



**THURBER** ENGINEERING LTD.

August 4, 2022

File No.: 32123

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

Attention: Mr. Ed Szmata

**ALBERTA TRANSPORTATION GRMP (CON0022165)  
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)  
INSTRUMENTATION MONITORING RESULTS – SPRING 2022**

**SECTION C**

**SITE GP012B: HWY 49:04, KSITUAN PILE WALL**

Dear Mr. Szmata:

This report provides the results of the annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation's Geohazard Risk Management Program for Peace Region Grande Prairie District – North (CON0022165).

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**

Four slope inclinometers (SI-1, SI-3, SI-6, and SI-8) and two pneumatic piezometers (PN-4B and PN-5B) were read at the Hwy 49:04 Ksituan Pile Wall site on June 21, 2022 by Mr. Niraj Regmi, G.I.T. and Mr. Jayden Del Cid, both of Thurber Engineering Ltd. PN-4B continued to show a very low reading compared to historical readings of this instrument, and it is likely that this instrument is damaged.

The SIs were read using two RST Digital Inclinometer probes with 2 ft. wheelbases and RST Pocket PC readouts. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The pneumatic piezometers were read using an RST C108 pneumatic piezometer readout.

**2. DATA PRESENTATION**

**2.1 General**

SI plots for A and B directions are included in Appendix A. Where movement has been recorded the resultant plot (X direction, if applicable) and rate of movement have also been provided. Pneumatic piezometer plots are also provided in Appendix A.



Slope inclinometer and piezometer reading summary tables are provided below. These tables also include instruments not included in the current GRMP for future reference.

## **2.2 Zones of Movement**

Zones of new movement were not observed in the SIs since the previous readings in the spring of 2021.

Zones of movements are summarized in Table GP012B-1 below. Table GP012B-1 also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred in the SIs since initialization.



**TABLE GP012B-1  
 SPRING 2022 – HWY 49:04, KSITUAN PILE WALL  
 SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 21, 2022

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)
SI-1	January 26, 2002	64.2 over 9.2 m to 12.2 m depth in 49° direction	99.3 in February 2002	Operational	July 17, 2021	<0.1	<0.1	1.5
SI-2	January 26, 2002	298.7 over 1.1 m to 5.9 m depth in 52° direction	84.8 in October 2017	Damaged	October 22, 2020	N/A	N/A	N/A
		45.2 over 10.8 m to 15.7 m depth in 43° direction	45.6 in February 2002			N/A	N/A	N/A
SI-3	January 26, 2002	20.1 over 11.2 m to 14.3 m depth in 64° direction	59.1 in November 2002	Operational	July 17, 2021	No discernible movement	N/A	N/A
SI-4	January 26, 2002	18.0 over 3.8 m to 5.7 m depth in 41° direction	22.4 in February 2002	Damaged	October 7, 2019	N/A	N/A	N/A
SI-6	January 26, 2002	5.1 over 1.1 m to 2.3 m depth in 67° direction	2.9 in May 2002	Operational	July 17, 2021	0.9	0.9	0.5
SI-8	November 29, 2002	58.3 over 0.9 to 19.2 m depth in 61° direction	30.6 in March 2003	Operational	July 17, 2021	1.9	2.0	0.9

Drawing 32123-GP012B in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



**TABLE GP012B-2  
 SPRING 2022 – HWY 49:04, KSITUAN PILE WALL  
 PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 21, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP ELEV. (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER ELEVATION (m)</b>	<b>MEASURED PORE PRESSURE (kPa)</b>	<b>CURRENT WATER ELEVATION (m)</b>	<b>PREVIOUS WATER ELEVATION (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
PN-4A	January 13, 1998	650.40	653.40	Destroyed	652.09 in January 1998	N/A	N/A	651.86 (June 22, 2020)	N/A
PN-4B	January 13, 1998	646.40	653.40	Damaged	651.08 in June 2020	N/A	N/A	650.58 (Oct. 22, 2020)	N/A
PN-5A	January 13, 1998	650.20	653.20	Destroyed	651.90 in May 2012	N/A	N/A	651.82 (October 2016)	N/A
PN-5B	January 13, 1998	646.20	653.20	Operational	652.10 in May 1998	39.1	650.19	650.43	-0.24

