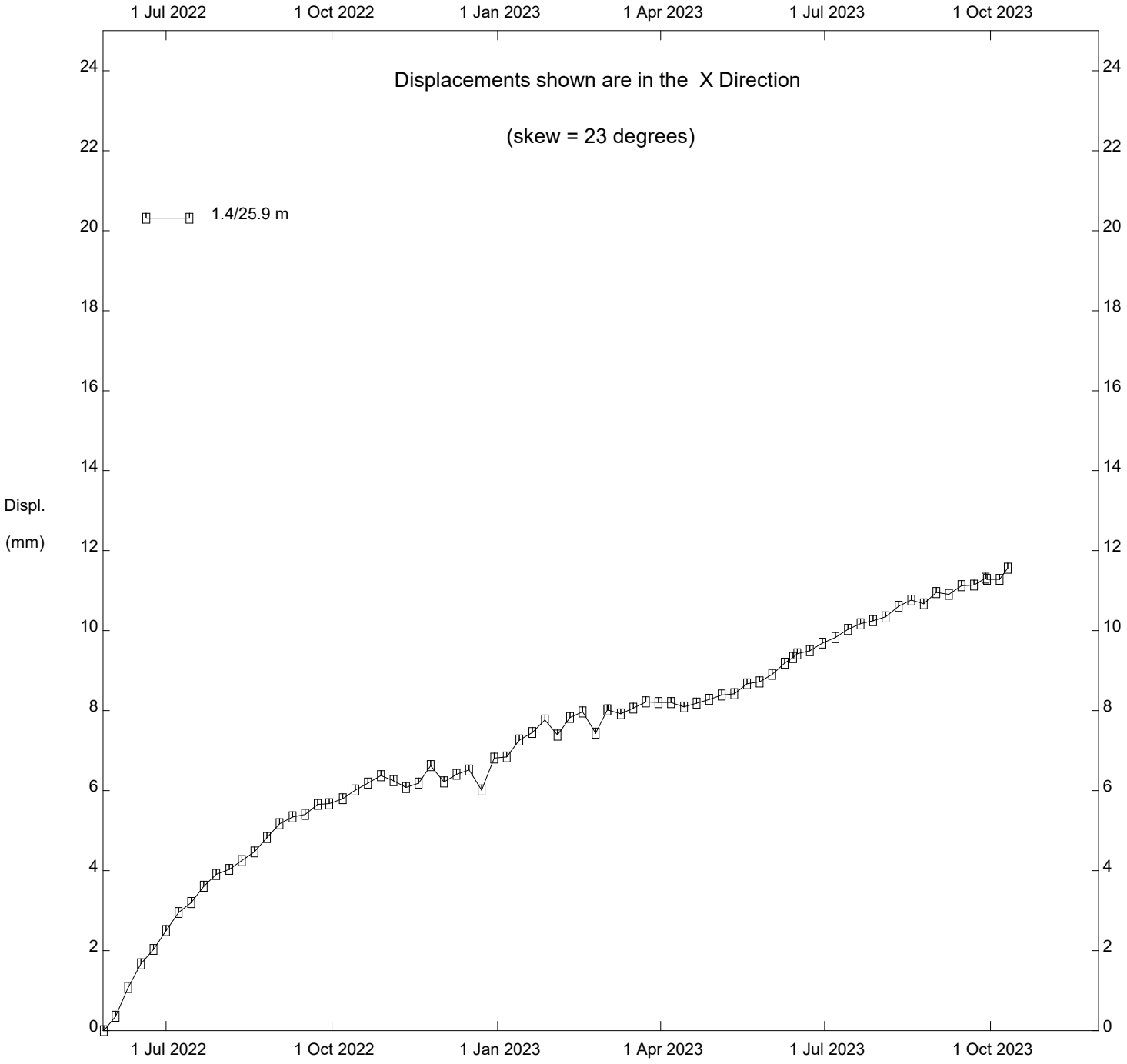
Thurber Engineering Ltd.



Shop Slide Wall Type 3, Inclinometer SAA-P113

Alberta Transportation

Dates of Note:
Sep. 23, 2022 - P113 Poured, SAA Installed
February 8-May 31, 2022 - Wall backfilled completed above waler
May 3-June 27,2022 - Grading downslope of pile wall

FIGURE PH009-1: PEACE RIVER SHOP SLIDE
P34 UPSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

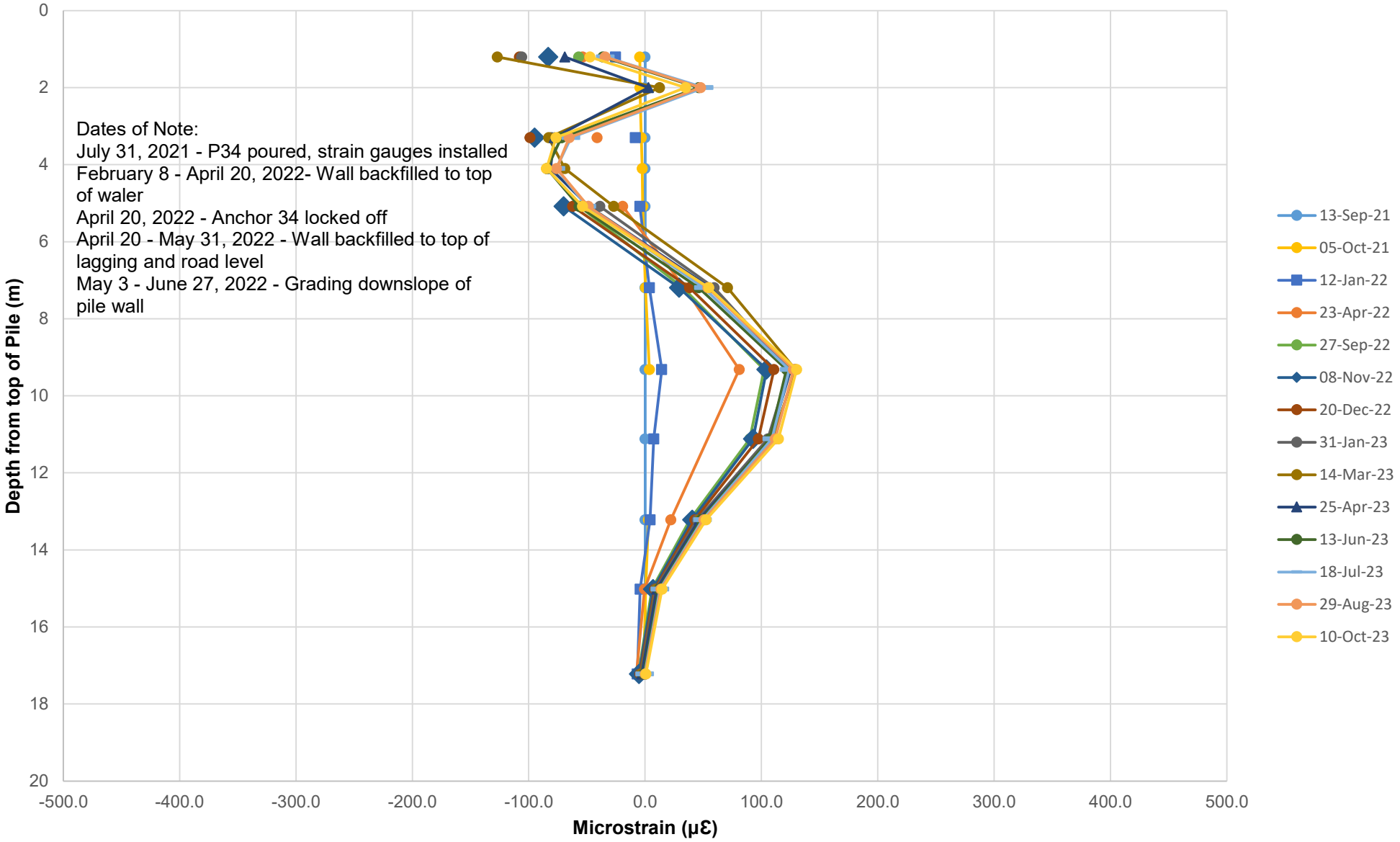


FIGURE PH009-2: PEACE RIVER SHOP SLIDE
P34 DOWNSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

