

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS GRMP
NORTH CENTRAL (ATHABASCA AND FORT
McMURRAY DISTRICTS)
INSTRUMENTATION MONITORING - SPRING 2025**



Site Number	Location	Name	Hwy	km
NC104 (NC024-4)	HWY 41:23 C1 7.66	Kehiwin Lake	41:23	Km 7.7
Legal Description: 9-25-58-7 W4		UTM Co-ordinates		
		12U E 506556	N	5988265

Current Monitoring:	23-May-2025 to 24-May-2025	Previous Monitoring	6-June-2024
Instruments Read By:	Mr. Niraj Regmi, G.I.T and Mr. Godfred Etiendem, of Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs): SI12-11, SI15-15 to 17, SI15-20 to 21, SI16-1 to 7 , and SI17-1 to 4	Pneumatic Piezometers (PN): PN15-15A, PN15-16 to 18, and PB15-19 to 21	Vibration Wire Piezometers (VW): N/A	Standpipe Piezometers (SP): SP12-6, SP12-9, SP15-14, and SP15-18
Load Cell (LC): VC1982 to VC1989, and VC1993 to VC1997	Strain Gauges: SG138017001 to SG138017018	SAA: SAA17-1	Others:

Readout Equipment Used			
Slope Inclinometers: Two RST Digital Inclinator probes with 2 ft wheelbases and RST Pocket PC readouts	Pneumatic Piezometers: RST C108 pneumatic piezometer readout	Vibration Wire Piezometers:	Standpipe Piezometers: Heron dipmeter
Load Cell: Two RST DT2040 dataloggers	Strain Gauges: RST CR6 Datalogger	SAA: RST CR6 Datalogger	Others:
Notes: The battery of the south load cell datalogger was replaced; the north load cell datalogger has continued to operate intermittently since November 2023 . The strain gauge and SAA data were downloaded manually.			

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	Slope inclinometer SI15-15, installed in the highway east ditch within the southern limit of the site, showed a rate of movement of 0.3 mm/yr over 5.1 m to 6.9 m depth since the spring of 2024 readings. Slope inclinometers SI15-16 and SI15-21, installed along the west edge of the highway, showed a rate of movement of 0.6 mm/yr over 9.7 m to

	11.5 m depth and 0.5 mm/yr over 8.5 m to 10.4 m depth, respectively, since the spring of 2024 readings. Slope inclinometer SI12-11, installed at the bottom of the slope, showed a rate of movement of 0.4 mm/yr over 9.2 m to 12.3 m depth since the spring of 2024 readings. SI15-17 installed at the bottom of the slope showed a rate of movement of 1.2 mm/yr over 9.2 m to 11.0 m depth. SI15-20, also installed at the bottom of the slope, showed a rate of movement of 0.9 mm/yr over 8.6 m to 10.4 m depth since the spring of 2024 readings. For the tied-back pile wall, SI16-1, SI16-2, SI16-3, and SI16-5 have shown total pile head movements in the upslope direction of 8.3 mm, 3.7 mm, 2.7 mm, and 0.2 mm, respectively. SI16-6 has shown a total pile head movement of 4.5 mm in the downslope direction. SI16-7 has not shown any discernible movement since it was reinitialized on September 18, 2020. For the interim cantilever pile wall, SI17-1, SI17-2, and SI17-4 showed rates of movement over the length of their respective piles of less than 0.1 mm/yr, 0.7 mm/yr, and 0.8 mm/yr, respectively, since the spring of 2024 readings. SI17-3 showed no discernible movement over the length of the pile. SI17-1, SI17-2, SI17-3, and SI17-4 have shown total pile head movements of 6.2 mm, 8.9 mm, 16.0 mm and 11.7 mm, respectively, since they were initialized. Overall, the current rates of movement shown in the SIs were comparable to those observed in the SIs over the past several years, since the completion of pile wall construction. SAA17-1, installed in pile P146 of the NC104-4 wall extension (i.e., interim pile wall), showed an average rate of movement of 0.2 mm/yr since the spring of 2024 readings. SAA17-1 has shown a total pile head movement of 1.7 mm in the downslope direction since it was installed. The strain gauges installed at 6.35 m below the top of the pile on both the upslope and downslope pile faces were not functioning during the readings, and the strain gauge installed at 0.8 m on the upslope pile face was functioning intermittently. Overall, the strain gauges showed relatively small changes in micro-strain since the previous readings in the spring of 2024, except for the 0.8 m depth upslope strain gauge, which showed a decrease in total microstrain of 22.4 $\mu\epsilon$. This may be due to it not functioning correctly. The pneumatic piezometers showed changes in groundwater level ranging from an increase 0.25 m in PN15-16 to a decrease of 0.22 m in PN15-21 since the spring of 2024 readings. Standpipe piezometers SP12-6, SP12-9, and SP15-18 showed increases in groundwater levels of 0.01 m, 0.08 m, and 0.45 m, respectively since the spring of 2024. SP15-14 is still dry. The north load cell datalogger has been operating intermittently since November 20, 2023, so the most recent reading recorded was on May 13, 2025. The south load cell datalogger battery died on October 20, 2024, and was replaced on May 23, 2025. The readings were downloaded on May 24, 2025. The Load cells showed relatively small changes in measured load since the spring of 2024 readings. The change in load ranged from a
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	decrease in measured load by 1.82 kN in VC1985 to an increase in measured load by 2.96 kN in VC1993. Load cells VC1996 and VC1985 currently have only two vibrating wire channels properly functioning, and hence the readings for these instruments are somewhat skewed when compared to the previous readings. Overall, the load cells are currently registering a trend of stable to slowly increasing measured loads, with seasonably higher loads measured during the winter months. Overall, the instrument readings show that the pile walls constructed in 2016-2017 have been effective in stabilizing the landslide movements. However, the readings of the interim pile wall instruments should be checked at least once a year and compared to the warning threshold values.
Future Work:	All instruments should be read again in the spring of 2026.
Instrumentation Repairs:	The battery of the north load cell datalogger should be tested, and the datalogger and wires should also be inspected to confirm the source of the ongoing issue. If it is a battery related issue, the battery should be replaced to enable readings to continue after the spring of 2024. If it isn't the battery or the wires, consideration should be given to replacing the datalogger. Consideration should be given to replacing the modem in the SAA and strain gauge datalogger, to allow for remote download.
Additional Comments:	

Attachments:	• Table NC104-1 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Slope Inclinator Instrumentation Reading Summary • Table NC104-2 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Shape Accelerometer Array Instrumentation Reading Summary • Table NC104-3 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Vibrating Wire Strain Gauge Instrumentation Reading Summary • Table NC104-4 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Pneumatic Piezometer Instrumentation Reading Summary • Table NC104-5 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Standpipe Piezometer Instrumentation Reading Summary • Table NC104-6 Spring 2025 – HWY 41:23 Kehiwin Lake (Km 7.7), Vibrating Wire Load Cell Instrumentation Reading Summary • Statement of Limitations and Conditions • APPENDIX A – NC104-1 SPRING 2025 ○ Field Inspector's report ○ Site Plan Showing Approximate Instrument Locations (Drawing No. 32122-NC104)
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	○ SI Reading Plots ○ Figures NC104-1 and NC104-2 (Strain Gauge Readings) ○ Figures NC104-3 and NC104-4 (Piezometric Depths) ○ Figures NC104-5 to NC104-8 (Load Cell Readings)
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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.
Tarek Abdelaziz, Ph.D., P. Eng.
Partner | Senior Geotechnical Engineer

Lucas Green, P.Eng.
Geotechnical Engineer

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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3. BASIS OF REPORT

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.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

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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The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Table NC104-1: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Slope Inclinometer Instrumentation Reading Summary

Date Monitored: May 23, 2025

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	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)
SI12-11	December 14, 2012	20.7 over 9.2 m to 12.3 m depth in 286° direction	22.8 in September 2014	Operational	June 6, 2024	0.4	0.4	3.0
SI15-15	August 20, 2015	22.7 over 5.1 m to 6.9 m depth in 297° direction	11.9 in September, 2017	Operational	June 6, 2024	0.3	0.3	1.2
SI15-16	August 20, 2015	29.3 over 9.7 m to 11.5 m depth in 299° direction	45.9 in September, 2017	Operational	June 6, 2024	0.6	0.6	1.3
SI15-17	August 20, 2015	29.3 over 9.2 m to 11.0 m depth in 275° direction	35.0 in September, 2017	Operational	June 6, 2024	1.1	1.2	1.6
SI15-20	August 20, 2015	31.2 over 8.6 m to 10.4 m depth in 270° direction	37.9 in September, 2017	Operational	June 6, 2024	0.9	0.9	1.4
SI15-21	August 20, 2015	20.2 over 8.5 m to 10.4 m depth in 323° direction	12.6 in September, 2017	Operational	June 6, 2024	0.5	0.5	0.1
SI16-1 (P06)	October 19, 2016	-8.3 over 2.7 m to 17.3 m depth in 274° direction	25.8 in January, 2017	Operational	June 6, 2024	No discernible movement	N/A	-4.7
SI16-2 (P28)	October 19, 2016	-3.7 over 2.7 m to 17.4 m depth in 29° direction	30.7 in January 2017	Operational	June 6, 2024	No discernible movement	N/A	>-0.1

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table NC104-1 – Continued: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Slope Inclinator Instrumentation Reading Summary

Date Monitored: May 23, 2025

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	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)
SI16-3 (P47)	October 19, 2016	-2.7 over 2.9 m to 14.5 m depth in 299° direction	65.6 in November 2016	Operational	June 6, 2024	0.6	0.7	1.1
SI16-5 (P83)	October 19, 2016	-0.2 over 2.9 m to 14.4 m depth in 319° direction	56.2 in November 2016	Operational	June 6, 2024	1.3	1.3	1.8
SI16-6 (P101)	September 7, 2016	4.5 over 2.9 m to 17.5 depth in 298° direction	36.7 in October 2016	Operational	June 6, 2024	0.4	0.4	0.3
SI16-7 (P122)	Reinitialized September 18, 2020	No discernible movement	N/A	Operational	June 6, 2024	N/A	N/A	N/A
SI17-1 (P130)	September 13, 2017	6.2 over 2.6 m to 17.8 m depth in 276° direction	8.4 in April 2018	Operational	June 6, 2024	<0.1	<0.1	-0.8
SI17-2 (P160)	September 13, 2017	8.9 over 2.6 m to 17.8 m depth in 295° direction	20.8 in September 2017	Operational	June 6, 2024	0.6	0.7	2.7
SI17-3 (P173)	July 9, 2017	16.0 over 2.6 m to 17.8 m depth in 323° direction	65.9 in July 2017	Operational	June 6, 2024	No discernible movement	N/A	0.1
SI17-4 (P186)	September 27, 2017	11.7 over 2.7 m to 17.3 m depth in 303° direction	8.8 in May 2018	Operational	June 6, 2024	0.8	0.8	0.5

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table NC104-2: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Shape Accelerometer Array Instrumentation Reading Summary

Date Monitored: May 23, 2025

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 SINCE PREVIOUS READING (mm/yr)	CHANGE IN AVERAGE RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SAA17-1 (P146)	September 27, 2017	1.7 mm over 3.1 m to 18.6 m depth	Operational	June 6, 2024	0.2	0.2	0.6

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table-NC104-3: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Vibrating Wire Strain Gauge Instrumentation Reading Summary

Date Monitored: May 23, 2025

DEPTH FROM TOP OF PILE P146 (m)	GAUGE #	TOTAL MICROSTRAIN ($\mu\epsilon$)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READING ($\mu\epsilon$)	THRESHOLD WARNING MICROSTRAIN ($\mu\epsilon$)	GAUGE #	TOTAL MICROSTRAIN ($\mu\epsilon$)	CHANGE IN MICROSTRAIN SINCE PREVIOUS READING ($\mu\epsilon$)	THRESHOLD WARNING MICROSTRAIN ($\mu\epsilon$)
	UPSLOPE PILE FACE				DOWNSLOPE PILE FACE			
0.8	138017001	-1.8	-22.4	1000	138017002	-9.3	1.7	-350
2.65	138017003	-49.2	0.9	1000	138017004	-37.9	1.9	-350
4.5	138017005	-41.2	1.9	1200	138017006	-9.5	1.3	-430
6.35	138017007	No Reading	N/A	1200	138017008	No Reading	N/A	-430
8.2	138017009	64.6	-0.1	1200	138017010	14.5	-0.1	-430
10.05	138017011	71.2	1.6	1200	138017012	-2.4	-0.7	-430
11.9	138017013	105.2	2.0	1200	138017014	53.6	-0.3	-430
13.75	138017015	12.2	1.8	1000	138017016	10.5	0.7	-350
15.6	138017017	30.7	0.9	1000	138017018	18.4	0.7	-350

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site; Negative values are compressive strains.

Table NC104-4: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: May 23, 2025

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER LEVEL BGS (m)	PREVIOUS GROUNDWATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN15-15A	August 20, 2015	6.1	-	Active	4.63 in May, 2017	6.2	5.47	5.52	0.05
PN15-16	August 20, 2015	8.4	-	Active	6.41 in September, 2018	13.1	7.04	7.29	0.25
PN15-17	August 20, 2015	12.2	-	Active	2.30 in May, 2020	90.8	2.93	3.0	0.07
PN15-19	August 20, 2015	9.1	-	Active	3.17 in September, 2016	35.2	5.55	5.53	-0.02
PN15-20	August 20, 2015	11.4	-	Active	1.29 in May, 2020	91.1	2.14	1.94	-0.20
PN15-21	August 20, 2015	9.1	-	Active	3.08 in May, 2019	41.4	4.92	4.70	-0.22

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table NC104-5: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Standpipe Piezometer Instrumentation Reading Summary

Date Monitored: May 23, 2025

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER LEVEL BGS (m)	CURRENT GROUNDWATER DEPTH BGS (m)	PREVIOUS GROUNDWATER DEPTH BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP12-6	December 14, 2012	18.5	-	Operational	2.21 in September 2014	3.24	3.25	0.01
SP12-9	December 14, 2012	11.5	-	Operational	0.96 in May 2017	3.18	3.26	0.08
SP12-12	December 14, 2012	14.6	-	Destroyed	0.79 in May 2017	N/A	1.56 (May 25, 2023)	N/A
SP15-14	August 20, 2015	2.47	-	Operational	N/A	DRY	DRY	N/A
SP15-18	August 20, 2015	14.78	-	Operational	0.00 in May 2020	1.92	2.37	0.45

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Table NC104-6: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Vibrating Wire Load Cell Instrumentation Reading Summary

Date Monitored: May 24, 2025

LOAD CELL SERIAL #	ANCHOR NUMBER	DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD ⁽¹⁾ (kN)	PREVIOUS RECORDED LOAD ⁽¹⁾ (June 6, 2024) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
VC1990	G001S	340/272	212.21 on Mach 21, 2017	190.51 (May 13, 2025)**	188.61	1.90
VC1982	G007U	340/272	225.14 on March 19, 2017	212.36 (May 13, 2025)**	211.50	0.86
VC1992	G007L	340/272	210.61 on March 5, 2017	193.39 (May 13, 2025)**	192.81	0.58
VC1993	G029U	340/272	192.34 on March 20, 2017	180.15 (May 13, 2025)**	177.19	2.96
VC1991	G029L	340/272	200.00 on March 22, 2017	183.79 (May 13, 2025)**	182.81	0.98
VC1997	G049U	340/272	229.65 on February 26, 2021	227.30 (May 13, 2025)**	225.32	1.98
VC1996	G049L	340/272	203.17* on January 27, 2023	204.15* (May 13, 2025)**	203.11*	1.04
VC1995	G070U	340/272	222.22 on March 22, 2017	203.10	201.40	1.70
VC1994	G070L	340/272	237.72 on March 23, 2017	228.08	226.57	1.51
VC1984	G087U	340/272	229.59 on March 25, 2017	207.15	205.29	1.86
VC1983	G087L	340/272	250.46 on March 25, 2017	244.97	243.71	1.26

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes:

- 1) Load cell data is recorded daily with datalogger on site. Dataloggers are uploaded annually during instrumentation readings.
- 2) The battery in the north load cell datalogger died on November 20, 2023, and the battery in the south load cell datalogger died on October 20, 2024. The datalogger was powered externally to download the Spring 2024 readings on June 6, 2024.
- 3) * Only two wires were functioning since the spring 2023 readings, the average load was the average of the two functioning wires.
- 4) **The recorded loads from the North datalogger load cells are from May 13, 2025, as the datalogger is reading sporadically.

Table NC104-6 – Continued: Spring 2025 – Hwy 41:23 Kehiwin Lake (Km 7.7) Vibrating Wire Load Cell Instrumentation Reading Summary

Date Monitored: May 24, 2025

LOAD CELL SERIAL #	ANCHOR NUMBER	DESIGN LOAD / LOCK-OFF LOAD (kN)	MAXIMUM RECORDED LOAD (kN)	RECORDED LOAD ⁽¹⁾ (kN)	PREVIOUS RECORDED LOAD ⁽¹⁾ (June 6, 2024) (kN)	CHANGE IN LOAD SINCE PREVIOUS READING (kN)
VC1985	G106U	340/272	231.15 on March 27, 2017	217.77*	219.59*	-1.82
VC1986	G106L	340/272	227.51 on March 24, 2017	214.55	213.82	0.73
VC1987	G126U	340/272	227.34 on February 25, 2021	220.56	220.18	0.38
VC1989	G126L	340/272	261.03 on January 18, 2022	257.54	256.58	0.96
VC1988	G132S	340/272	248.82 on February 1, 2022	247.09	245.67	1.42

Drawing 32122-NC104 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes:

- 1) Load cell data is recorded daily with datalogger on site. Dataloggers are uploaded annually during instrumentation readings.
- 2) The battery in the north load cell datalogger died on November 20, 2023, and the battery in the south load cell datalogger died on October 20, 2024. The datalogger was powered externally to download the Spring 2024 readings on June 6, 2024.
- 3) *Only two wires were functioning since the spring 2023 readings, the average load was the average of the two functioning wires.



**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022163)
NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2025

**APPENDIX A
DATA PRESENTATION AND SITE PLANS**

SITE NC104 (NC024-4): HWY 41:23 KEHIWIN LAKE

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC104)
SPRING 2025**

Location: Kehiwin Lake (HWY41:23 C1 7.666)
File Number: 32122

Probe: RST SET 5R and 8R
Cable: RST SET 5R and 8R

Readout: RST C109 Unit 8, DGS1 Dipmeter

Casing Diameter: 2.75"

Temp (deg C) : 15

Read by: NKR/GE

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 12)		Date	Stickup (m)	Depth from top of CASING (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Size (")	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-			
SI12-11	506555.99	5988265.01	23-May-25	0.85	62 to 2	278	468	-450	-278	284	8R/8R	2.75	
SI15-15	506537.94	5988152.50	23-May-25	0.72	48 to 2	299	-430	443	143	-167	5R/5R	2.75	
SI15-16	506518.93	5988168.05	23-May-25	0.36	68 to 2	273	-303	320	722	-718	8R/8R	2.75	
SI15-17	506502.55	5988175.82	23-May-25	0.87	64 to 2	257	1643	-1682	-853	820	5R/5R	2.75	
SI15-20	506498.70	5988117.95	23-May-25	0.85	68 to 2	272	-526	536	-353	329	5R/5R	2.75	
SI15-21	506465.37	5988066.73	23-May-25	0.92	68 to 2	305	-764	776	458	-477	5R/5R	2.75	
SI16-1	506677.30	5990167.86	23-May-25	0.65	58 to 2	291	963	-906	893	-892	8R/8R	2.75	Pile Wall NC24C (Labelled as P06)
SI16-2	506653.91	5990135.91	23-May-25	0.63	58 to 2	355	741	-749	1026	-1025	8R/8R	2.75	Pile Wall NC24C (Labelled as P28)
SI16-3	506633.17	5990107.58	23-May-25	0.42	48 to 2	286	373	-360	1420	-1422	8R/8R	2.75	Pile Wall NC24C (Labelled as P47) (Repaired / Initialized)
SI16-5	506592.58	5990052.14	23-May-25	0.49	48 to 2	314	488	-472	-273	274	8R/8R	2.75	Pile Wall NC24C (Labelled as P83)
SI16-6	506573.96	5990026.72	23-May-25	0.50	58 to 2	289	382	-364	-684	687	8R/8R	2.75	Pile Wall NC24C (Labelled as P101) (Repaired / Initialized)
SI16-7	506551.63	5989996.22	23-May-25	1.32	58 to 2	265	-90	104	-534	539	8R/8R	2.75	Pile Wall NC24C (Labelled as P122) (Repaired / Initialized)
SI17-1	506540.94	5988185.77	23-May-25	0.78	60 to 2	283	3	15	-44	45	8R/8R	2.75	NC24C Extension (Labelled as P130) ((Repaired / Initialized)
SI17-2	506509.43	5988142.83	23-May-25	0.78	60 to 2	307	191	-180	674	-694	5R/5R	2.75	NC24C Extension (Labelled as P160)
SI17-3	506495.67	5988122.42	23-May-25	0.76	60 to 2	295	-283	287	-1933	1912	5R/5R	2.75	NC24C Extension (Labelled as P173)*
SI17-4	506482.48	5988101.32	23-May-25	0.67	58 to 2	305	-205	223	-17	-8	5R/5R	2.75	NC24C Extension (Labelled as P186)

INSPECTOR REPORT

SAA and straining gauges are connected to a modem for remote download - no need to take manual readings any more

* Stiff at 10 ft.

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC104)
SPRING 2025**

Location: Kehiwin Lake (HWY41:23 C1 7.666)
File Number: 32122

Readout: RST C109 Unit 8, DGSi Dipmeter
Temp (deg C): 15/ Rain
Read by: NKR/GE

PNEUMATIC PIEZOMETER (PN) READINGS

PN #	GPS Location (UTM 12)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN15-15A	506537.29	5988151.39	23-May-25	6.2	36686
PN15-16	Attached to SI15-16		23-May-25	13.1	36687
PN15-17	Attached to SI15-17		23-May-25	90.8	36680
PN15-19	Attached to SI15-19		23-May-25	35.2	36684
PN15-20	Attached to SI15-20		23-May-25	91.1	36681
PN15-21	Attached to SI15-21		23-May-25	41.4	36690

STANDPIPE PIEZOMETER (SP) READINGS

SP#	GPS Location (UTM 12)		Date	Stick-up (m)	Water level below top of pipe (m)	Total length of pipe (m)
	Easting (m)	Northing (m)				
SP12-6	506613.00	5988323.00	23-May-25	0.99	4.23	19.14
SP12-9	506601.99	5988238.04	23-May-25	0.93	4.11	12.31
SP12-12	506564.99	5988193.04	23-May-25	1.12	**	15.54
SP15-14	506531.96	5988218.14	23-May-25	0.98	Dry	3.45
SP15-18	506500.66	5988121.29	23-May-25	0.85	2.77	14.78

VIBRATING WIRE LOAD CELL (VC) READINGS

VC#	GPS Location (UTM 11)		Datalogger Serial #	Date	Remarks
	Easting (m)	Northing (m)			
VC1983-89, VC1994-95	506570.06	5988227.65	RST 2202	23-May-25	Data downloaded
VC1982, VC1990- 1993, VC1996-97	506666.83	5988360.52	RST 2203	23-May-25	Data downloaded

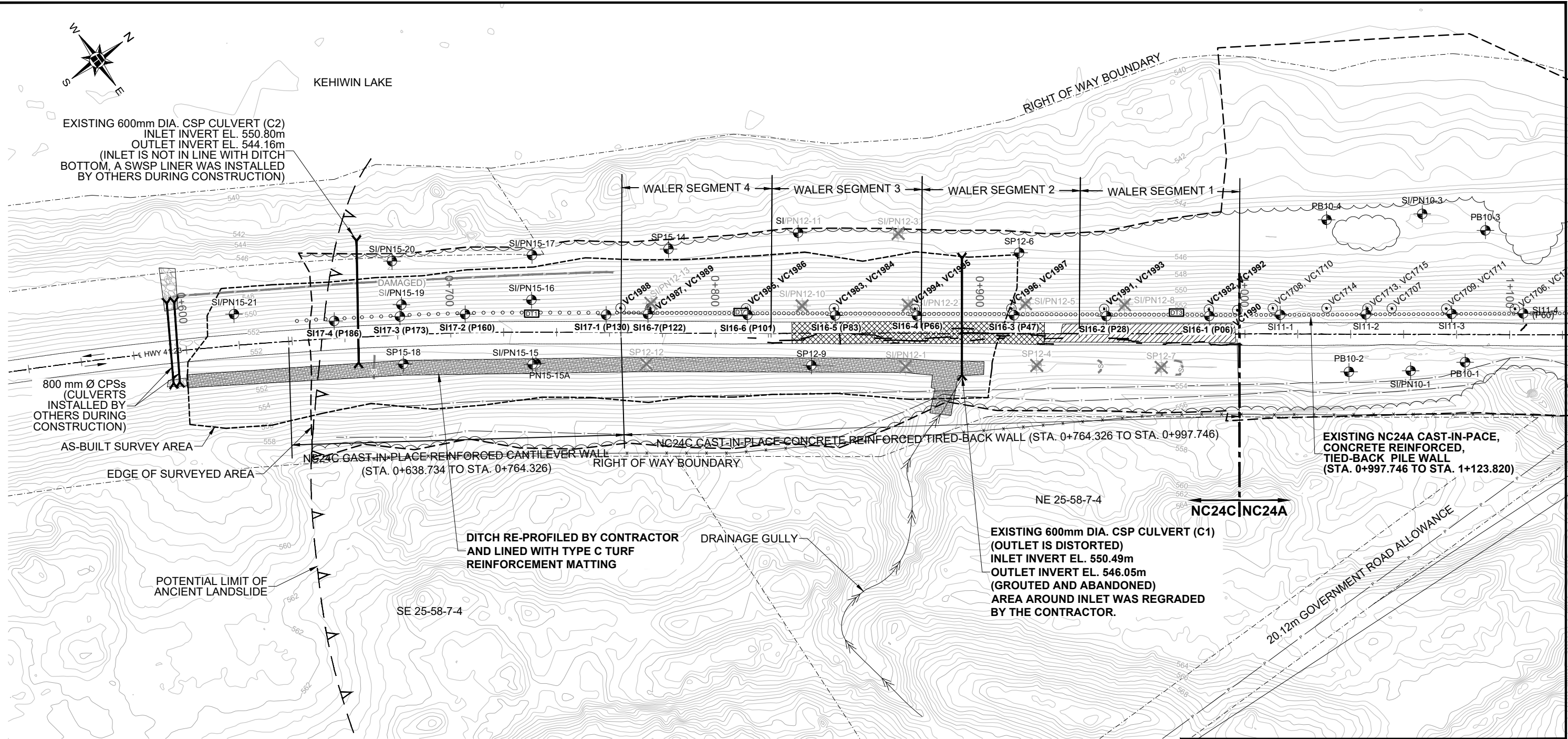
INSPECTOR REPORT

**** Rundown by lawn mower, stickup protector sunk 4 ft in the ground and bent at top. IF repair needed, will need mechanical excavation.**

RST 2202 datalogger reading erratic reading informed PE see data file

RST 2203 datalogger battery down, replaced battery and down

See photograph, bird was nesting inside datalogger , removed bird nest, will have to plug the hole under the cabinet where the cable goes inside the cabinet.



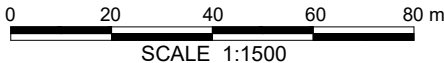
LEGEND

- | | | | |
|--------|--------------------------------|-------|-----------------------------------|
| oooooo | PILE WALL | —550— | GROUND SURFACE CONTOUR |
| —x—x— | FENCE LINE | —P— | OVERHEAD POWER LINE (APPROXIMATE) |
| —w—w— | BUSH LINE | —T— | TELUS LINE (APPROXIMATE) |
| — — — | ACTIVE SLIDE CRACKS ON HIGHWAY | —S— | SILT FENCE |
| ⊙ | TEST HOLE LOCATION | ⊙ | VIBRATING WIRE LOAD CELL LOCATION |
| ⊗ | DAMAGED INSTRUMENT | ▨ | PAVEMENT DISTRESS AREA |
| SI | SLOPE INCLINOMETER | ▧ | ACP PATCH (OLD) |
| PN | PNEUMATIC PIEZOMETER | ▩ | RIP RAP |
| SP | STANDPIPE PIEZOMETER | | |
| PB | POORBOY | | |
| VC | VIBRATING WIRE LOAD CELL | | |
| SAA | SHAPE ACCELEROMETER ARRAY | | |
| □ | DATALOGGER | | |

Load Cell Serial #	Anchor
VC1990	G0001S
VC1982	G007U
VC1992	G007L
VC1993	G029U
VC1991	G029L
VC1997	G049U
VC1996	G049L
VC1995	G070U
VC1994	G070L
VC1984	G087U
VC1983	G087L
VC1985	G106U
VC1986	G106L
VC1987	G126U
VC1989	G126L
VC1988	G132S

NOTES:

1. CONTOUR INTERVAL IS 0.5m.
2. CONTOURS INSIDE SURVEYED AREA WERE SURVEYED BY WSP. ELEVATION CONTOURS OUTSIDE SURVEYED AREA WERE DERIVED FROM LIDAR DATA.
3. THE LOCATION OF THE END OF THE NC24A WALL IS APPROXIMATE.
4. INSTRUMENTS AND DATALOGGERS INSTALLED DURING CONSTRUCTION ARE SHOWN IN BOLD.
5. SHAPE ACCELEROMETER ARRAY AND STRAIN GAUGES ARE CONNECTED TO DT1 (CAMPBELL SCIENTIFIC CR6 DATALOGGER, SERIAL No. 5839); LOAD CELLS VC1983 - VC1989, VC1994, VC1995 ARE CONNECTED TO DT2 (RST DT2040 DATALOGGER, SERIAL No. 2202); AND LOAD CELLS VC1982, VC1990 - VC1993, VC1996, VC1997 ARE CONNECTED TO DT3 (RST DT2040 DATALOGGER, SERIAL No. 2203).
6. SHAPE ACCELEROMETER ARRAY AND STRAIN GAUGES ARE INSTALLED IN PILE P146.



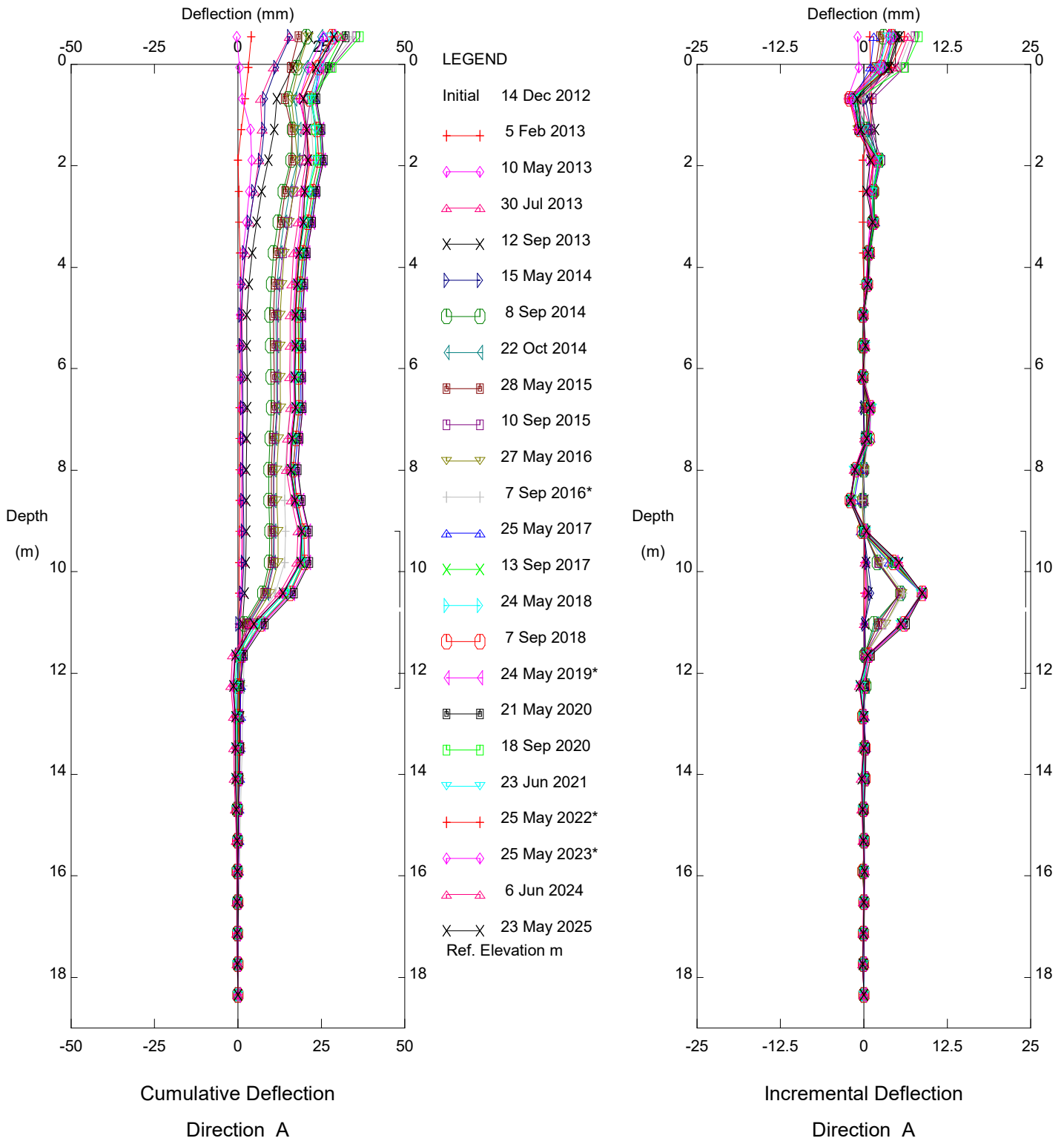
**NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)**
NC104: HWY 41:23 LANDSLIDE (km 7.7)
**SITE PLAN SHOWING APPROXIMATE
INSTRUMENT LOCATIONS**

DWG NO. 32122-NC104

DRAWN BY	ML
DESIGNED BY	LRG
APPROVED BY	TSA
SCALE	1:1500
DATE	JUNE 2024
FILE No.	32122



Thurber Engineering Ltd.

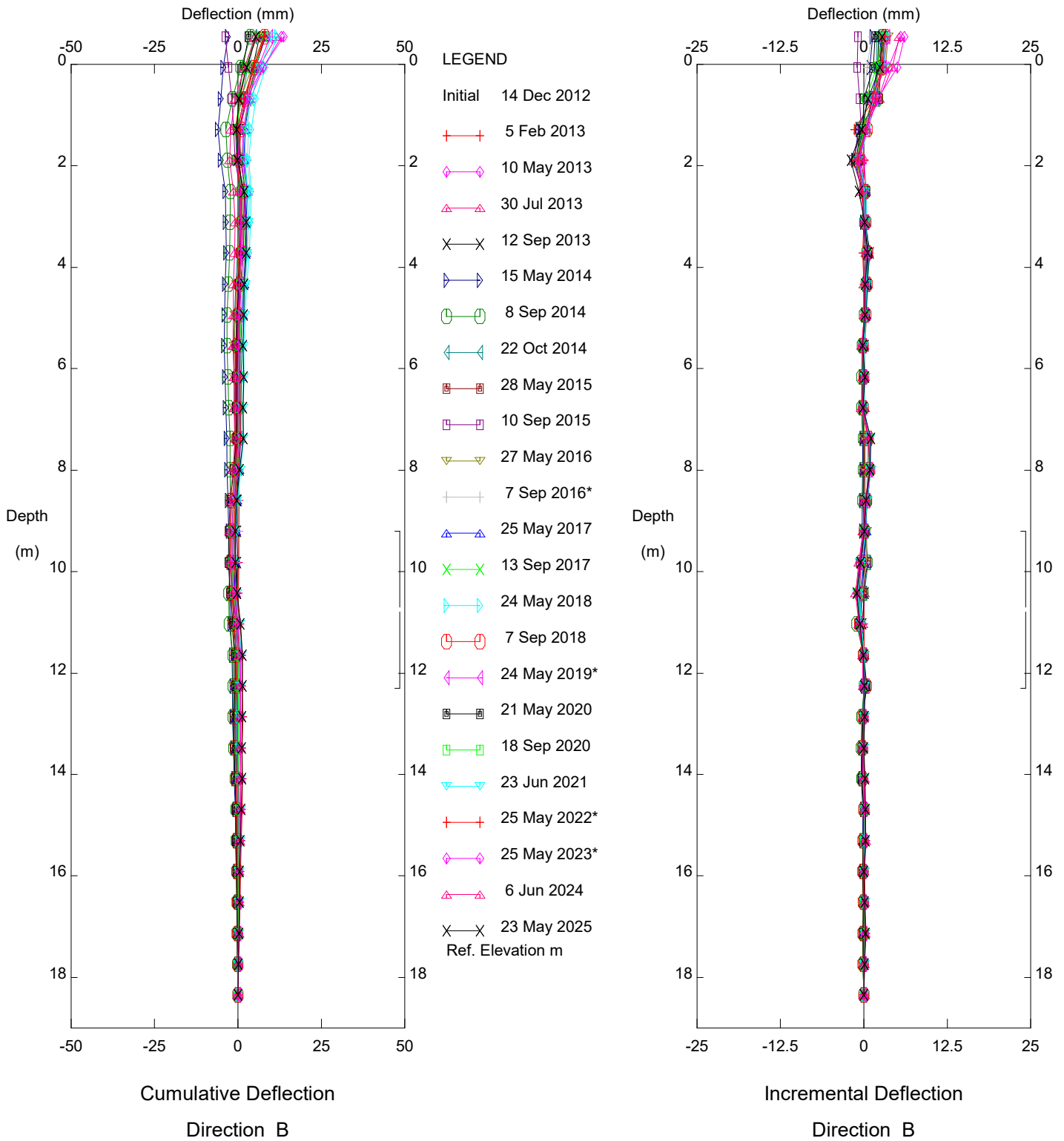


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI12-11

Alberta Transportation

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

Thurber Engineering Ltd.

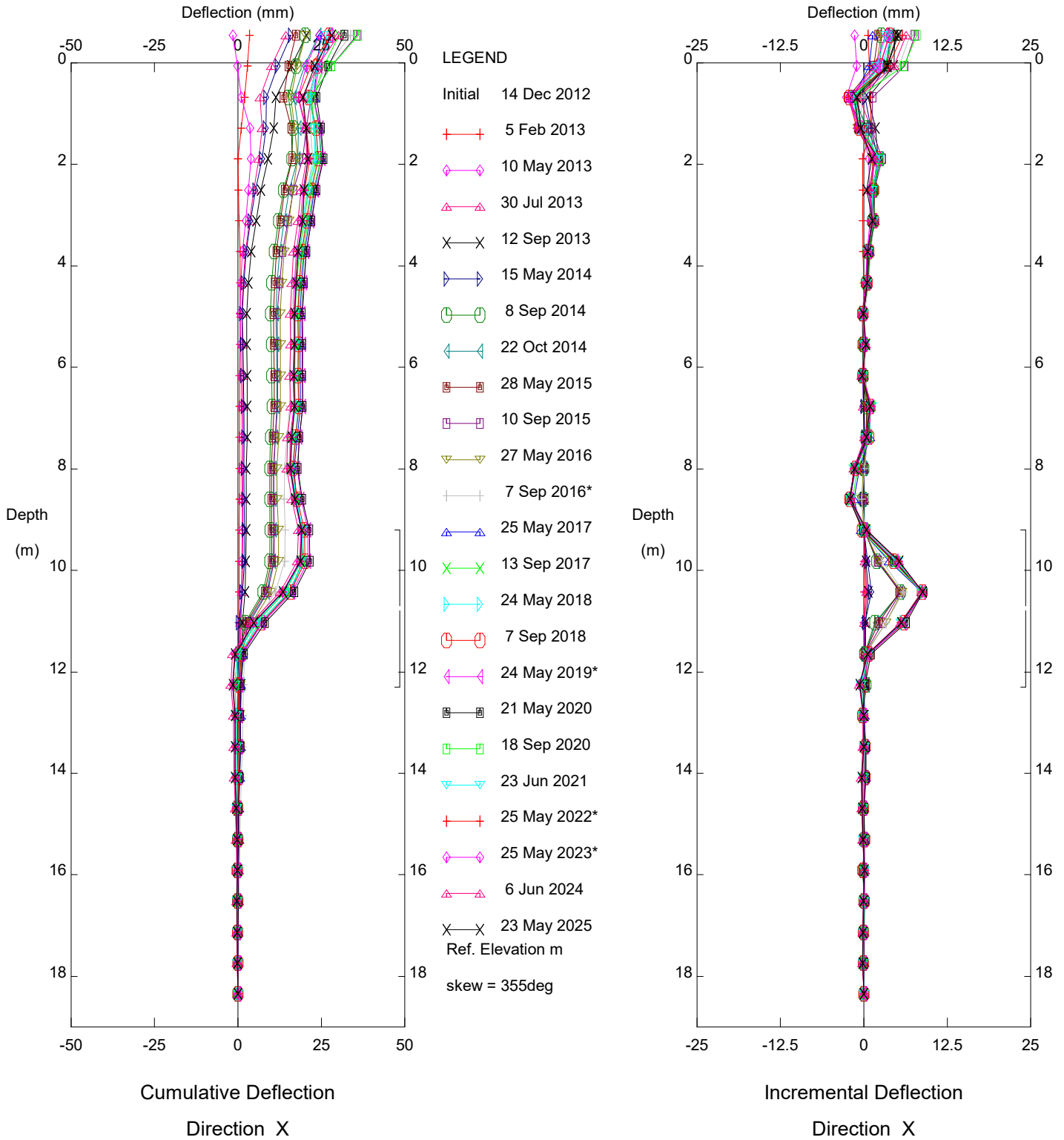


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Alberta Transportation

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Thurber Engineering Ltd.

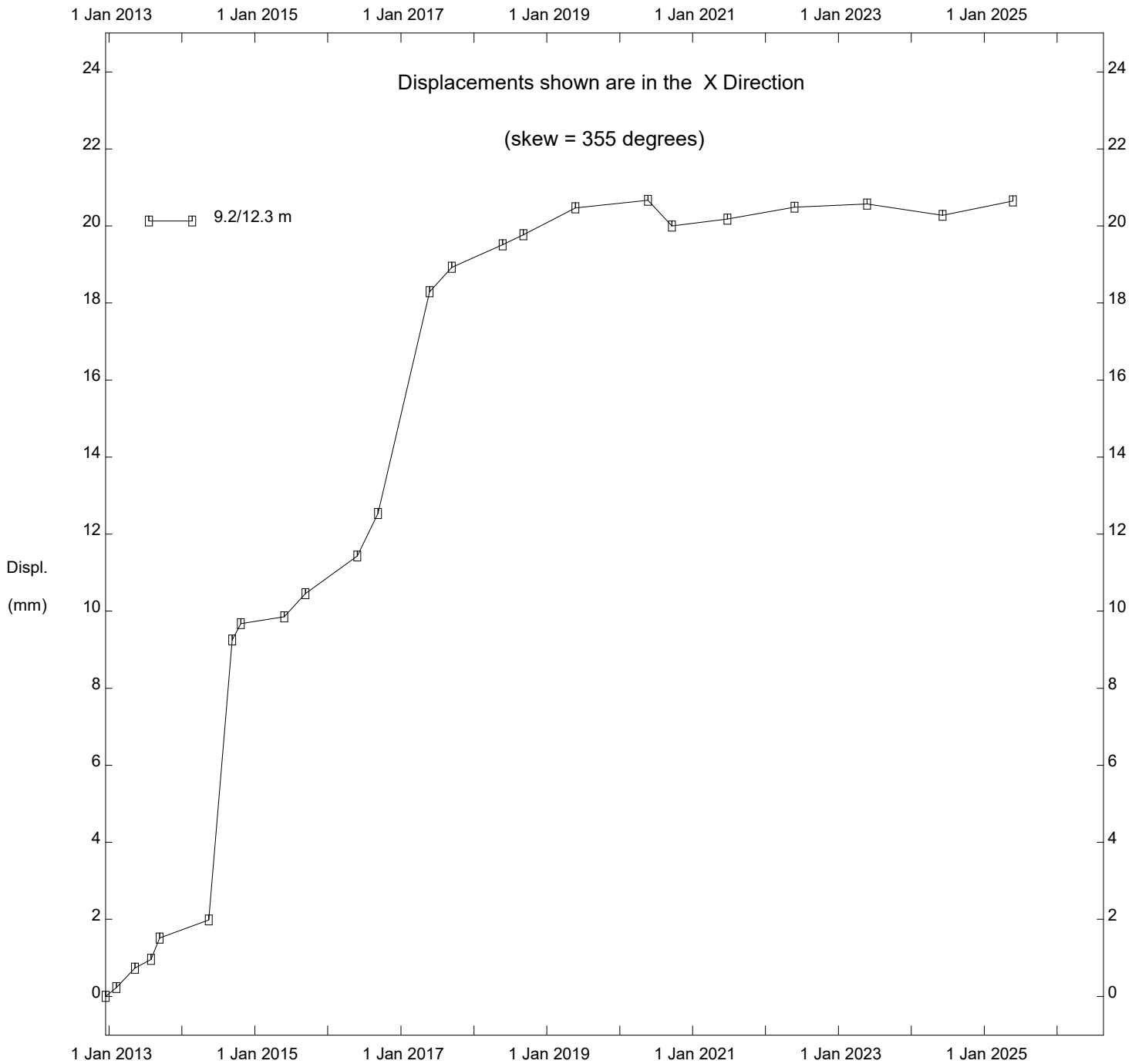


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Alberta Transportation

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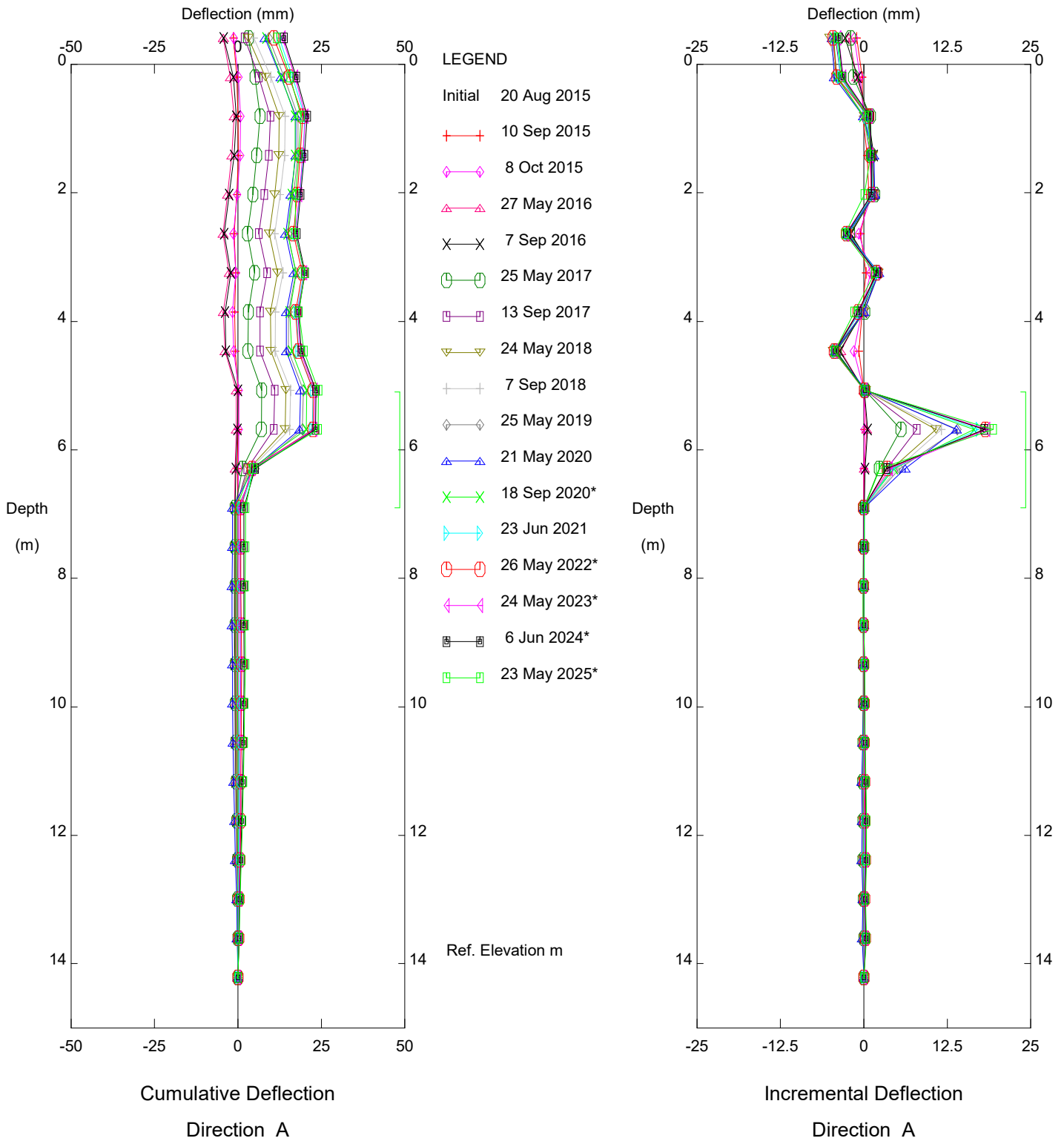
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI12-11

Alberta Transportation

Thurber Engineering Ltd.