Drawing 32123-GP012B in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



### **3. INTERPRETATION OF MONITORING RESULTS**

Slope inclinometer SI-1 showed a rate of movement of less than 0.1 mm/yr over 9.2 to 12.2 m since the spring of 2021 readings. SI-3 showed no discernible movement since the spring of 2021 readings. SI-6 showed a rate of movement of 0.9 mm/yr over 1.1 m to 2.3 m depth since the spring of 2021 readings. SI-8 showed a rate of movement of 2.0 mm/yr over 0.9 m to 19.2 m depth since the spring of 2021 readings. SI-8 has shown a total pile head movement of 58.3 mm to date.

The last two readings for pneumatic piezometer PN-4B do not match historical readings for this instrument and the readings show the groundwater level near the piezometer tip; in addition, the reading was not stable. It is, therefore, likely that the measured groundwater level can be attributed to the instrument being damaged. PN-5B showed a decrease in groundwater level of 0.24 m compared to the spring of 2021 readings. Pneumatic piezometer results are summarized in Table GP012B-2 below and are plotted in Figures GP012B-1 (by elevation) and GP012B-2 (by depth) in Appendix A.

### **4. RECOMMENDATIONS**

#### **4.1 Future Work**

The instruments should be read again in the spring of 2023. PN-4B will be removed from future readings cycles as it is likely that this instrument is damaged.

#### **4.2 Instrumentation Repairs**

No instrument repairs are required at this time.



## 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.  
Renato Clementino, Ph.D., P.Eng.  
Principal | Senior Geotechnical Engineer

Bruce Nestor, P.Eng.  
Geotechnical Engineer  
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### Attachments:

- Statement of Limitations and Conditions
- Appendix A
  - Field Inspector's report
  - Site Plan Showing Approximate Instrument Locations (Drawing No. 32123-GP012B)
  - SI Reading Plots
  - Figure GP012B-1 (Piezometric Elevations)
  - Figure GP012B-2 (Piezometric Depths)



## 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.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 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.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

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.



**ALBERTA TRANSPORTATION GRMP (CON0022165)  
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)  
INSTRUMENTATION MONITORING RESULTS**

**SPRING 2022**

**APPENDIX A  
DATA PRESENTATION**

**SITE GP012B: HWY 49:04, KSITUAN PILE WALL**



**ALBERTA TRANSPORTATION  
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (GP012B)  
SPRING 2022**

<b>Location:</b> Ksituan Pile Wall (HWY 49:04 C1 2.398) <b>File Number:</b> 32123 <b>Probe:</b> RST Set 5R & 8R <b>Cable:</b> RST Set 5R & 8R	<b>Readout:</b> RST PN C108 Unit 2 <b>Extension:</b> 2.75" except SI#8 - 3.34" <b>Temp:</b> 16 <b>Read by:</b> NKR/JD
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**SLOPE INCLINOMETER (SI) READINGS**

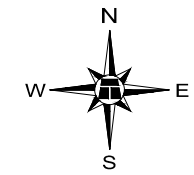
SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Azimuth of A+ Groove degree	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI-1	364166.28	6189642.38	21-Jun-22	0.86	90 to 4	58	858	-835	-508	509	8R/8R	
SI-3	364131.21	6189689.89	21-Jun-22	0.65	86 to 4	42	538	-529	56	-69	5R/5R	
SI-6	364197.31	6189687.82	21-Jun-22	0.45	48 to 4	10	-826	845	123	116	8R/8R	
SI-8	364160.87	6189636.36	21-Jun-22	0.61	70 to 4	30	113	-156	701	-719	5R/5R	

**PNEUMATIC PIEZOMETER (PN) READINGS**



PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN-4B	364192.96	6189660.11	21-Jun-22	1.1 **	55839
PN-5B	364180.27	6189679.54	21-Jun-22	39.1	27765