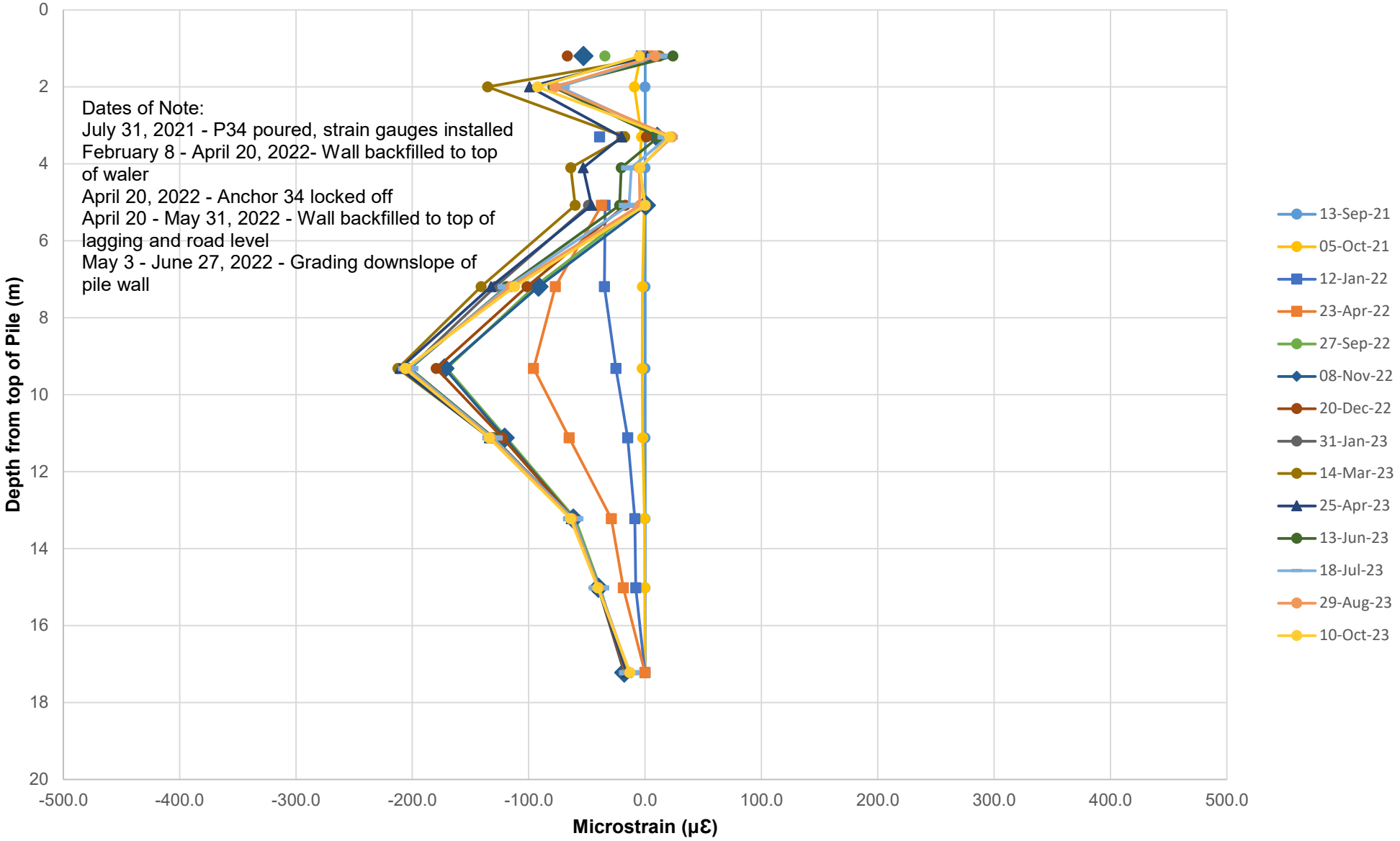


FIGURE PH009-3: PEACE RIVER SHOP SLIDE
P34 MAXIMUM STRAIN VS TIME (9.3 m DEPTH)