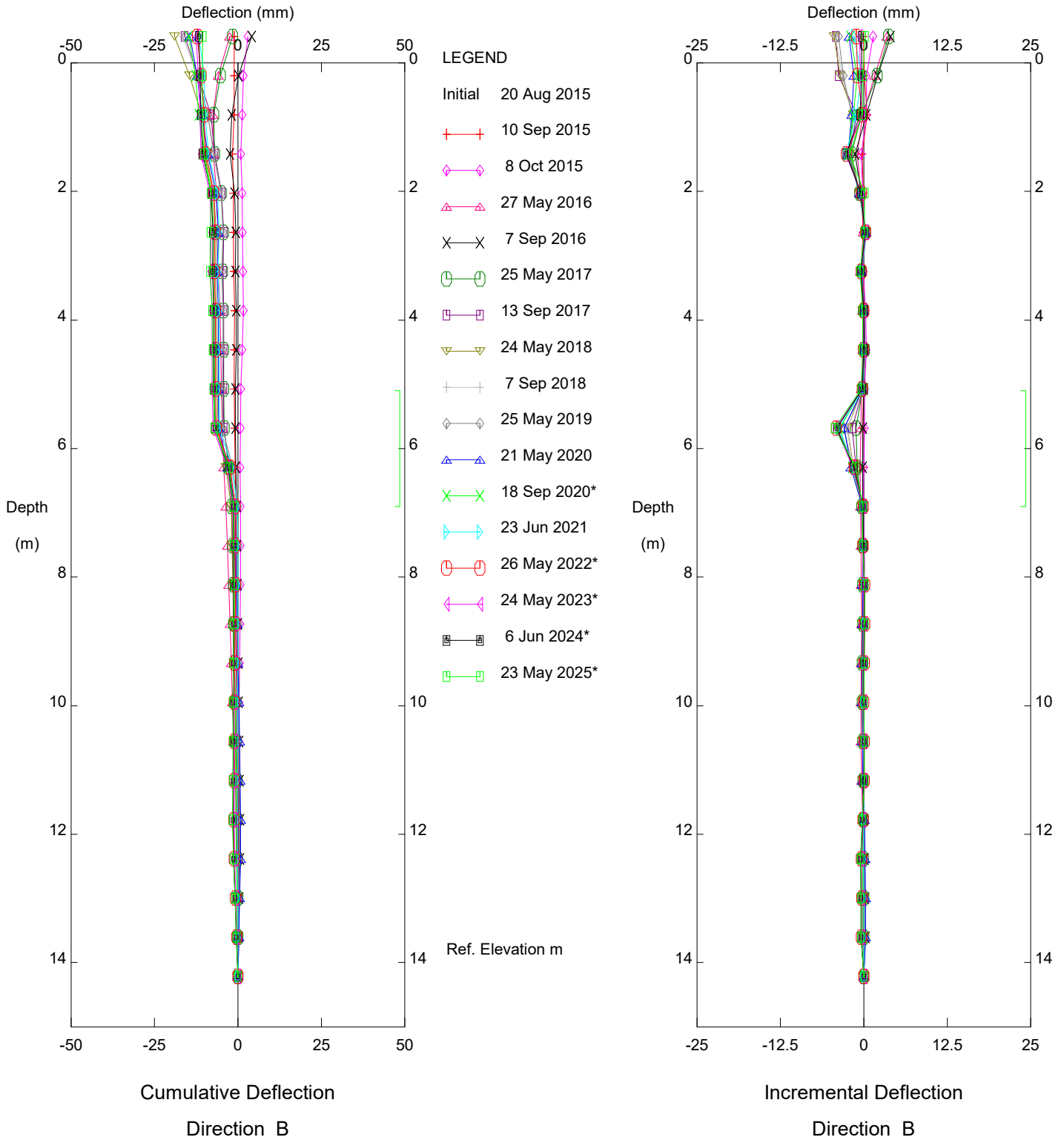


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Alberta Transportation

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Thurber Engineering Ltd.

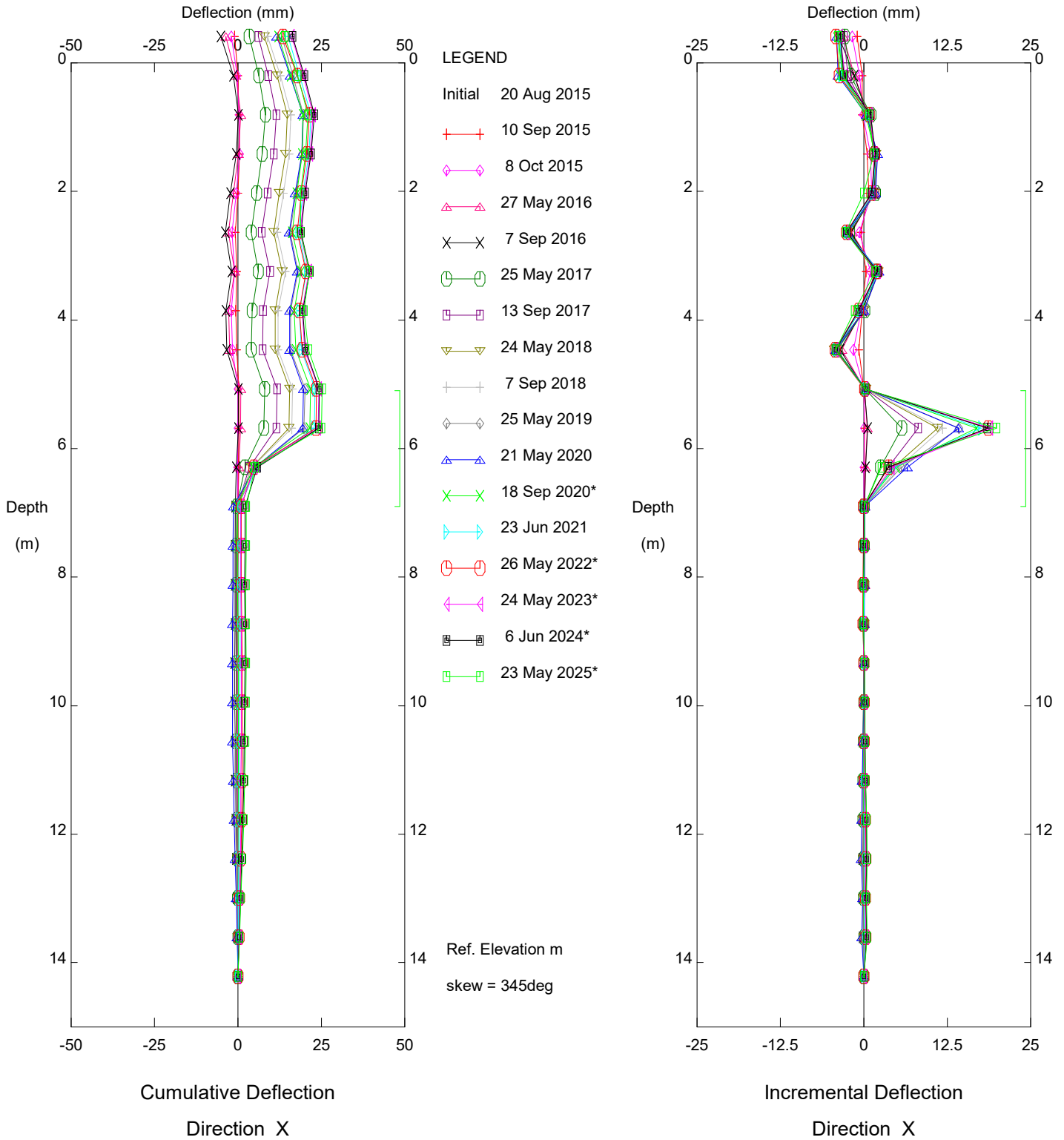


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI15-15

Alberta Transportation

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Thurber Engineering Ltd.

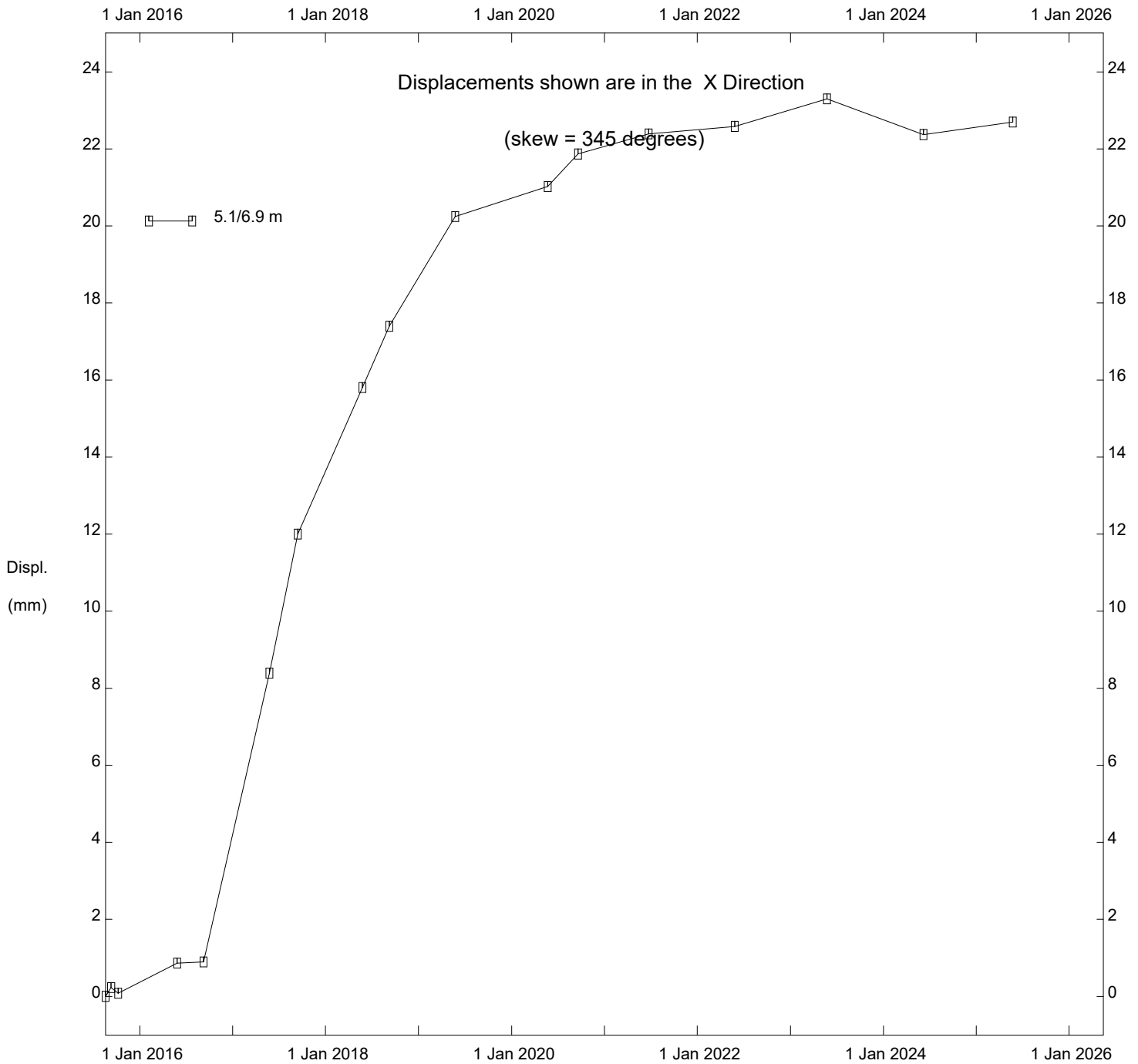


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Alberta Transportation

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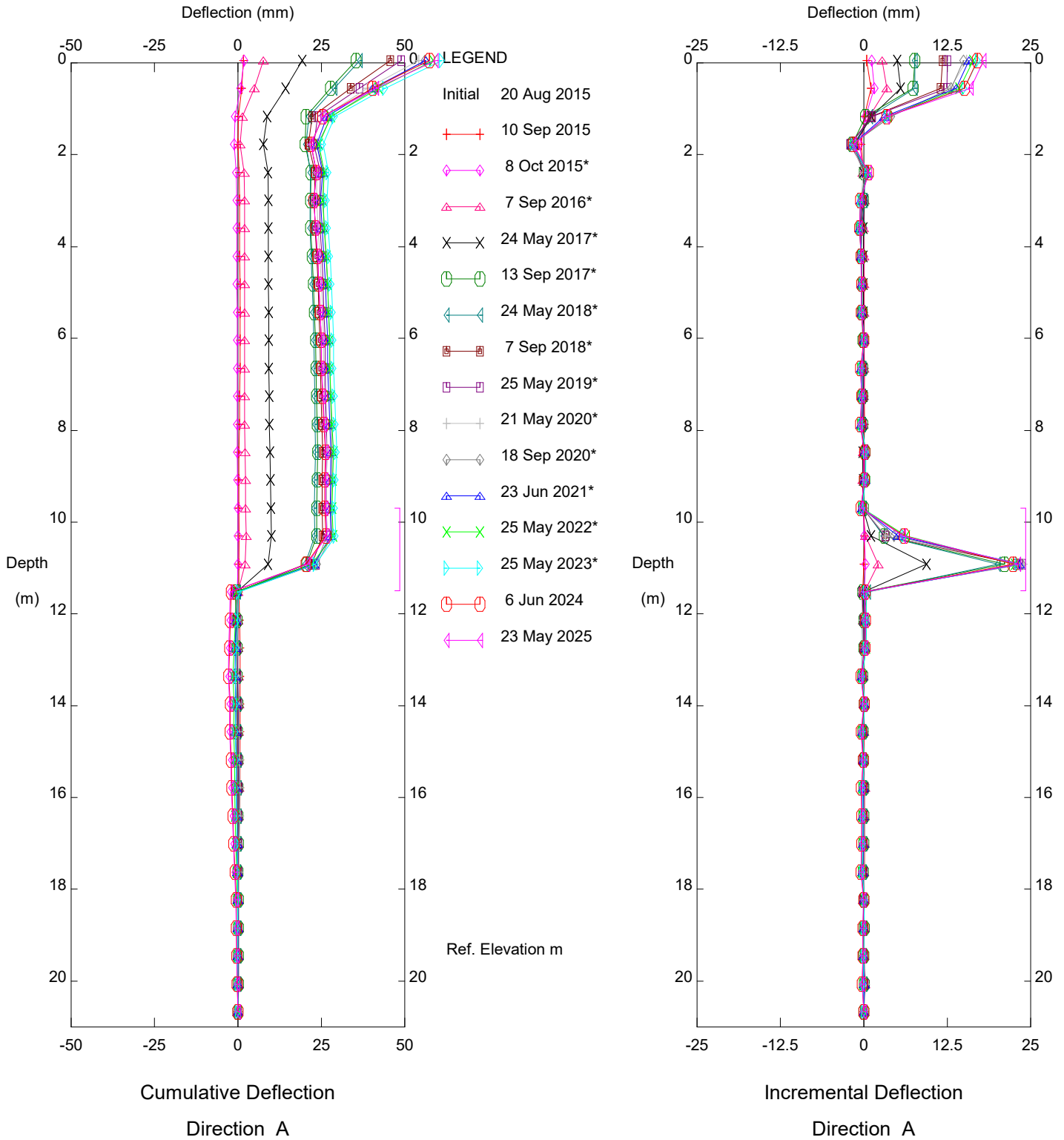
Thurber Engineering Ltd.



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Alberta Transportation

Thurber Engineering Ltd.

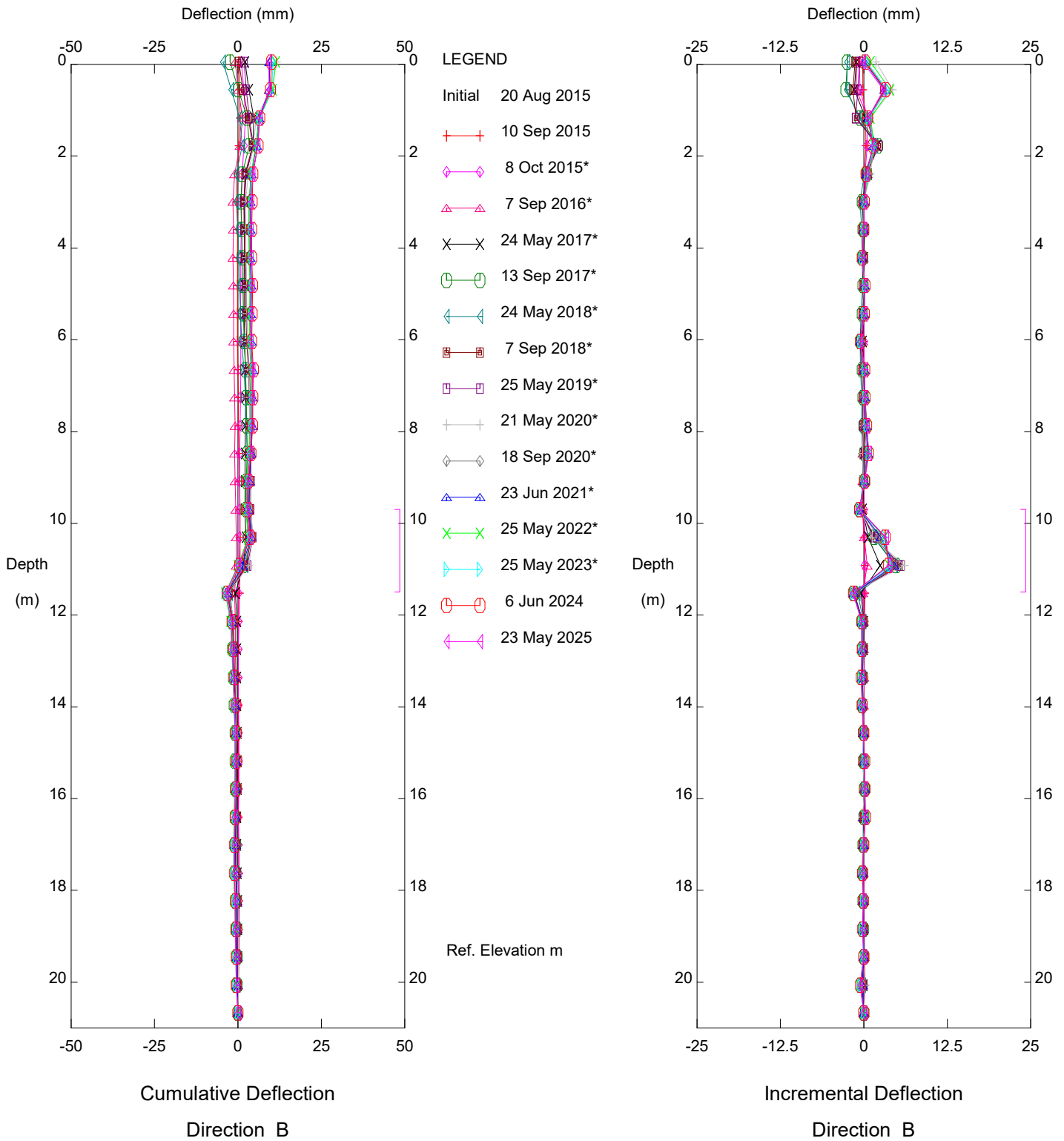


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI15-16

Alberta Transportation

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Thurber Engineering Ltd.

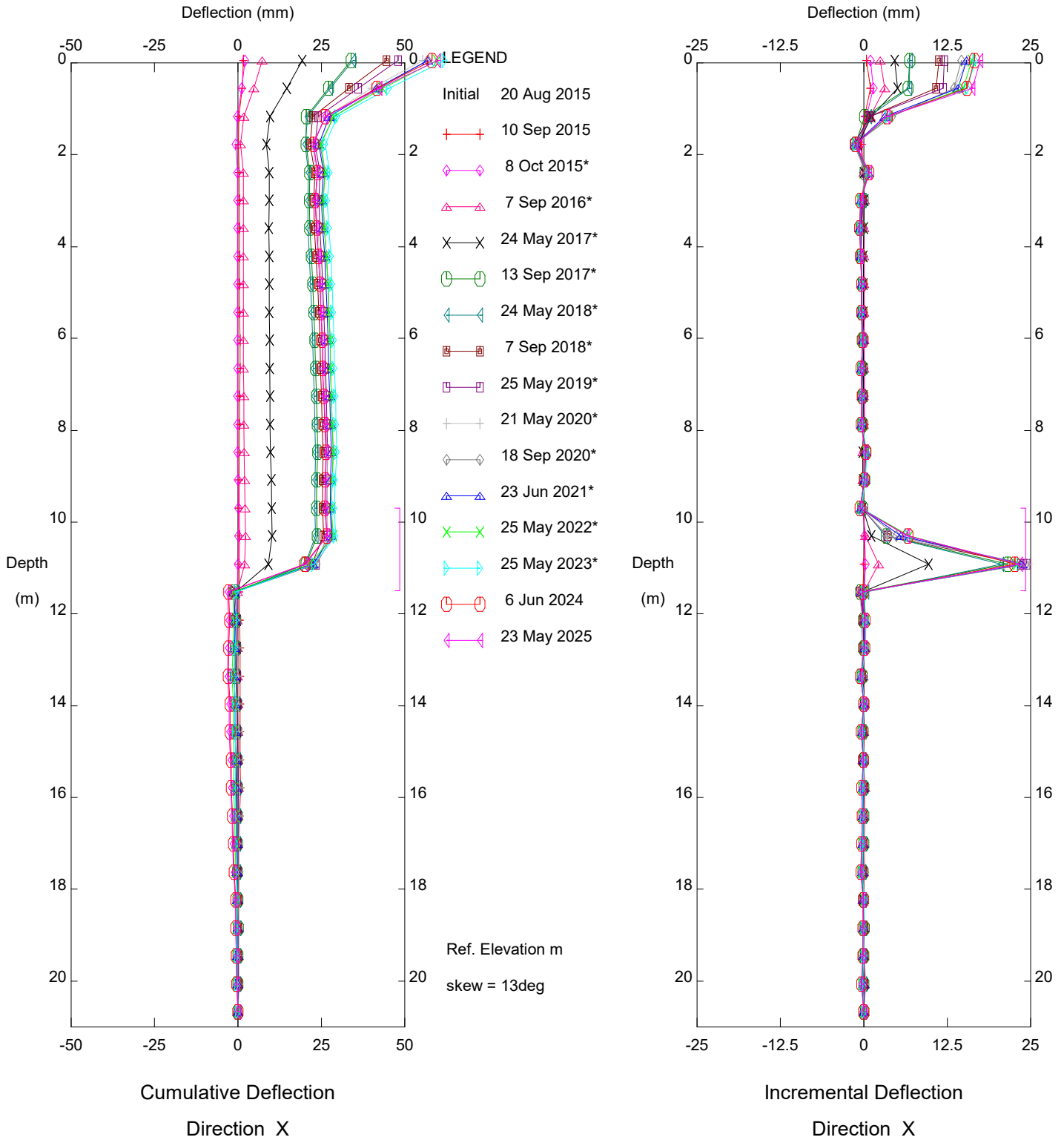


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI15-16

Alberta Transportation

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Thurber Engineering Ltd.

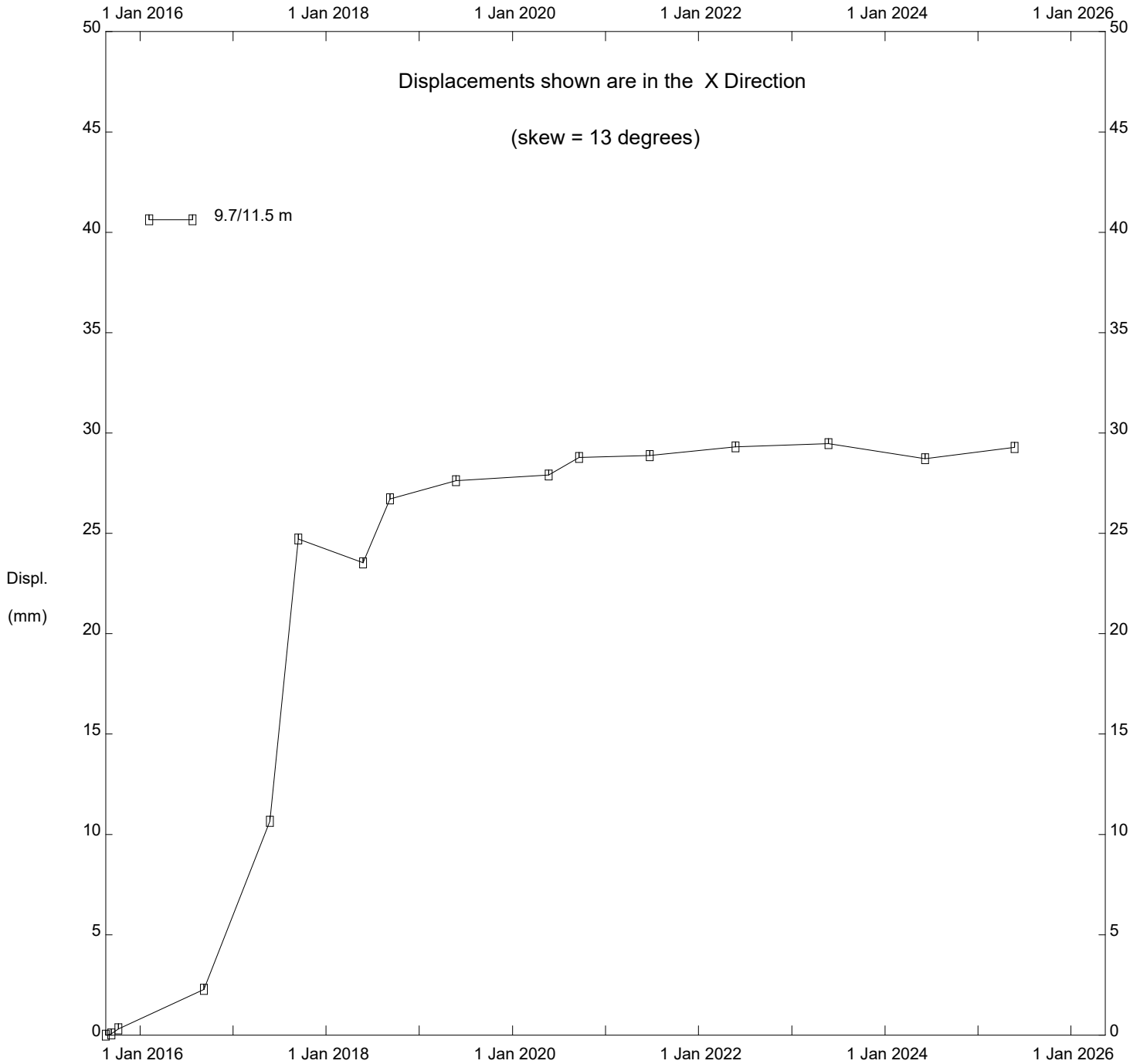


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Alberta Transportation

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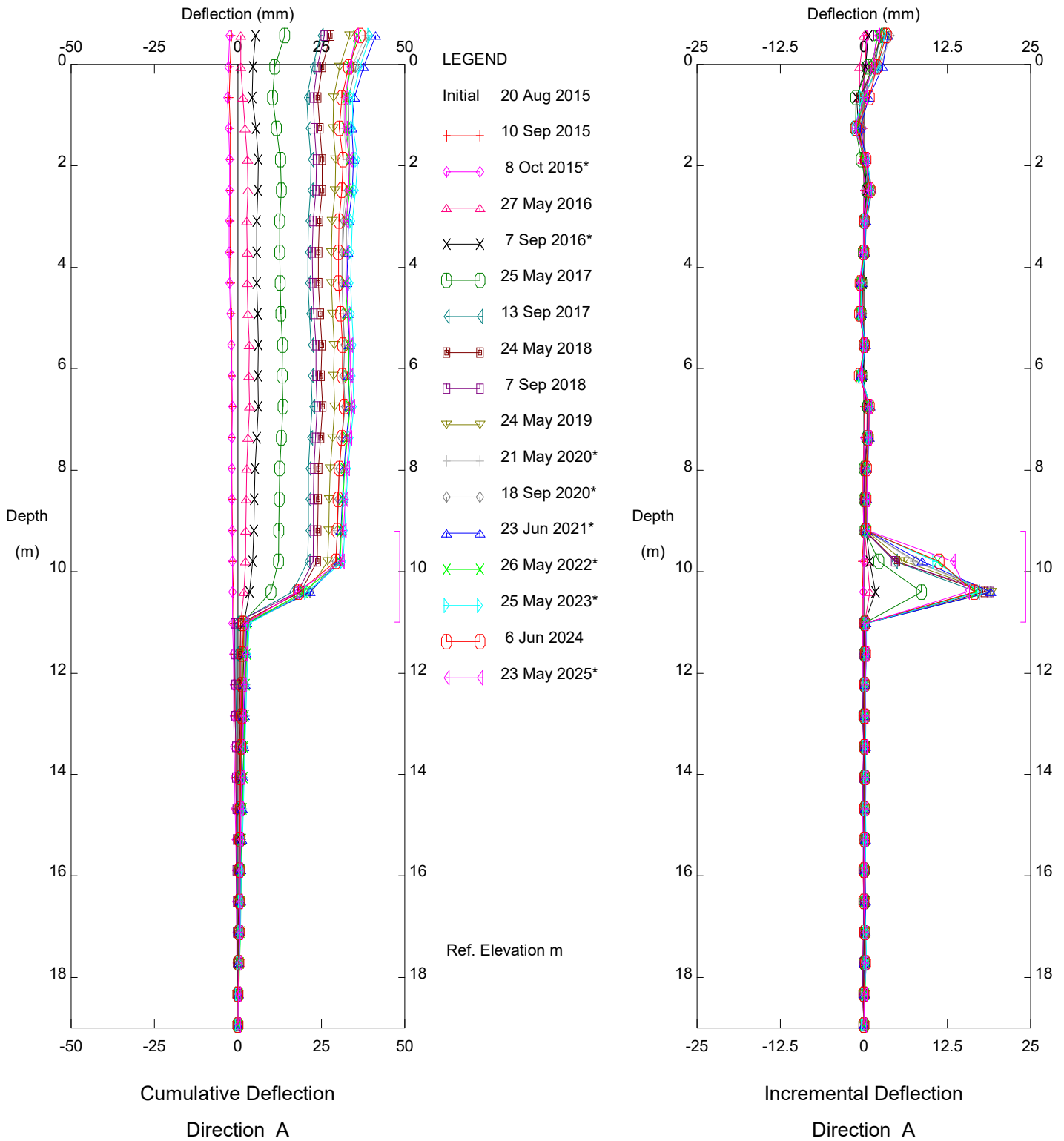
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI15-16

Alberta Transportation

Thurber Engineering Ltd.

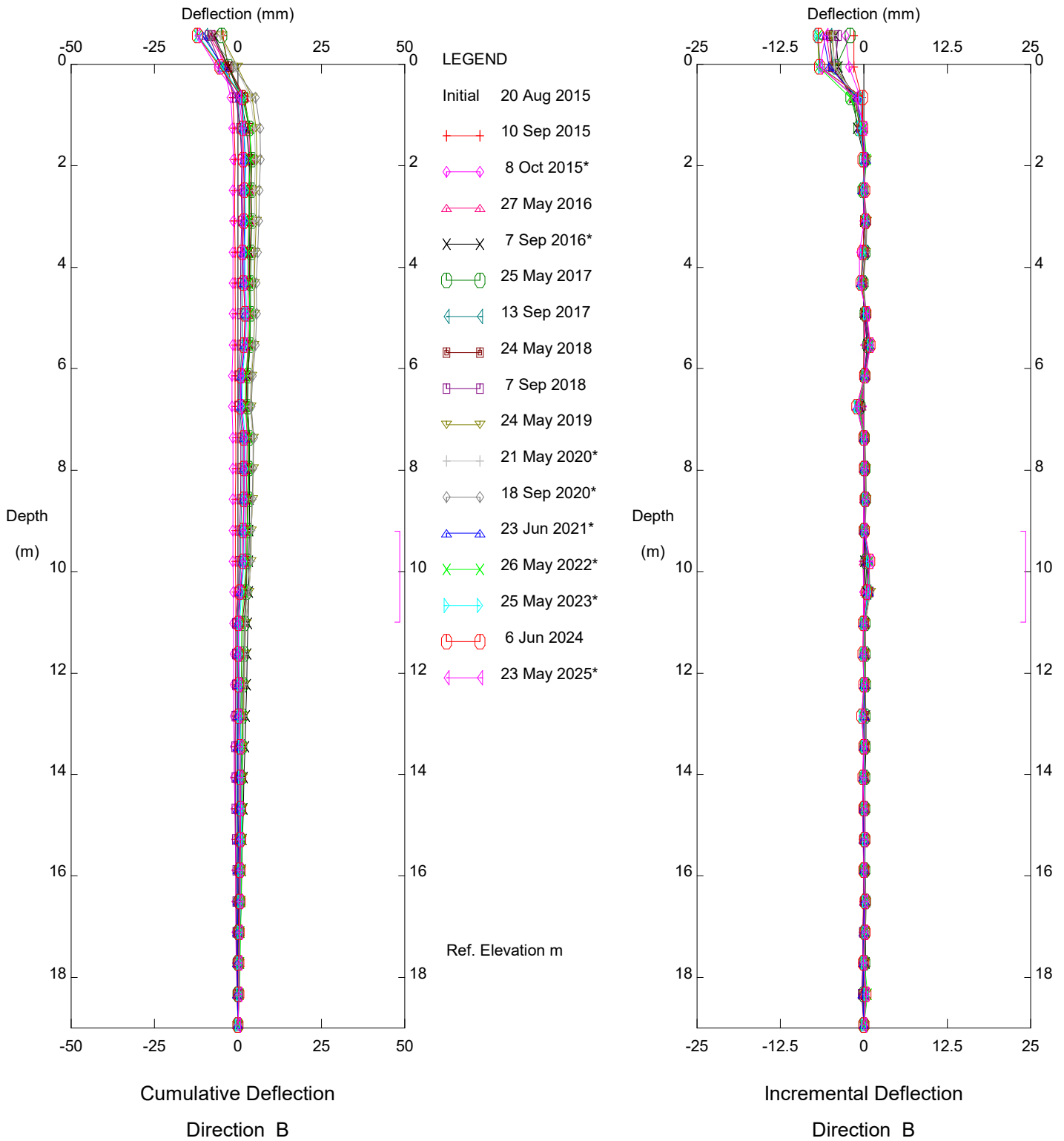


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Alberta Transportation

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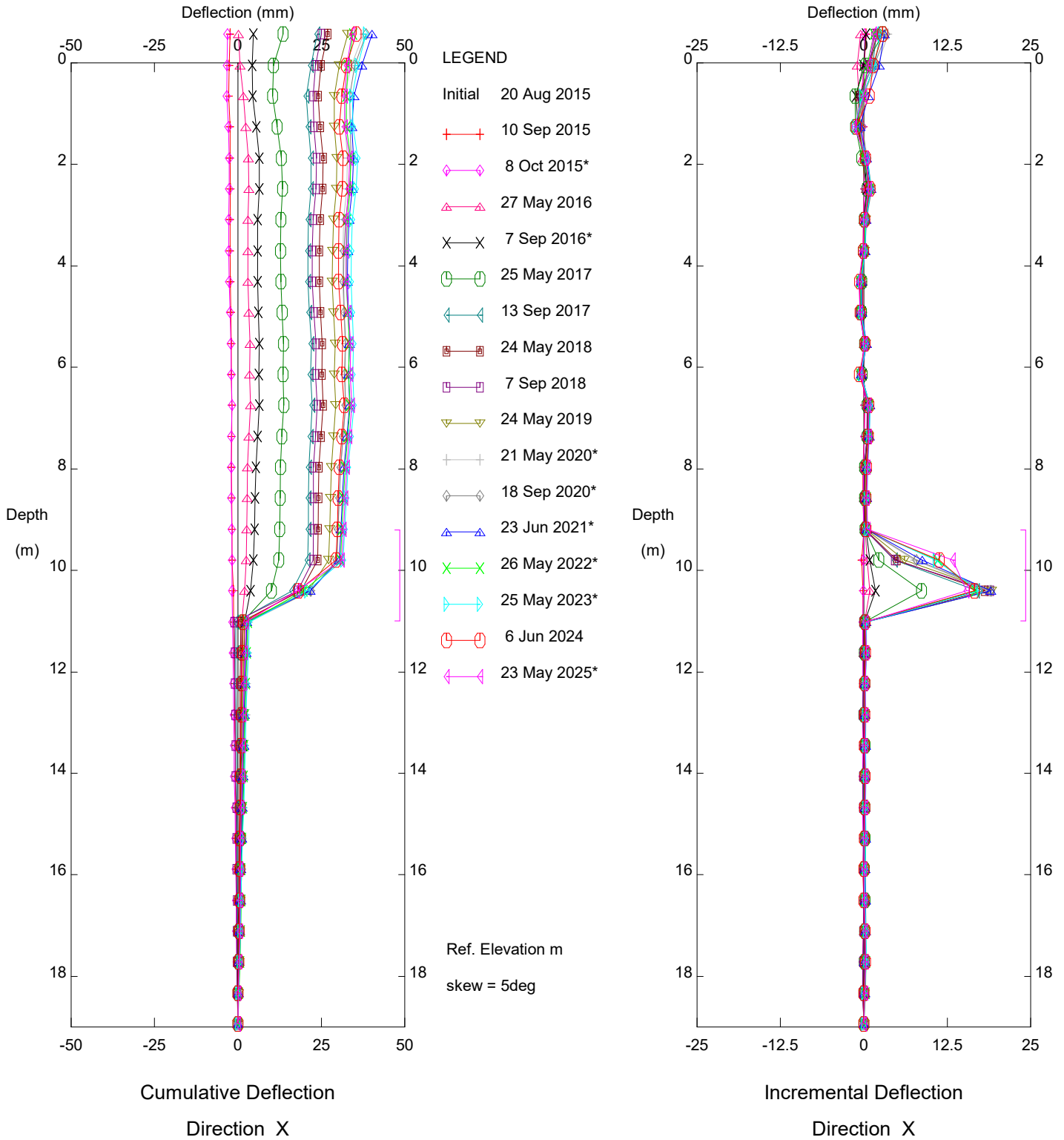


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Alberta Transportation

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Thurber Engineering Ltd.

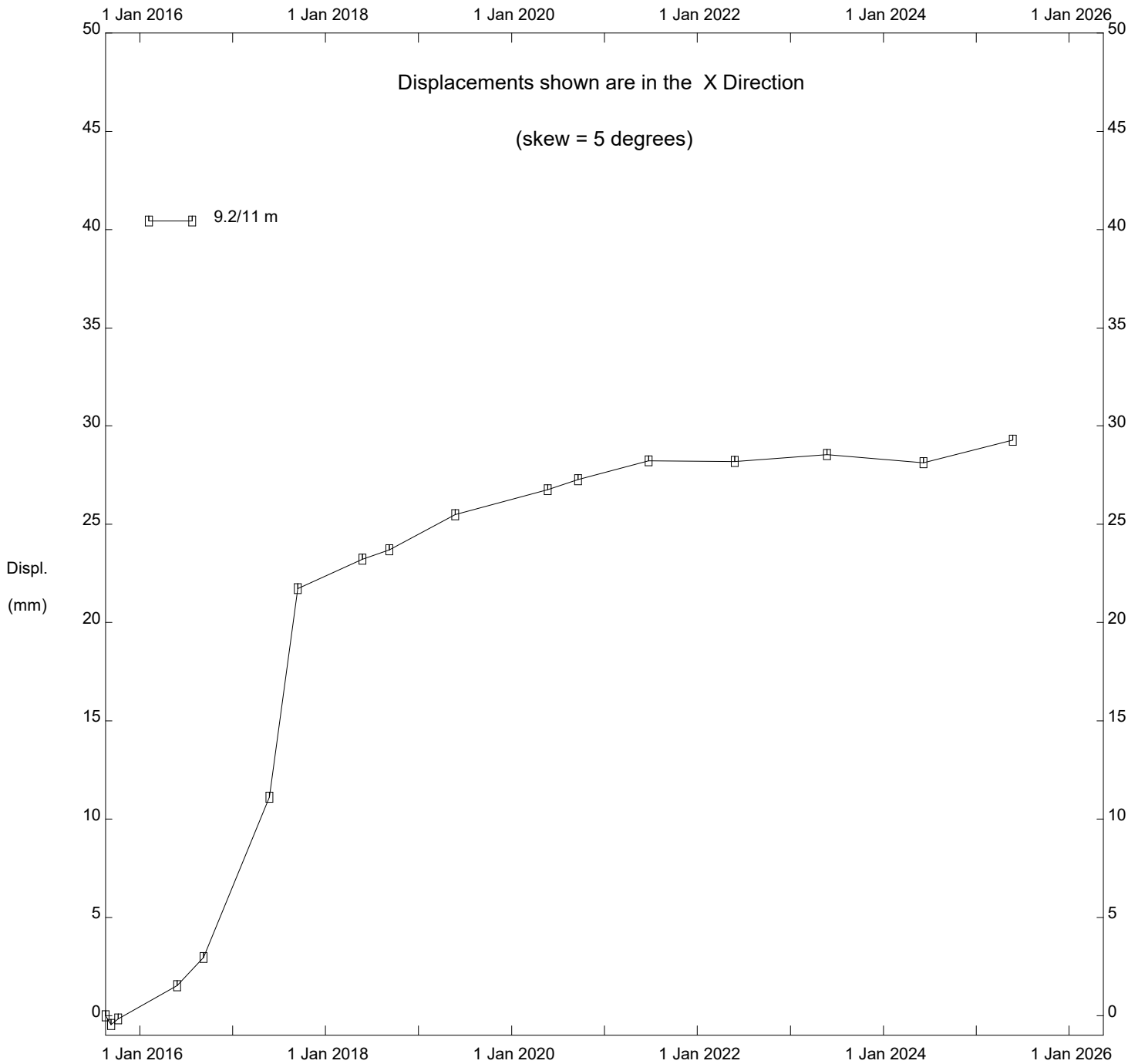


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Alberta Transportation

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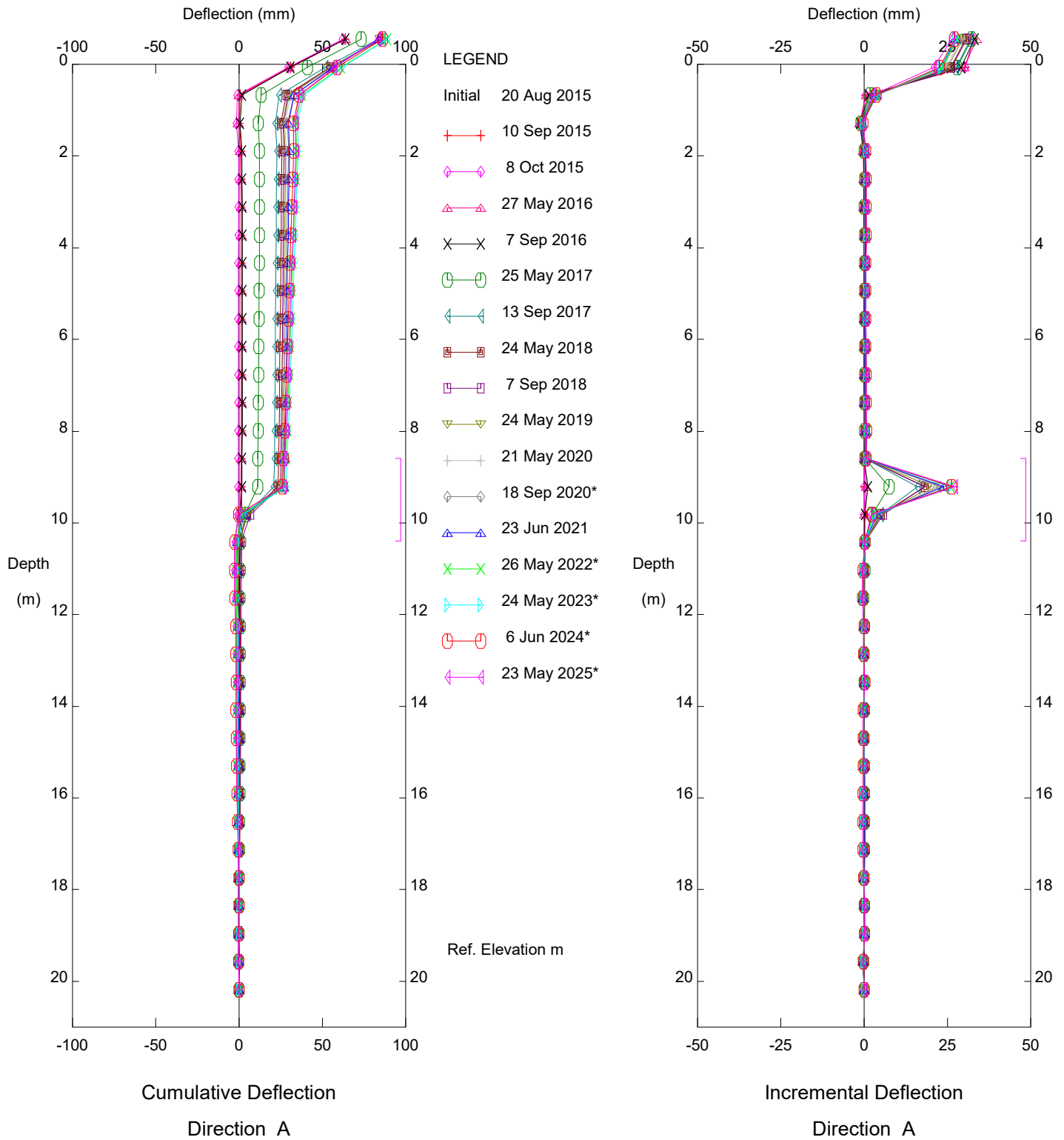
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI15-17

Alberta Transportation

Thurber Engineering Ltd.