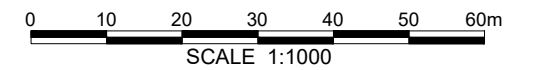
**INSPECTOR REPORT**

** Reading dropped down significantly - took readings twice



**LEGEND**

-  APPROXIMATE INSTRUMENT LOCATION
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
-  NON-OPERATIONAL



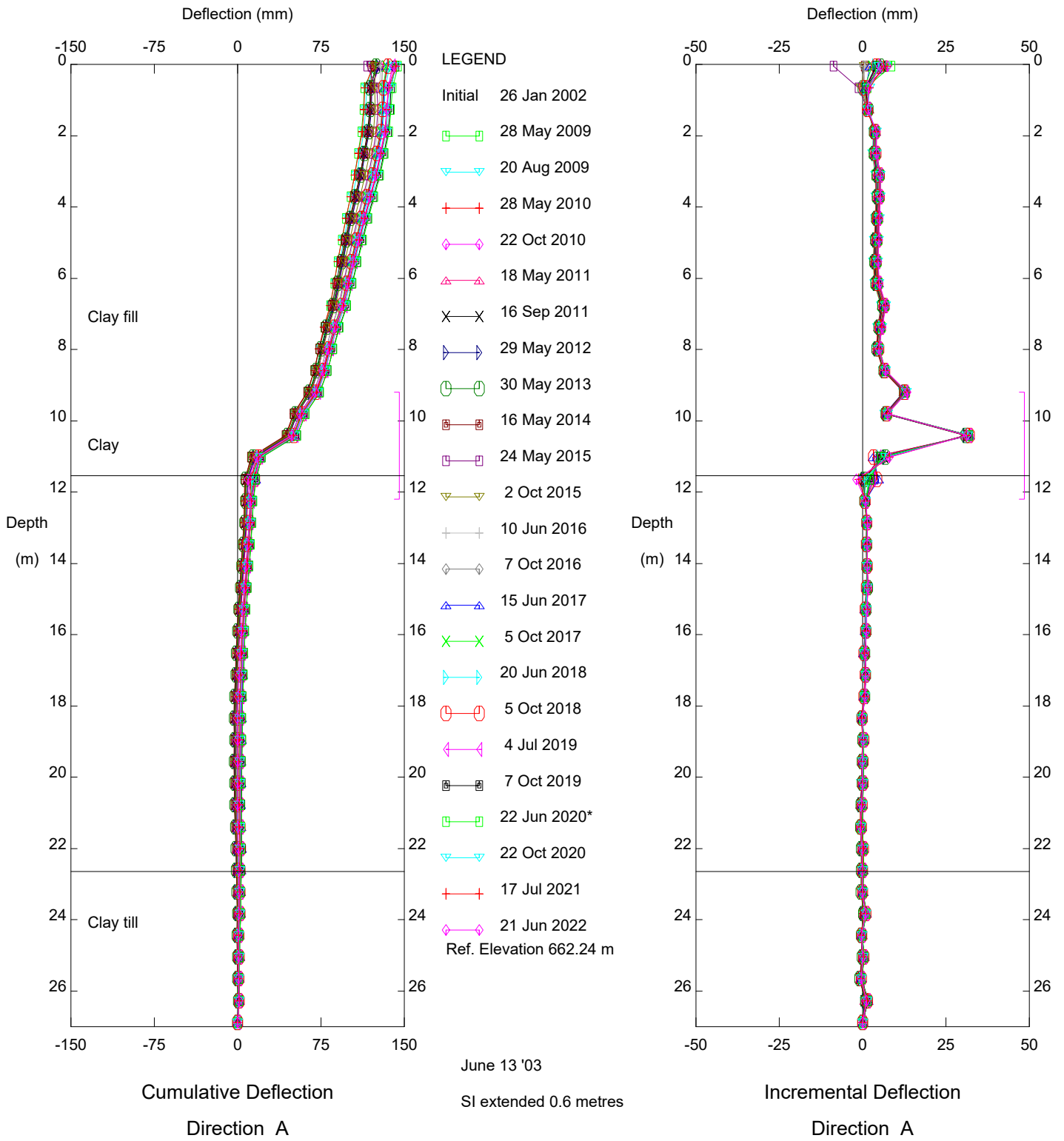
**PEACE REGION  
(GRANDE PRAIRIE DISTRICT NORTH)**