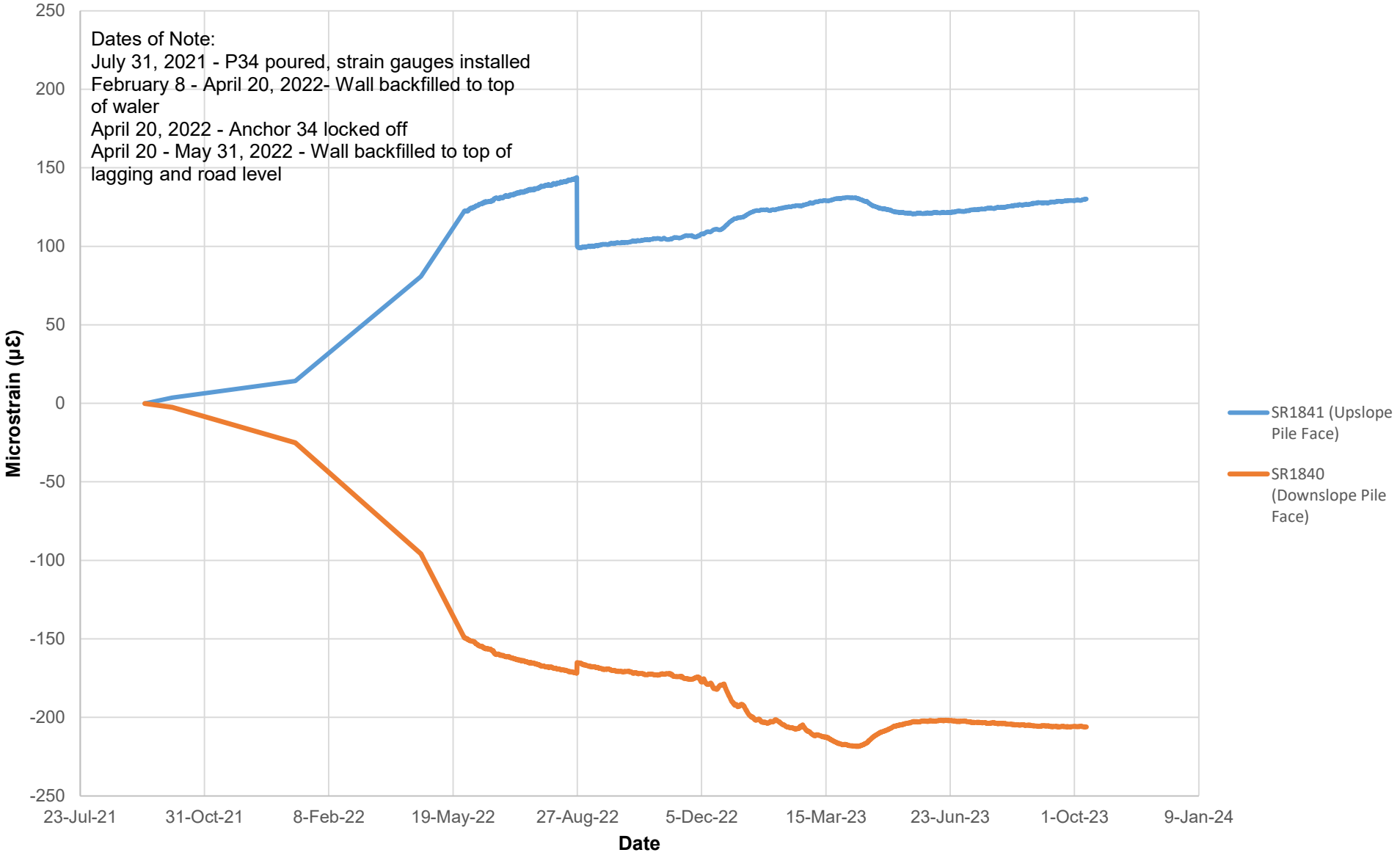


FIGURE PH009-4: PEACE RIVER SHOP SLIDE
P77 UPSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

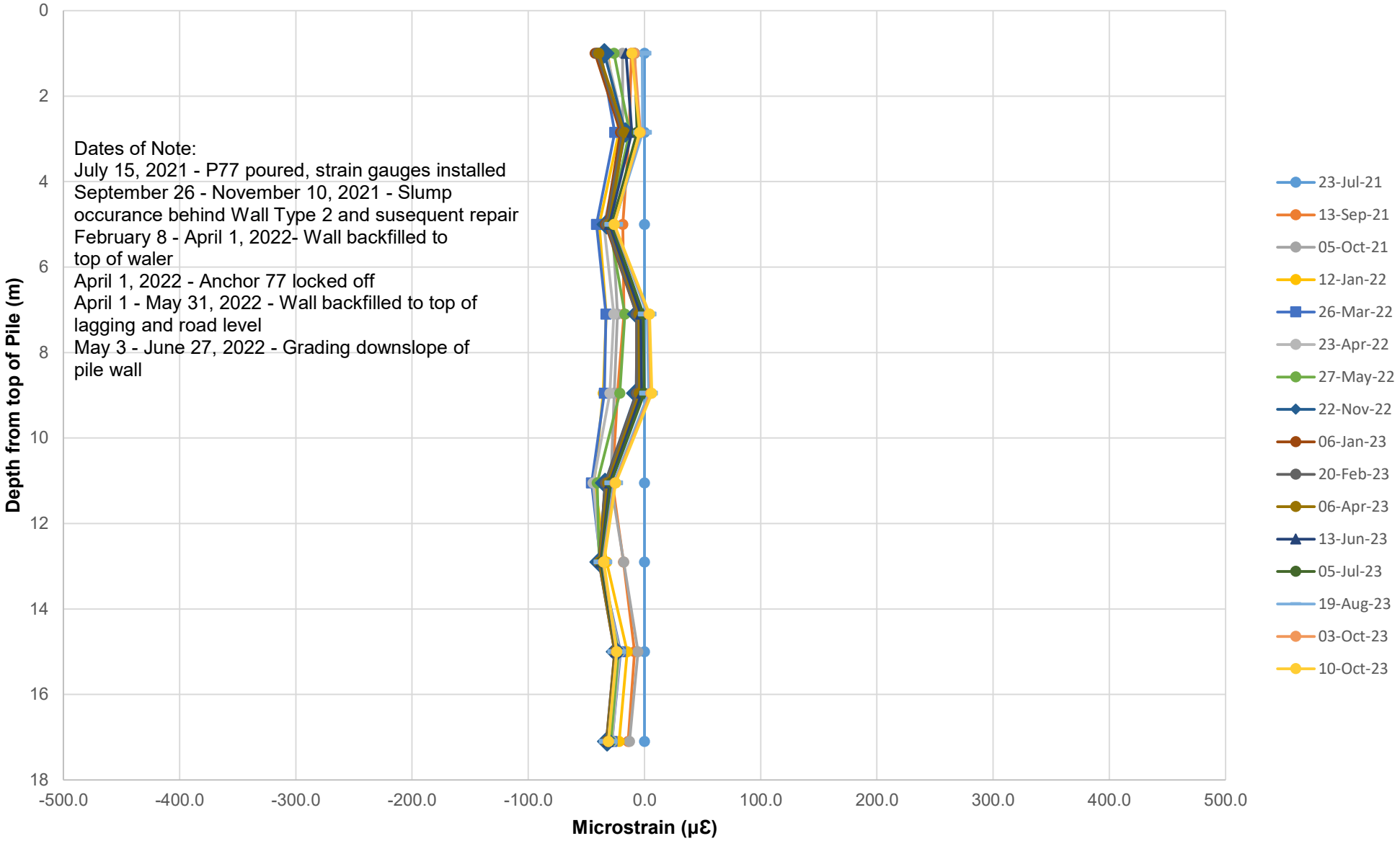


FIGURE PH009-5: PEACE RIVER SHOP SLIDE
P77 DOWNSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