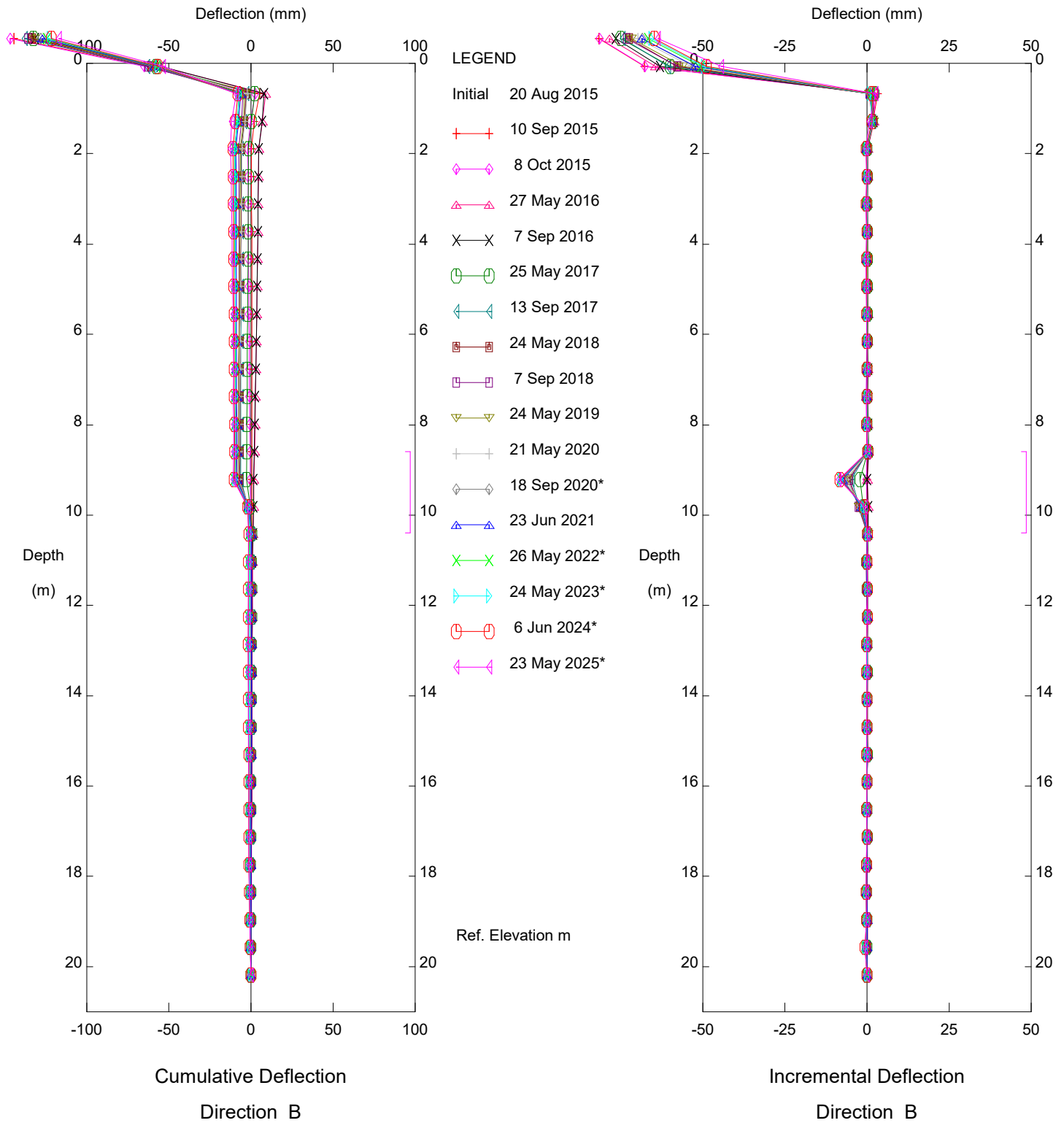


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Alberta Transportation

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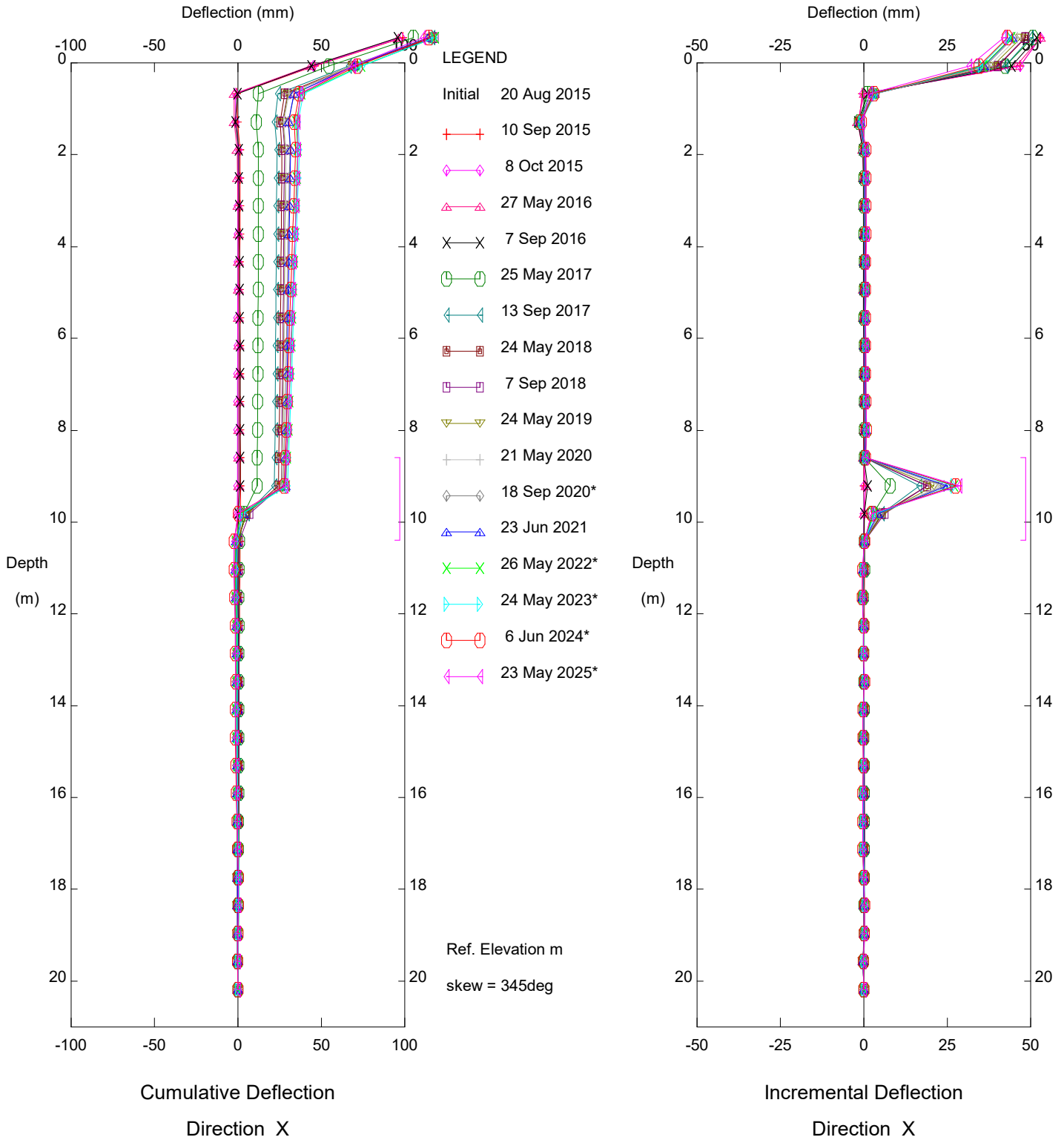


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Alberta Transportation

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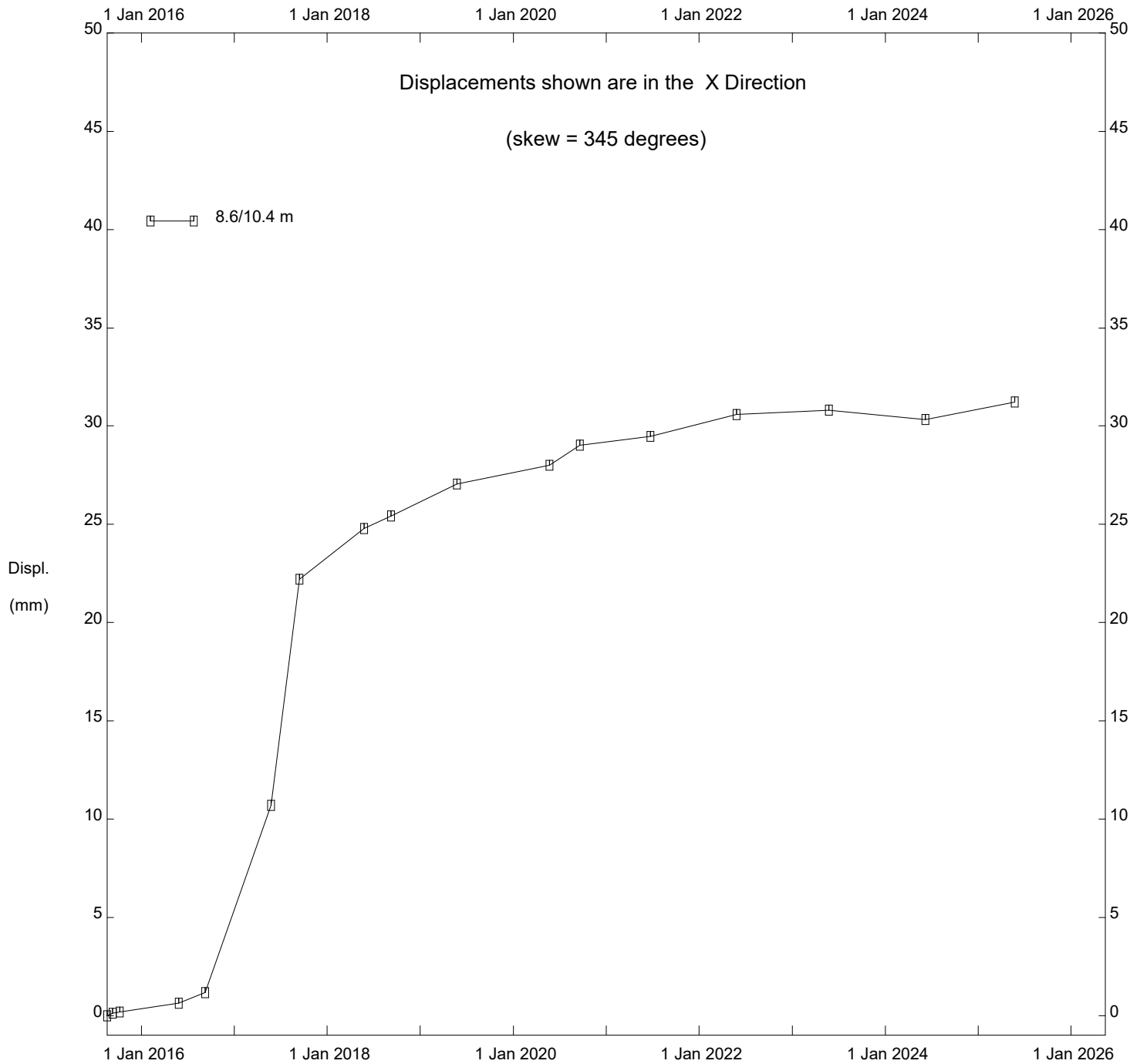


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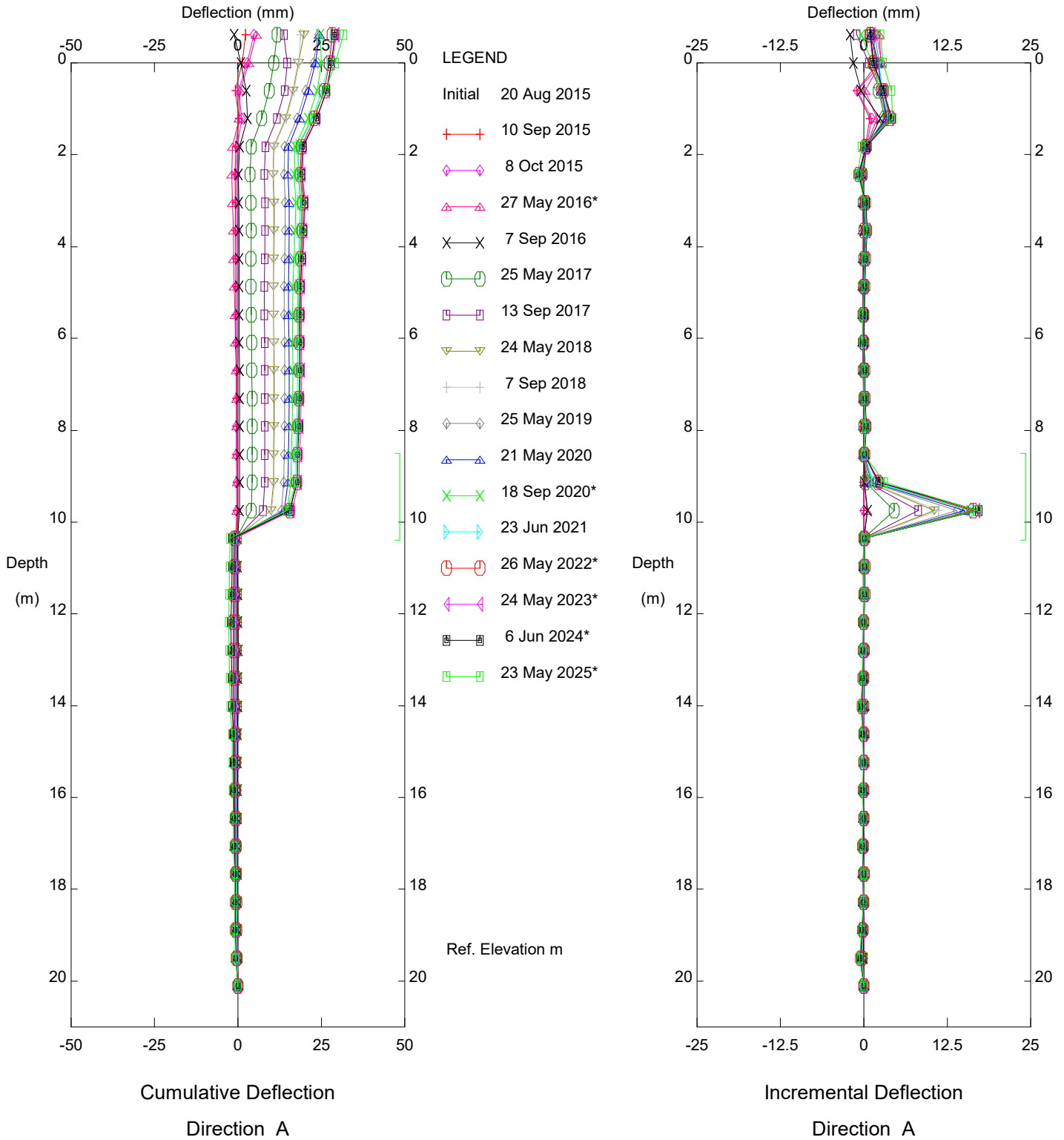
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Alberta Transportation

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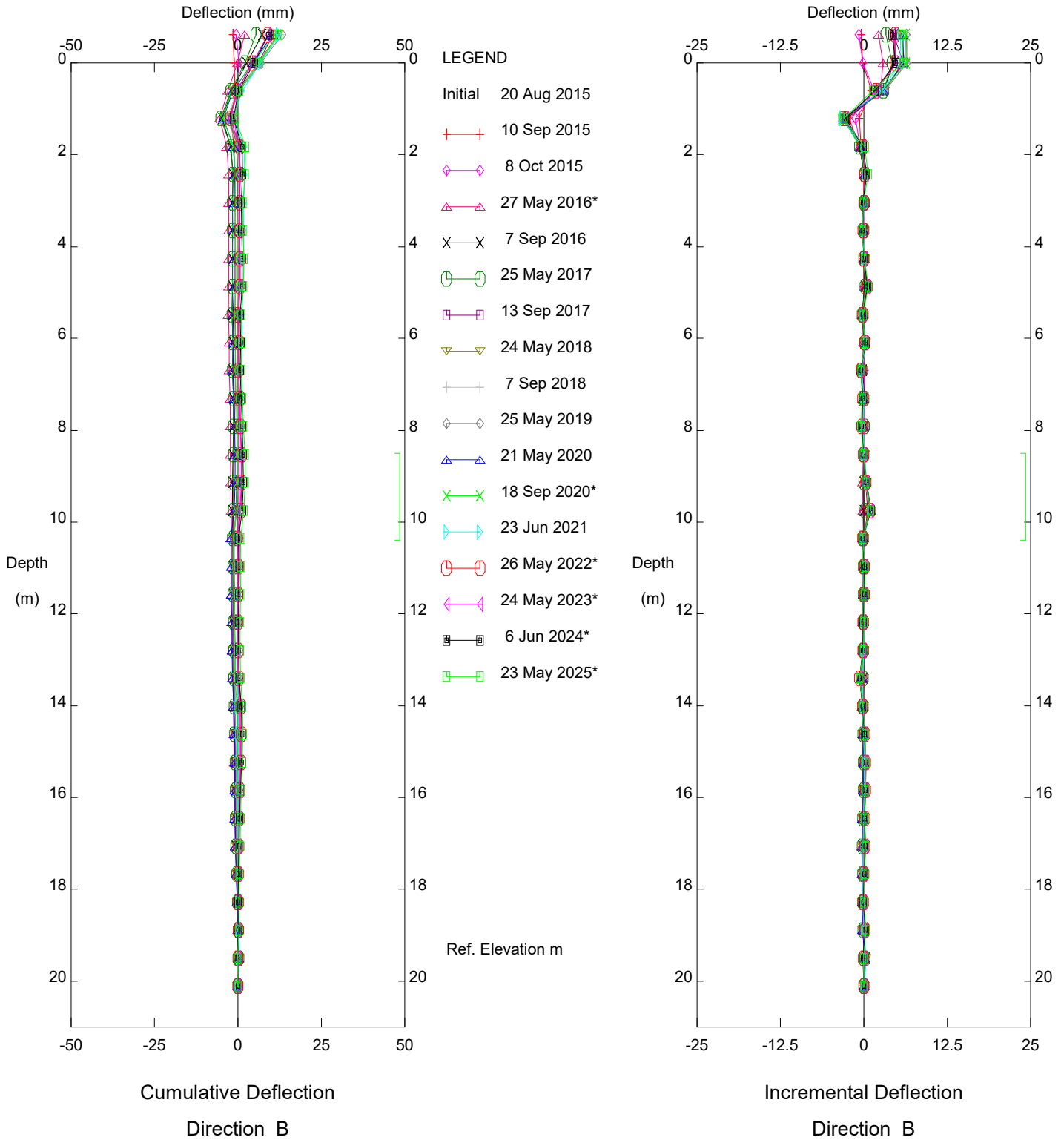


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI15-21

Alberta Transportation

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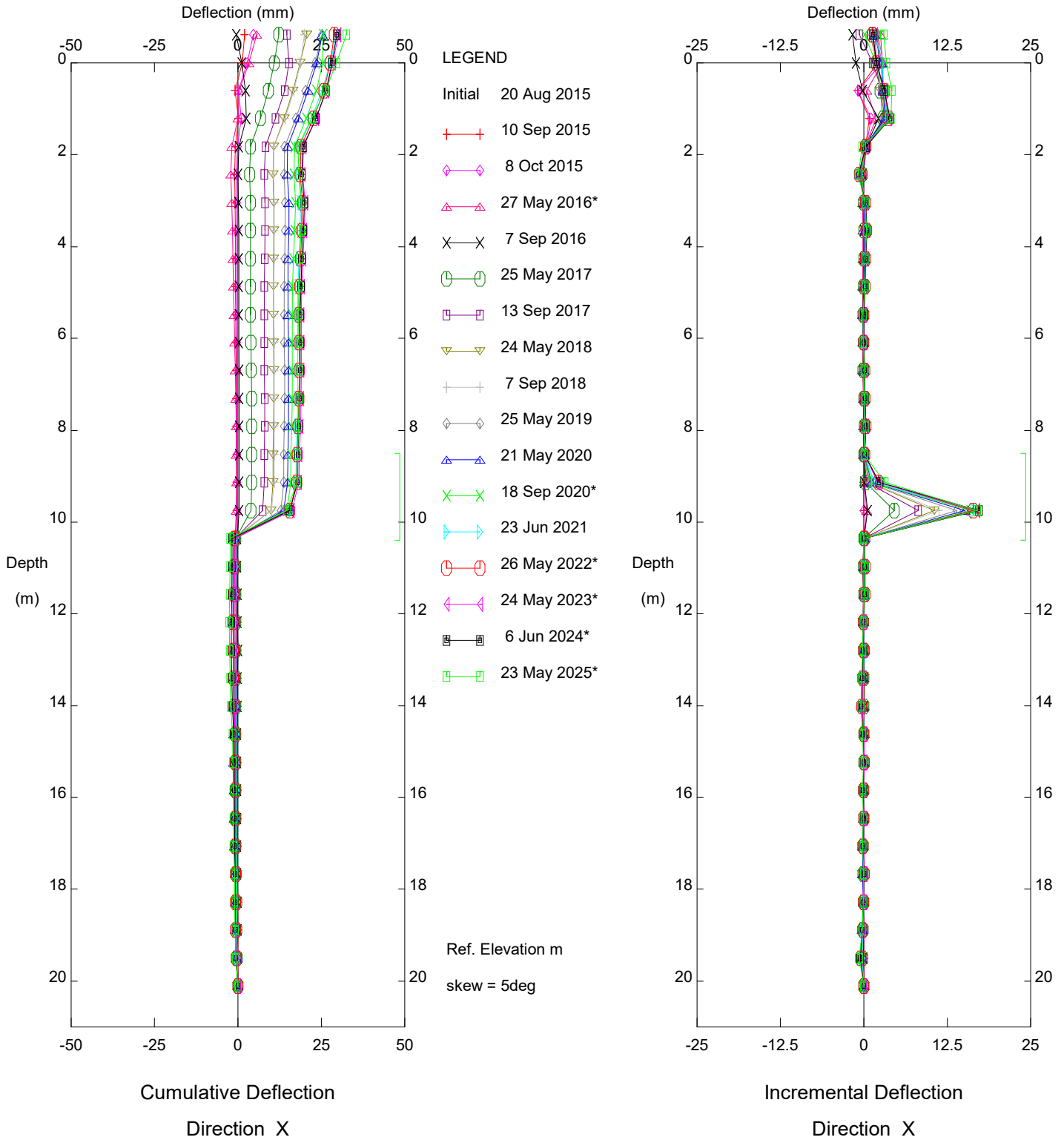


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Alberta Transportation

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Thurber Engineering Ltd.

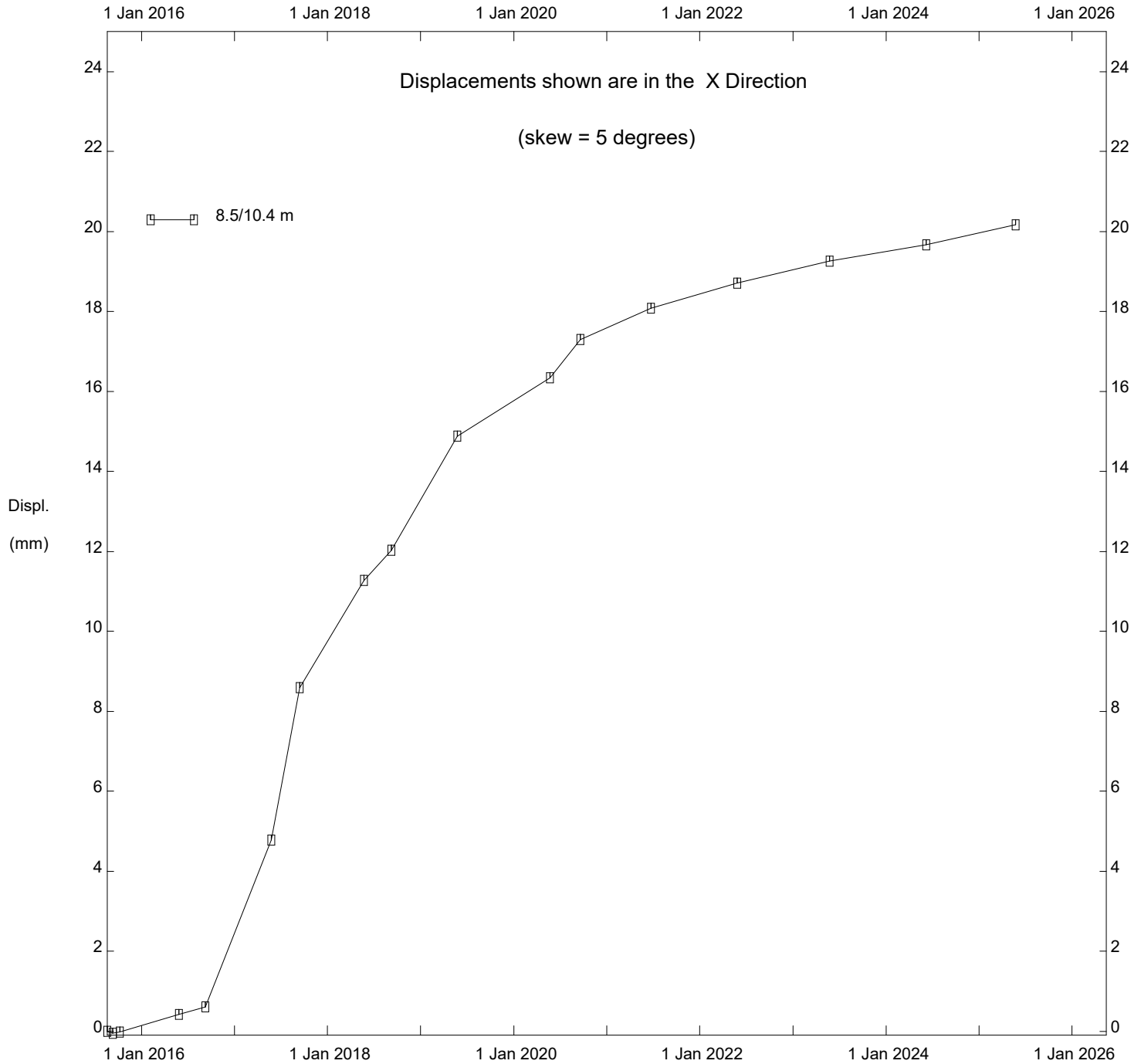


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Alberta Transportation

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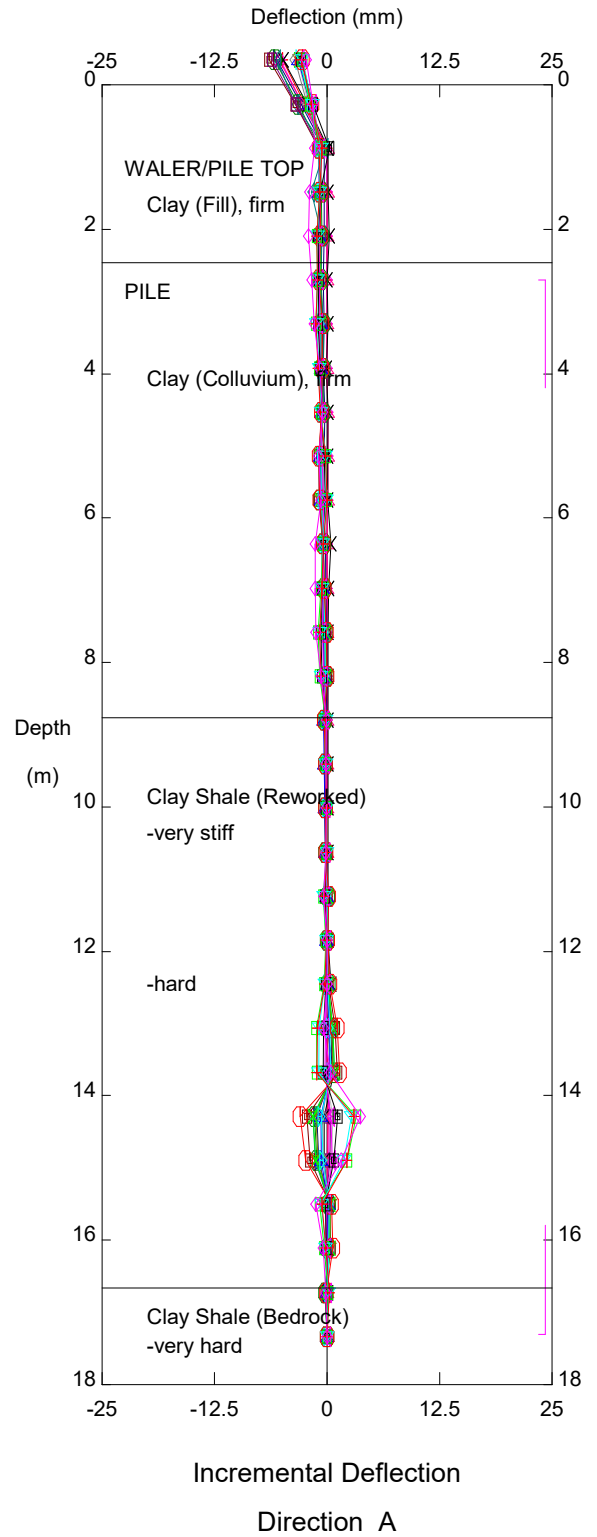
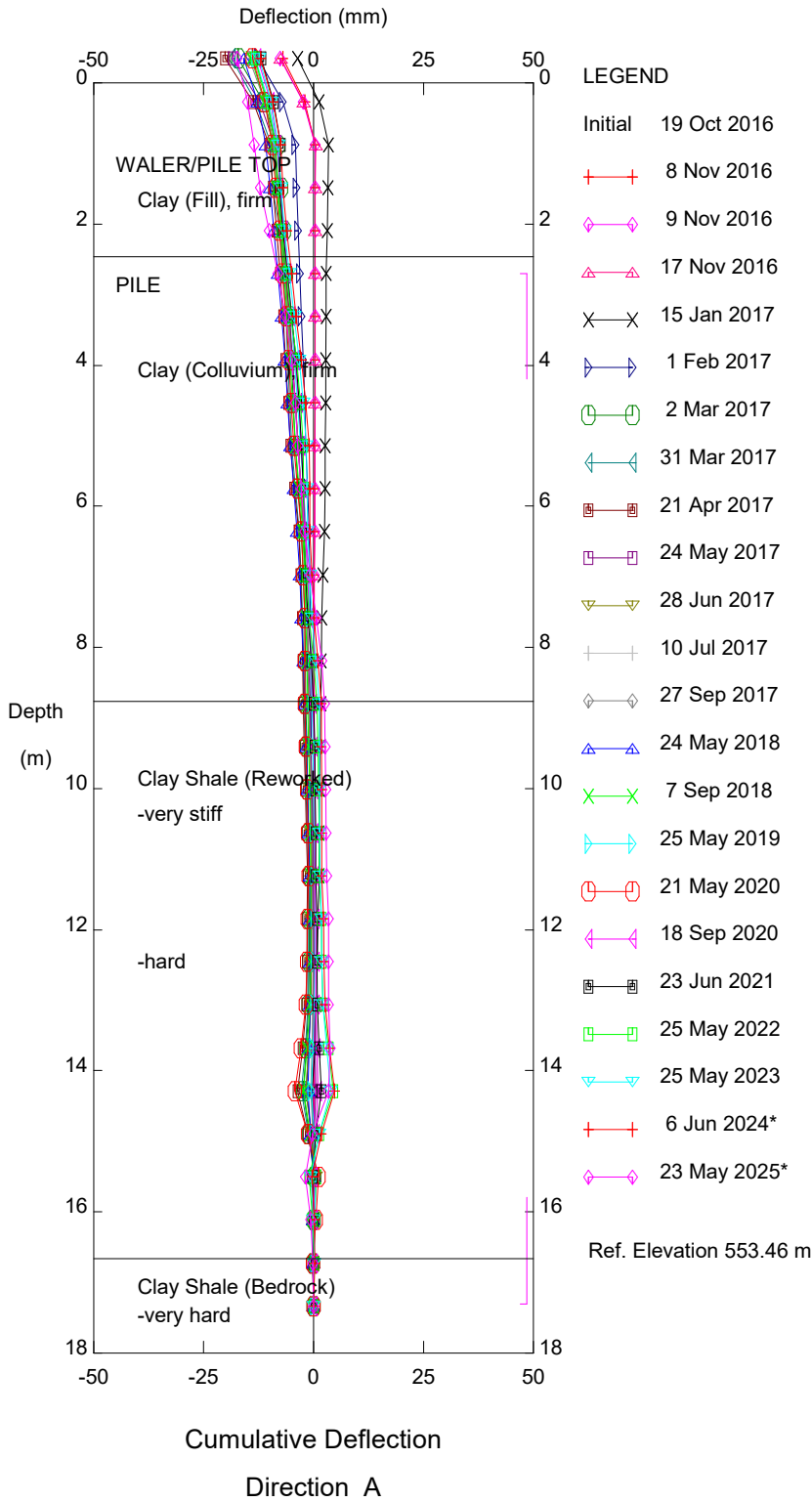
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI15-21

Alberta Transportation

Thurber Engineering Ltd.

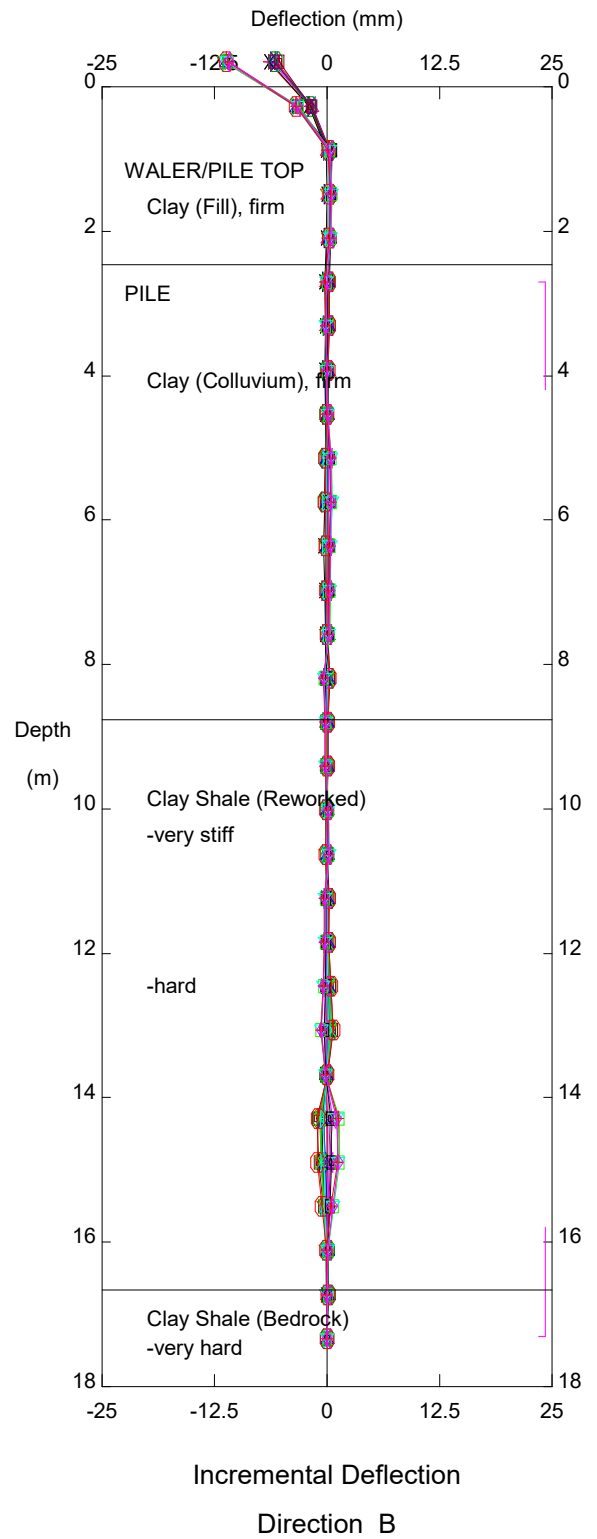
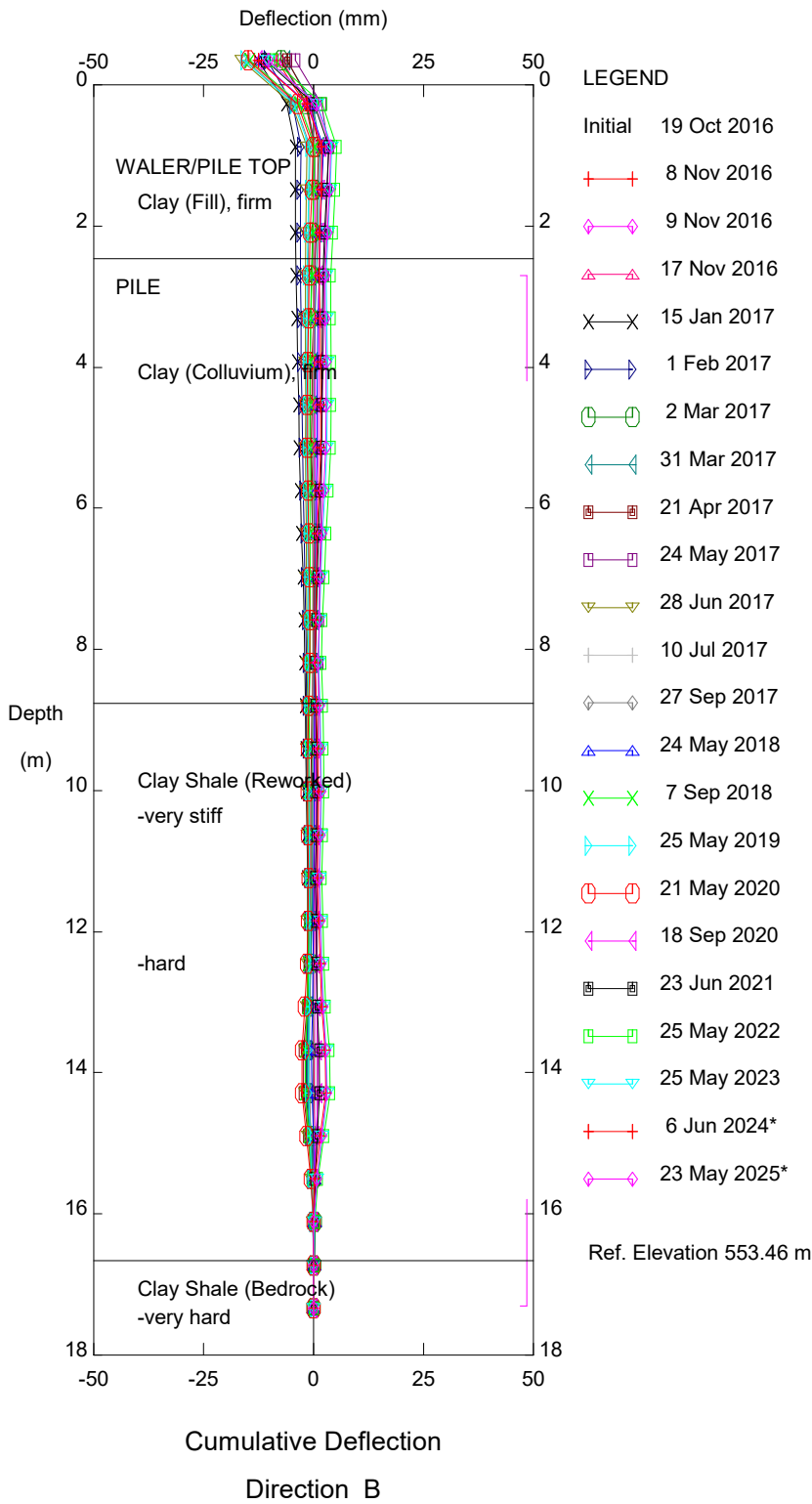


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-1 (P06)

Alberta Transportation

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

Thurber Engineering Ltd.

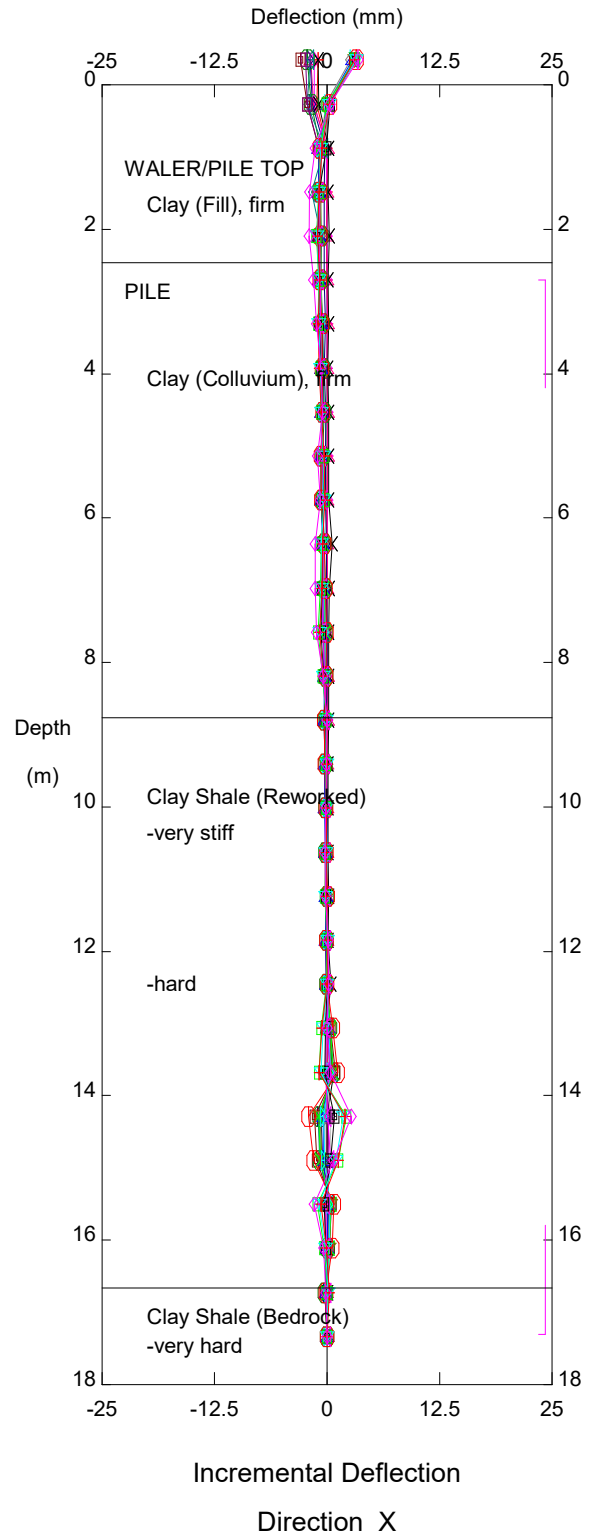
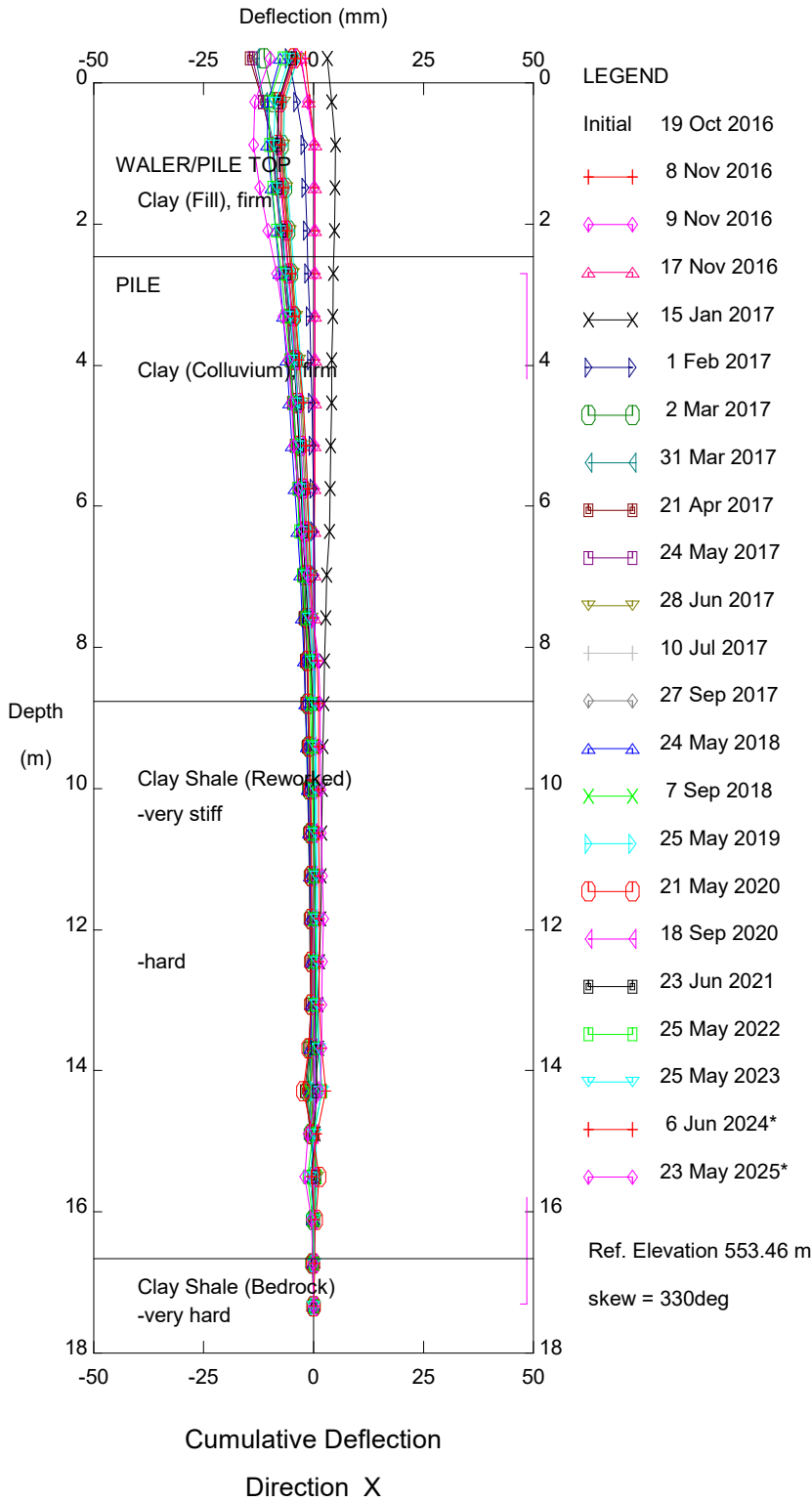


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-1 (P06)

Alberta Transportation

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

Thurber Engineering Ltd.