**GP012B: HWY 49:04 KSITUAN PILE WALL  
INSTRUMENT LOCATIONS**

**DWG No. 32123-GP012B**

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	RVC
SCALE	1:1000
DATE	AUGUST 2021
FILE No.	32123



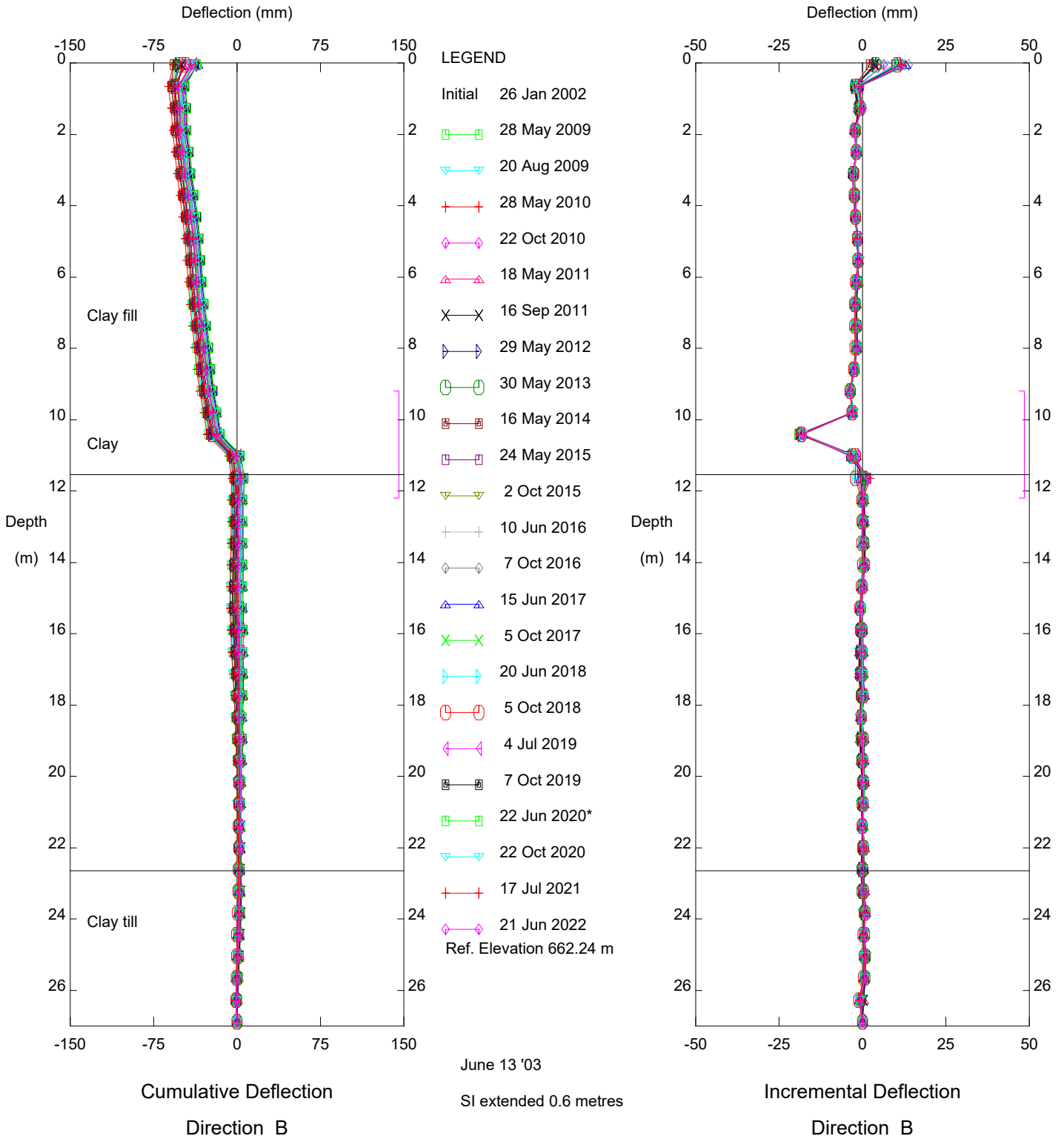