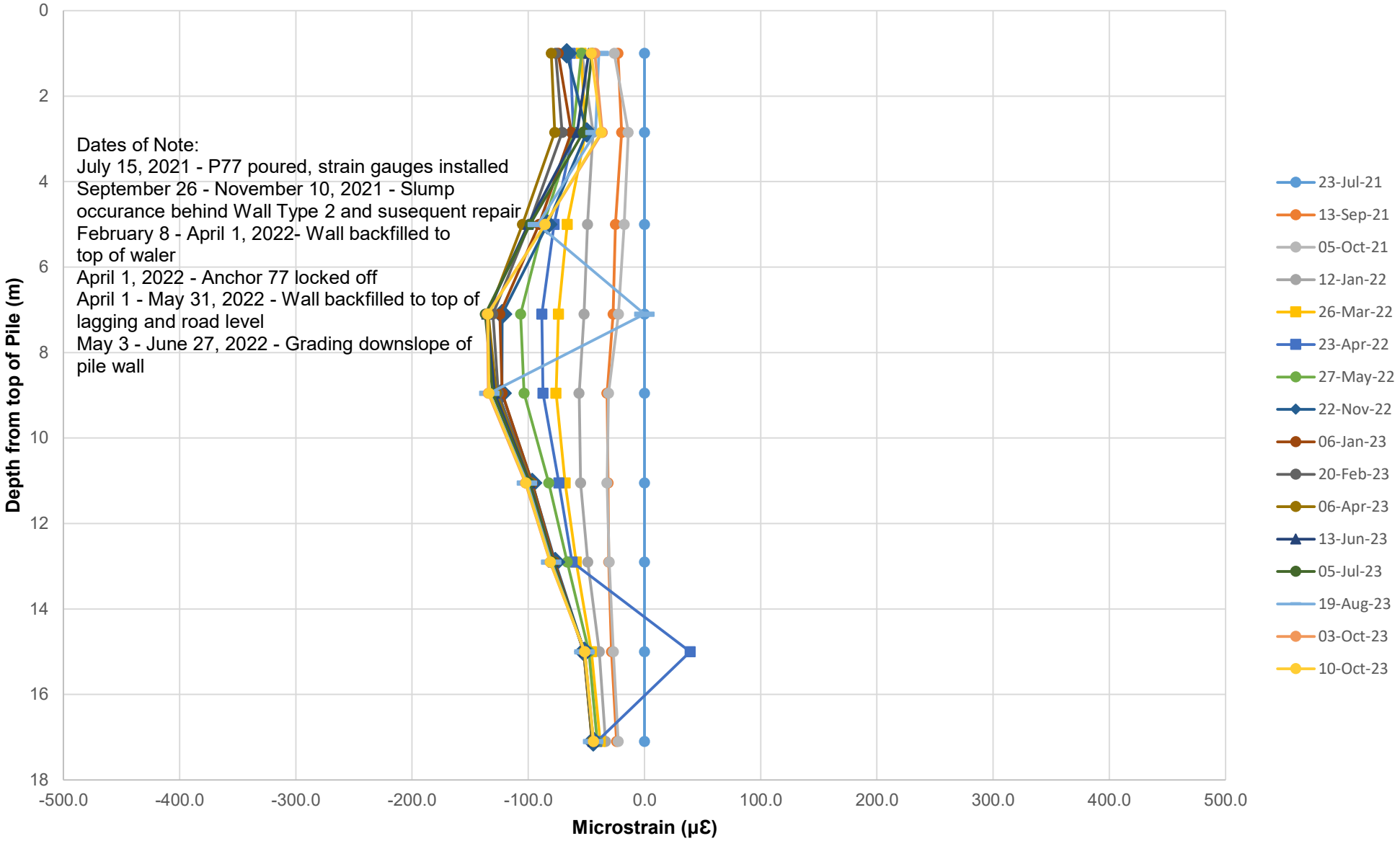


FIGURE PH009-6: PEACE RIVER SHOP SLIDE
P77 MAXIMUM STRAIN VS TIME (7.1 m DEPTH)

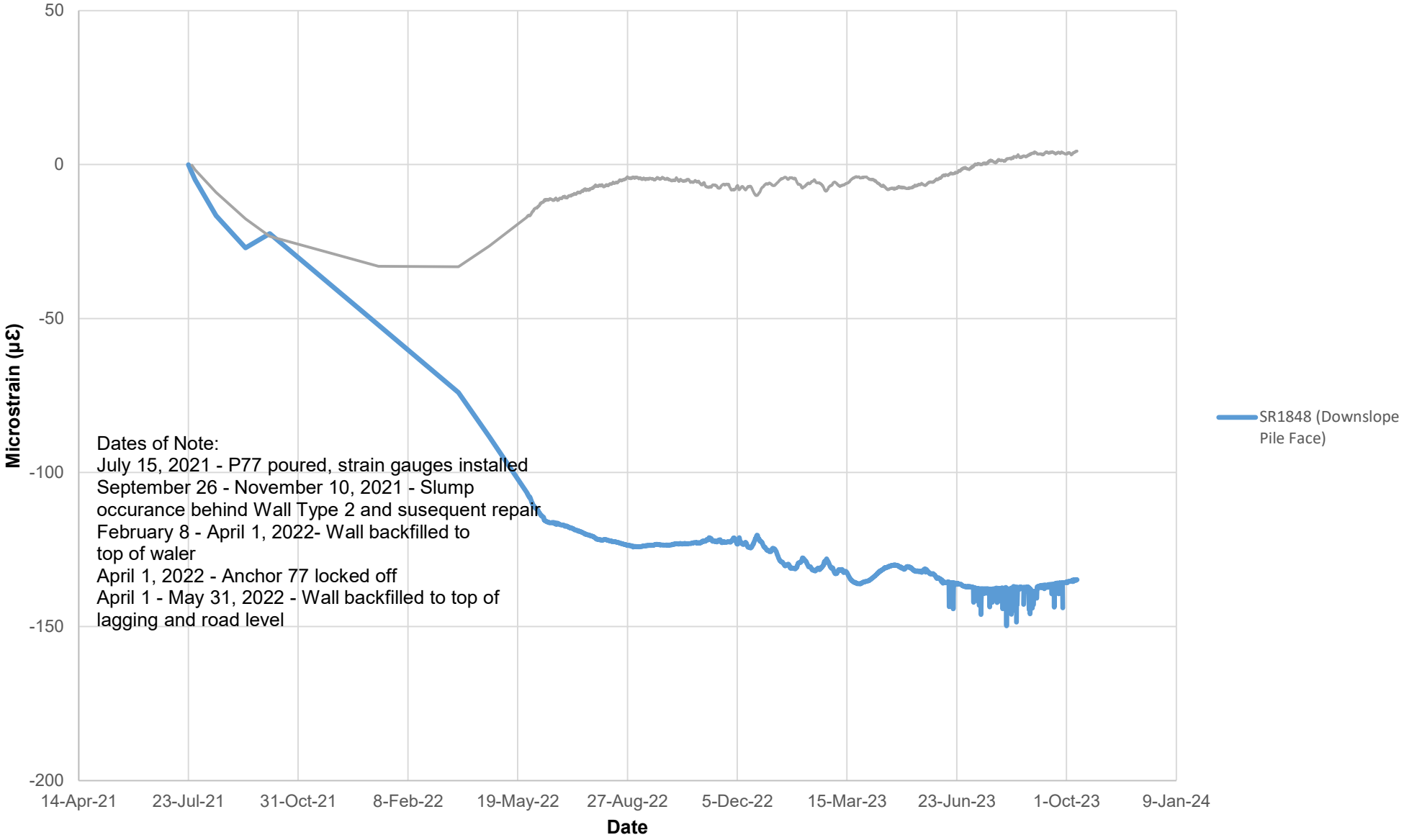


FIGURE PH009-7: PEACE RIVER SHOP SLIDE
P77 MAXIMUM STRAIN VS TIME (12.9 m DEPTH)