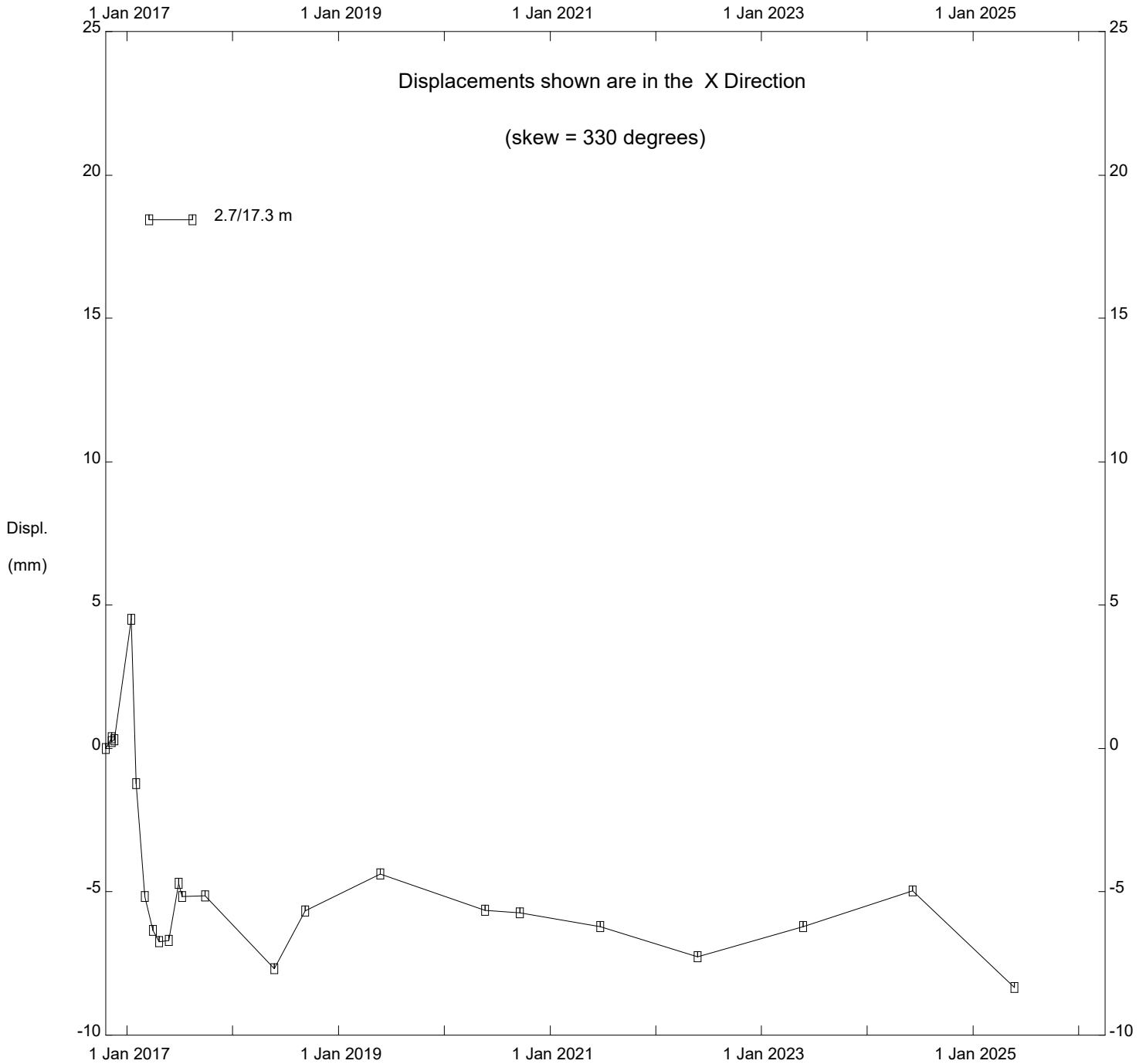


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-1 (P06)

Alberta Transportation

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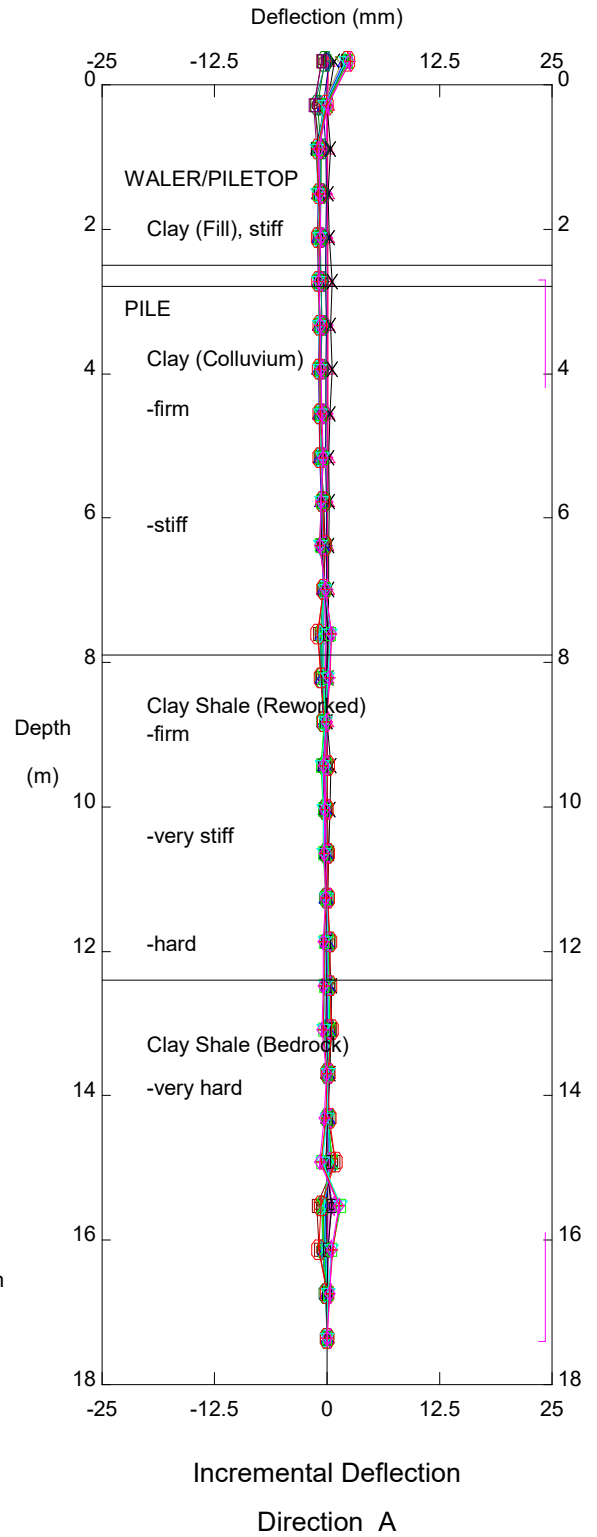
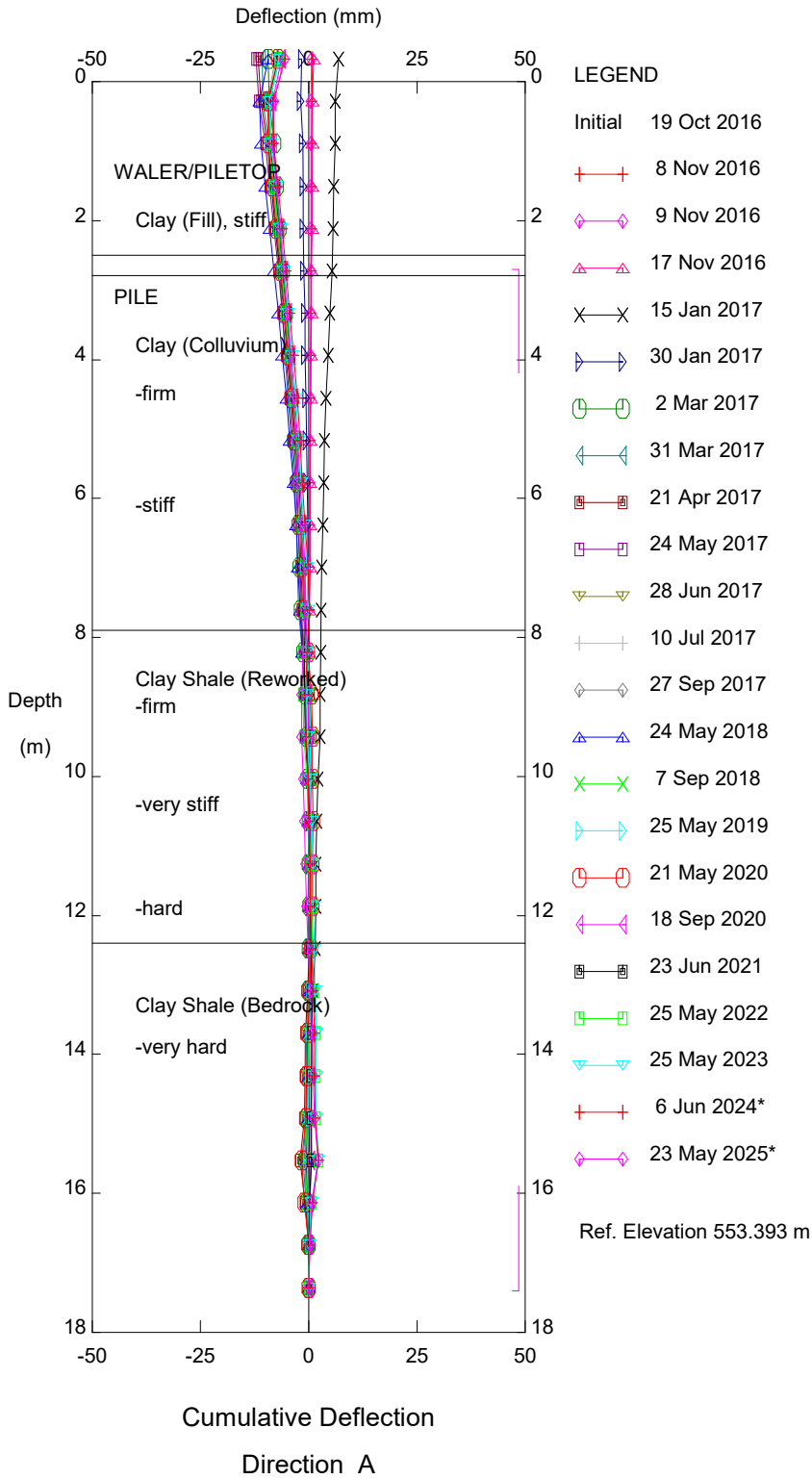
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-1 (P06)

Alberta Transportation

Thurber Engineering Ltd.

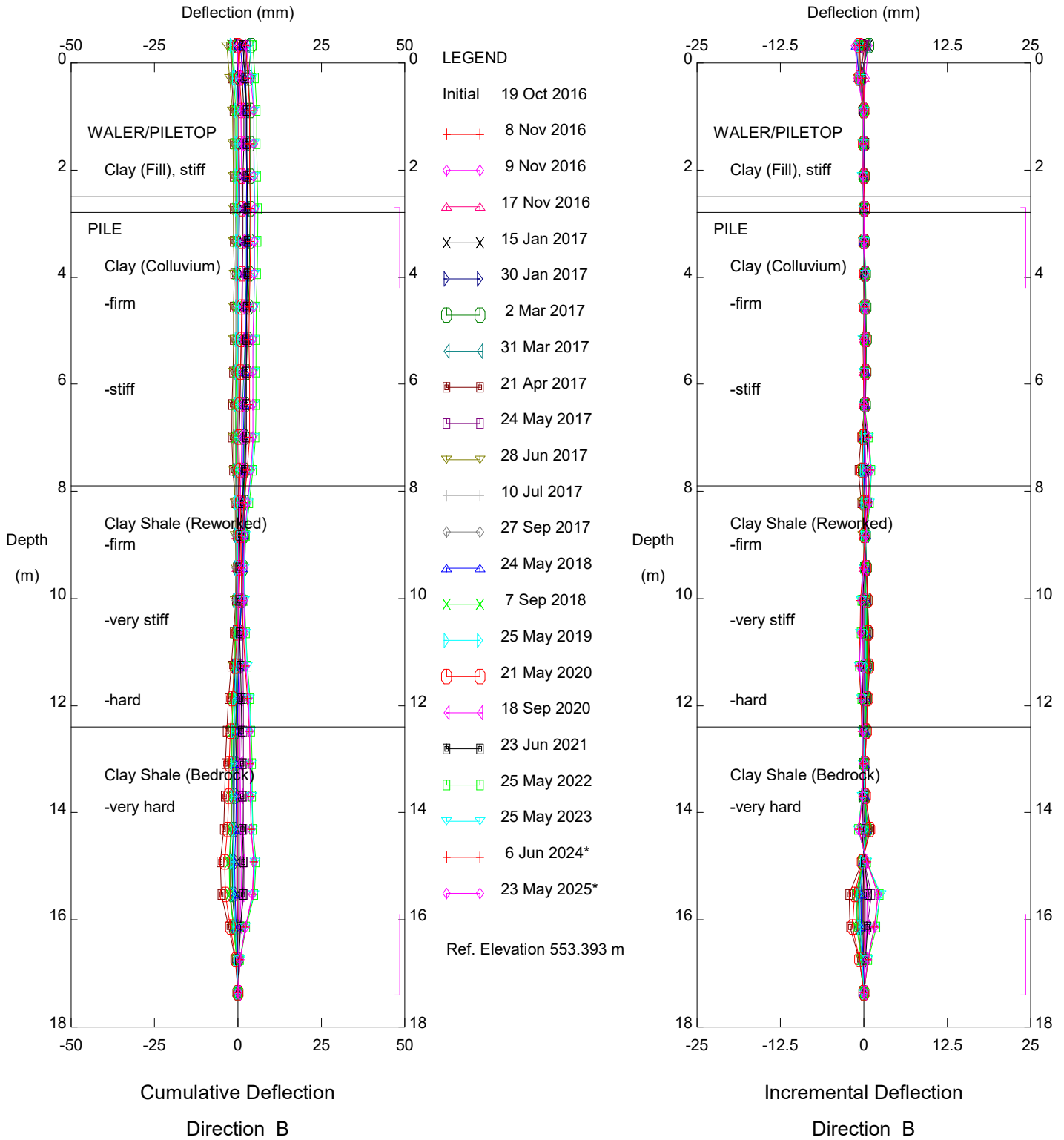


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-2 (P28)

Alberta Transportation

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

Thurber Engineering Ltd.

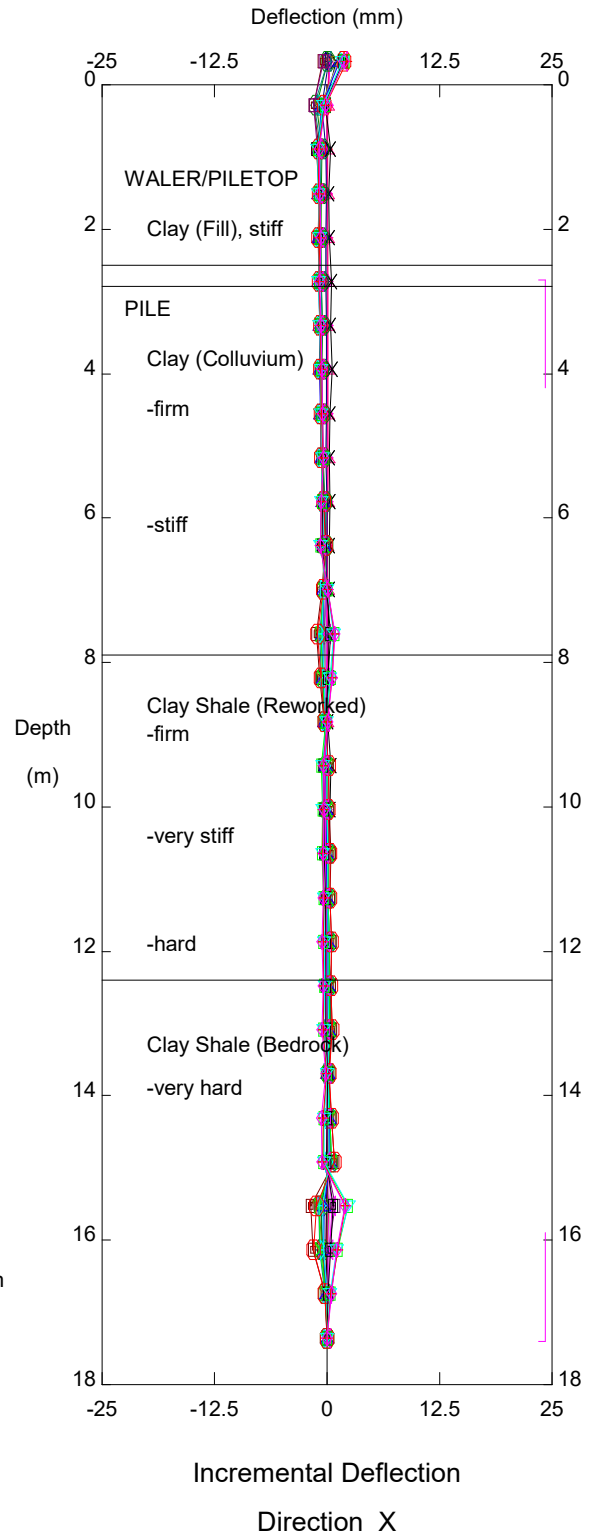
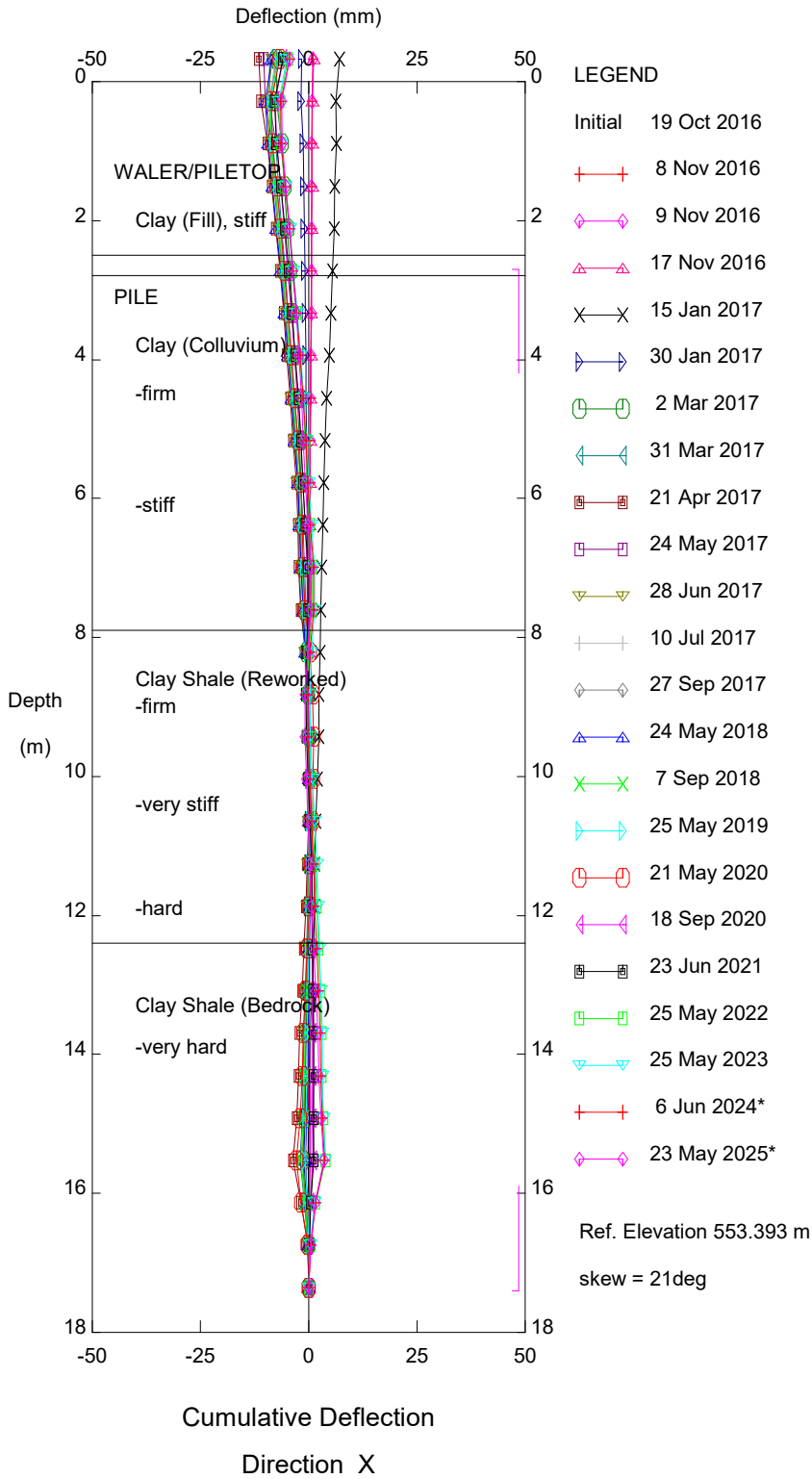


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-2 (P28)

Alberta Transportation

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

Thurber Engineering Ltd.

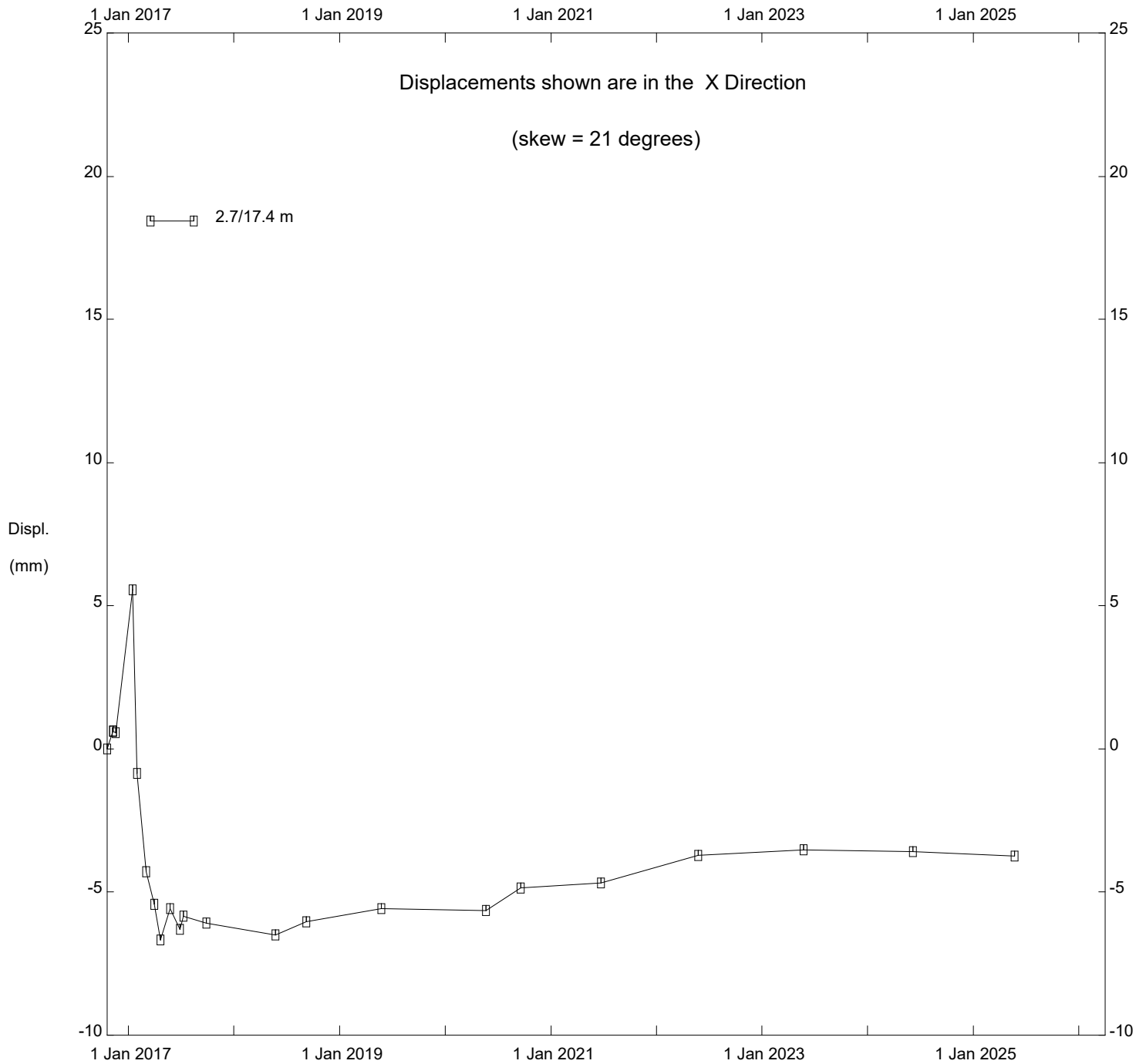


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-2 (P28)

Alberta Transportation

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

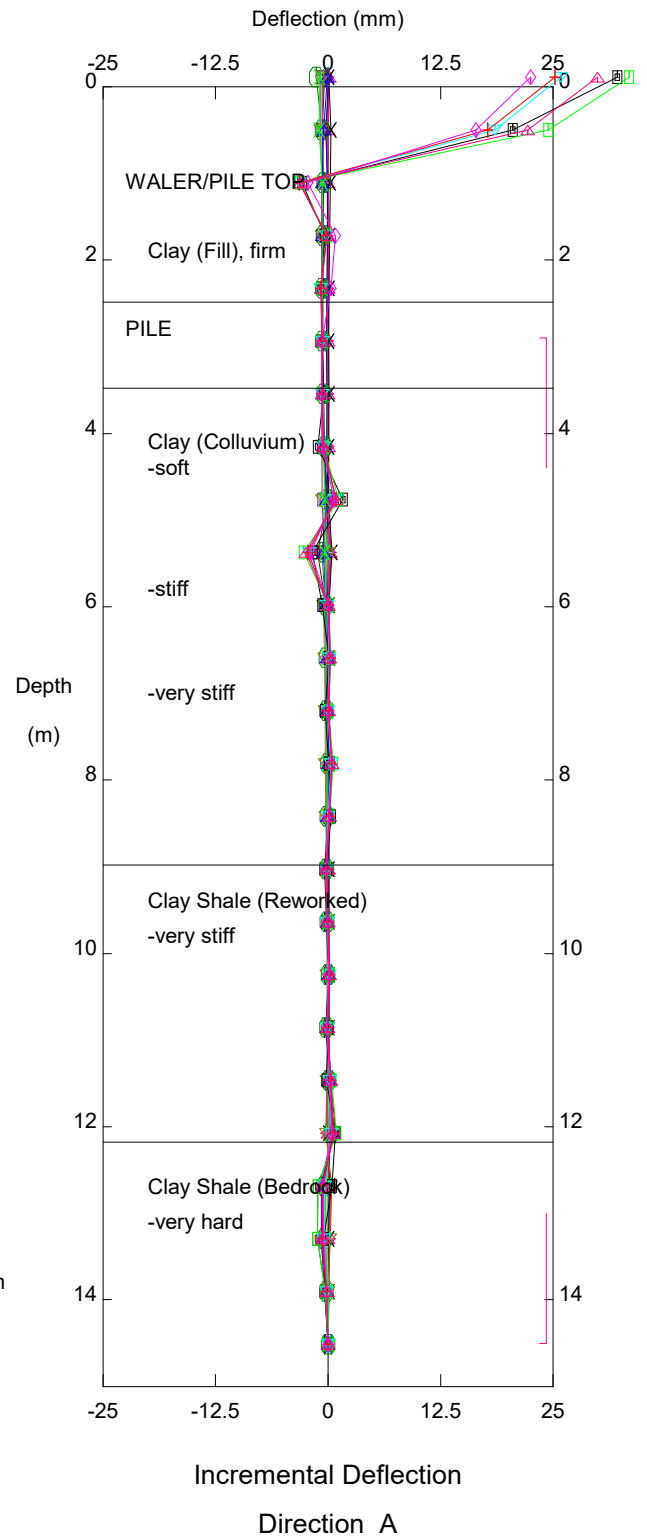
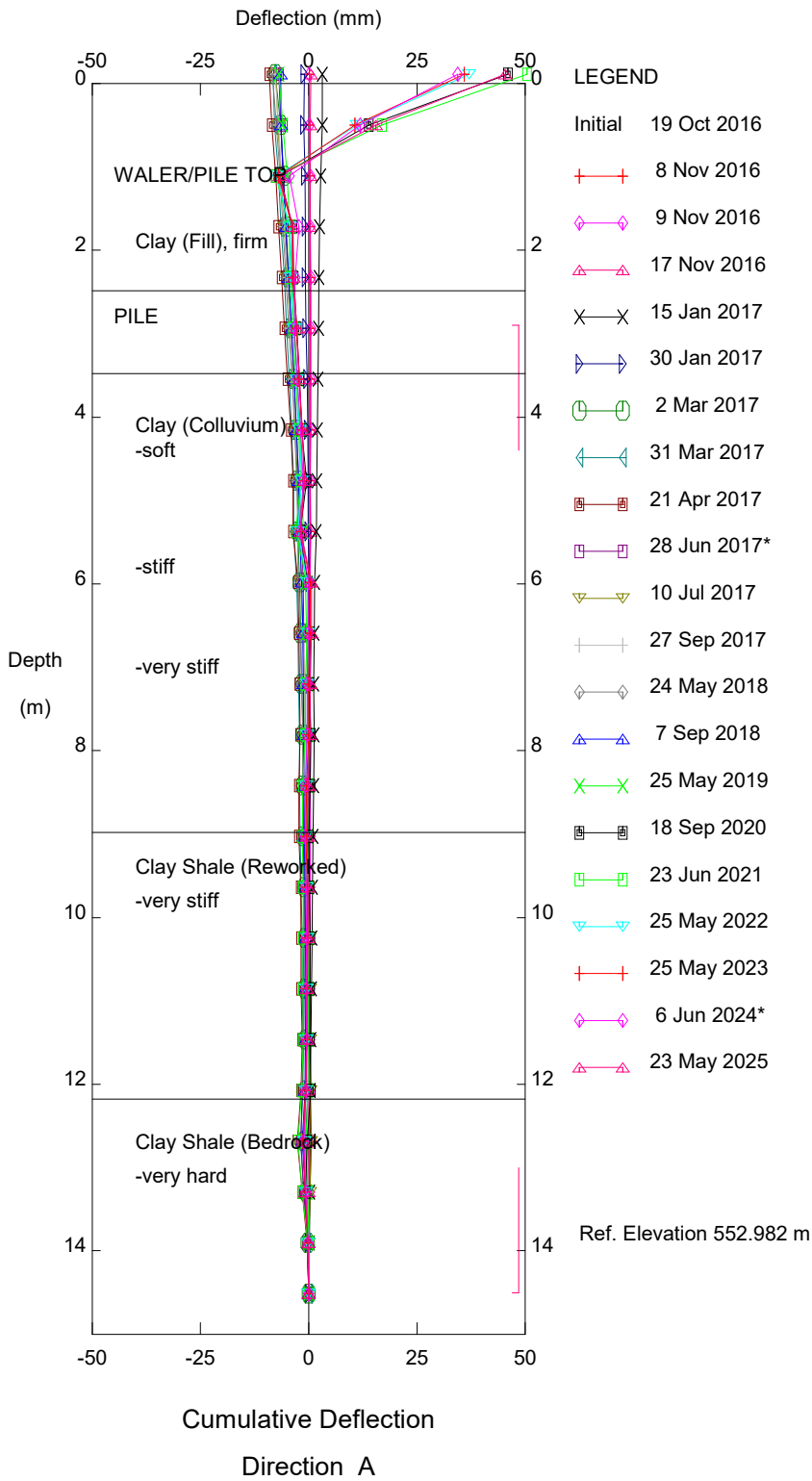
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-2 (P28)

Alberta Transportation

Thurber Engineering Ltd.

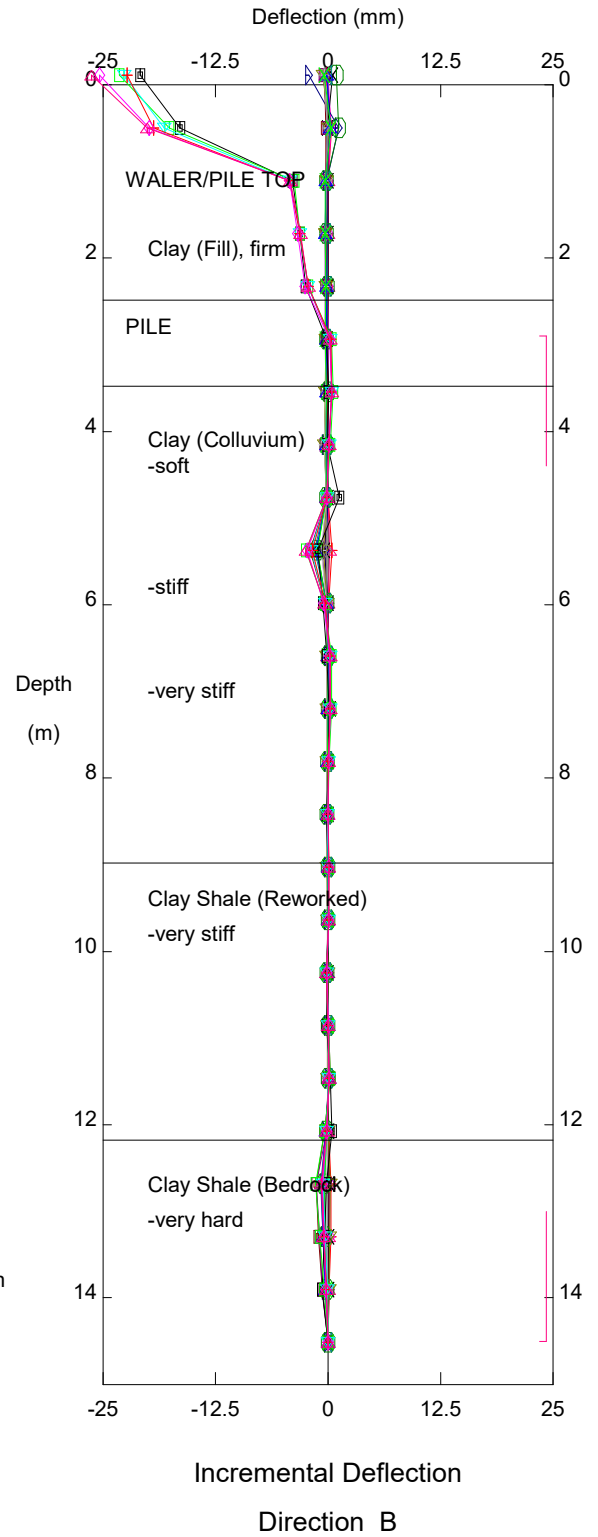
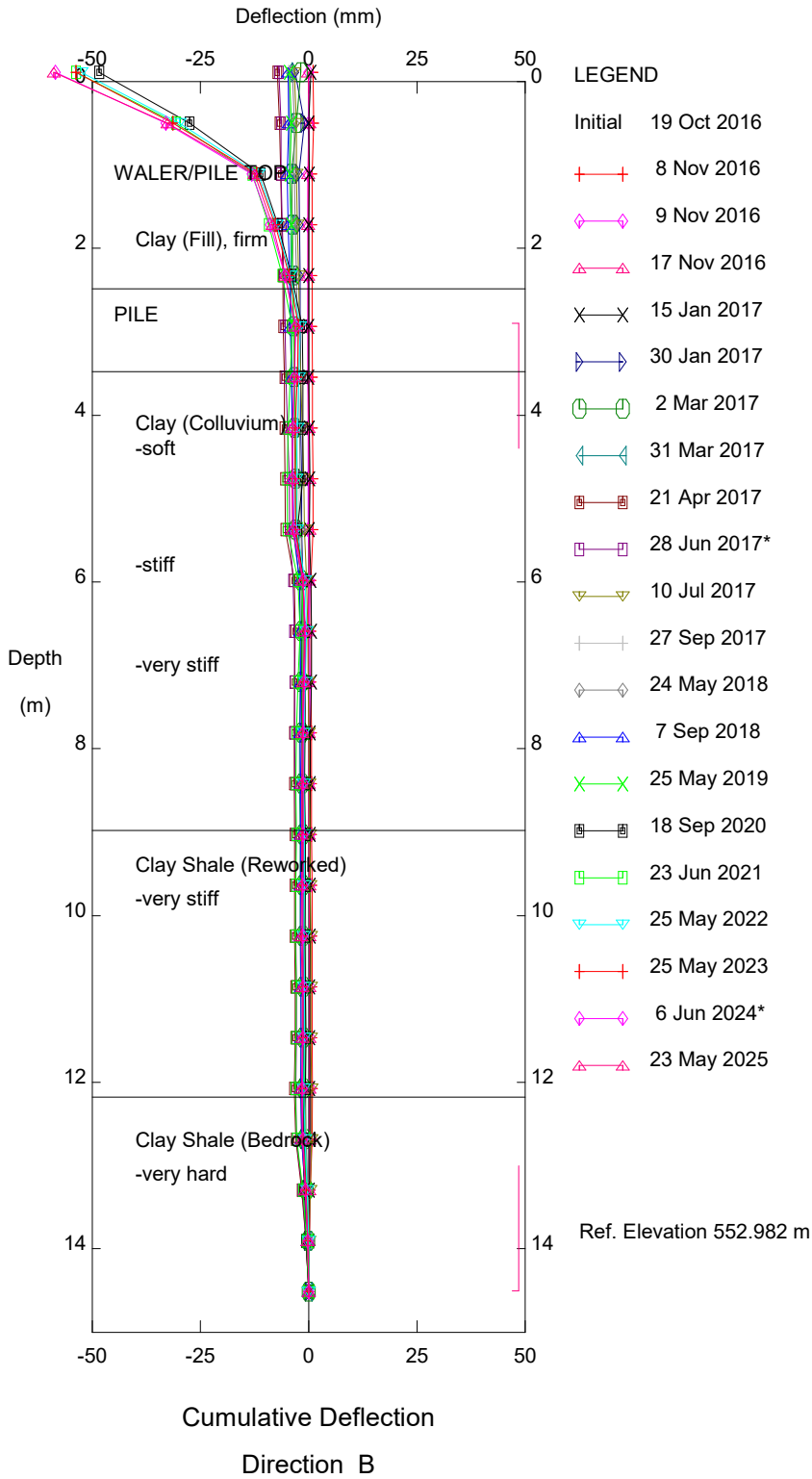


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-3 (P47)

Alberta Transportation

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

Thurber Engineering Ltd.