GP012B Ksituan River Crossing, Inclinometer SI-1

Alberta Transportation

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

Thurber Engineering Ltd

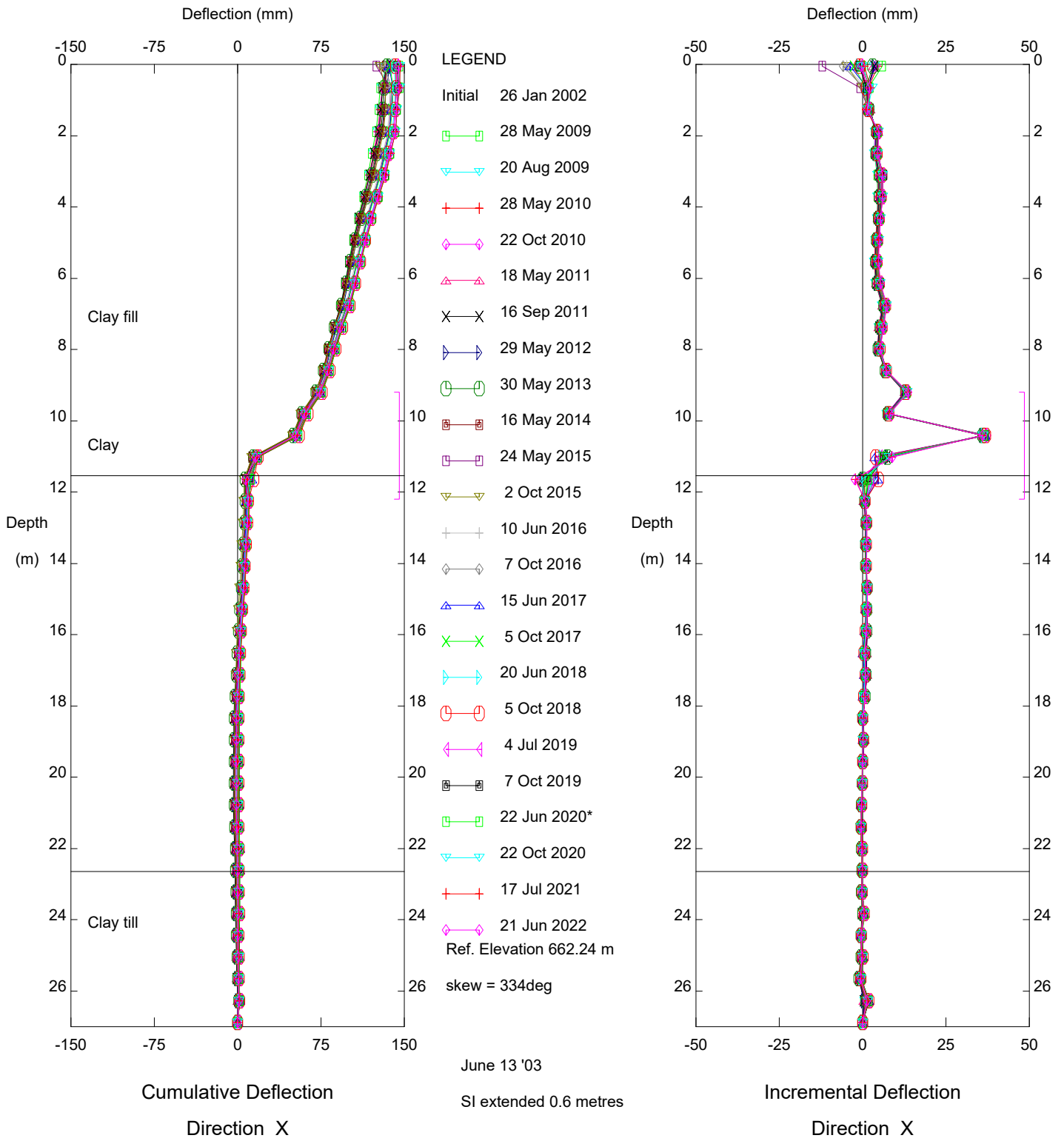