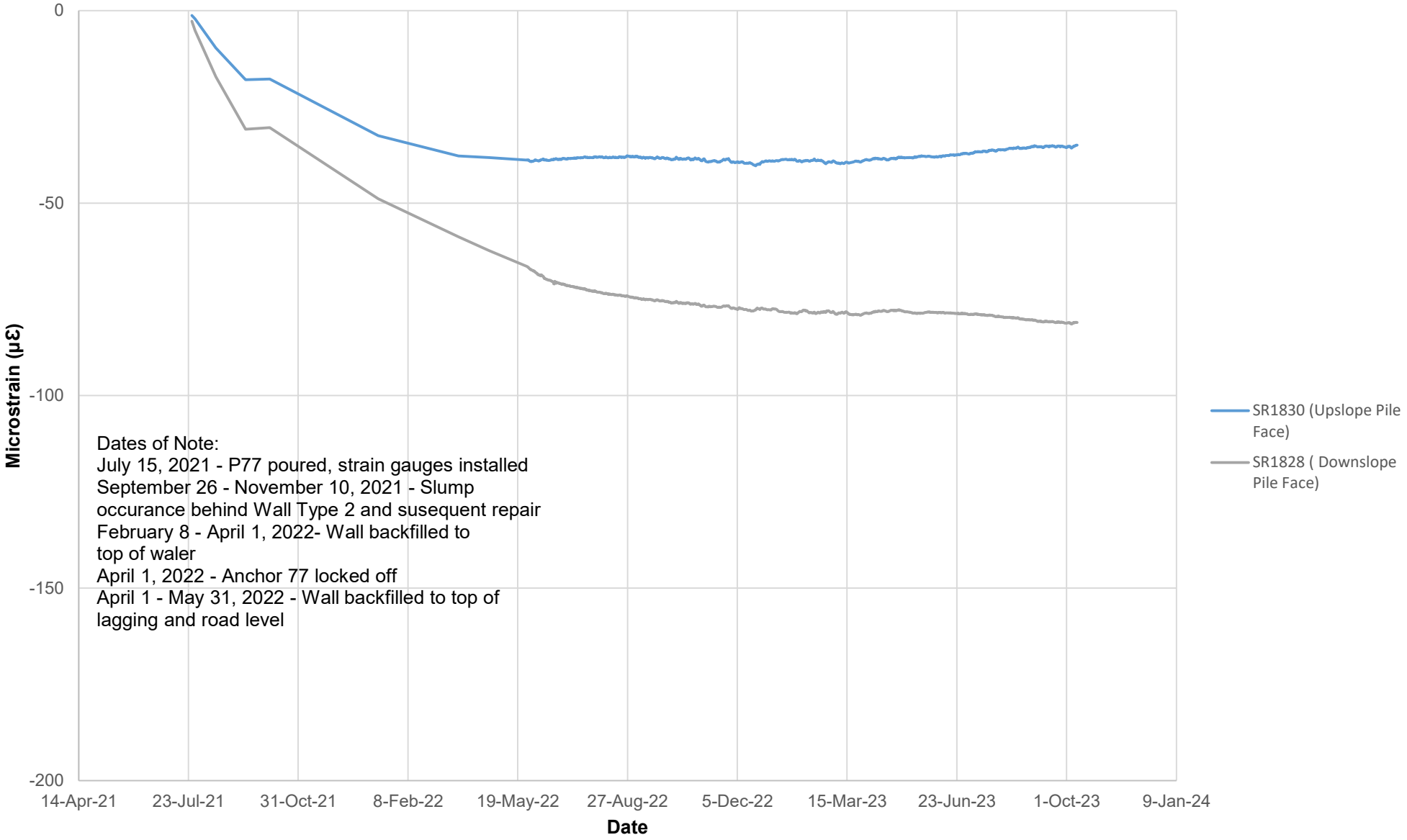


FIGURE PH009-8: PEACE RIVER SHOP SLIDE
P113 UPSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