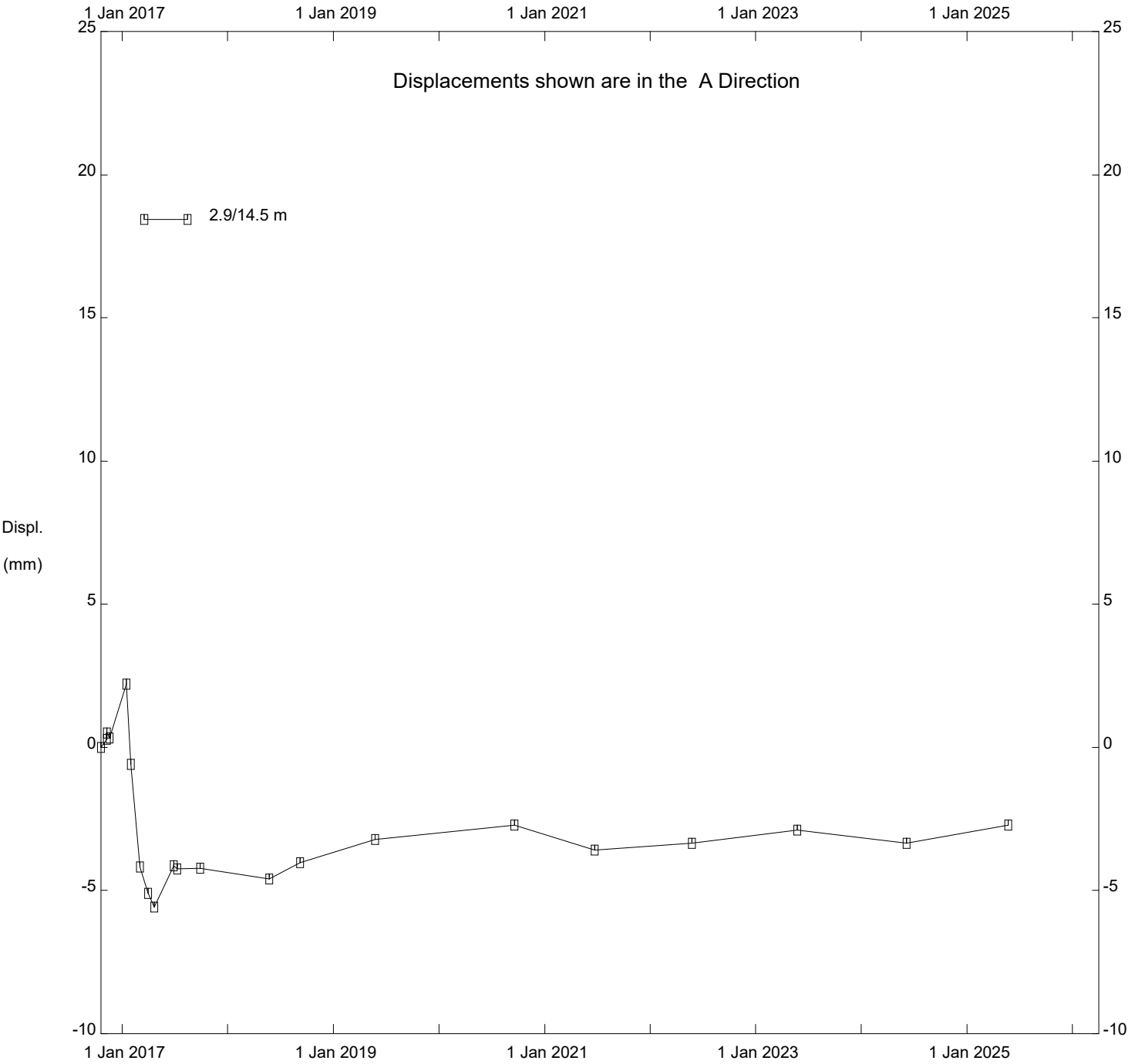


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-3 (P47)

Alberta Transportation

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

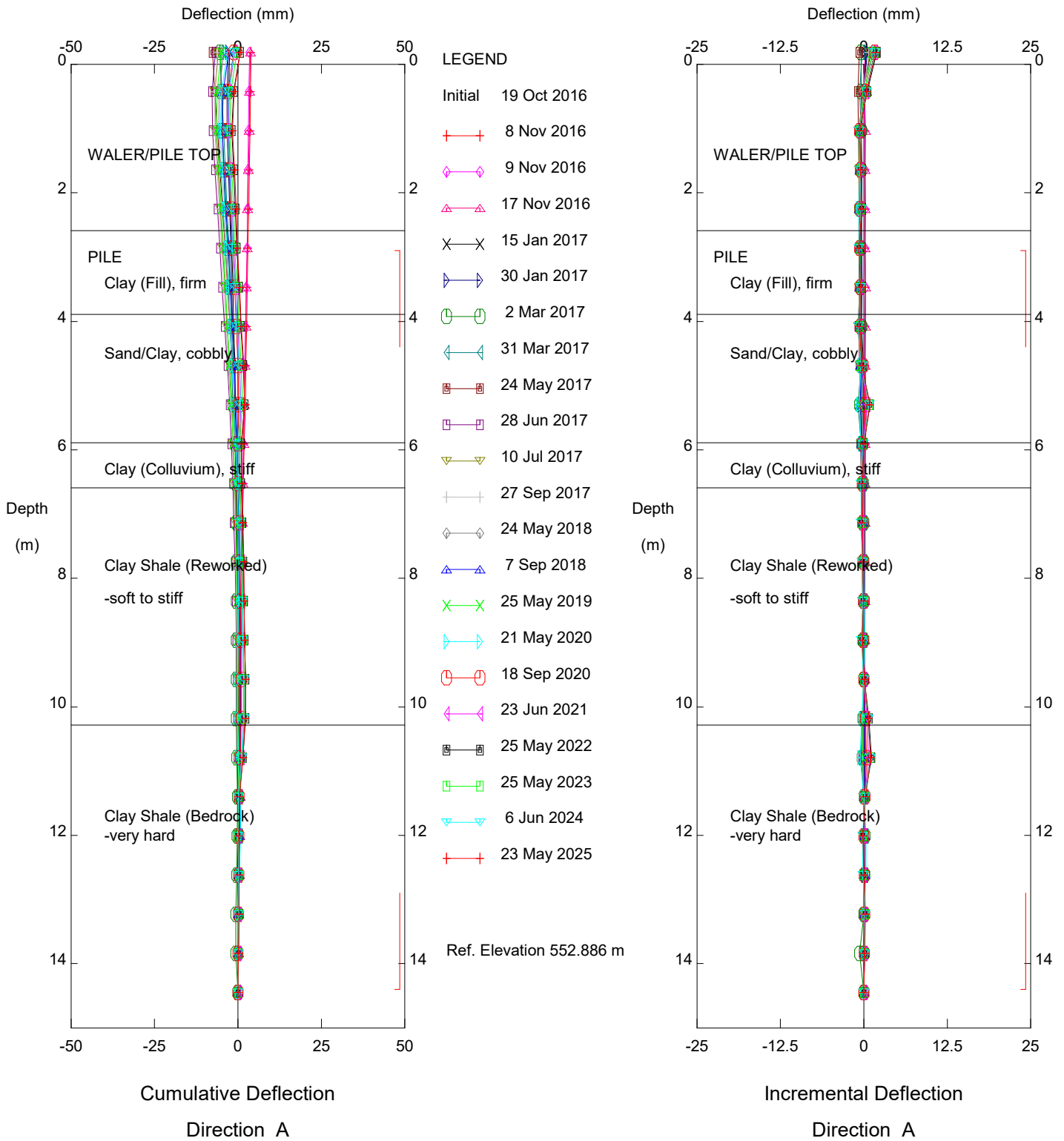
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-3 (P47)

Alberta Transportation

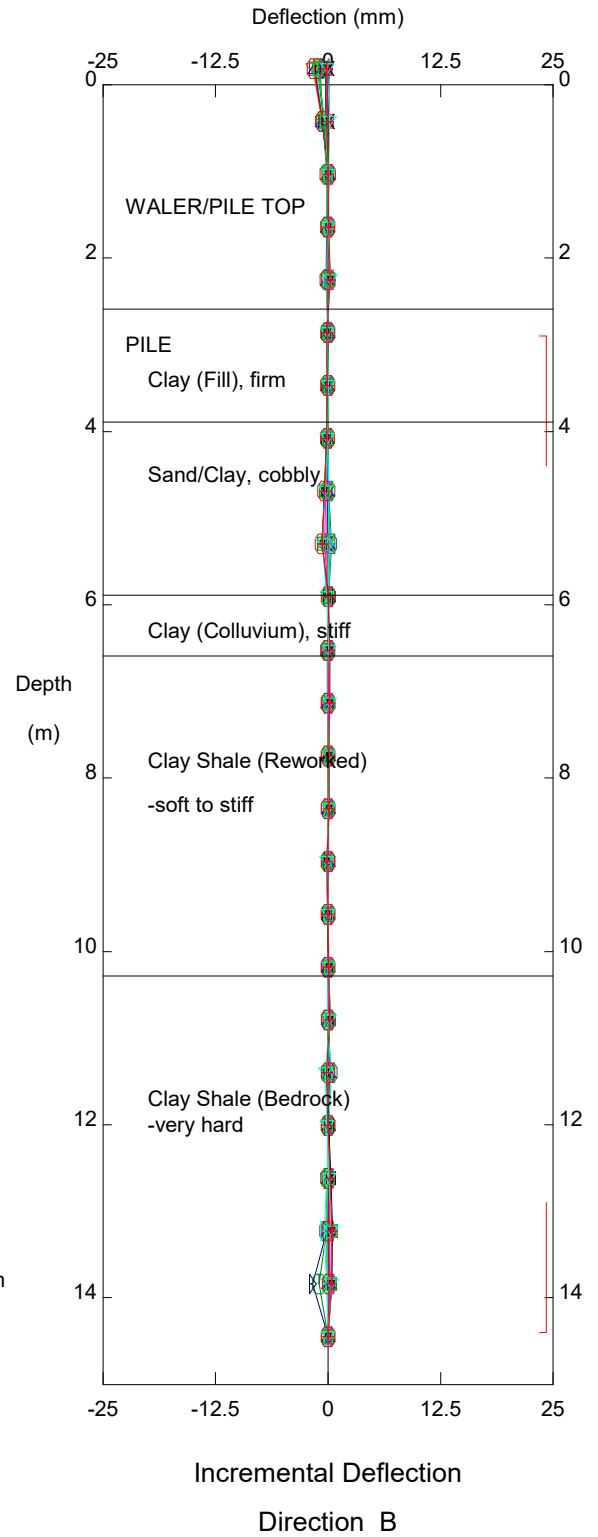
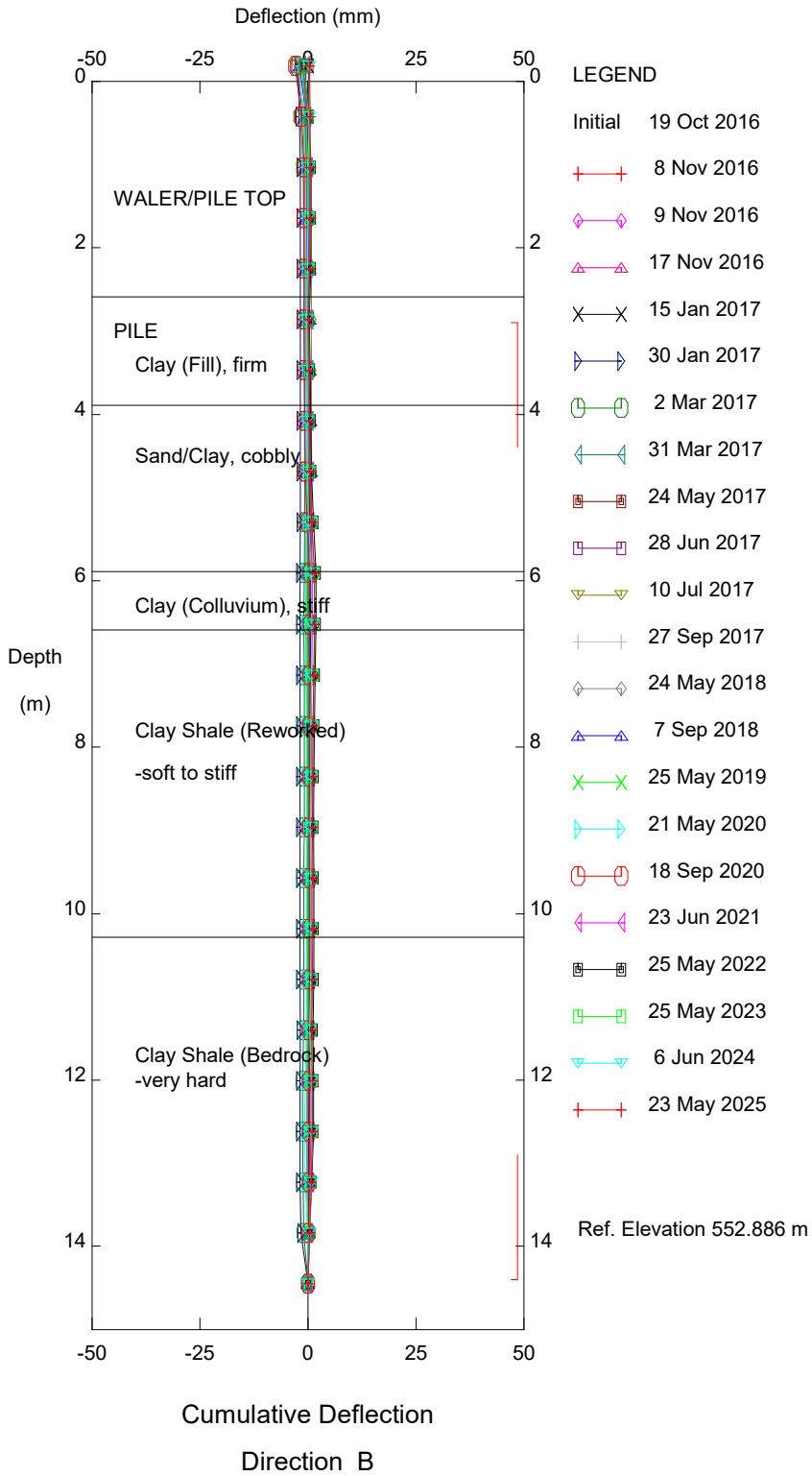
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-5 (P83)

Alberta Transportation

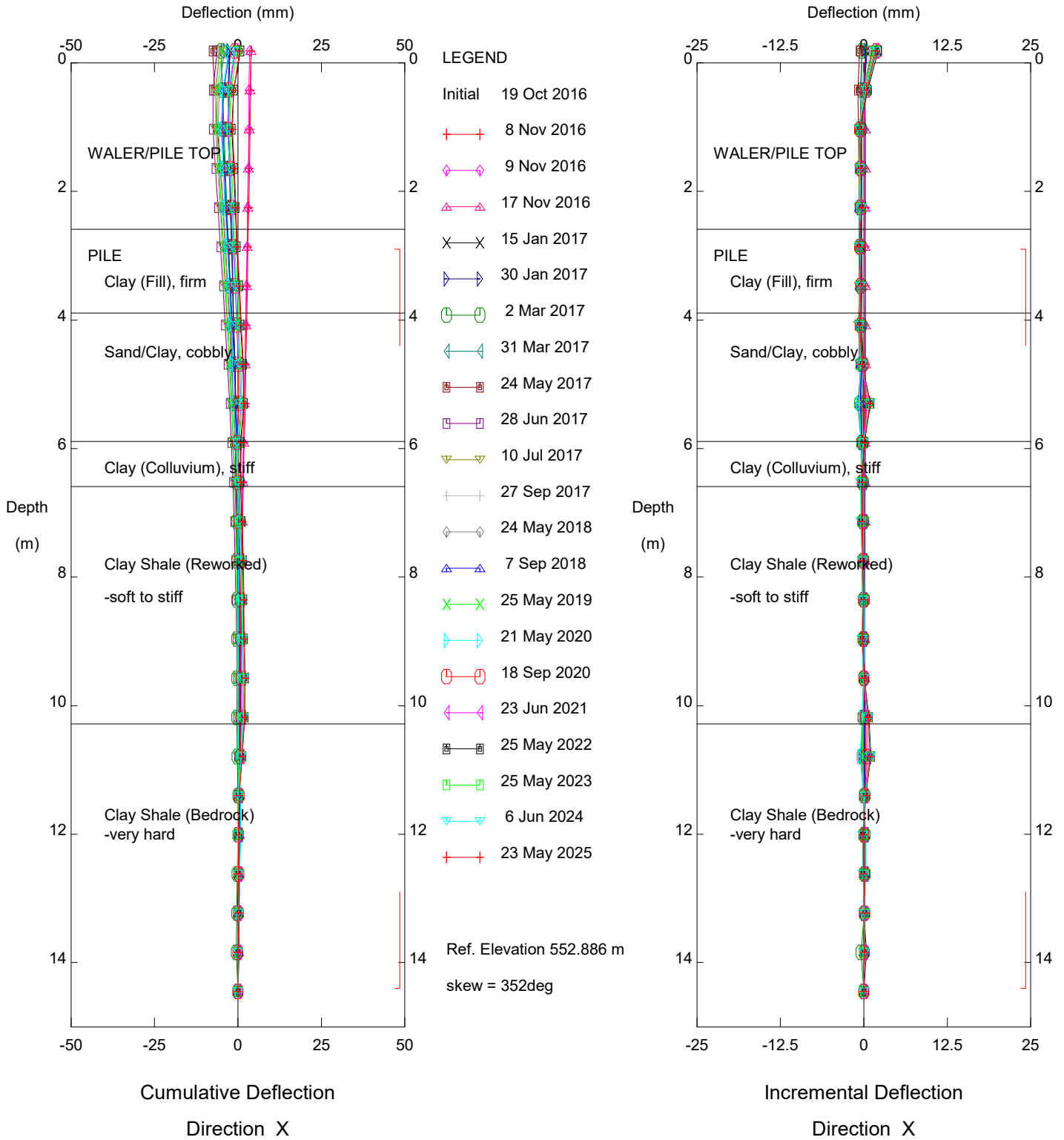
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-5 (P83)

Alberta Transportation

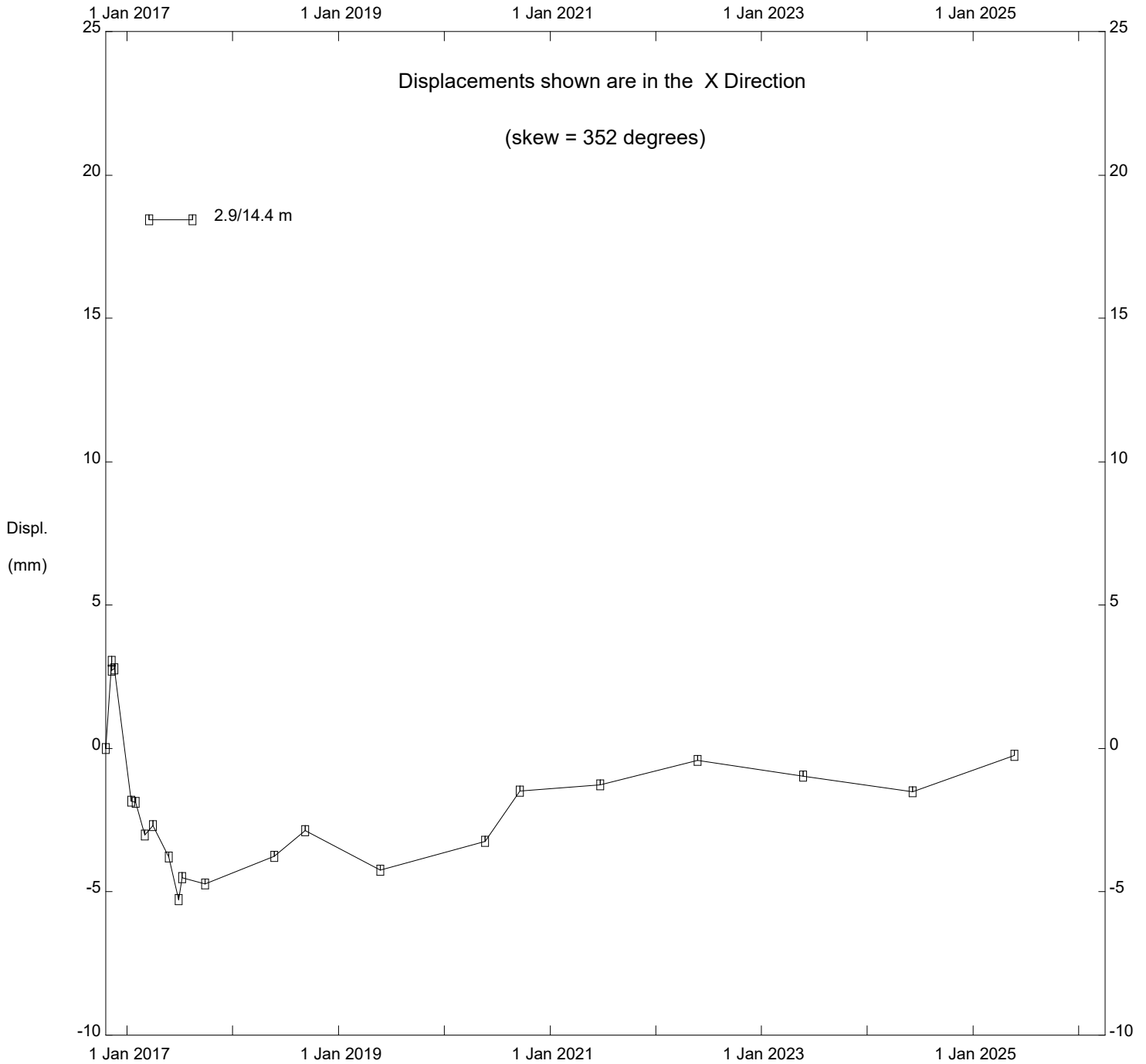
Thurber Engineering Ltd.



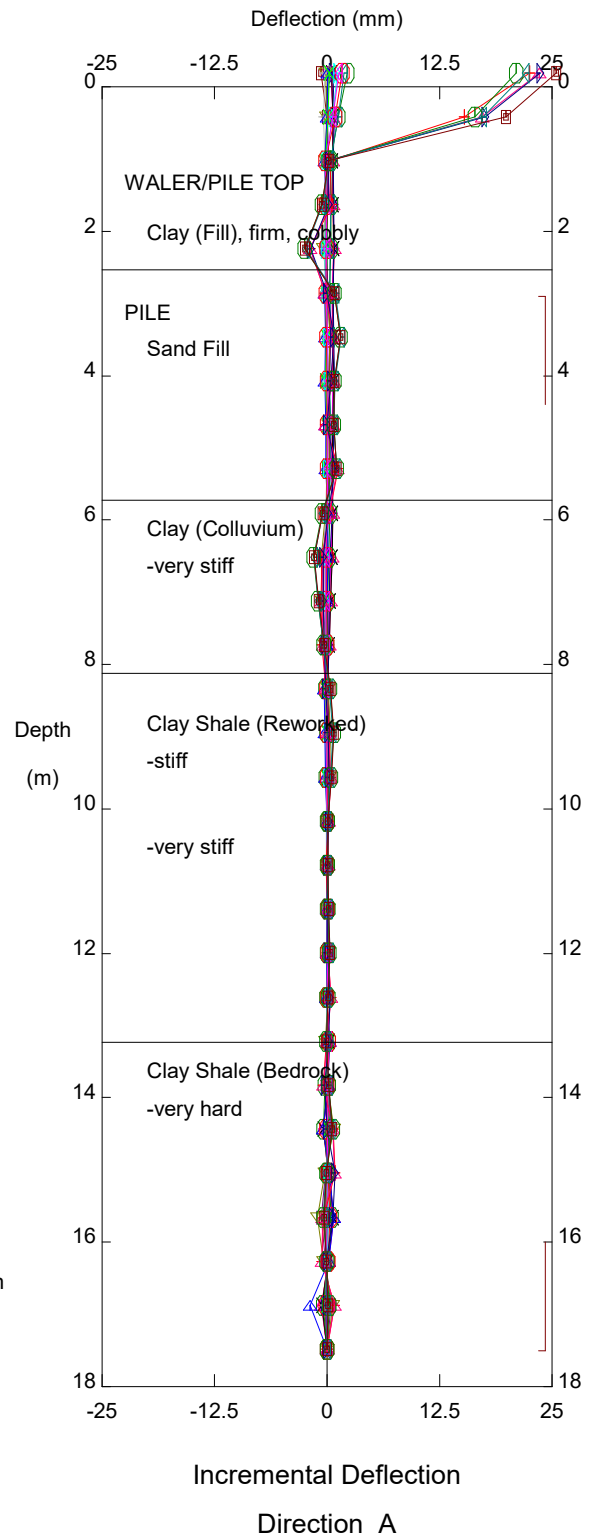
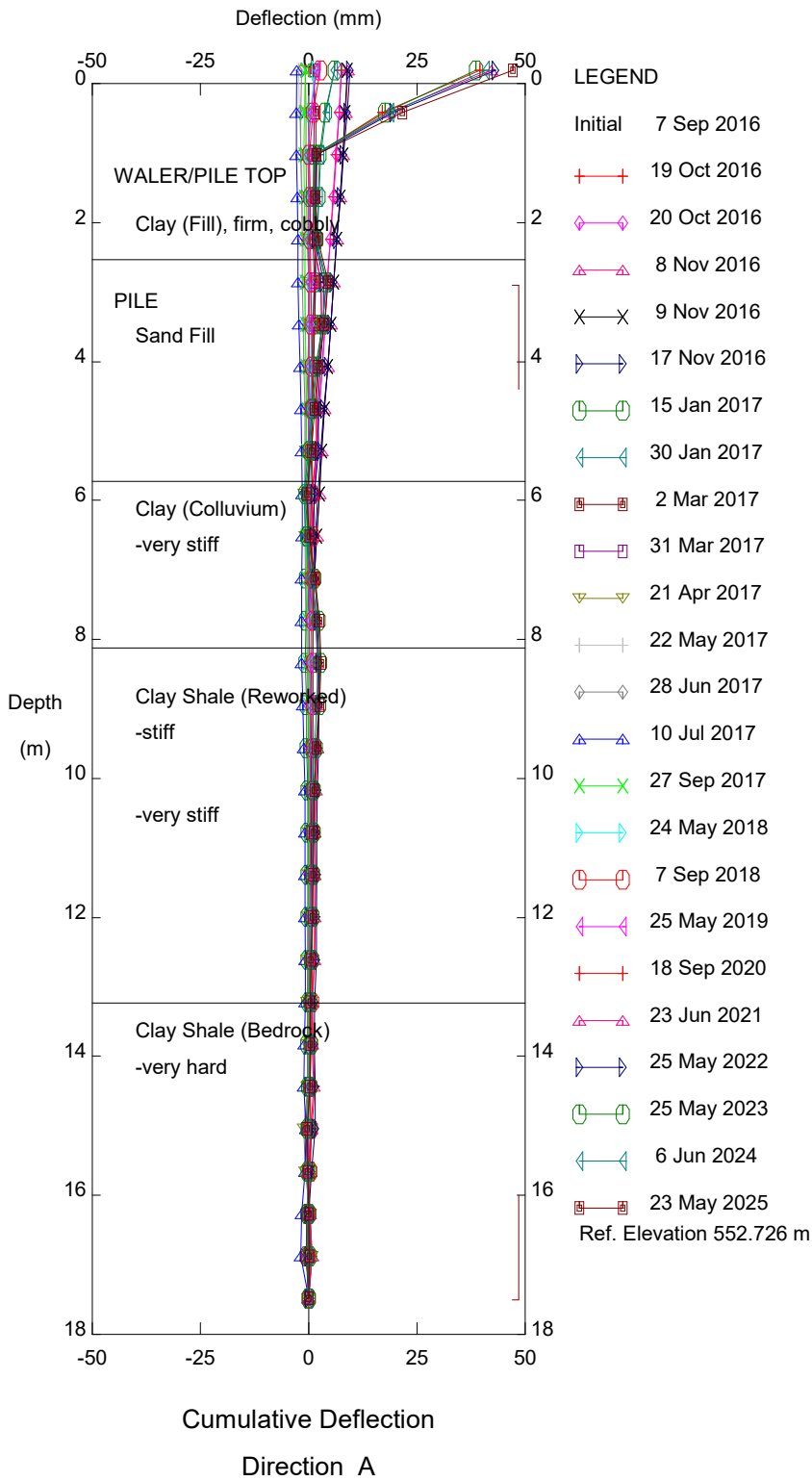
Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-5 (P83)

Alberta Transportation

Thurber Engineering Ltd.



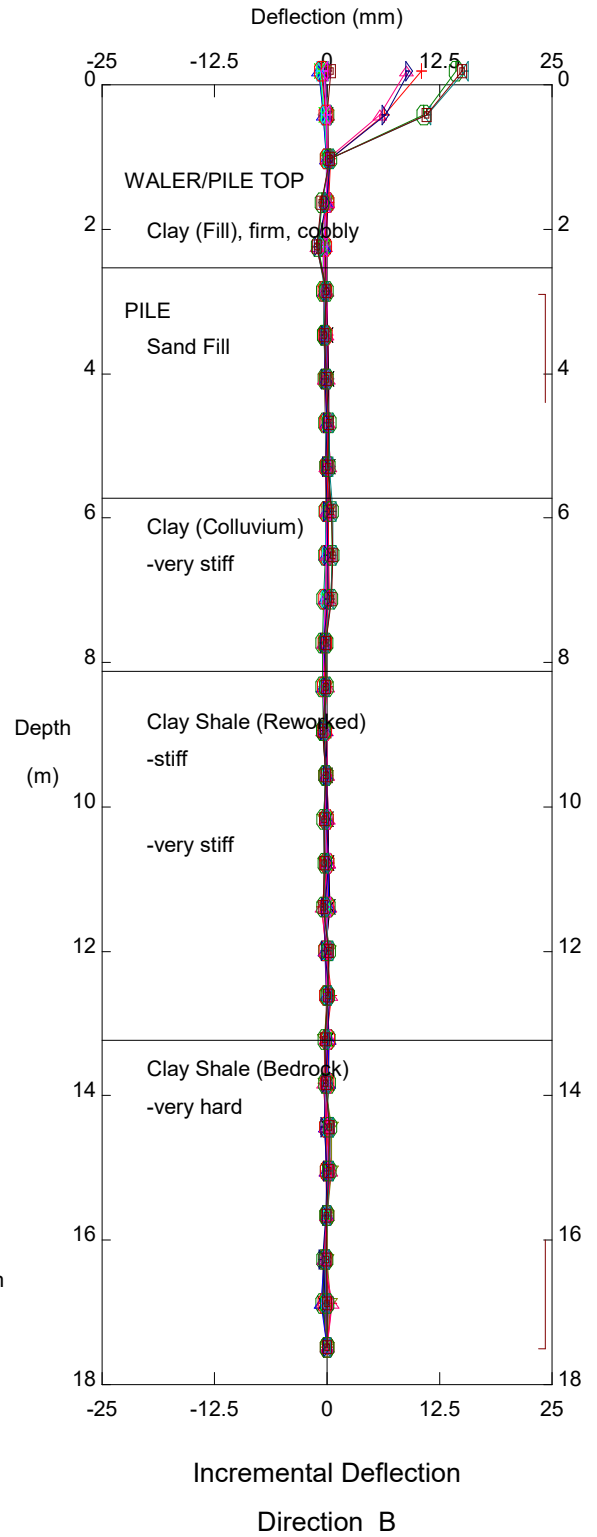
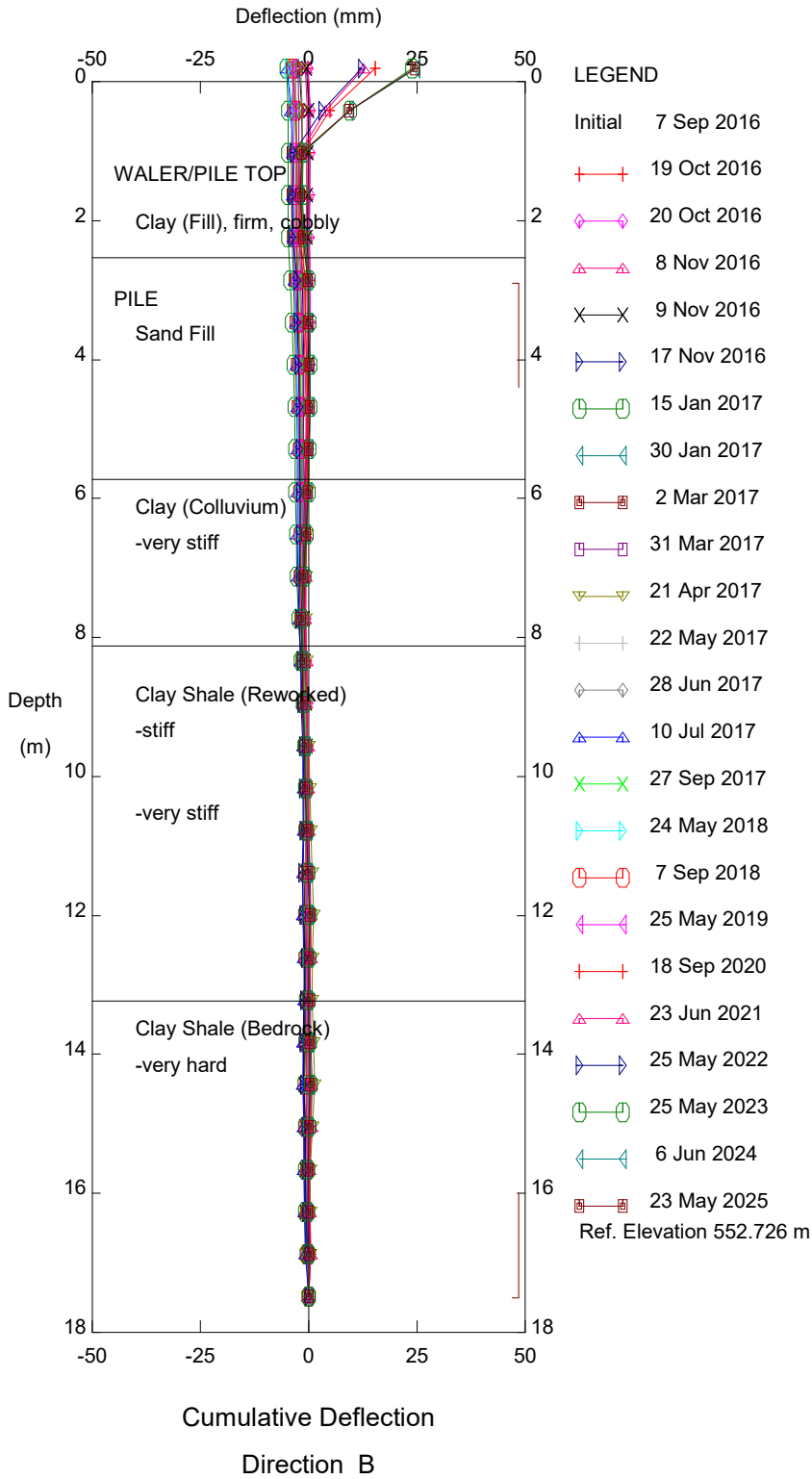
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-6(P101)

Alberta Transportation

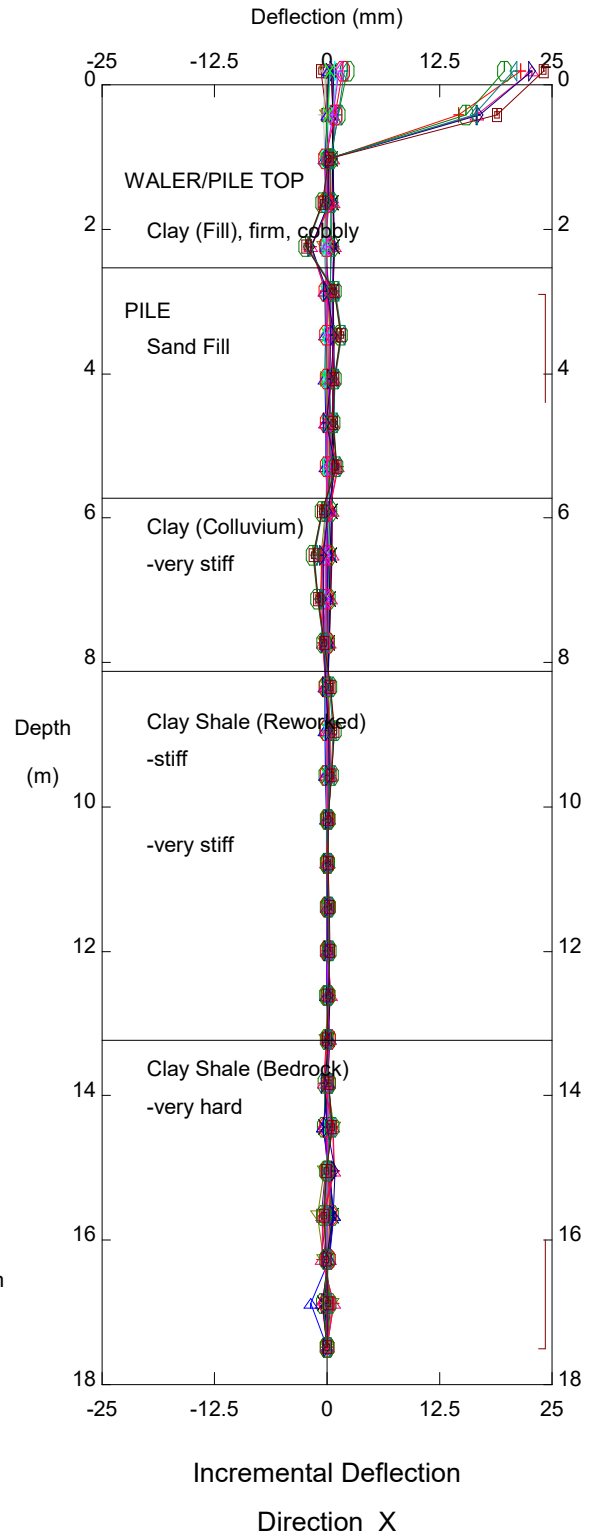
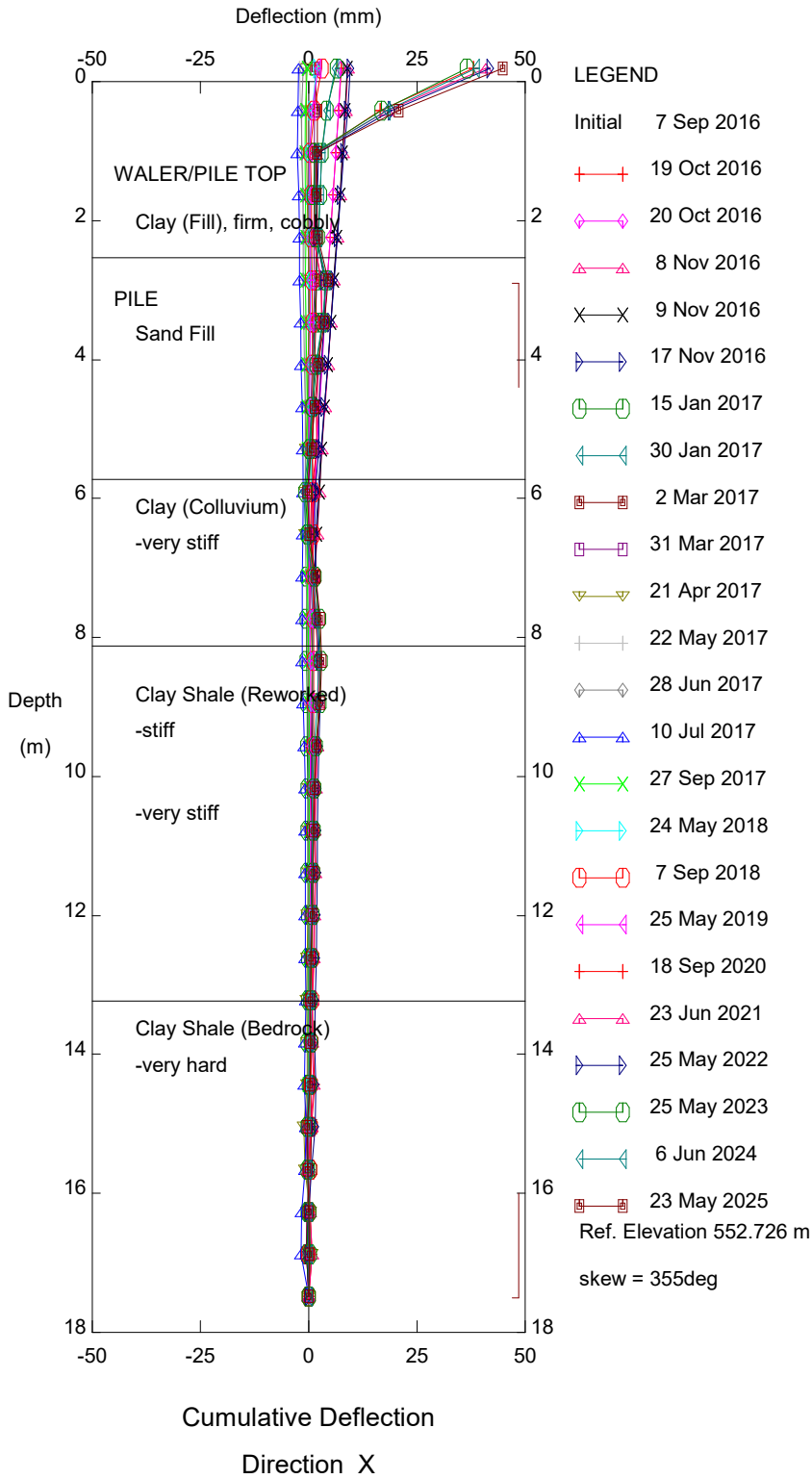
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-6(P101)

Alberta Transportation

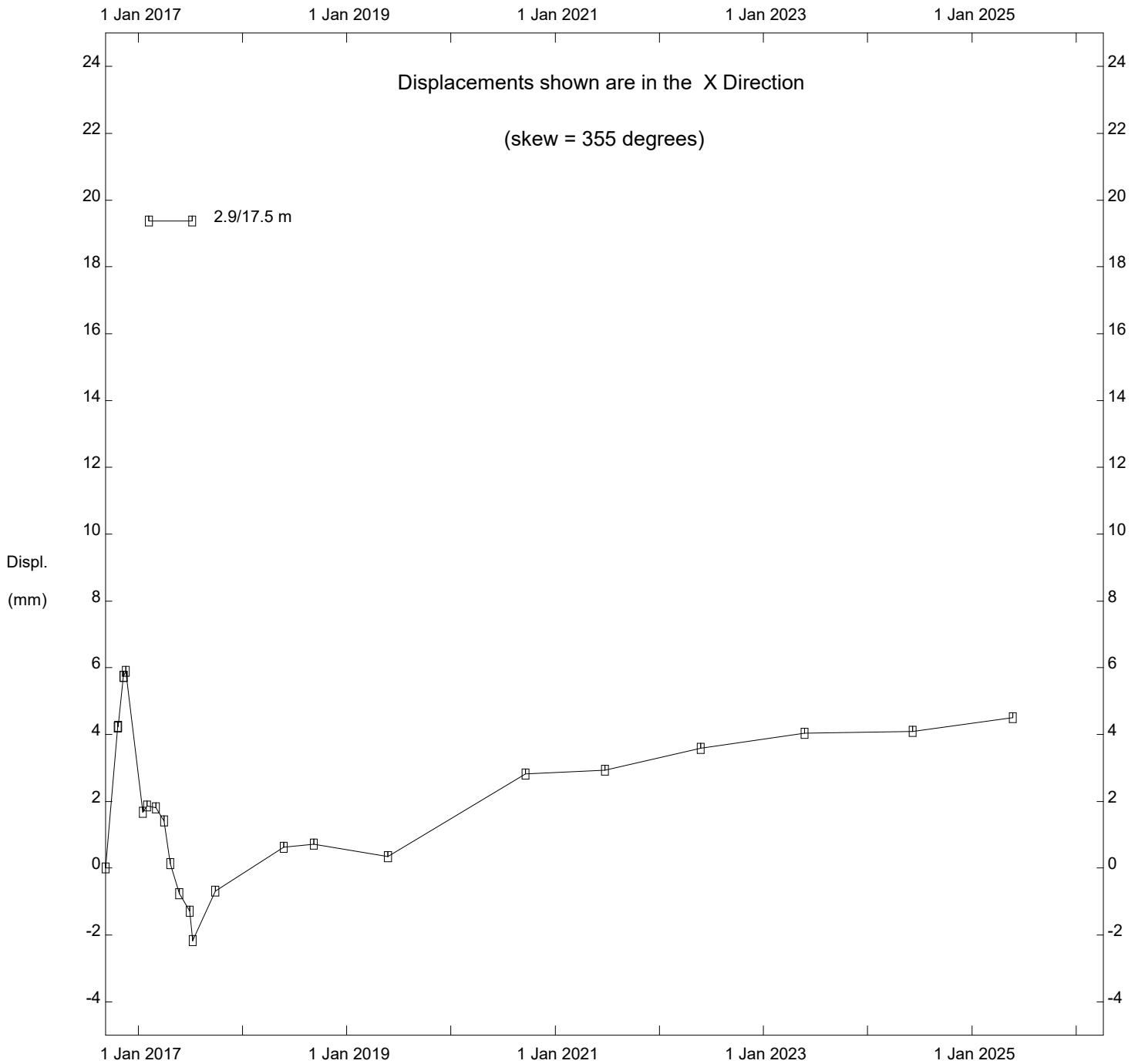
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Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-6(P101)

Alberta Transportation

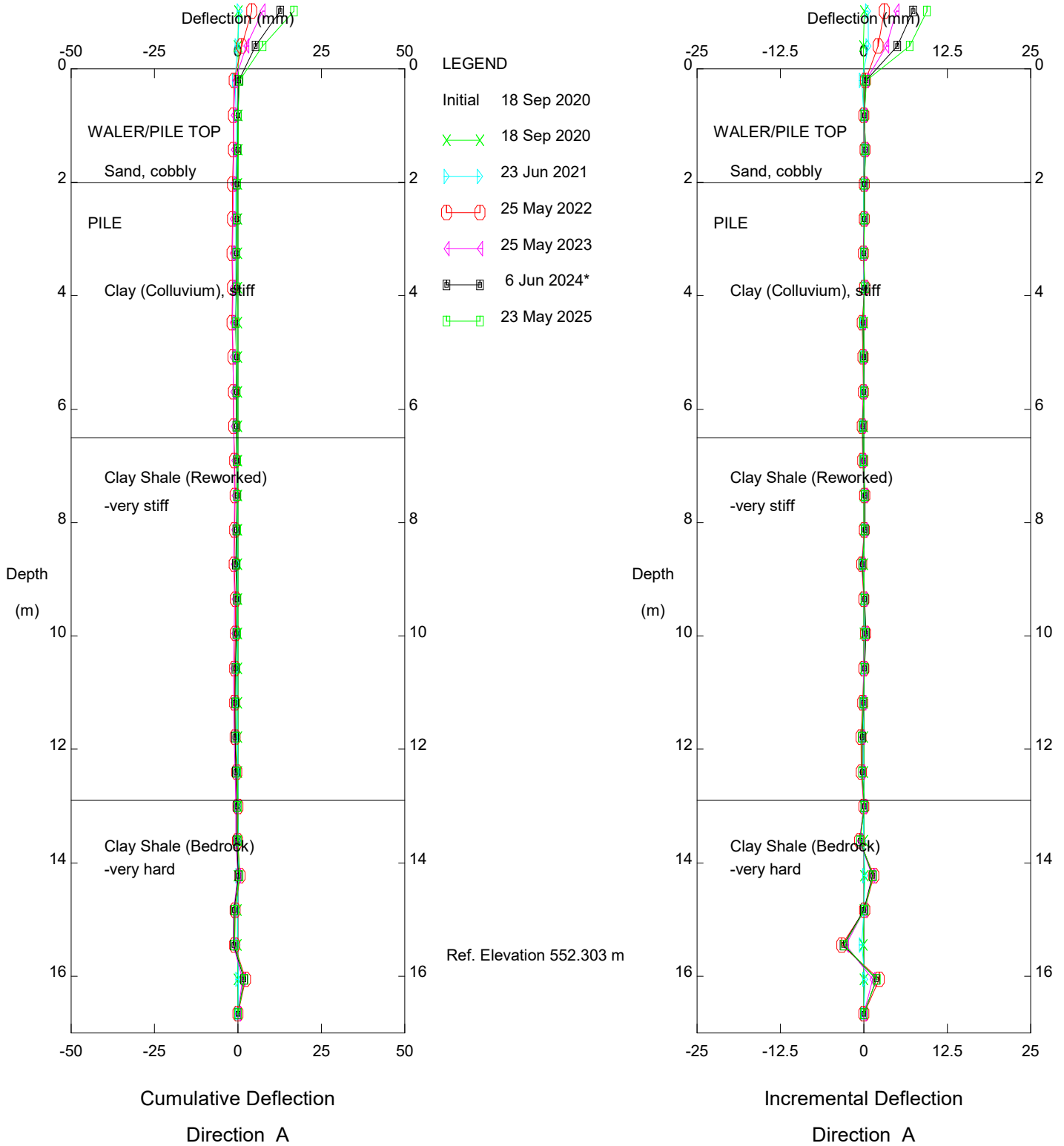
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI16-6(P101)

Alberta Transportation

Thurber Engineering Ltd.