GP012B Ksituan River Crossing, Inclinometer SI-1

Alberta Transportation

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

Thurber Engineering Ltd

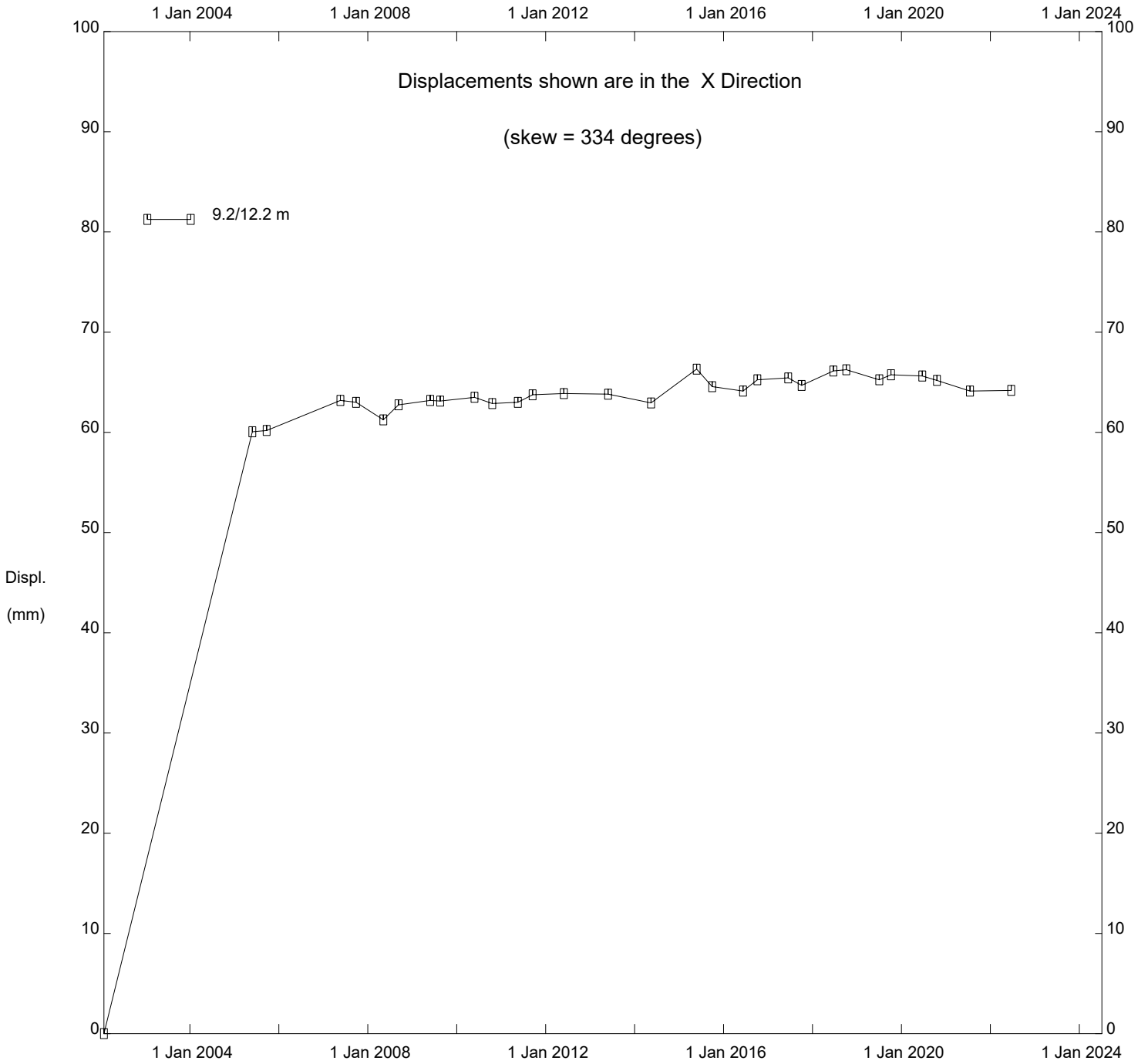


GP012B Ksituan River Crossing, Inclinometer SI-1