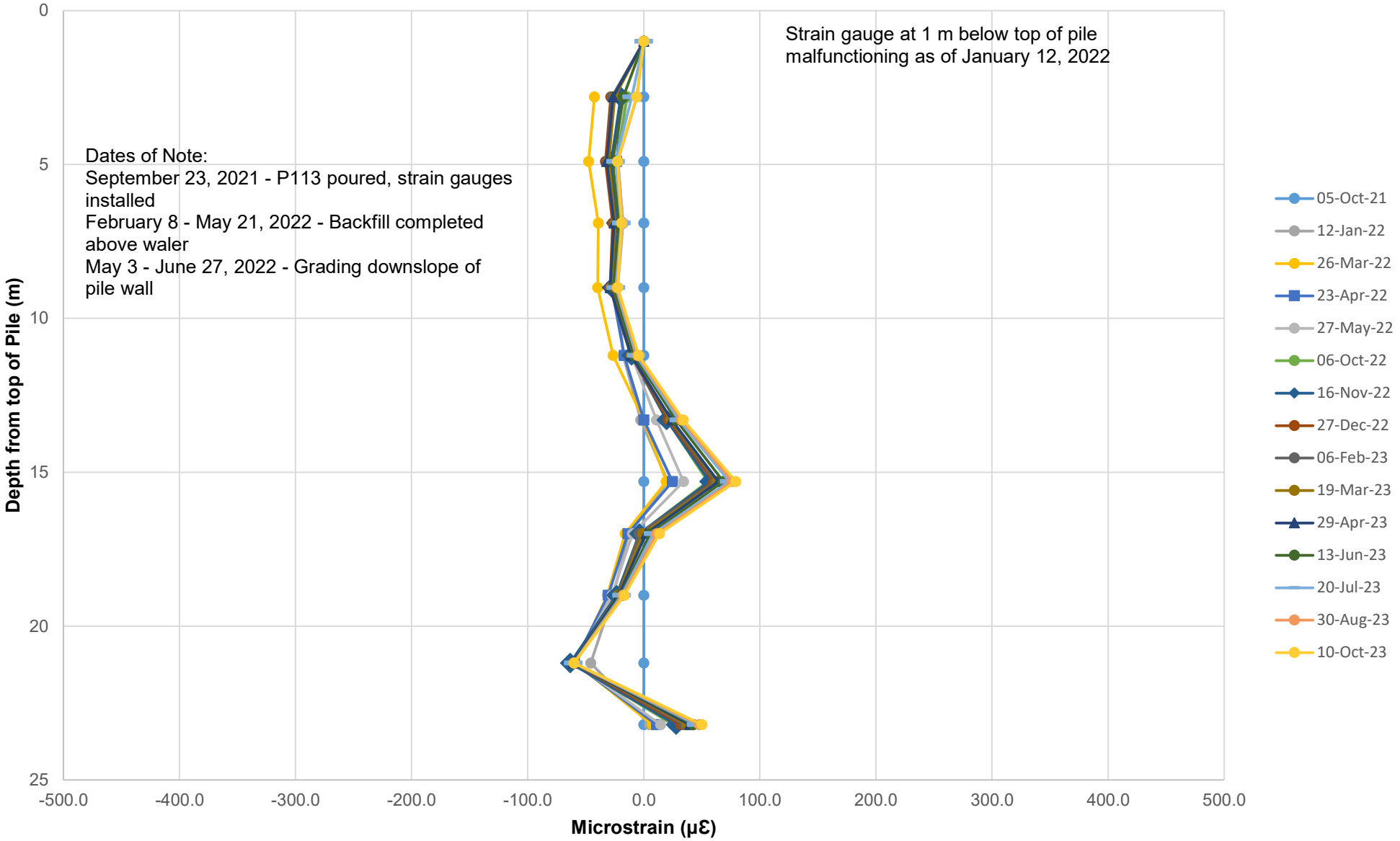


FIGURE PH009-9: PEACE RIVER SHOP SLIDE
P113 DOWNSLOPE SIDE STRAIN GAUGE VALUES VS DEPTH

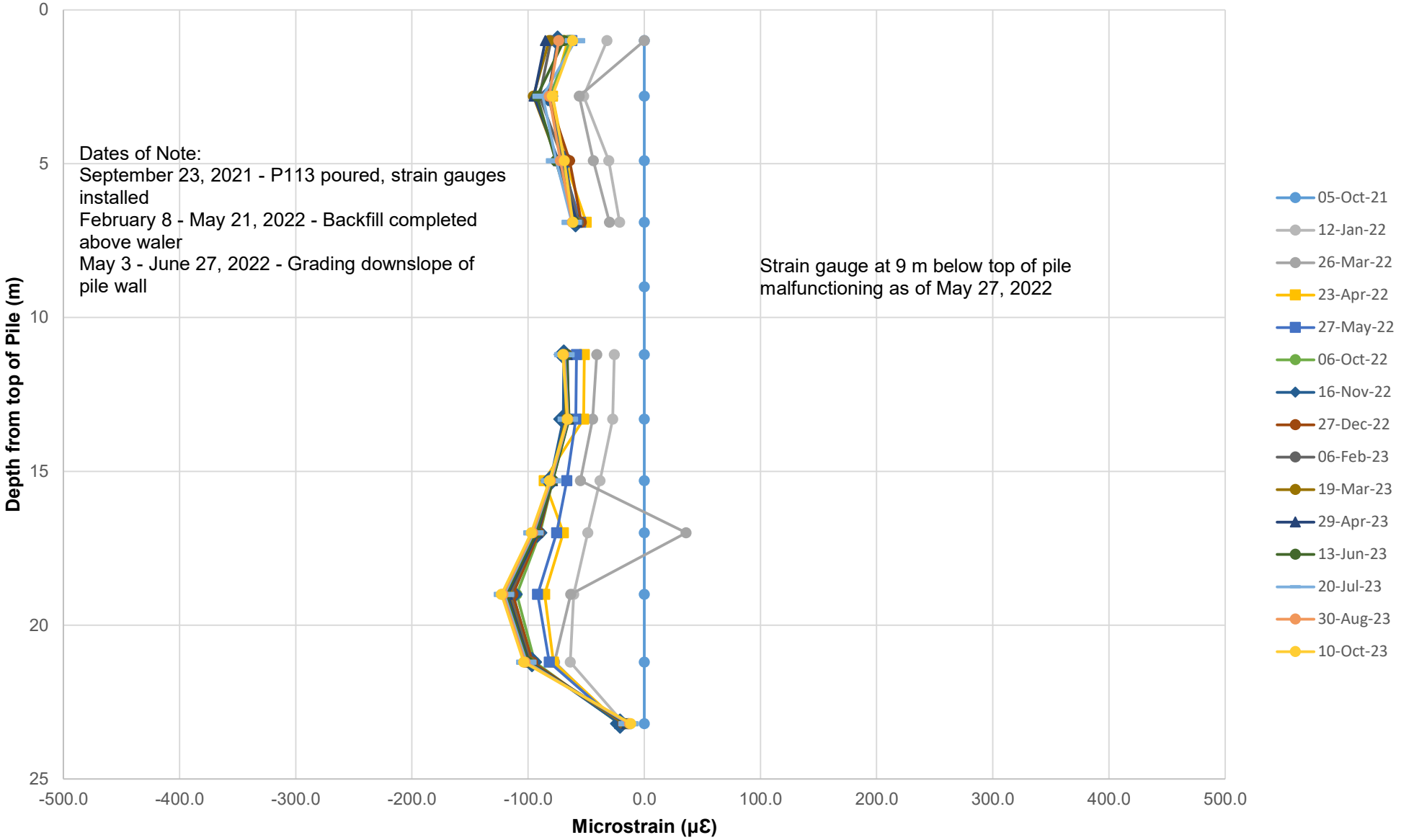


FIGURE PH009-10: PEACE RIVER SHOP SLIDE
P113 MAXIMUM STRAIN VS TIME (15.3 m DEPTH)

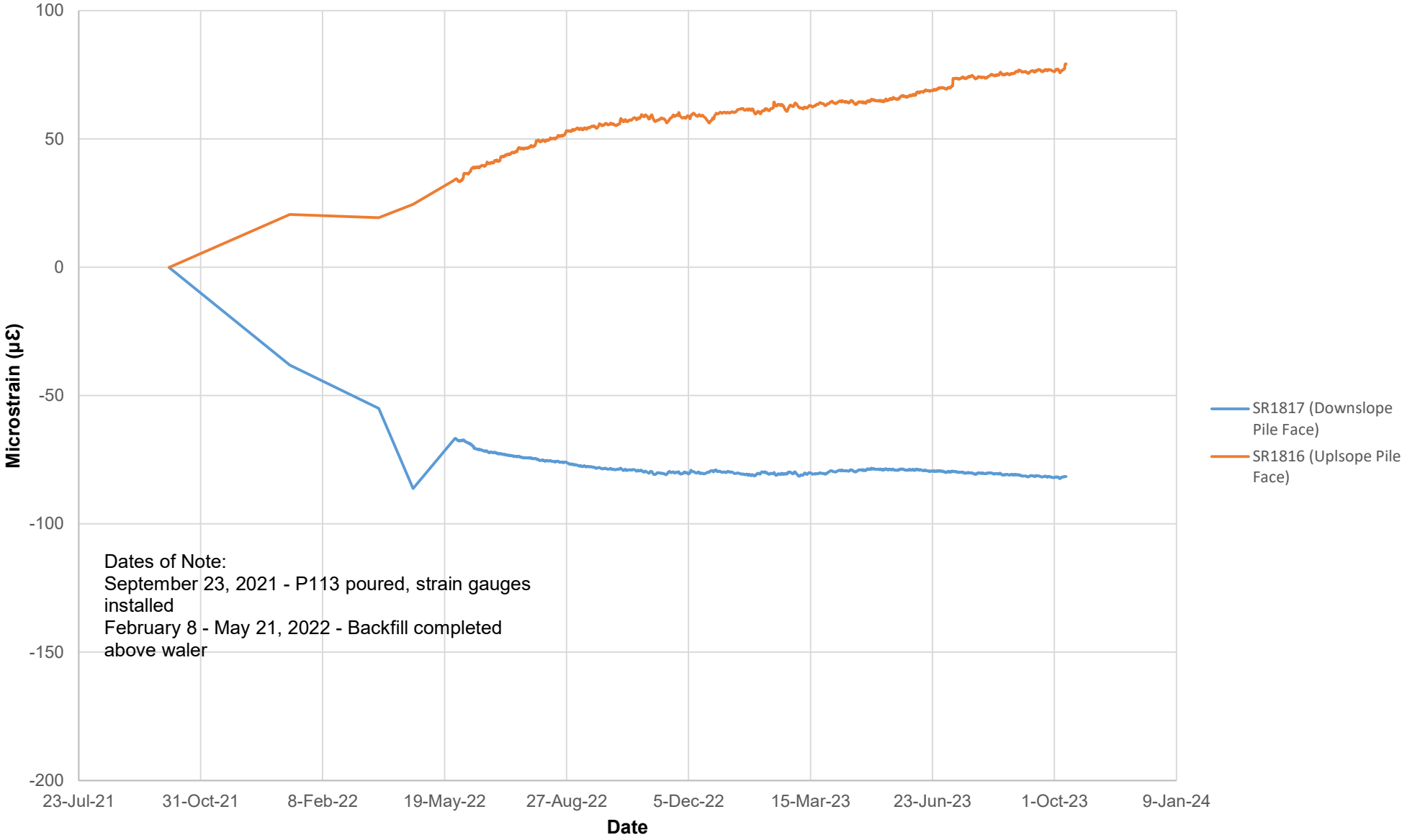


FIGURE PH009-11: PEACE RIVER SHOP SLIDE
P113 MAXIMUM STRAIN VS TIME (19.0 m DEPTH)