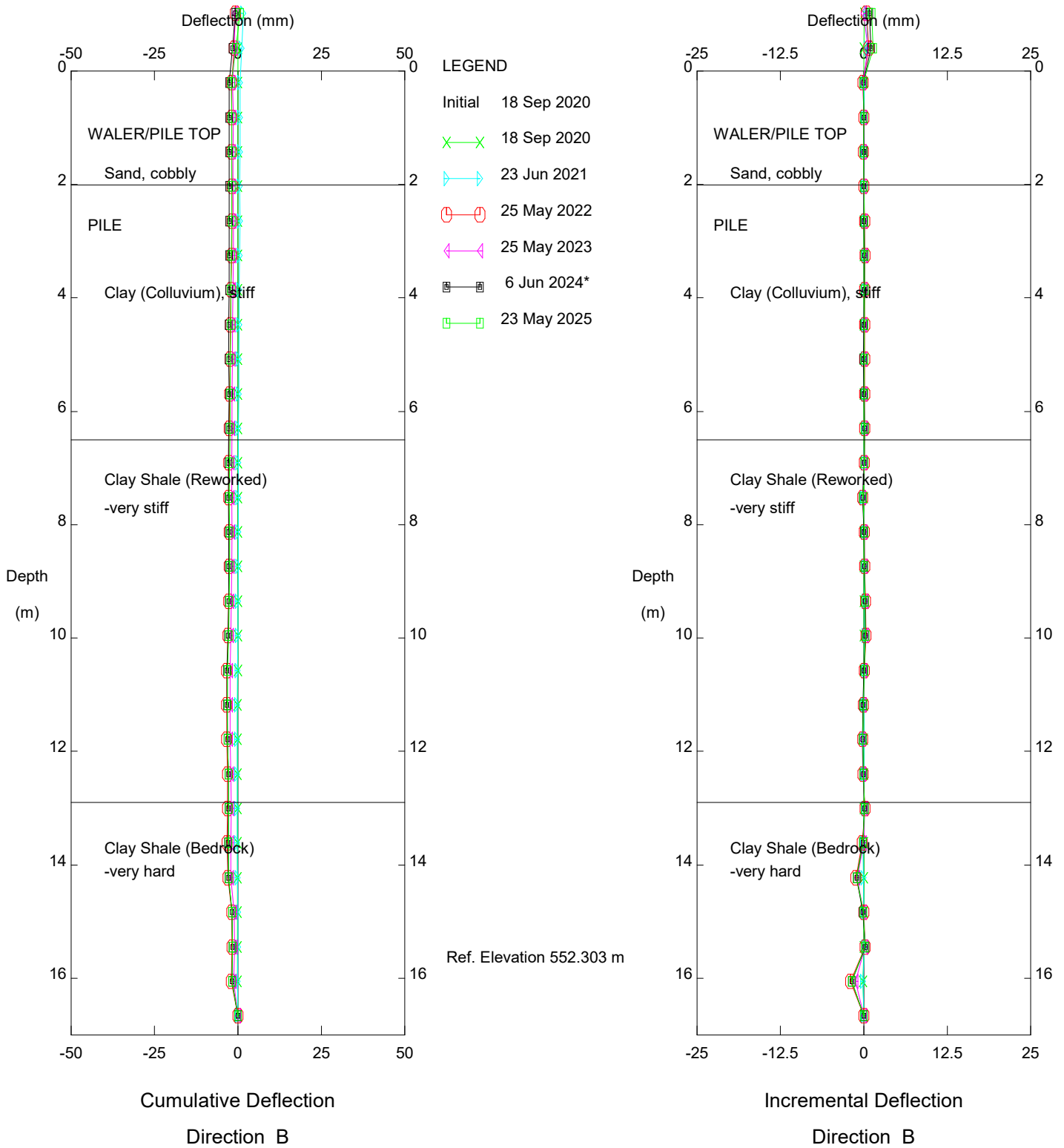


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-7(P122)

Alberta Transportation

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

Thurber Engineering Ltd.

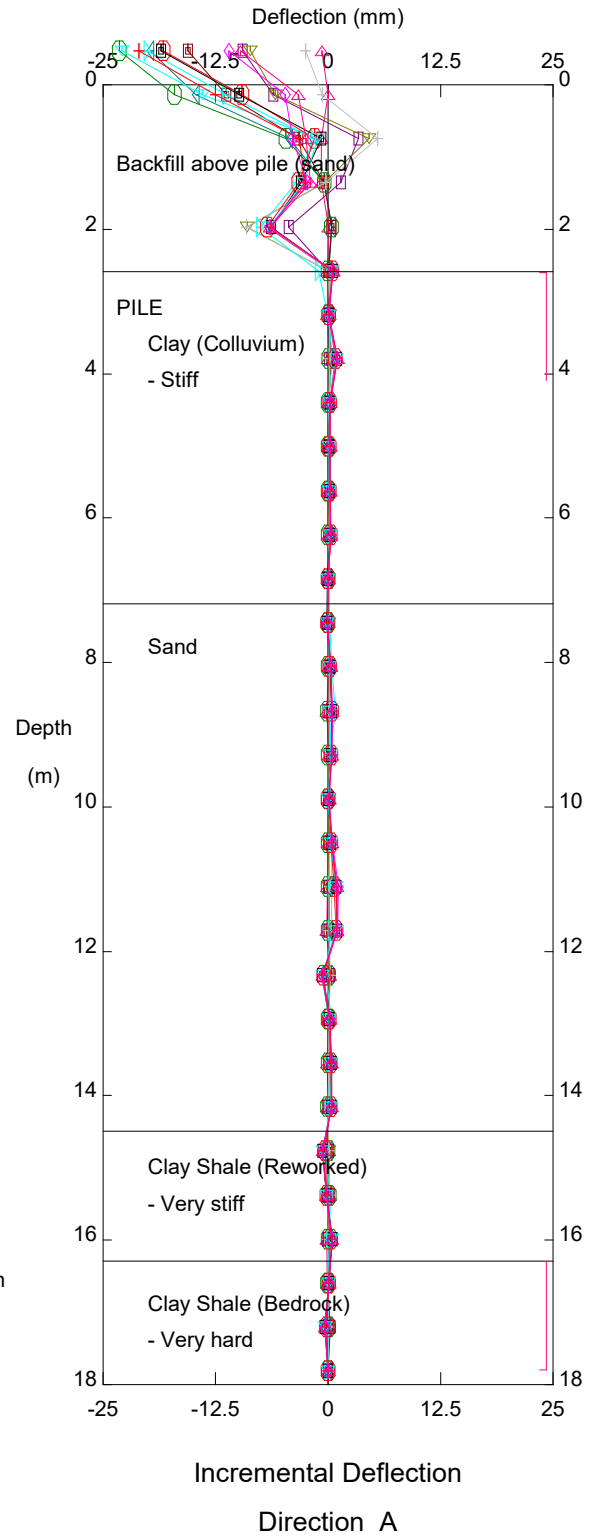
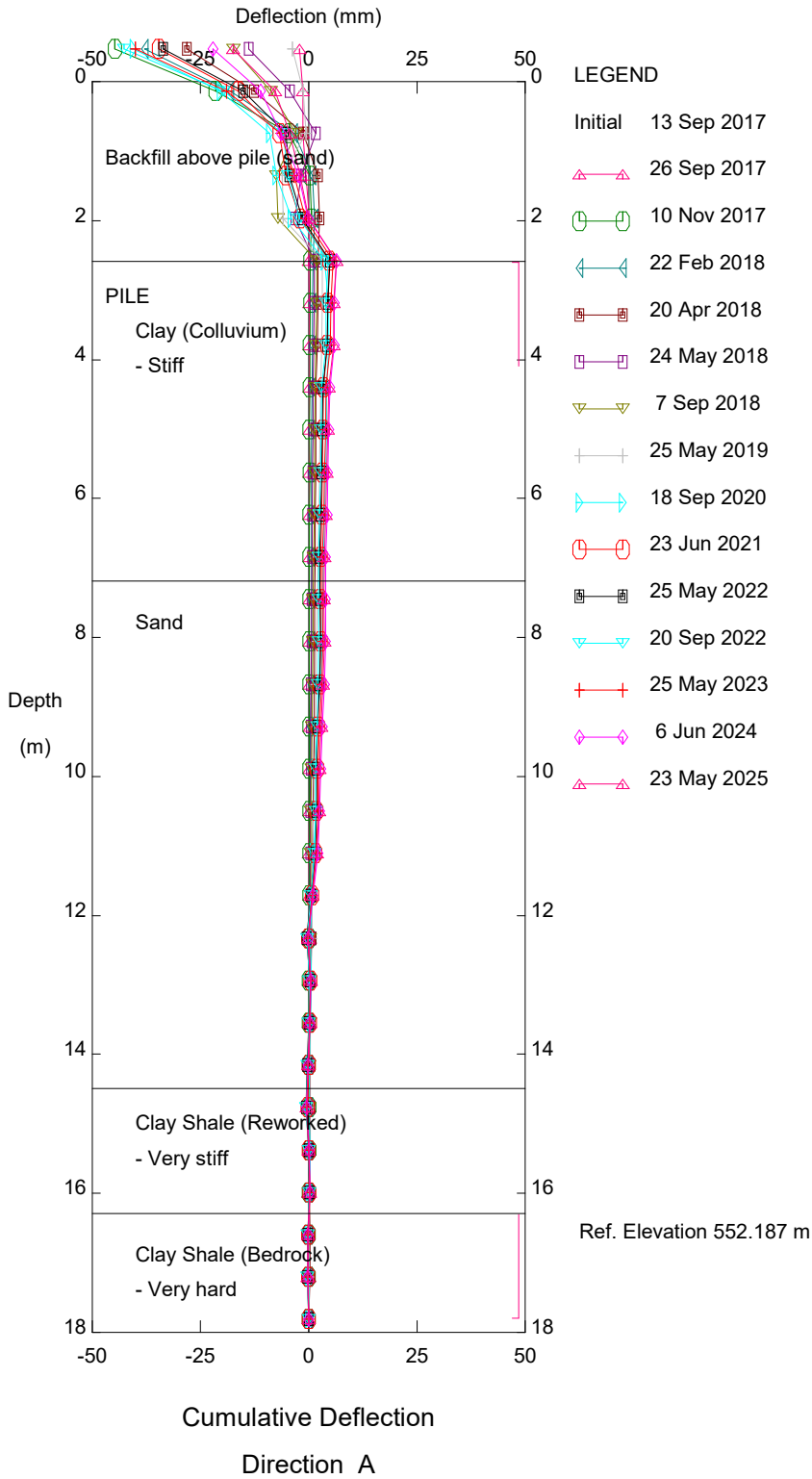


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI16-7(P122)

Alberta Transportation

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

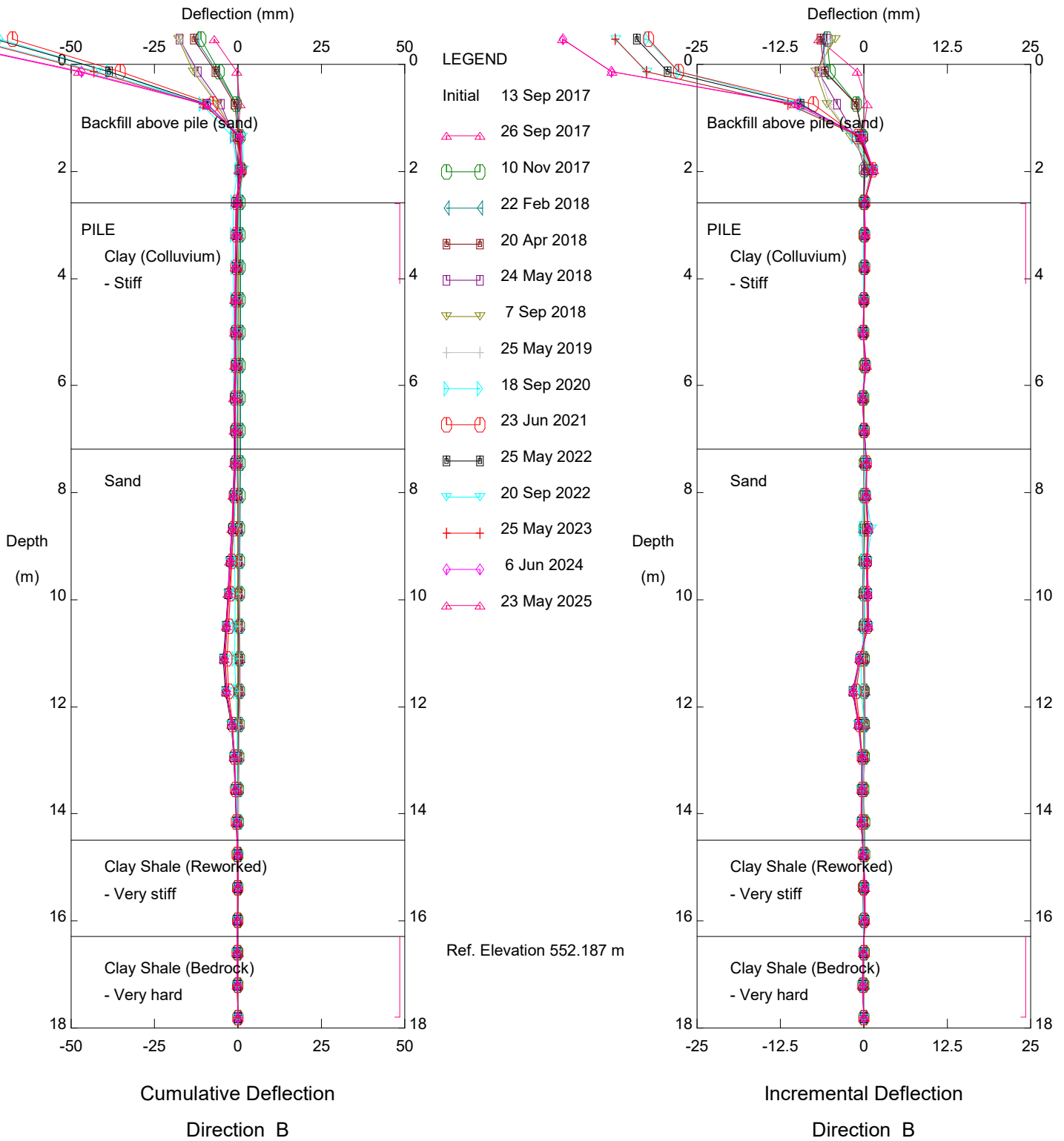
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-1(P130)

Alberta Transportation

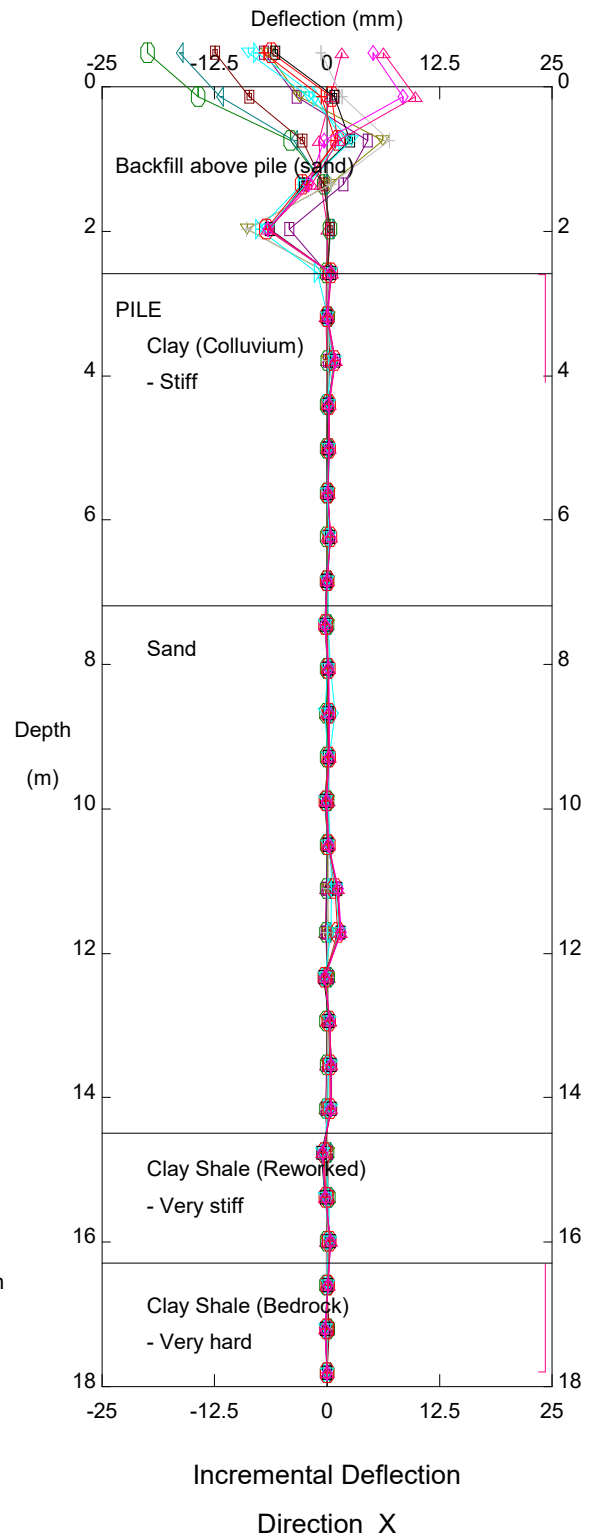
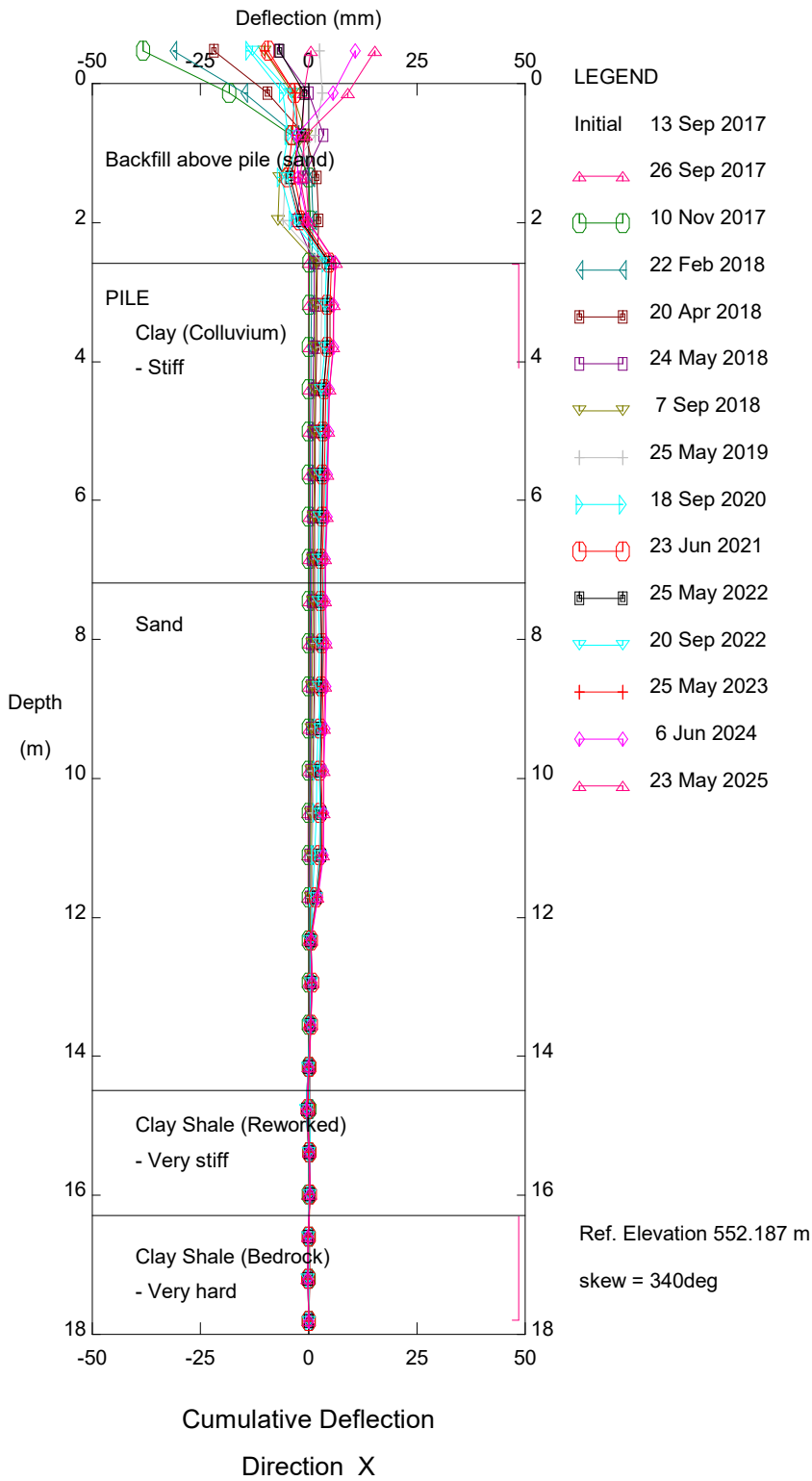
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-1(P130)

Alberta Transportation

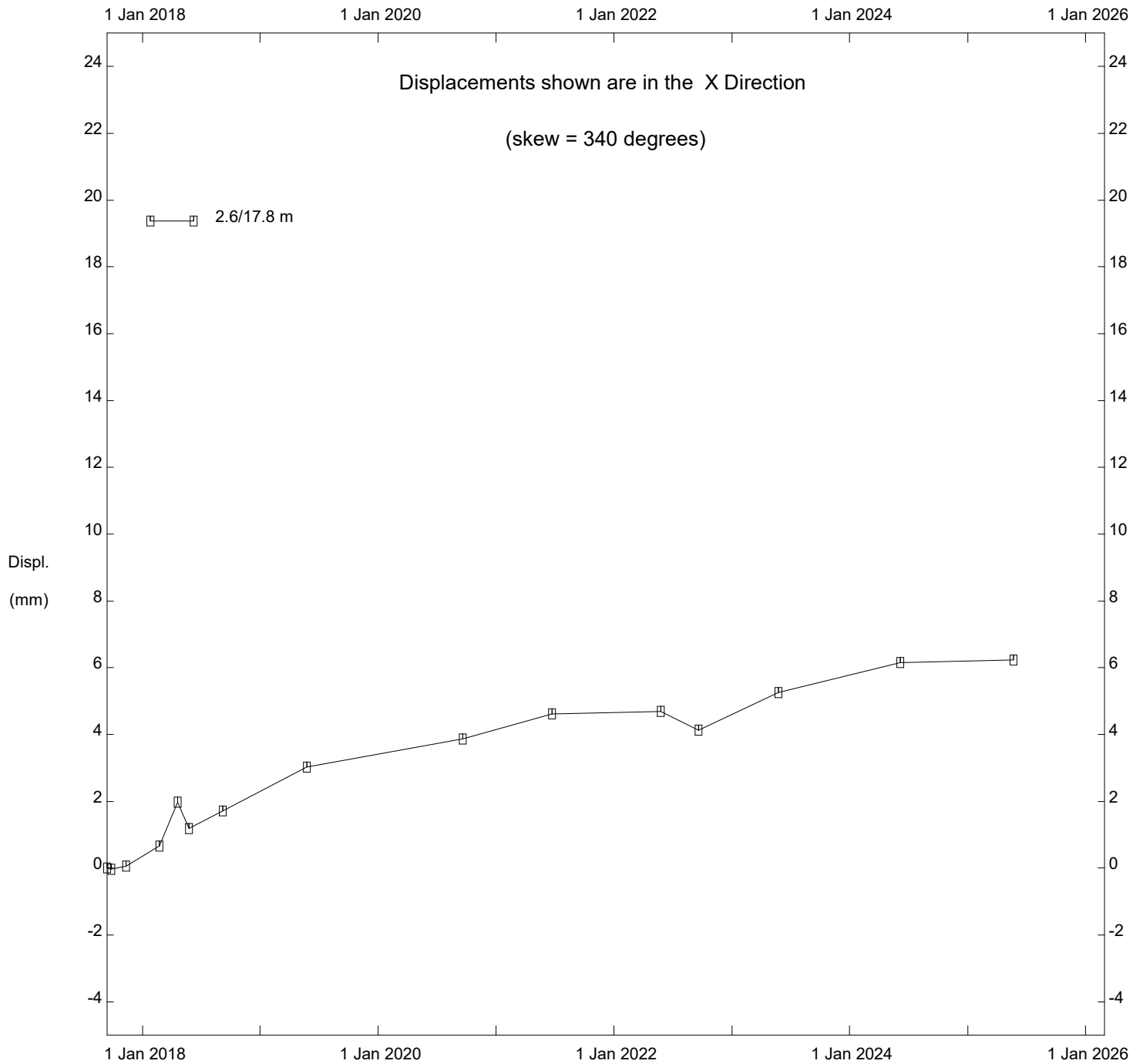
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-1(P130)

Alberta Transportation

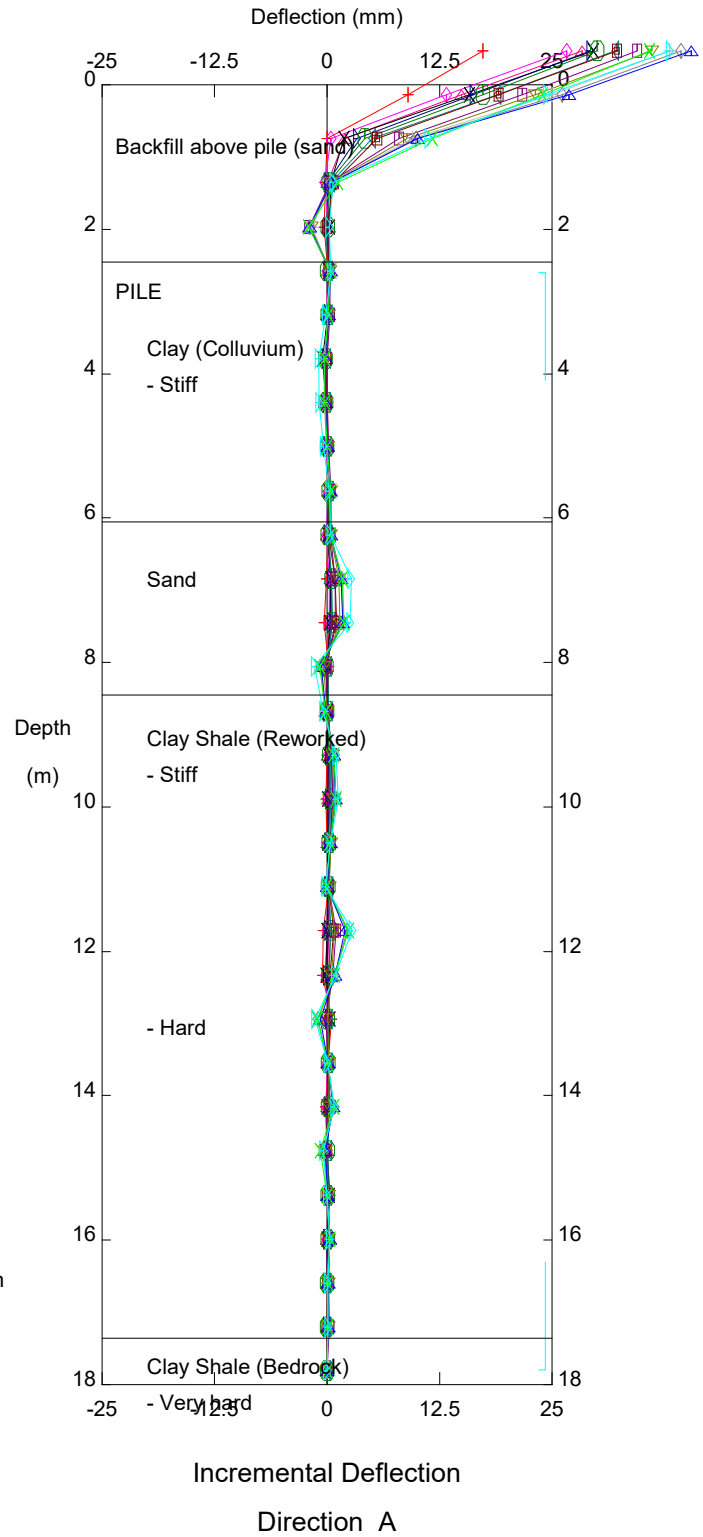
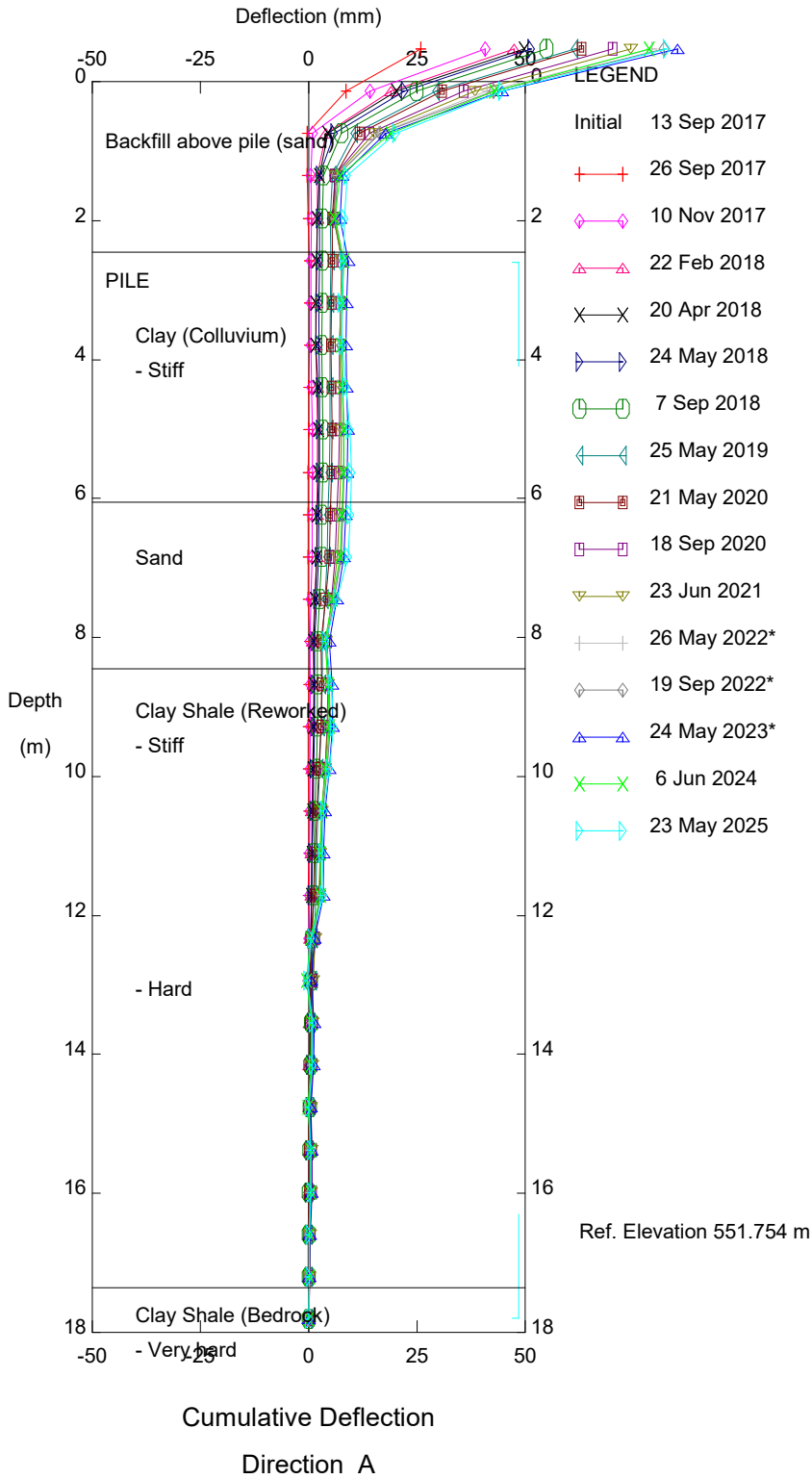
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-1(P130)

Alberta Transportation

Thurber Engineering Ltd.

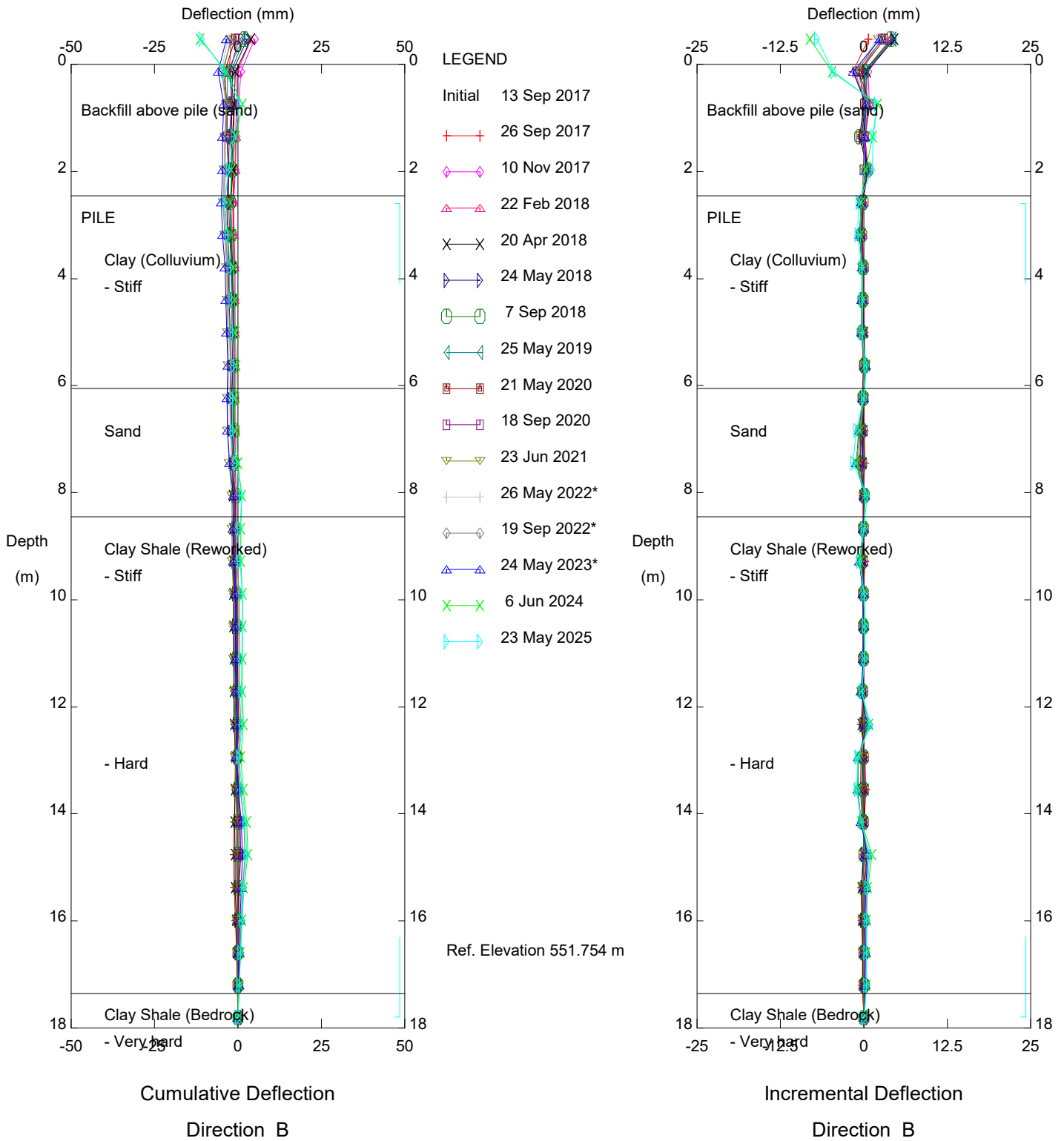


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-2(P160)

Alberta Transportation

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

Thurber Engineering Ltd.

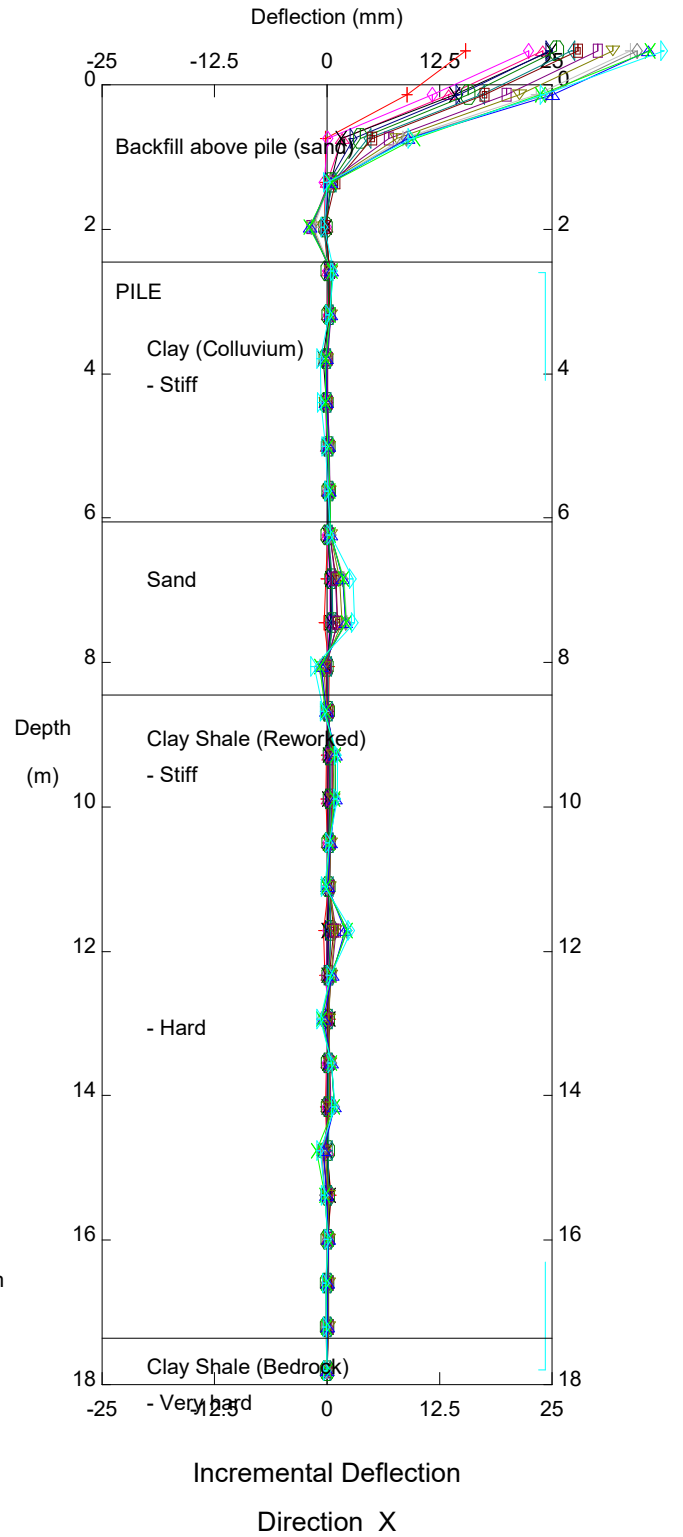
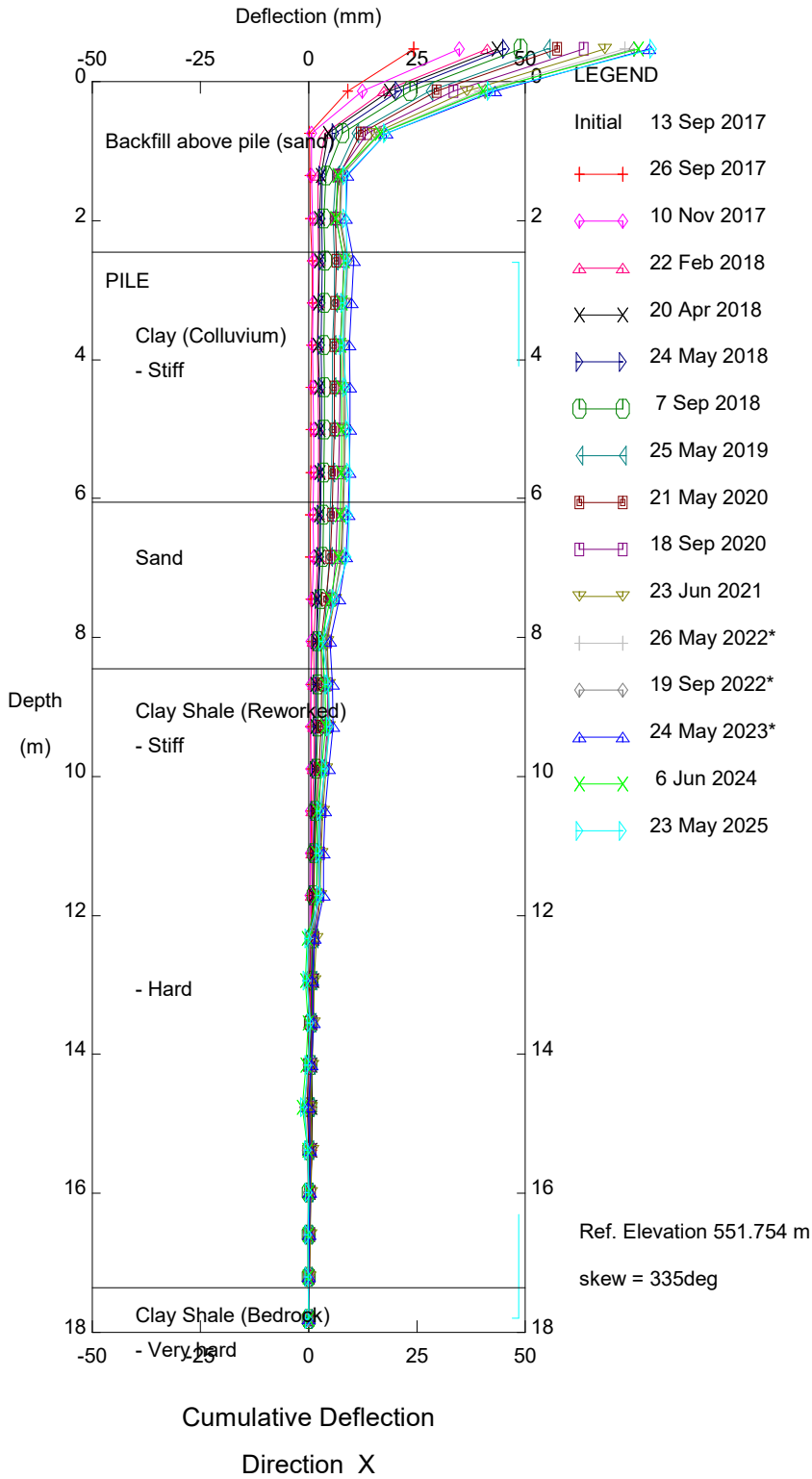


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-2(P160)

Alberta Transportation

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

Thurber Engineering Ltd.