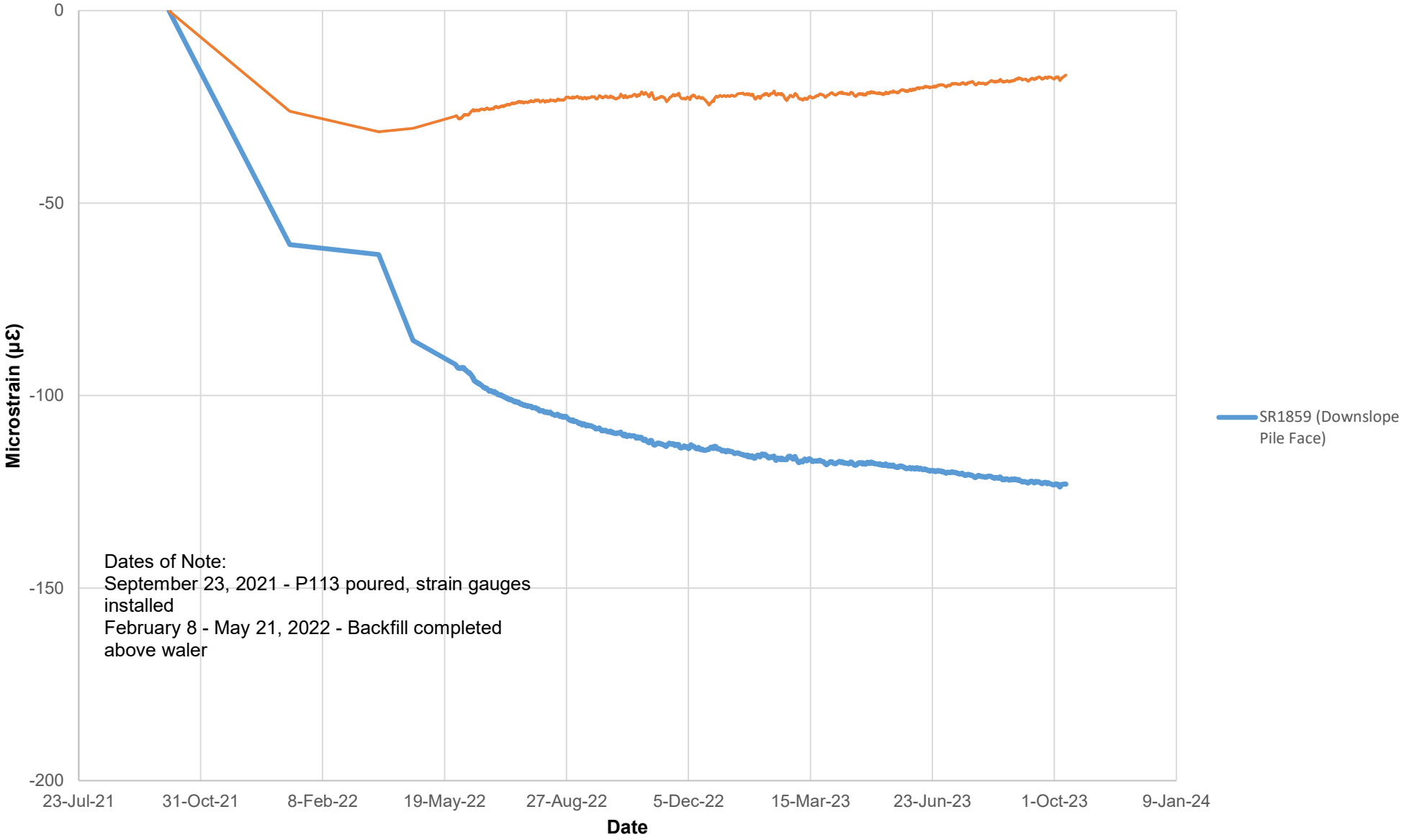


FIGURE PH009-12: PEACE RIVER SHOP SLIDE
P113 MAXIMUM STRAIN VS TIME (21.2 m DEPTH)