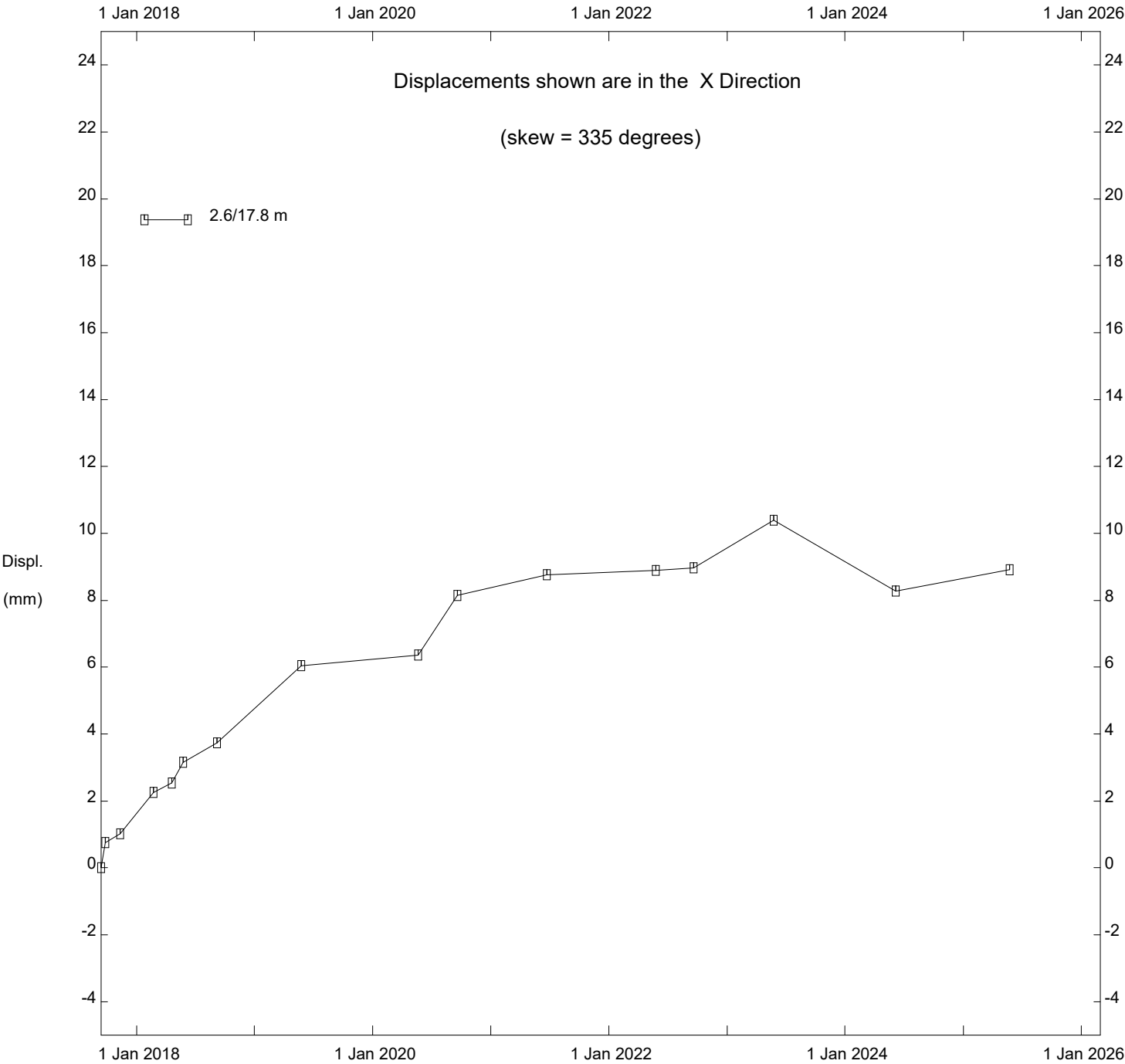


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-2(P160)

Alberta Transportation

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

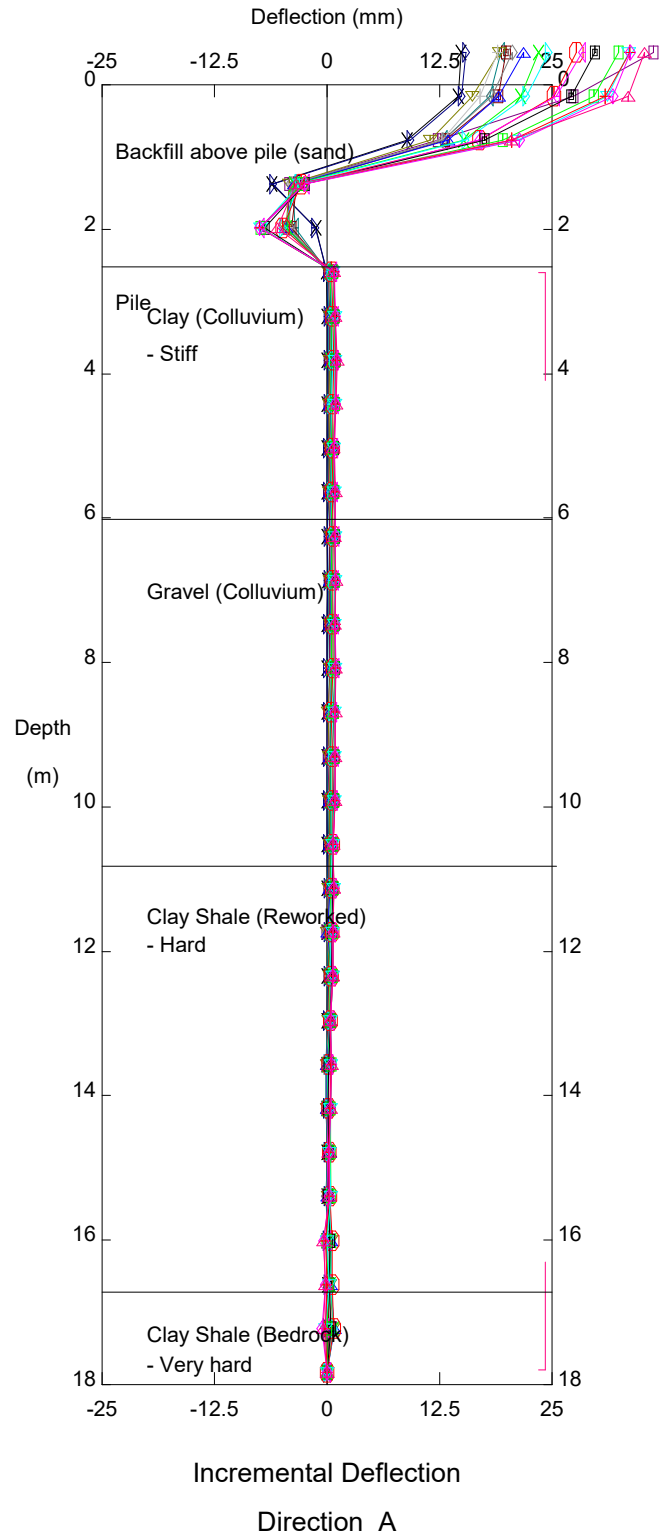
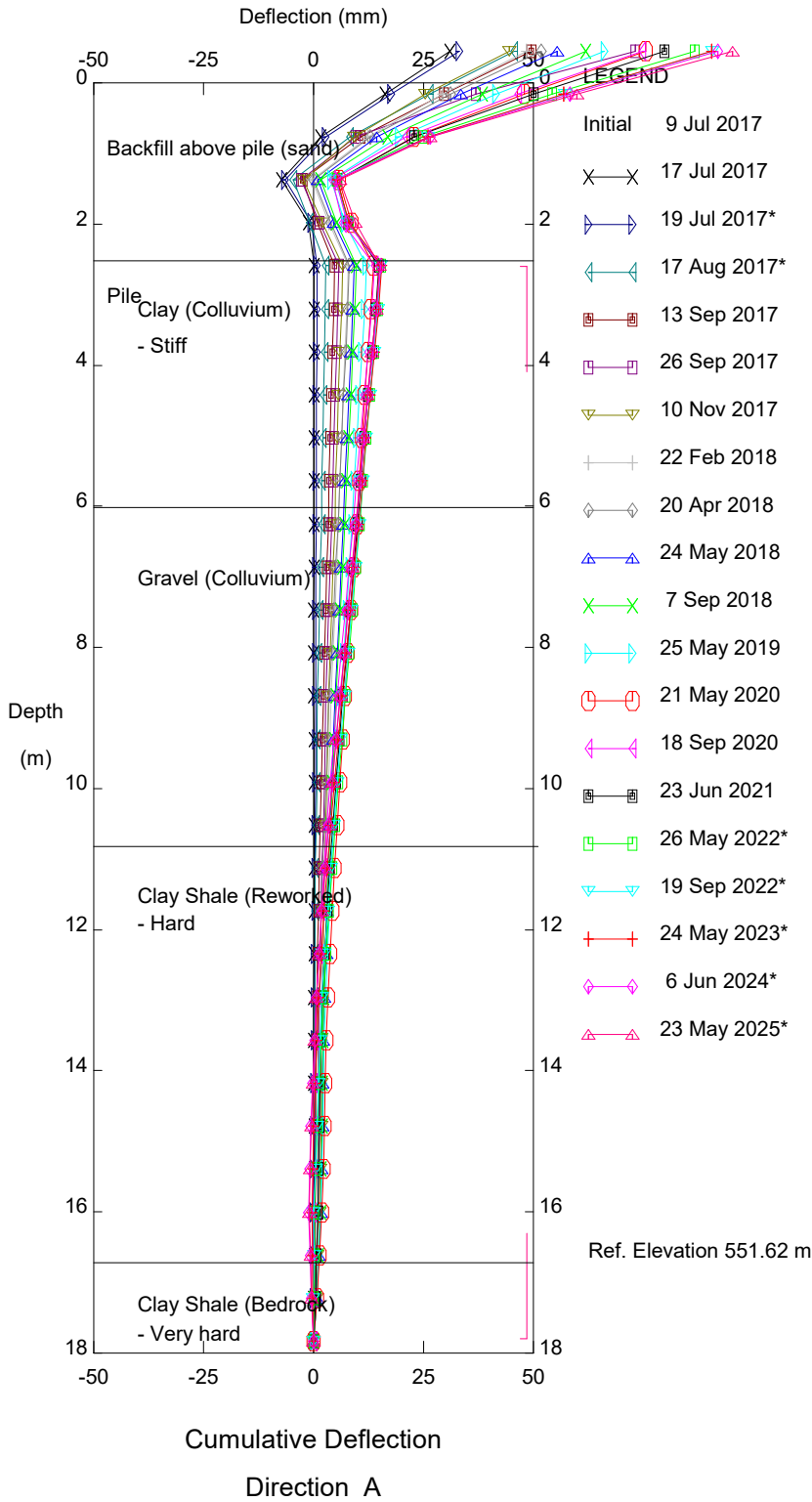
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-2(P160)

Alberta Transportation

Thurber Engineering Ltd.

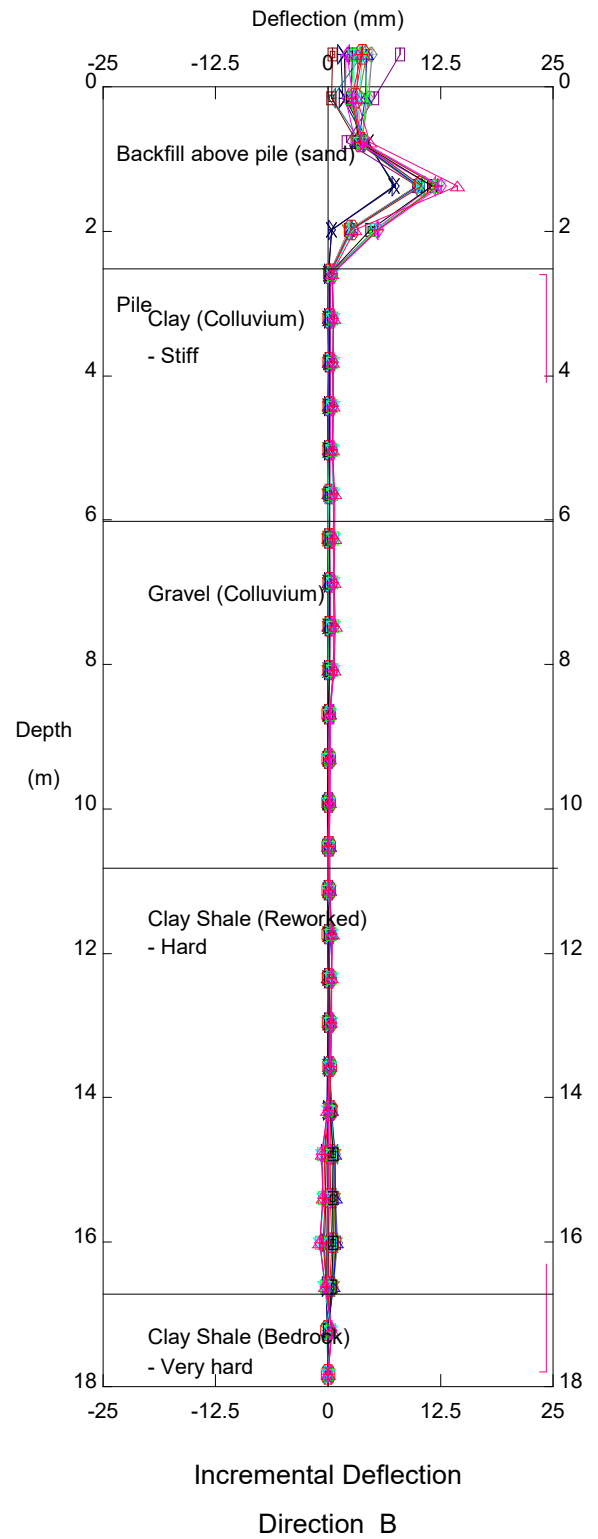
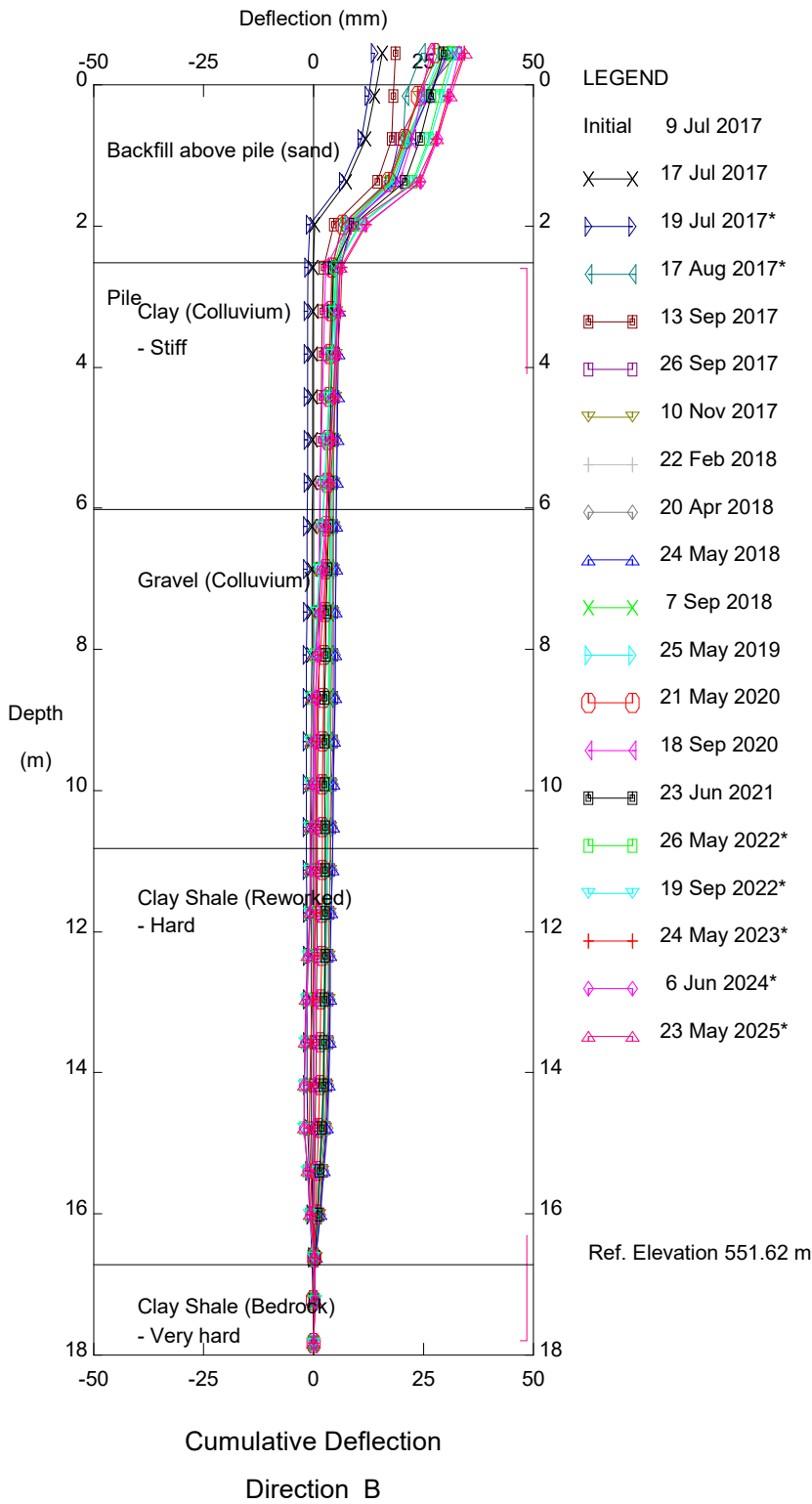


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-3(P173)

Alberta Transportation

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

Thurber Engineering Ltd.

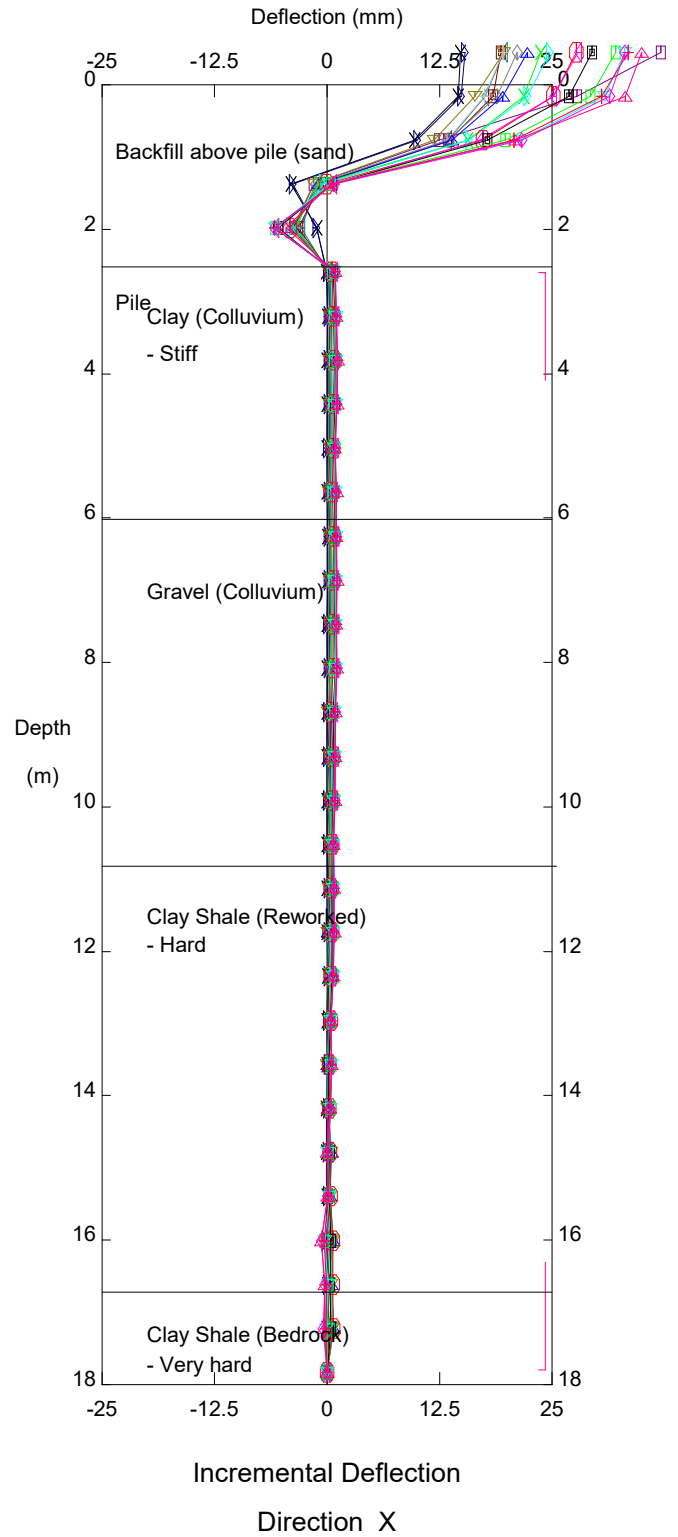
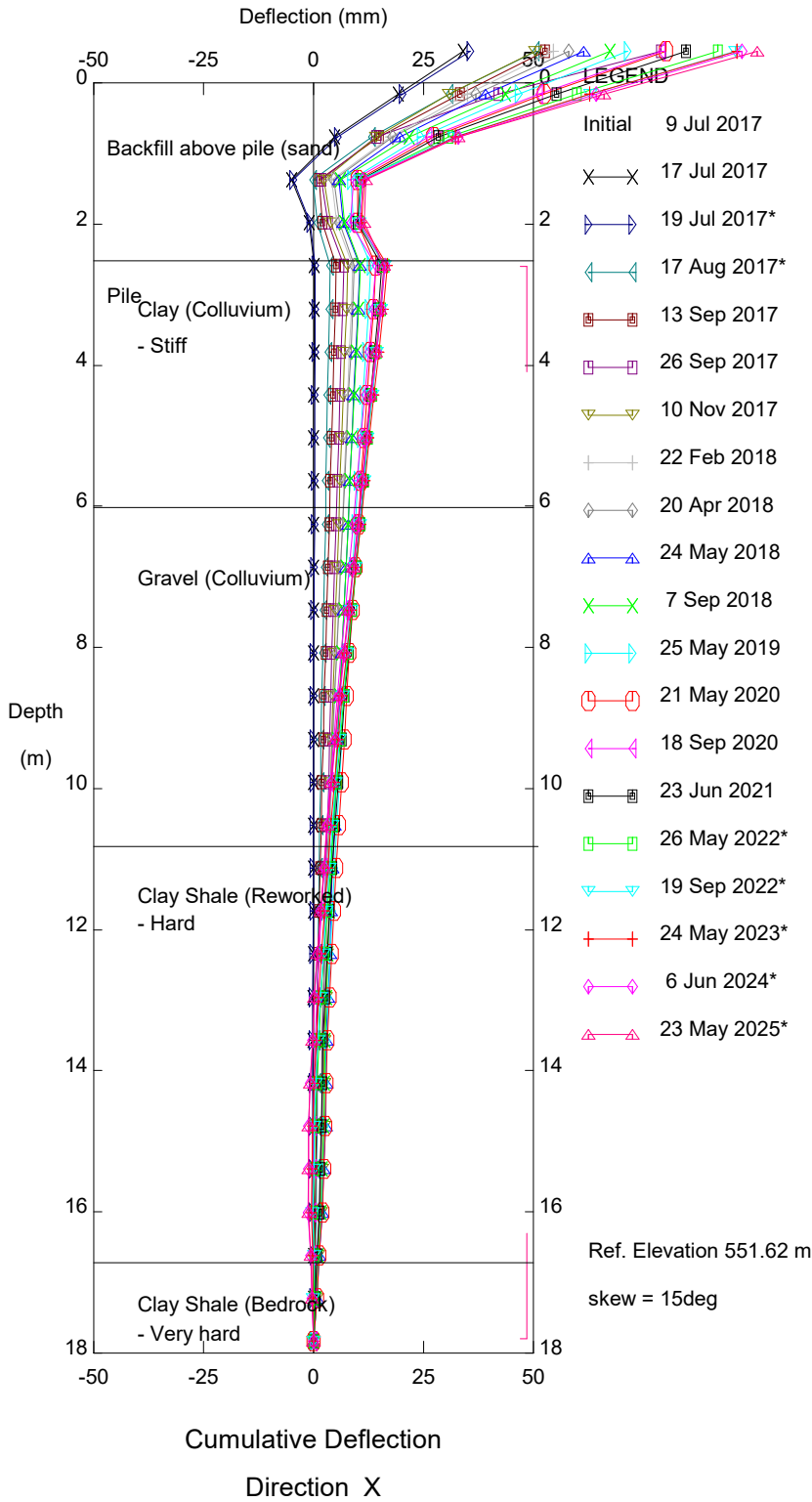


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-3(P173)

Alberta Transportation

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

Thurber Engineering Ltd.

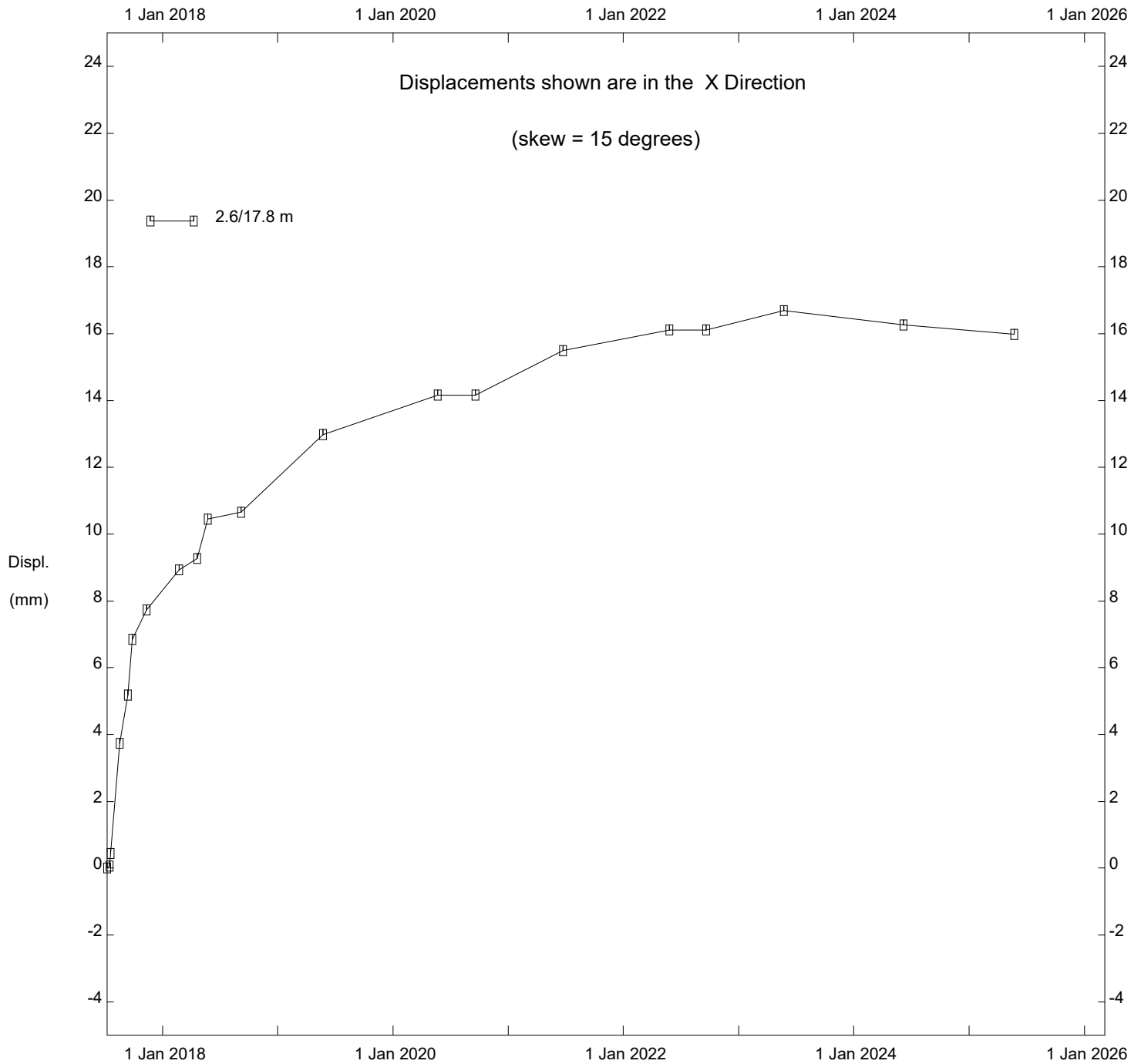


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-3(P173)

Alberta Transportation

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

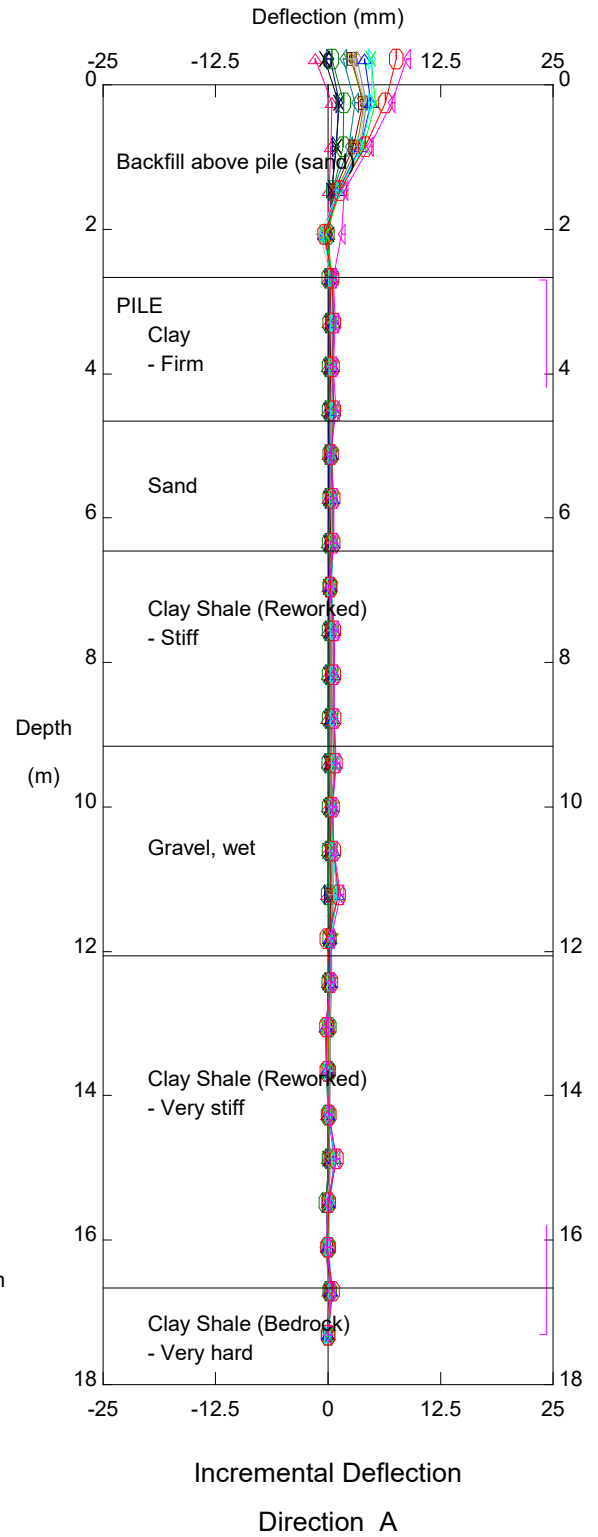
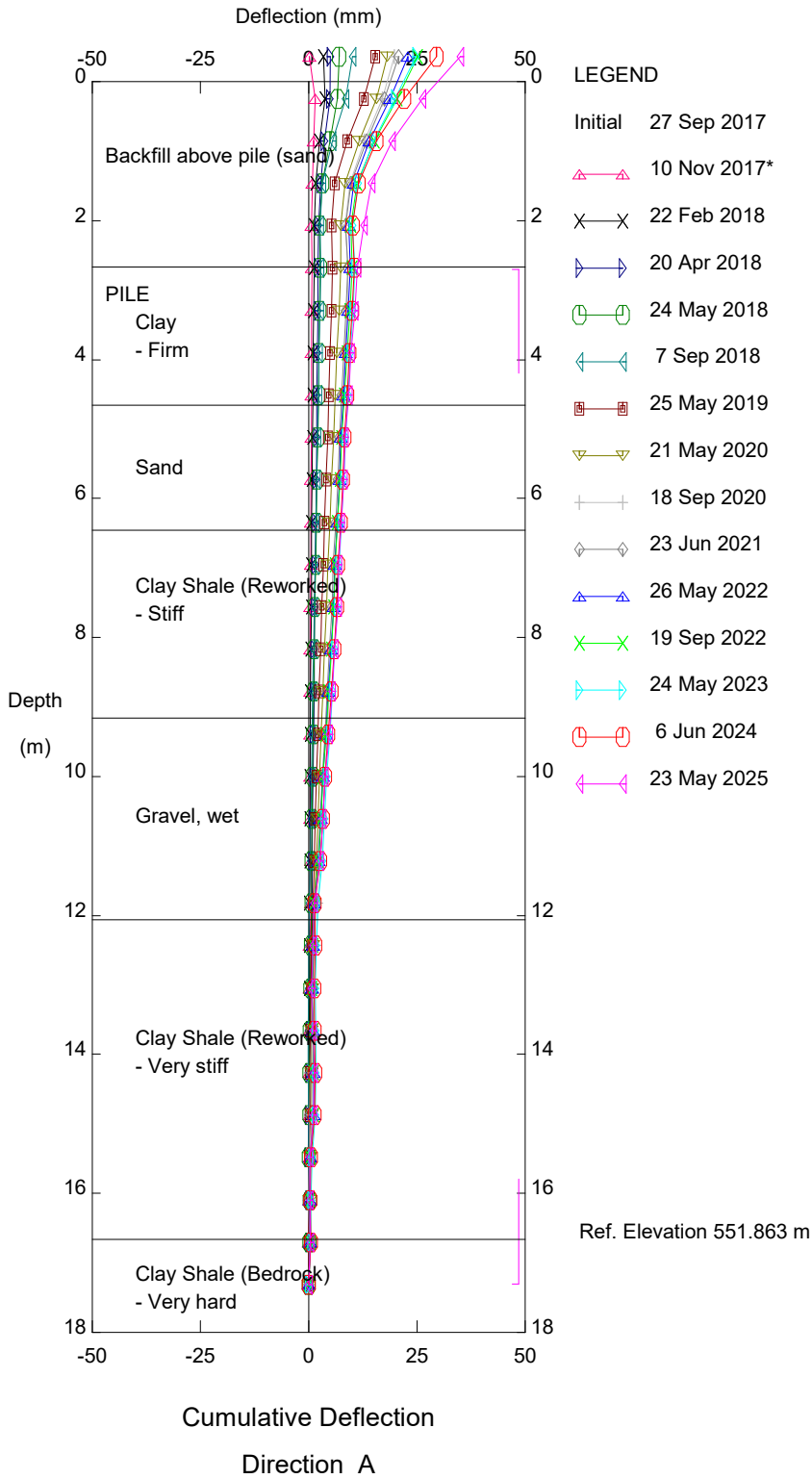
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-3(P173)

Alberta Transportation

Thurber Engineering Ltd.

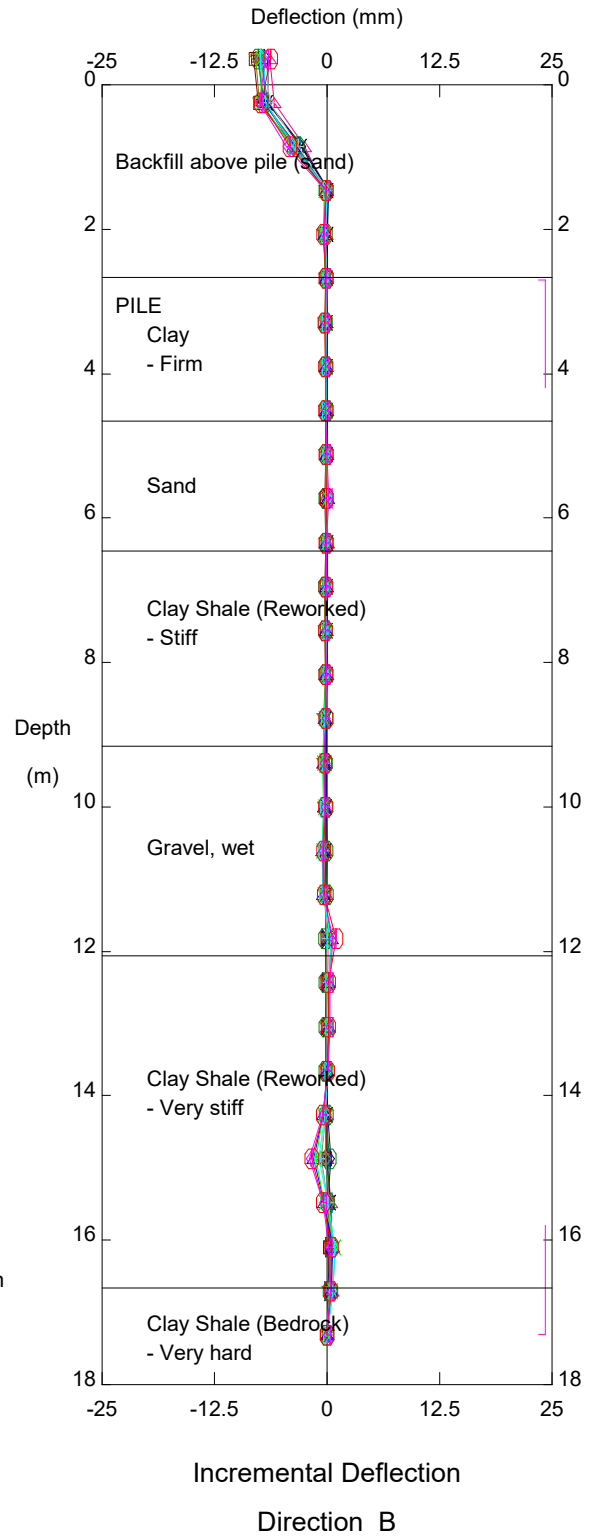
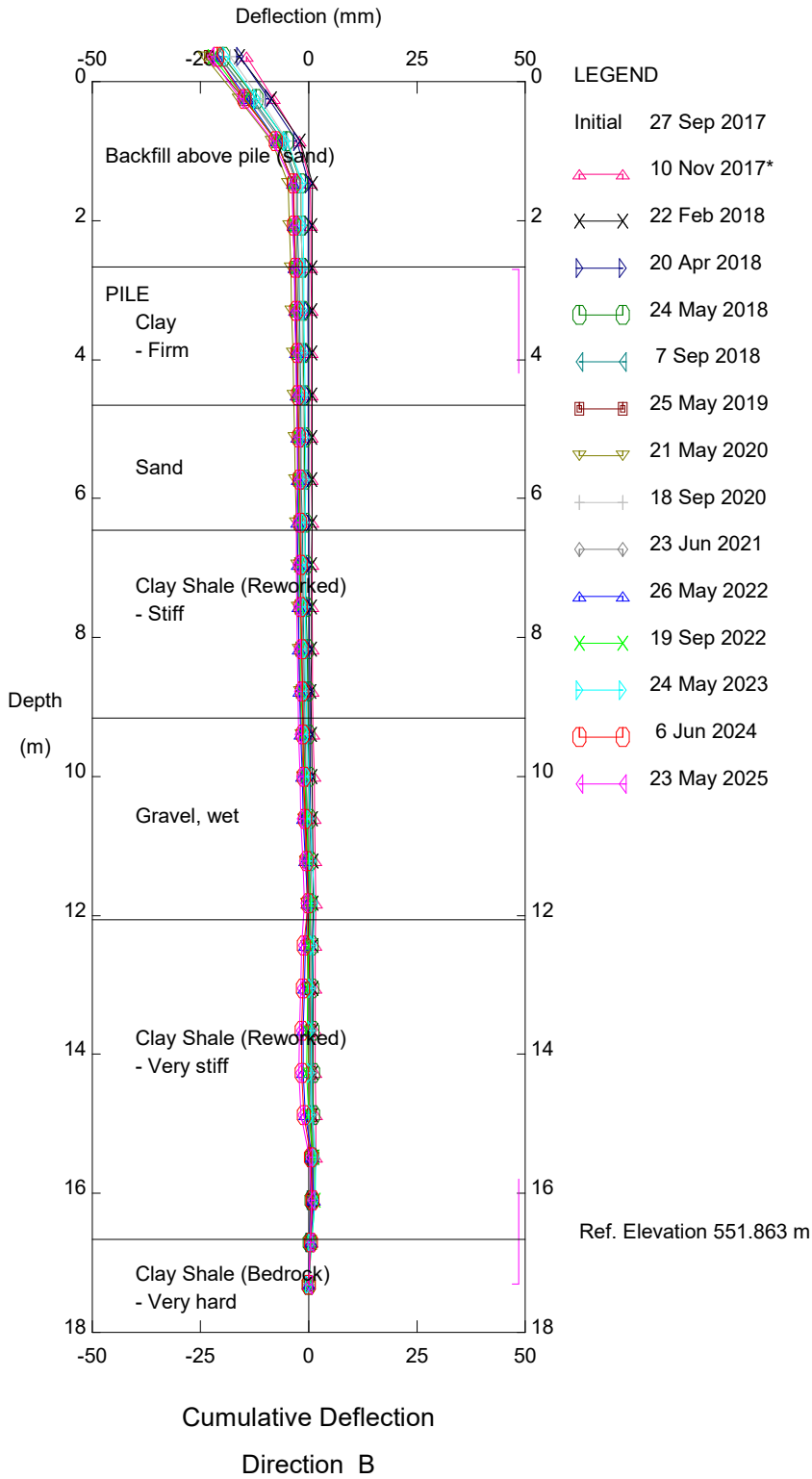


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-4(P186)

Alberta Transportation

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

Thurber Engineering Ltd.

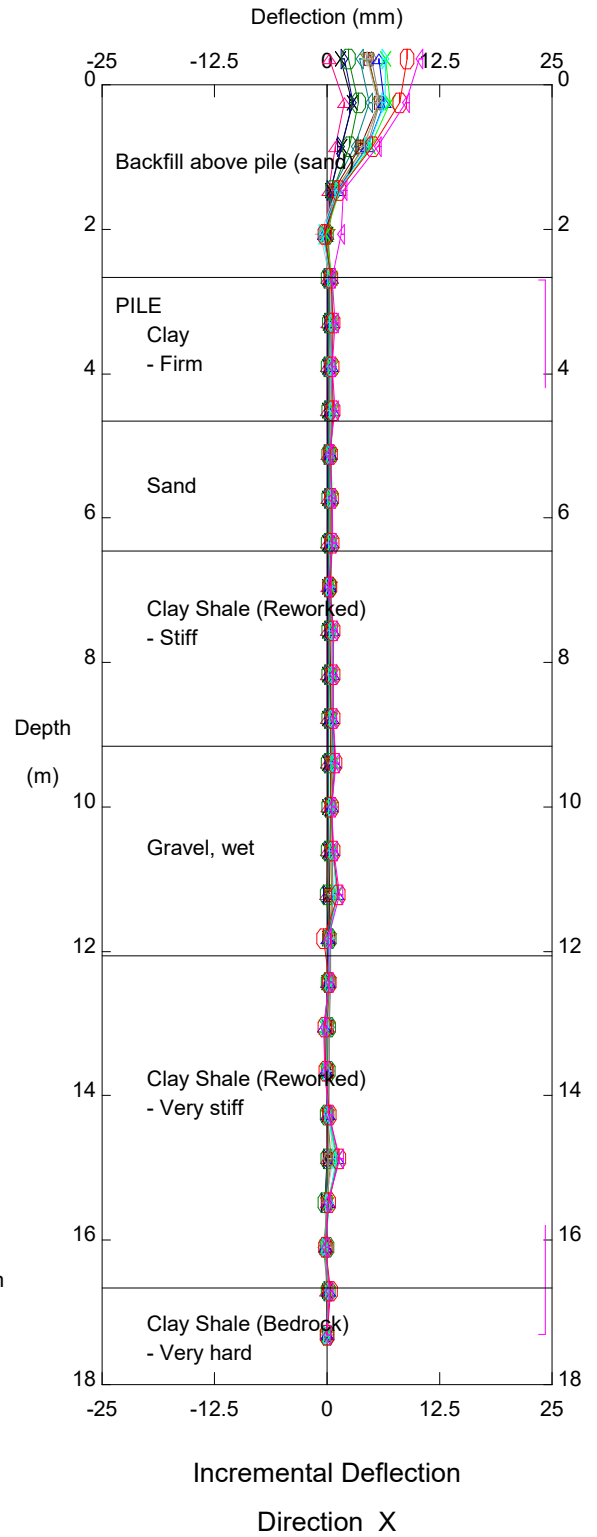
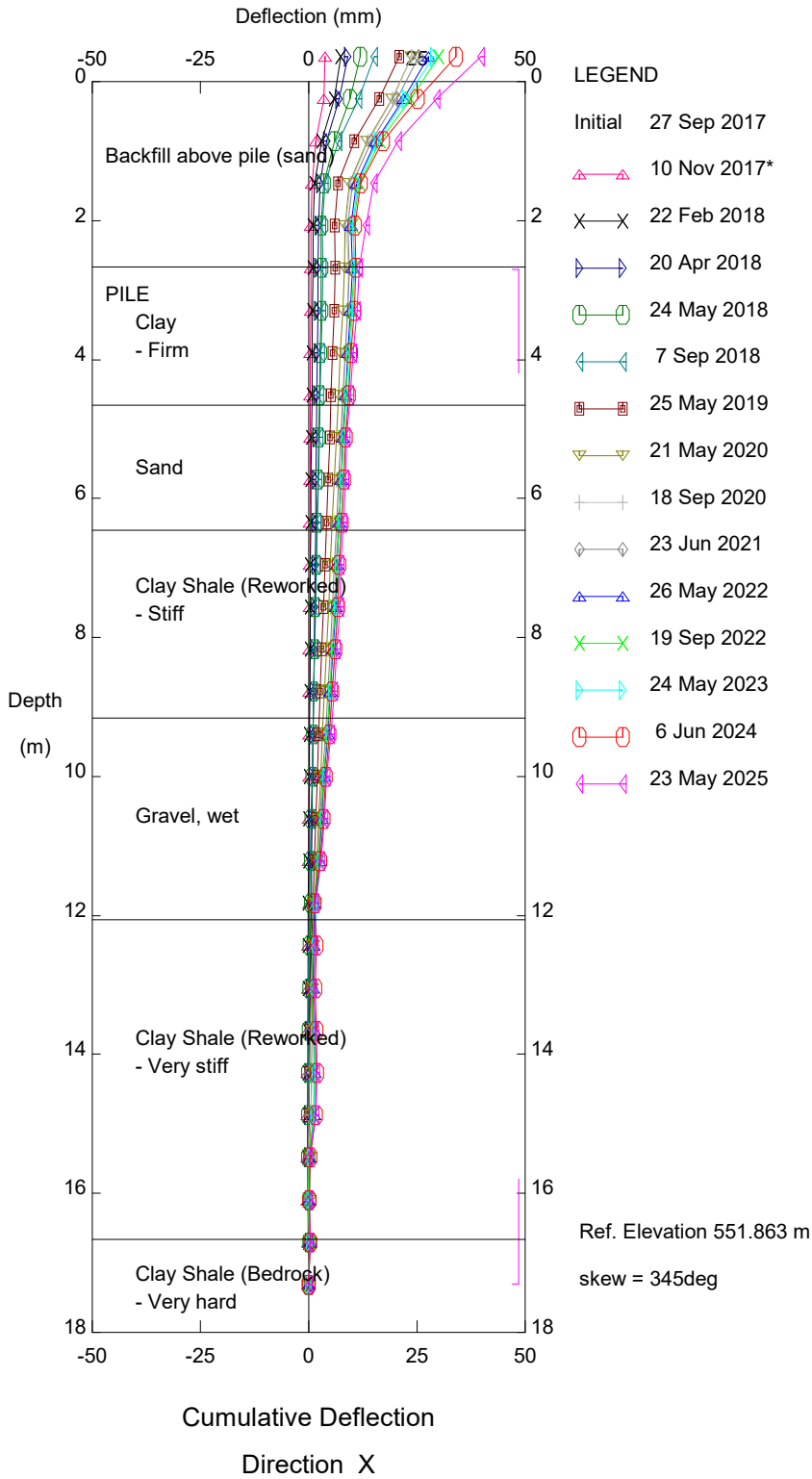


Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SI17-4(P186)

Alberta Transportation

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

Thurber Engineering Ltd.