FIGURE PH009-13
OLD HWY 2:02 SHOP SLIDE LOAD CELL READINGS

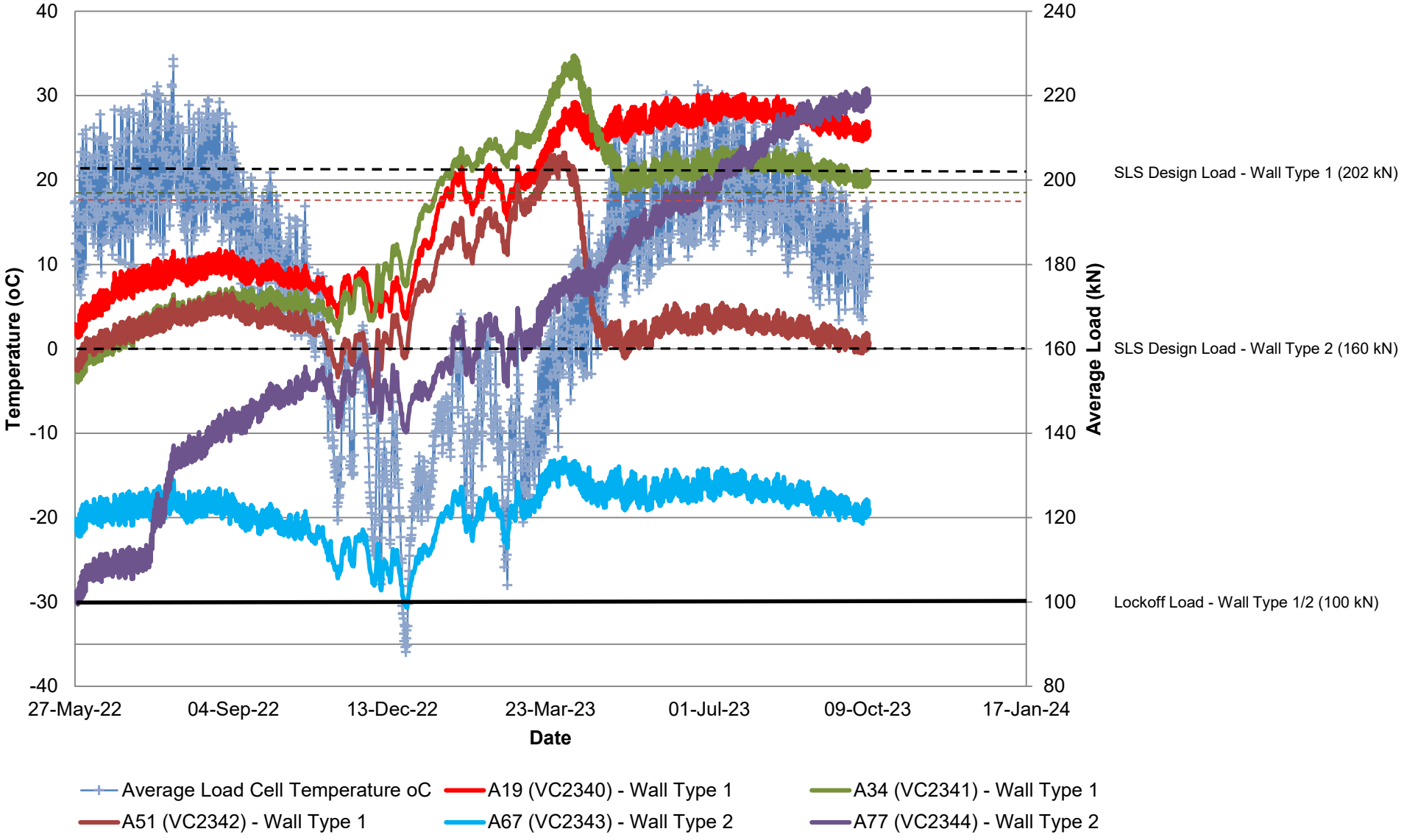


FIGURE PH009-14
STANDPIPE PIEZOMETER READINGS:
OLD HWY 2:02 SHOP SLIDE

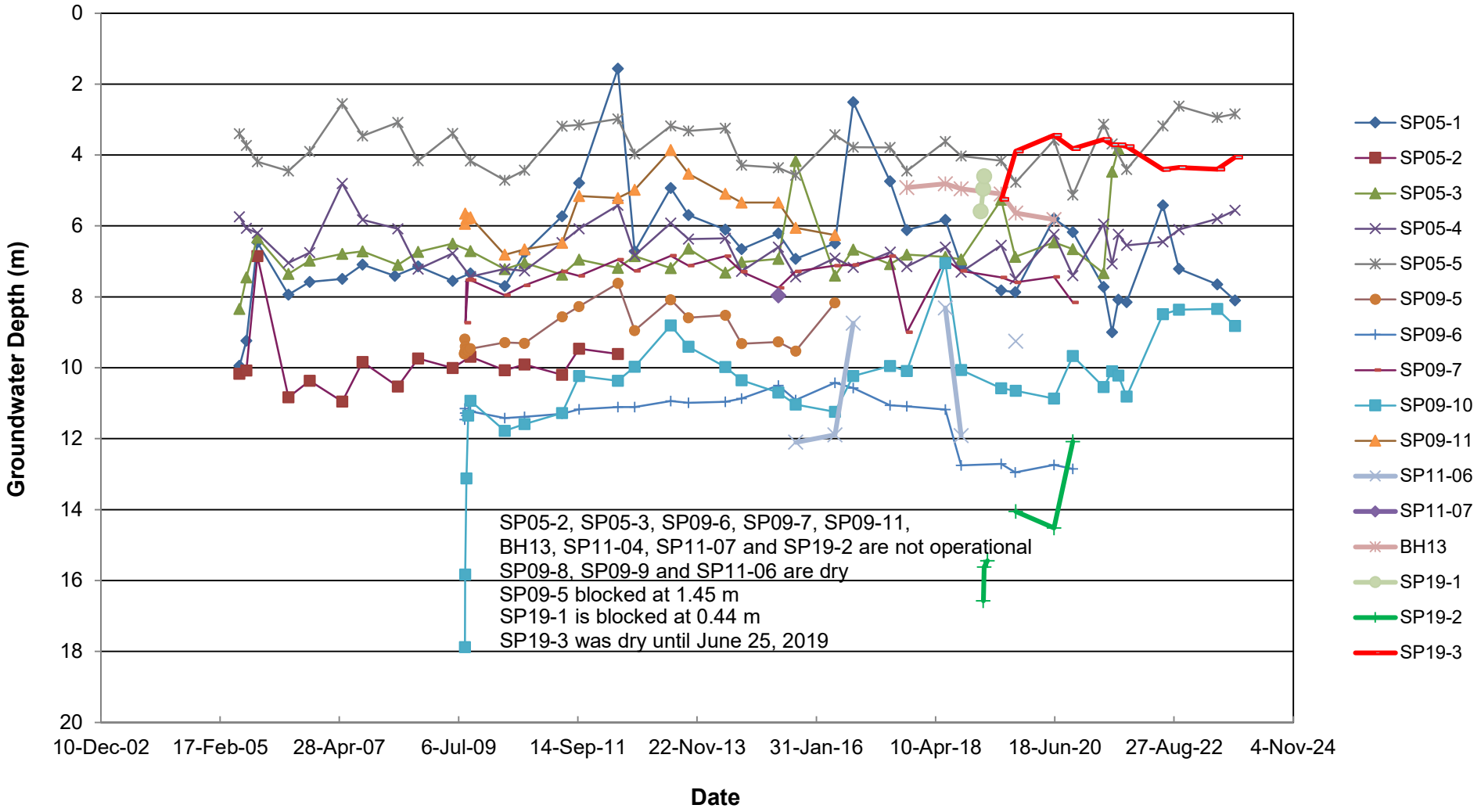


FIGURE PH009-15
VIBRATING WIRE PIEZOMETER DATA
OLD HWY 2:02 SHOP SLIDE

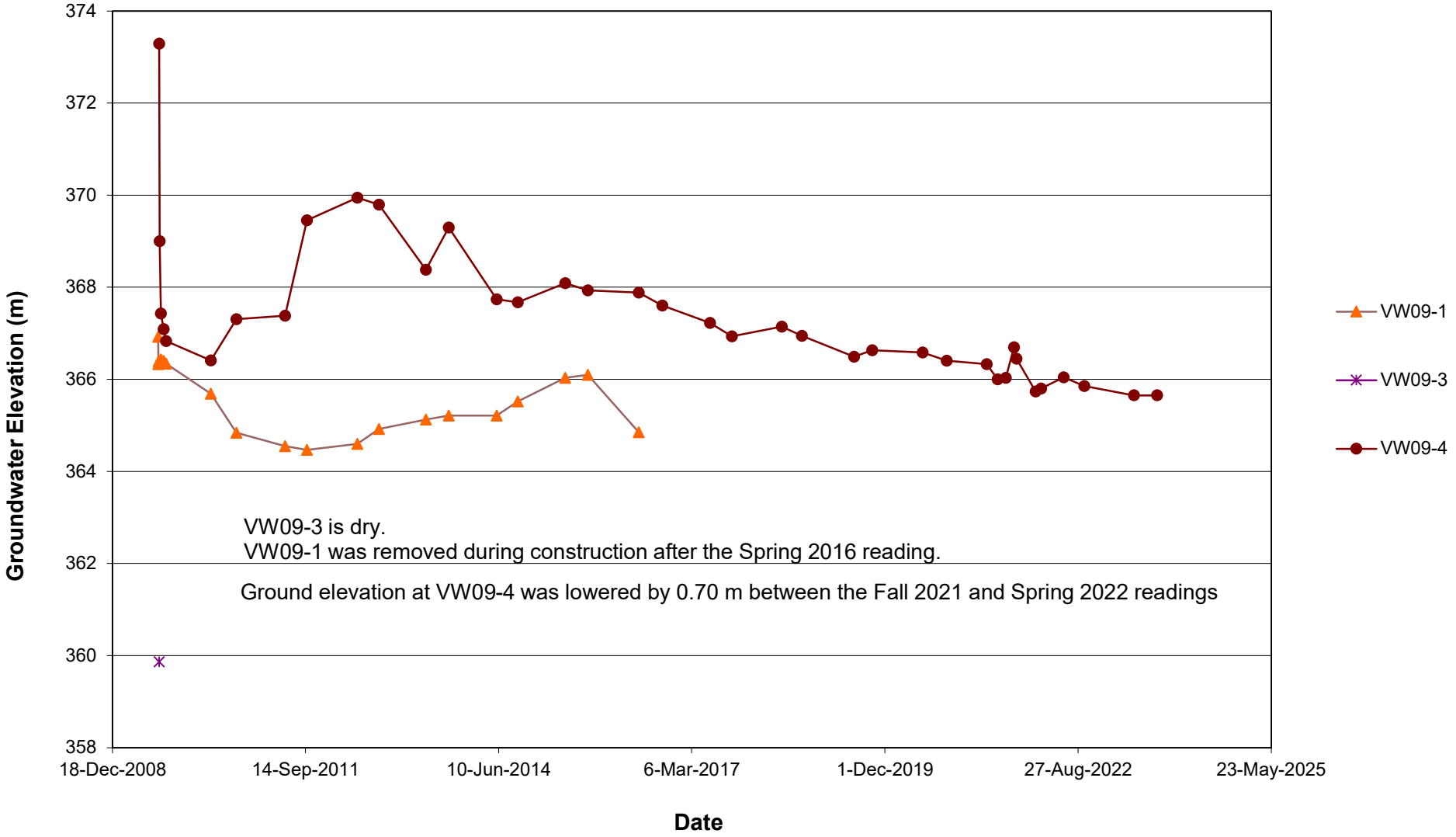


FIGURE PH009-16
PNEUMATIC PIEZOMETER READINGS: OLD HWY 2:02 (SHOP SLIDE)