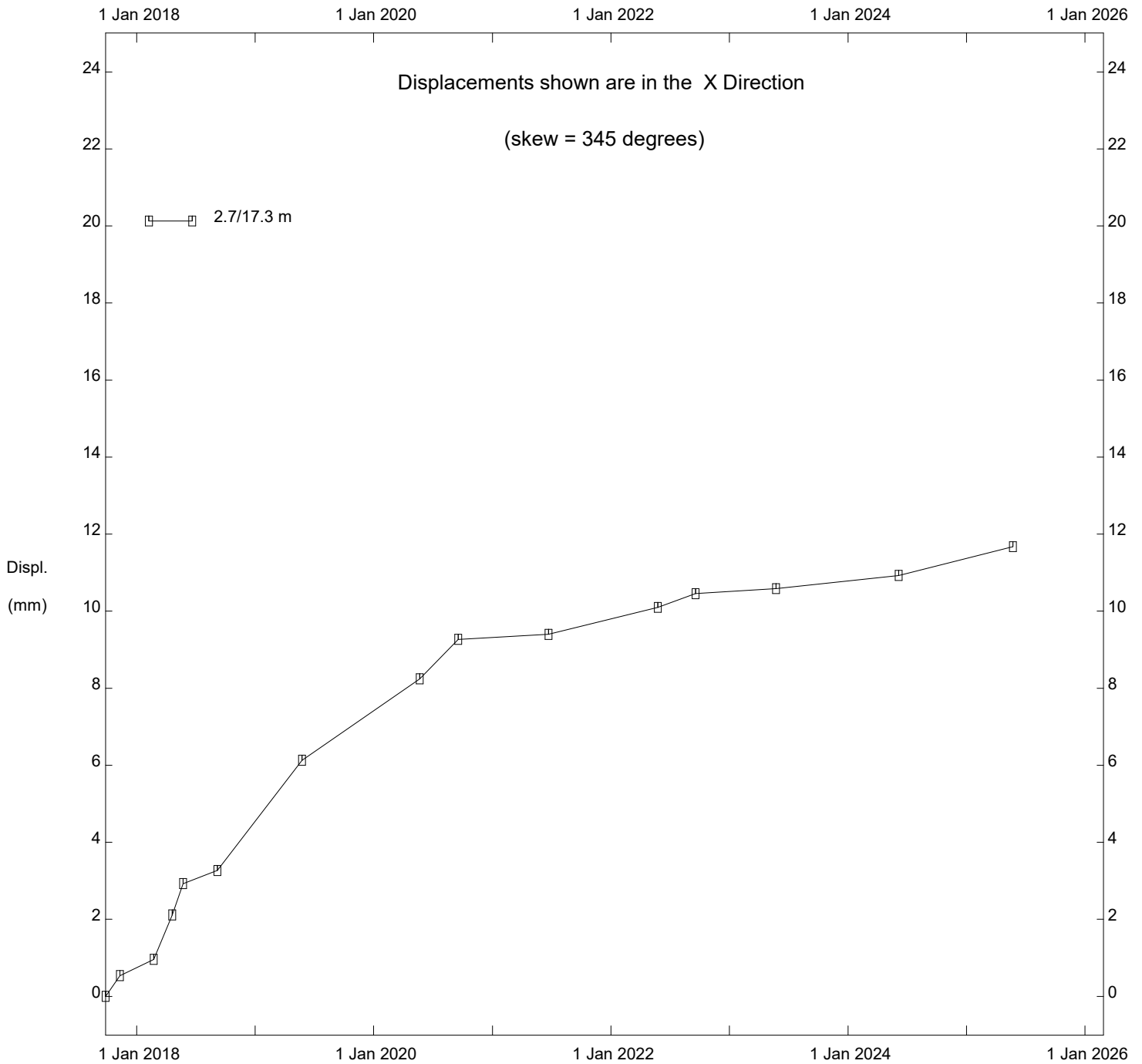


Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-4(P186)

Alberta Transportation

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

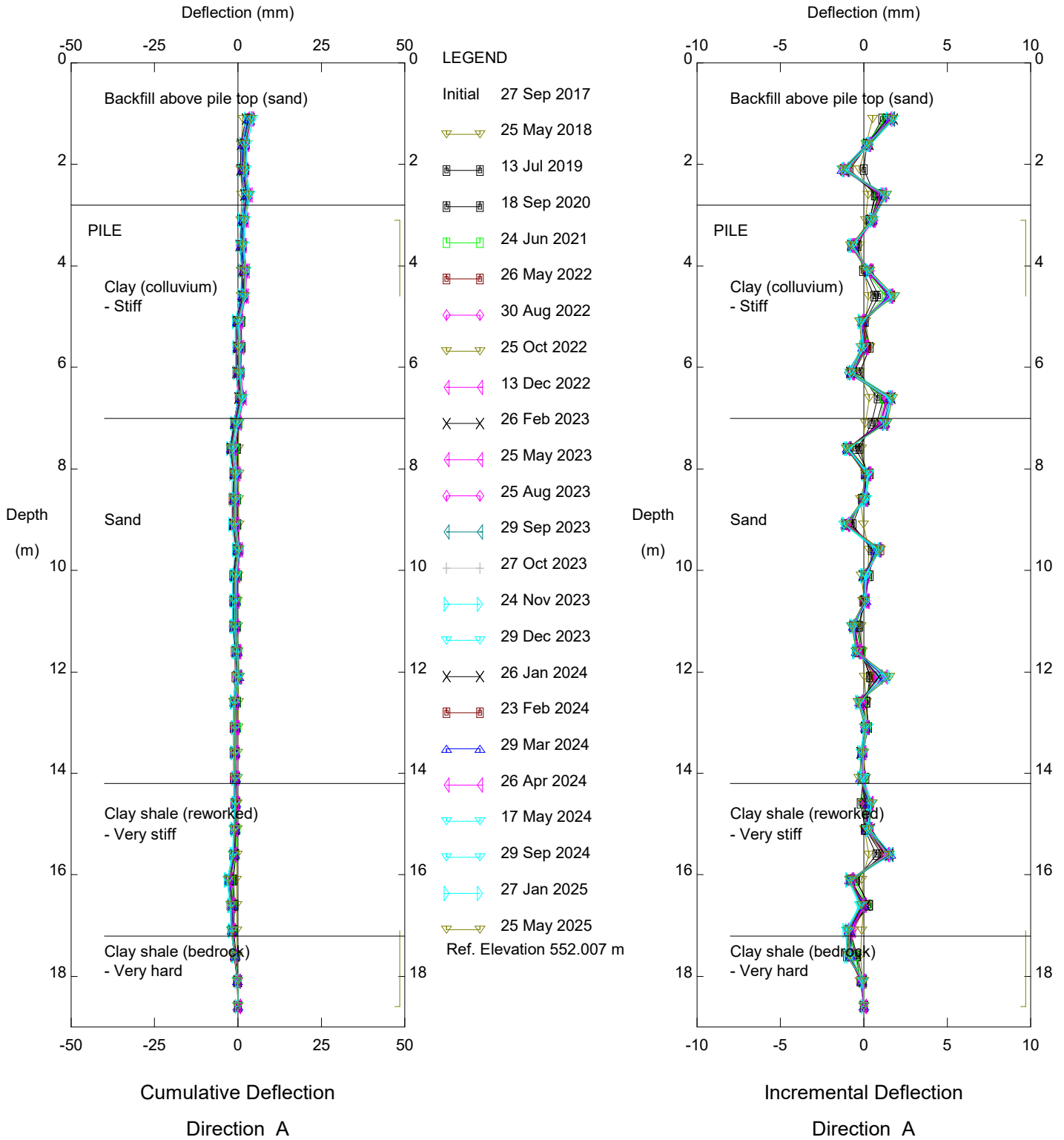
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SI17-4(P186)

Alberta Transportation

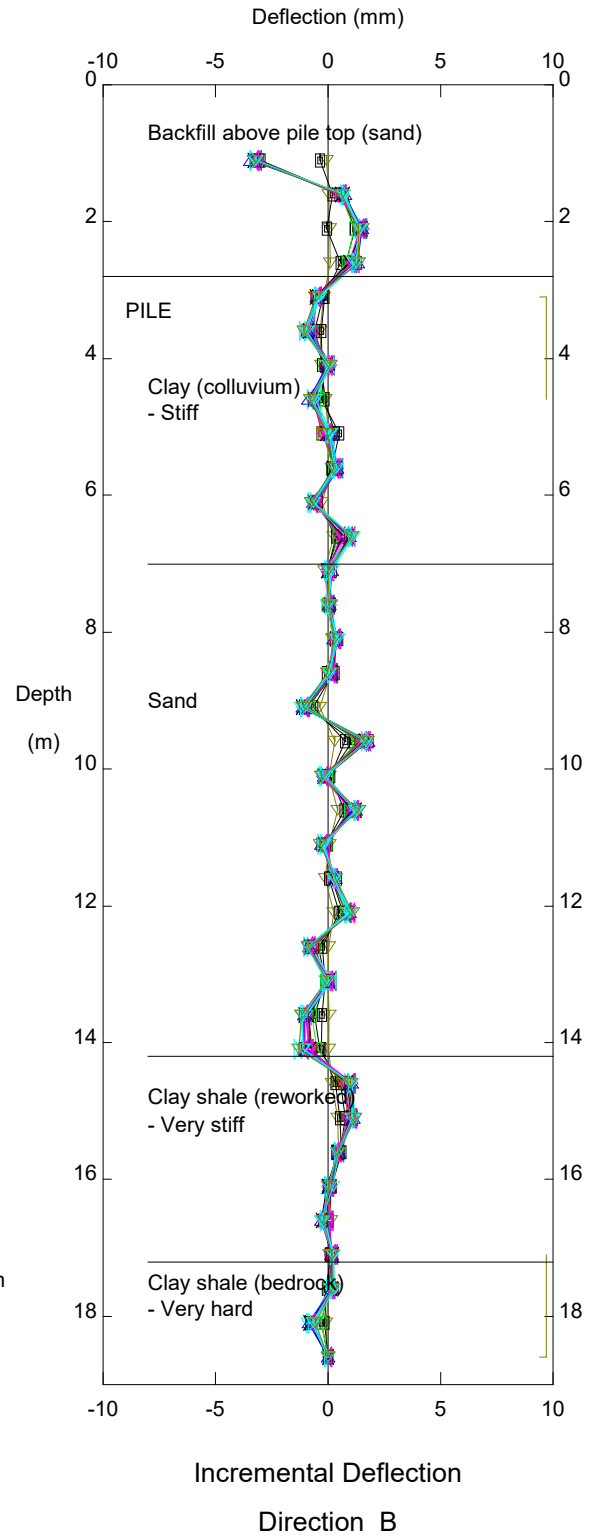
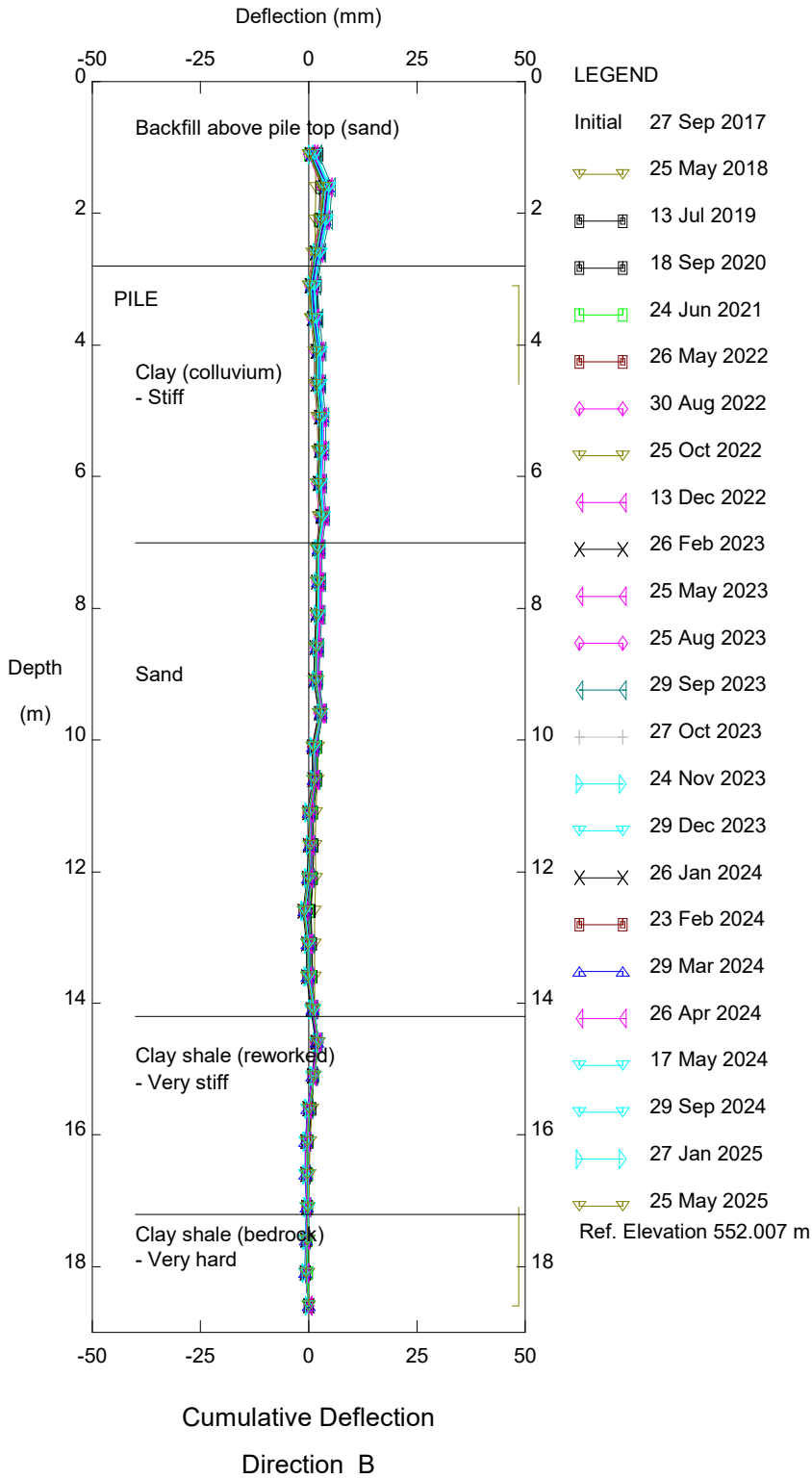
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SAA17-1(P146

Alberta Transportation

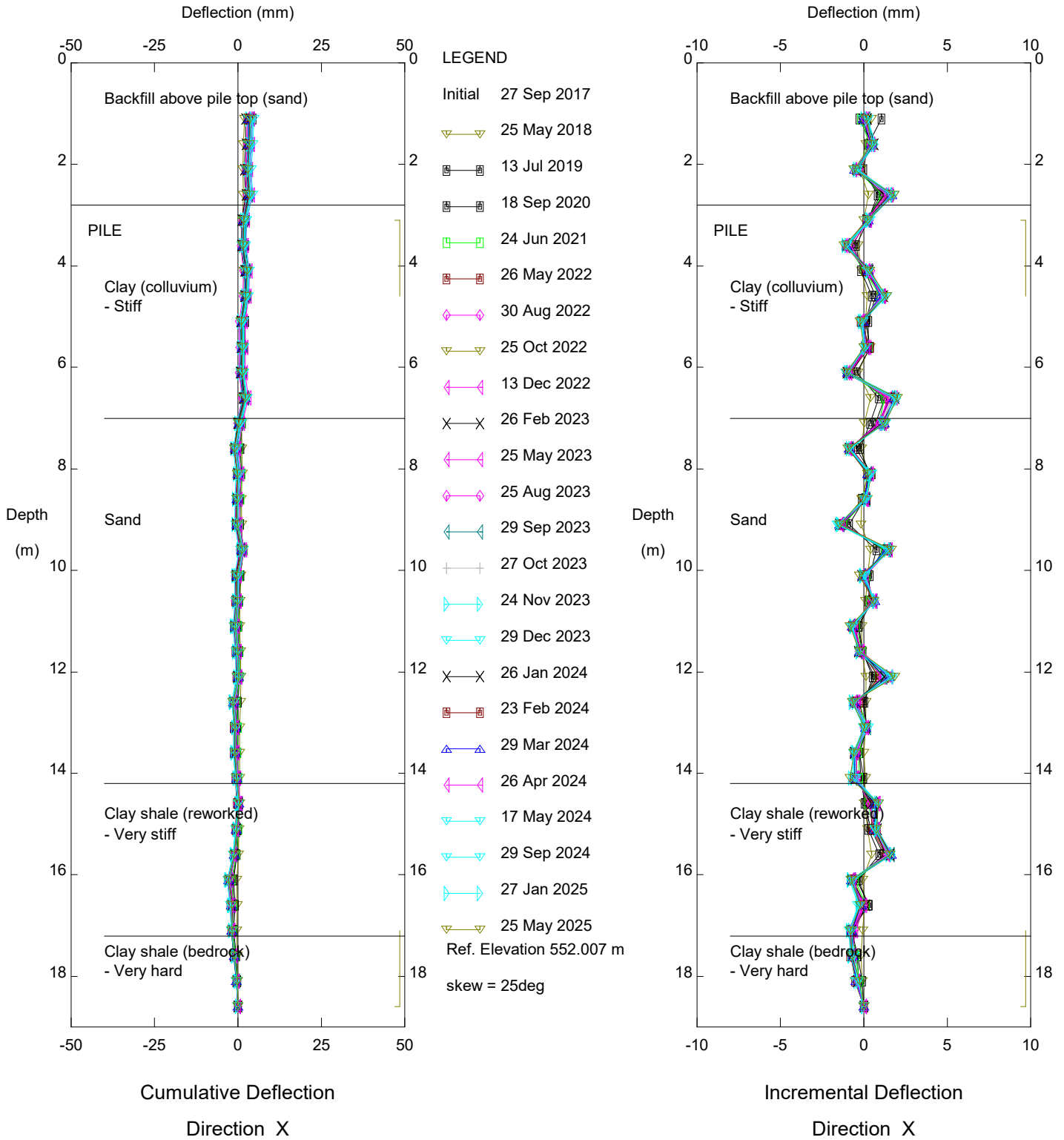
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinometer SAA17-1(P146)

Alberta Transportation

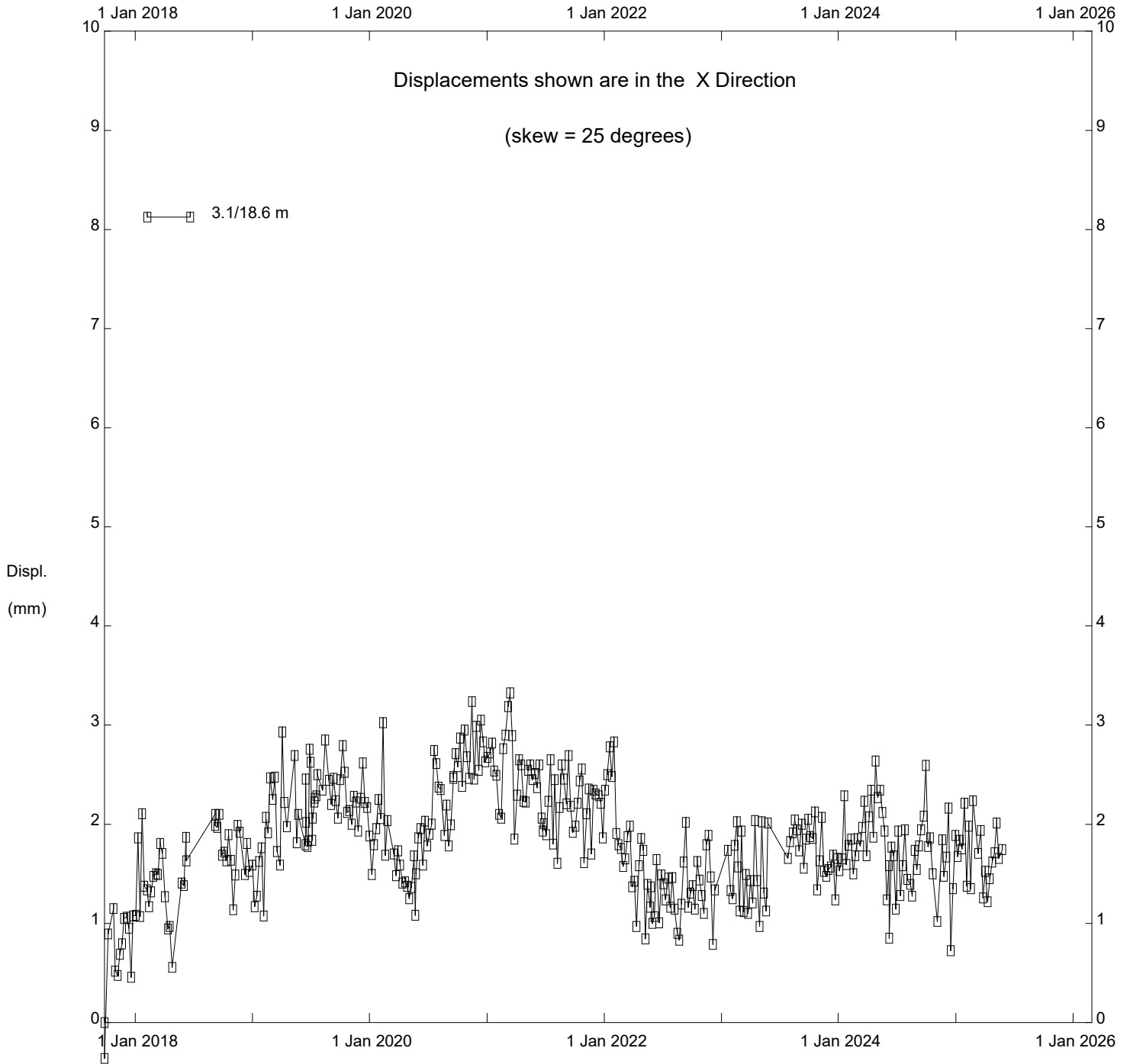
Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SAA17-1(P146

Alberta Transportation

Thurber Engineering Ltd.



Hwy 41:23 Kehiwin Lake (NC104), Inclinator SAA17-1(P146)

Alberta Transportation

FIGURE NC104-1
STRAIN GAUGE DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - PILE P146 UPSLOPE

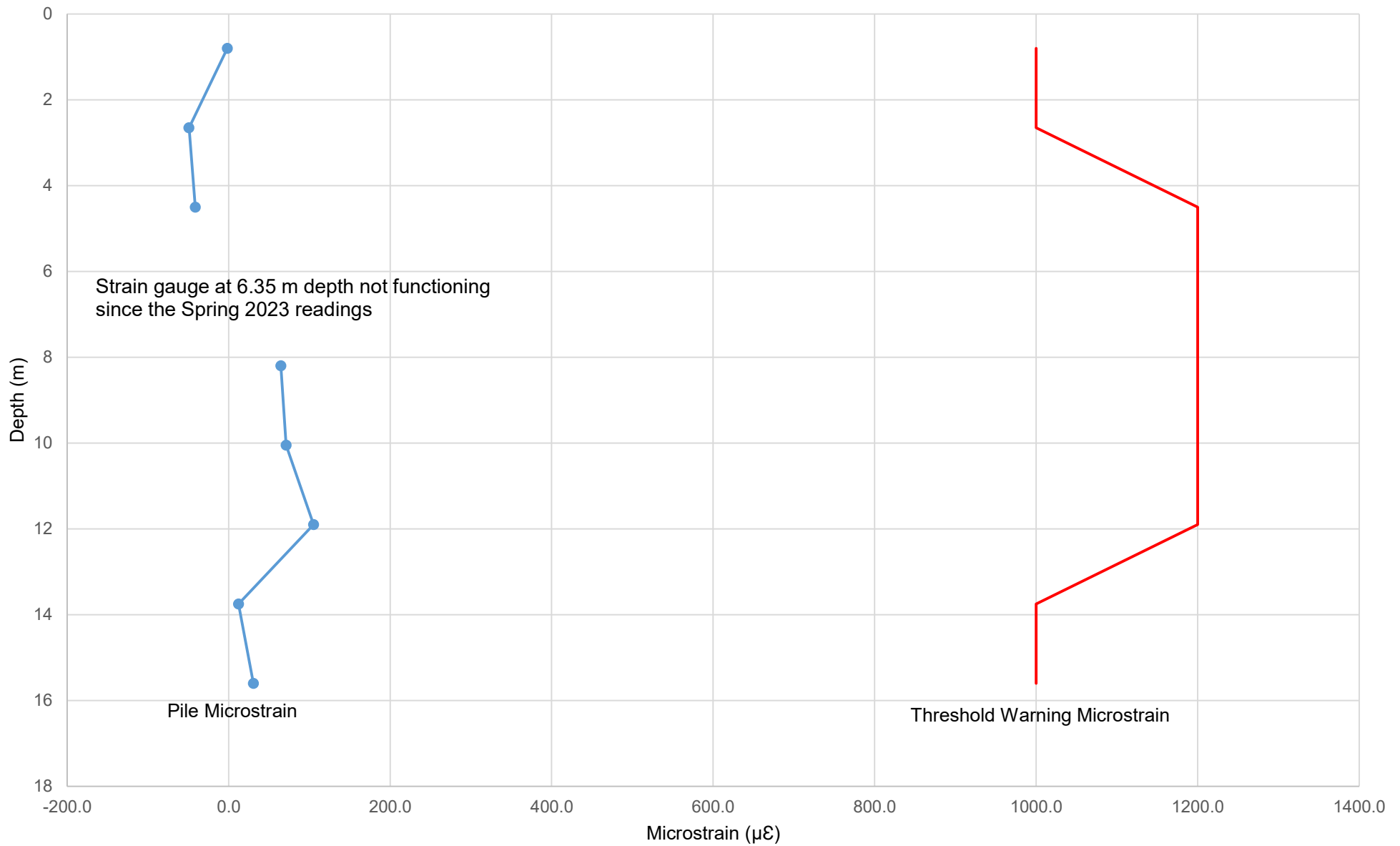
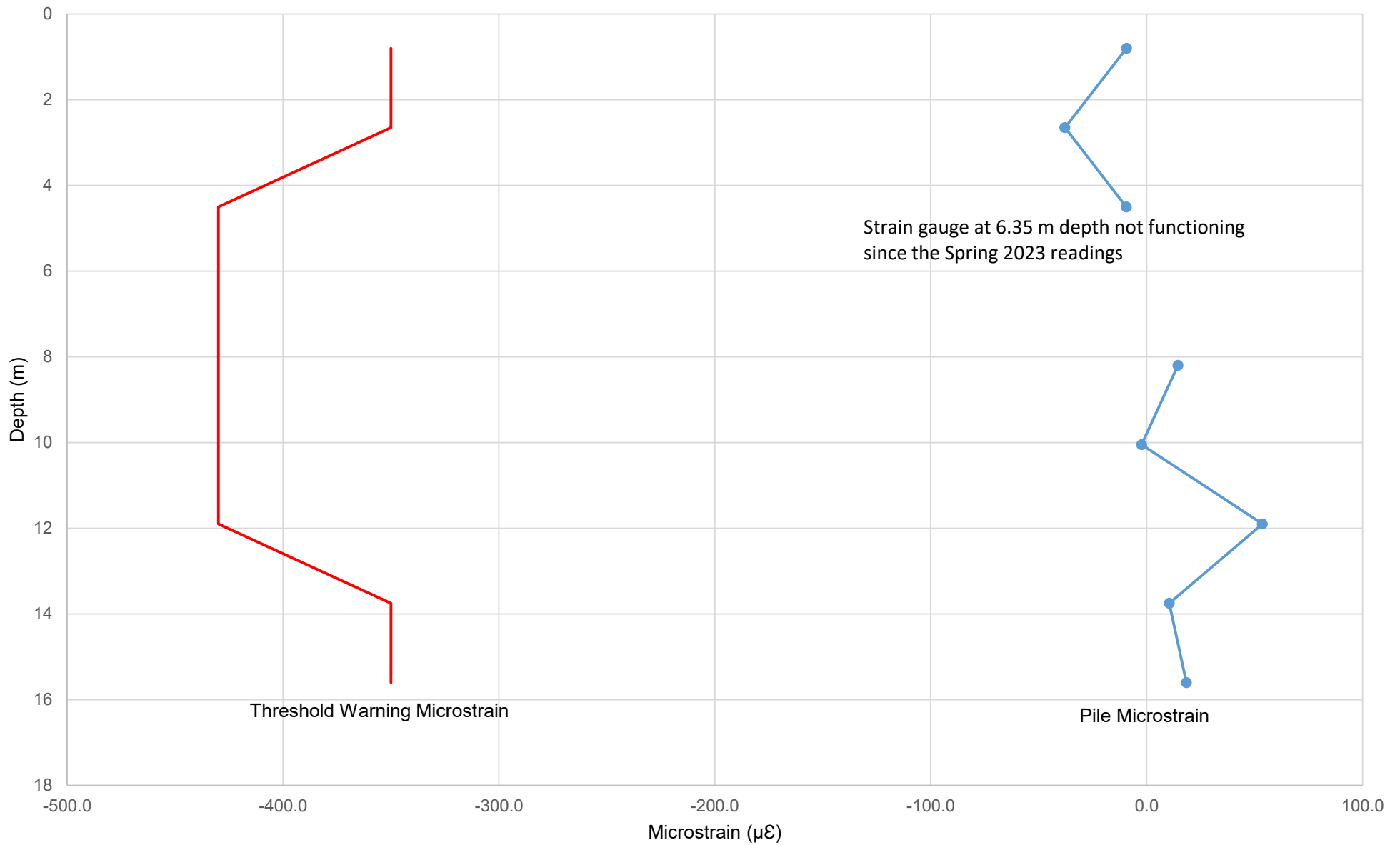


FIGURE NC104-2
STRAIN GAUGE DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - PILE P146 DOWNSLOPE



- PN12-1, PN12-13, SP12-4 and SP12-7 were destroyed during construction.
 - SP12-12 is blocked at 4.08 m depth as of Spring 2019 - not read Spring 2020
 - SP12-12 was dry between Spring 2019 and Spring 2022, and found to be broken

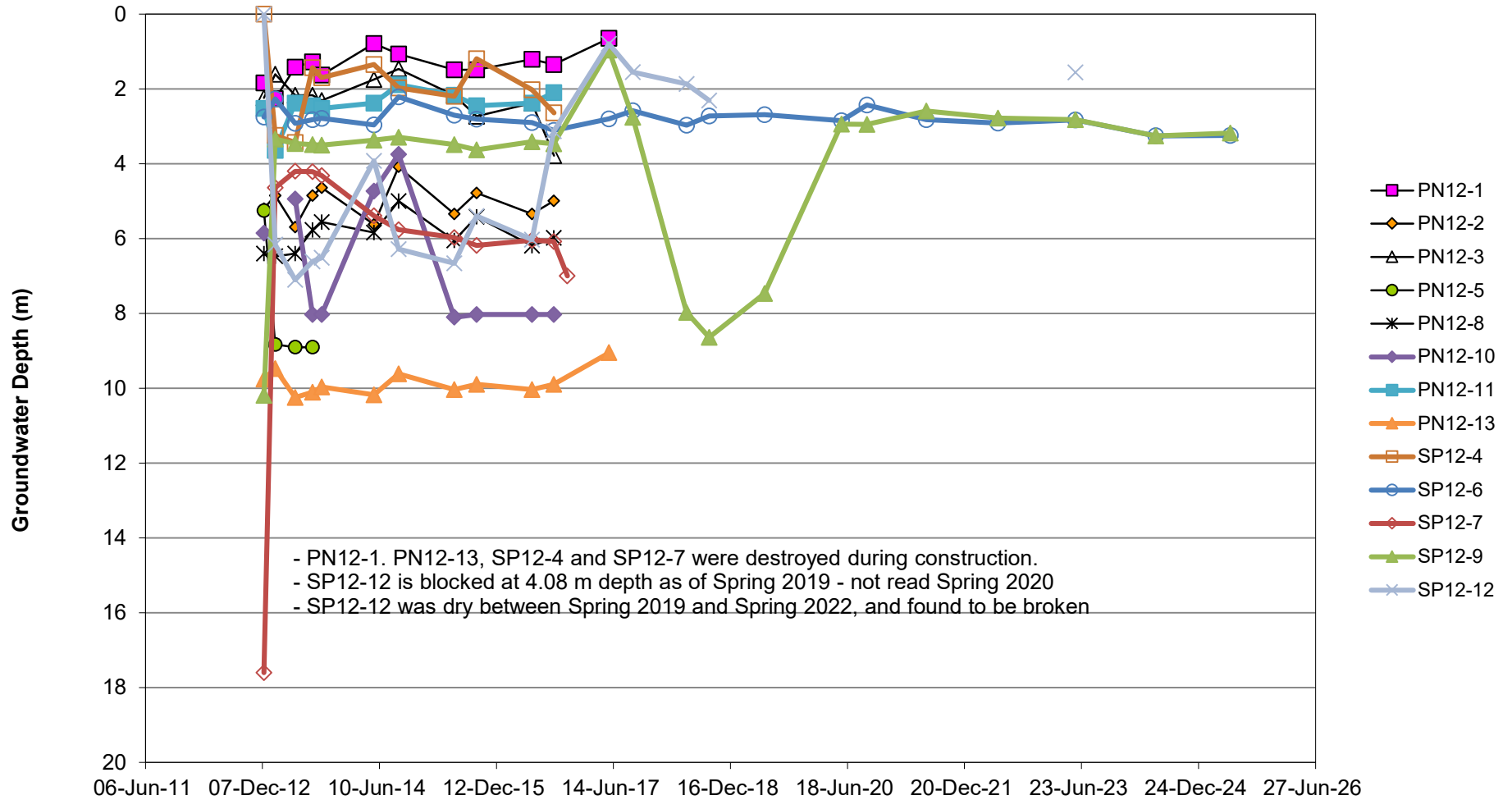


FIGURE NC104-4
PIEZOMETER DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - 2015 INSTRUMENTS

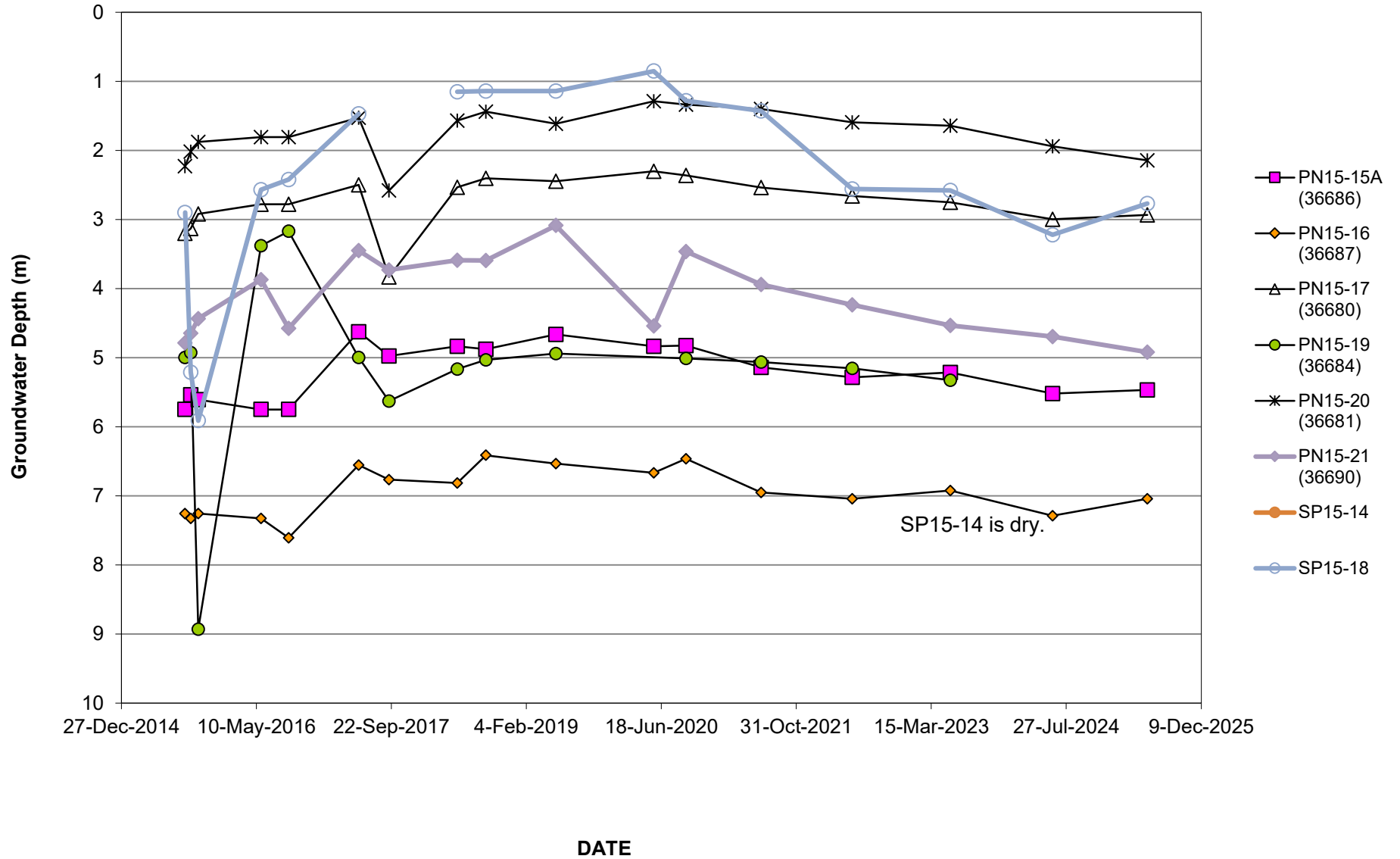


FIGURE NC104-5
LOAD CELL DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - WALL SEGMENT 1

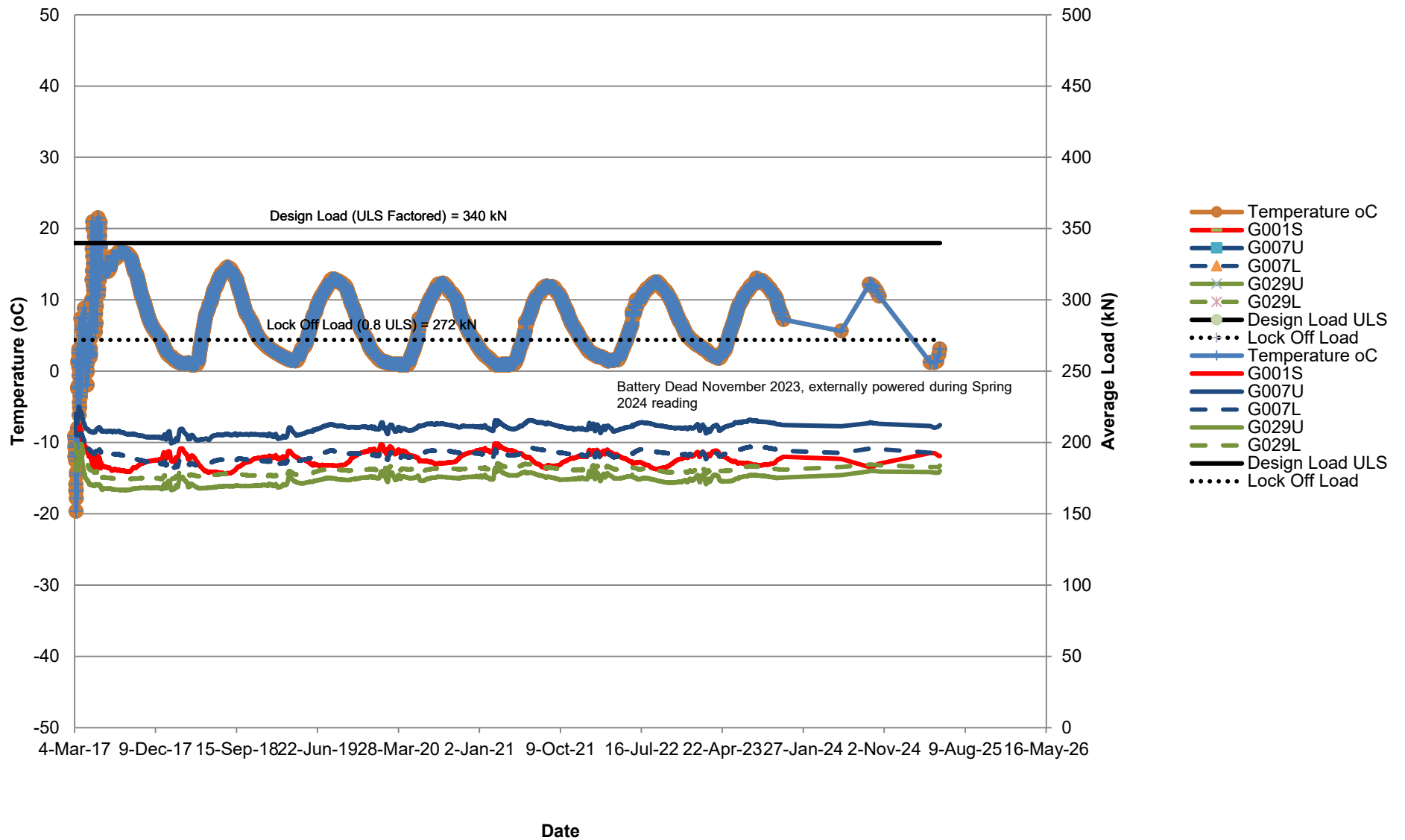


FIGURE NC104-6
LOAD CELL DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - WALL SEGMENT 2

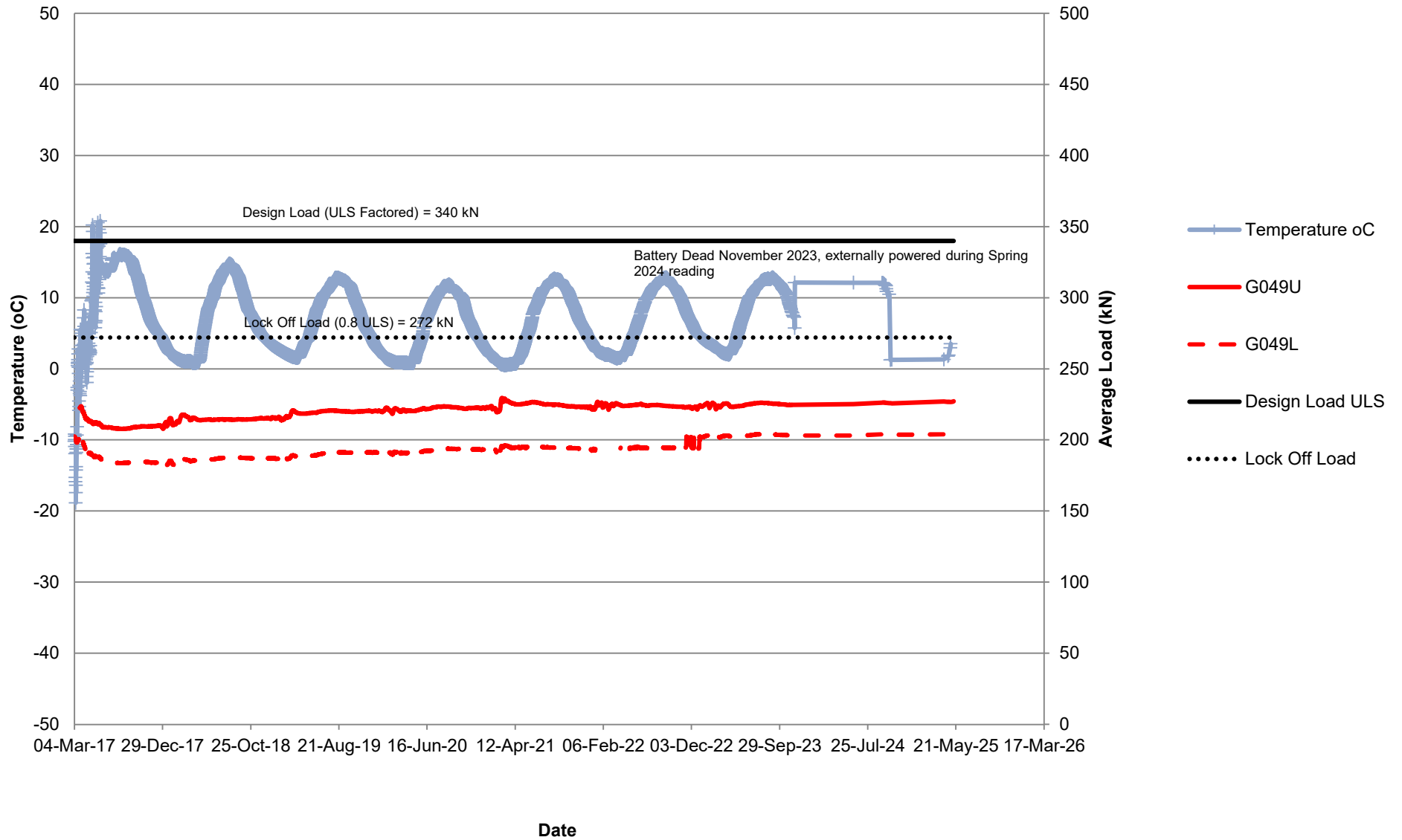


FIGURE NC104-7
LOAD CELL DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - WALL SEGMENT 3

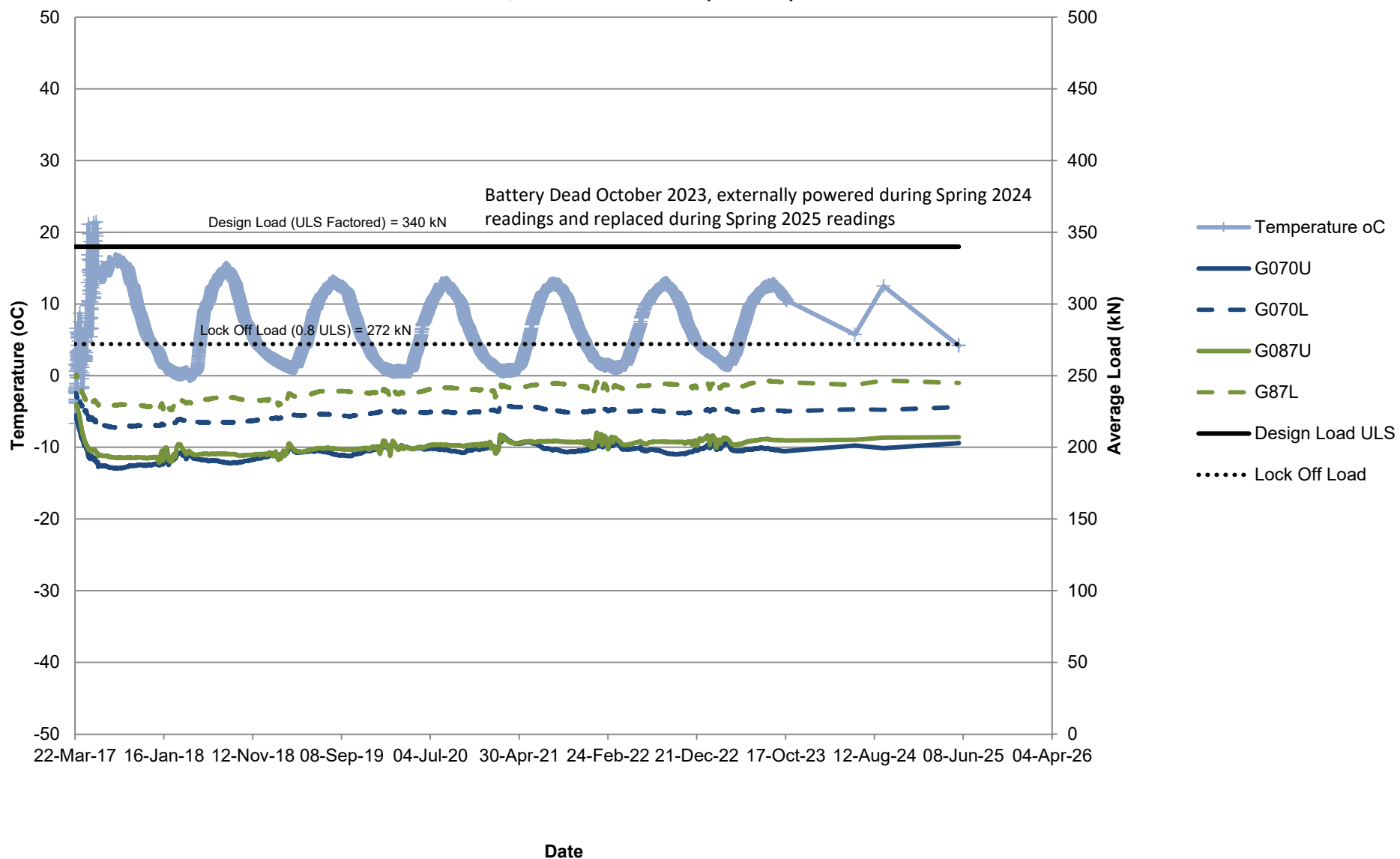


FIGURE NC104-8
LOAD CELL DATA FOR HWY 41:23, KEHIWIN LAKE (KM 7.7) - WALL SEGMENT 4