Alberta Transportation

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

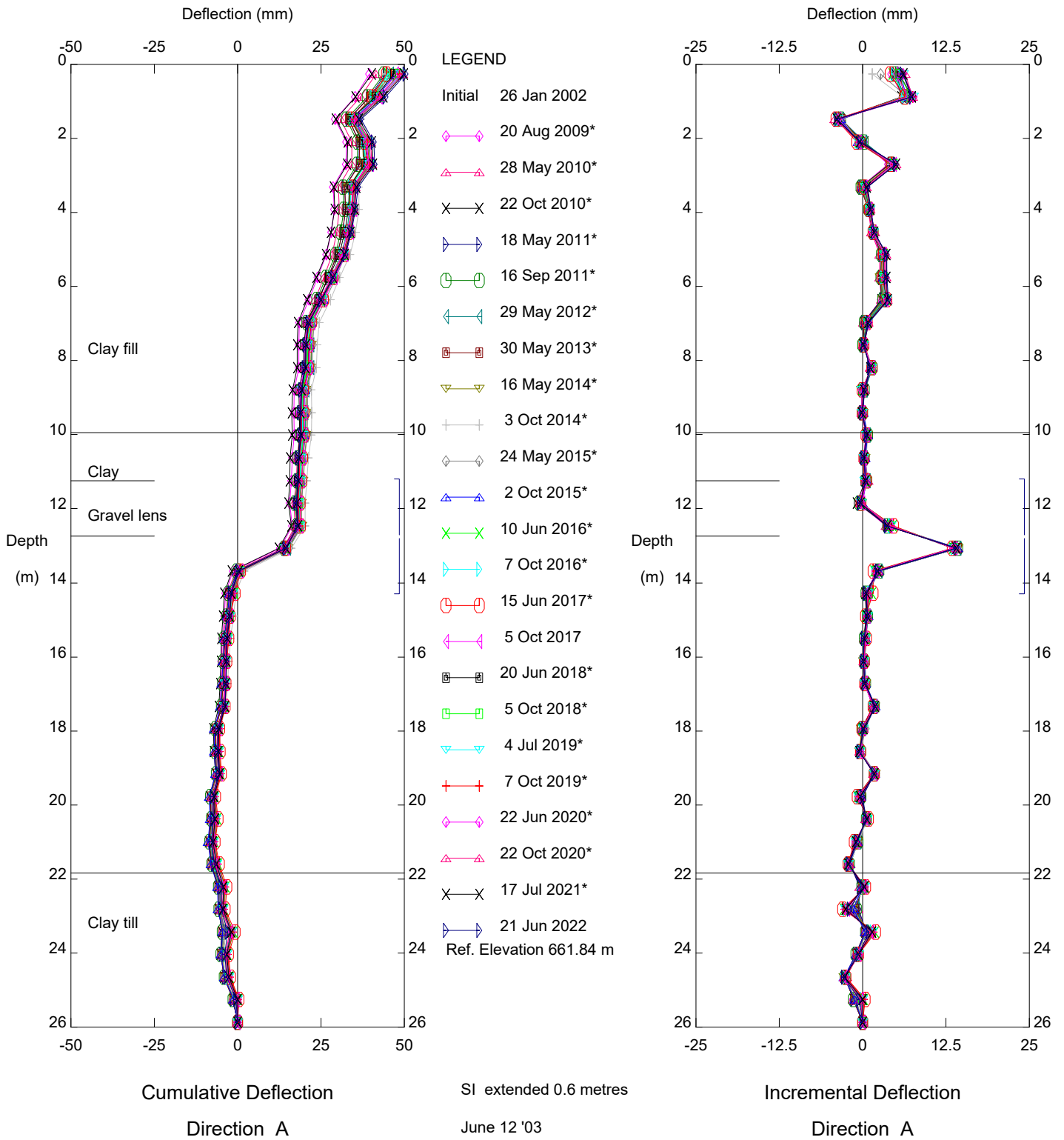
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinator SI-1

Alberta Transportation

Thurber Engineering Ltd

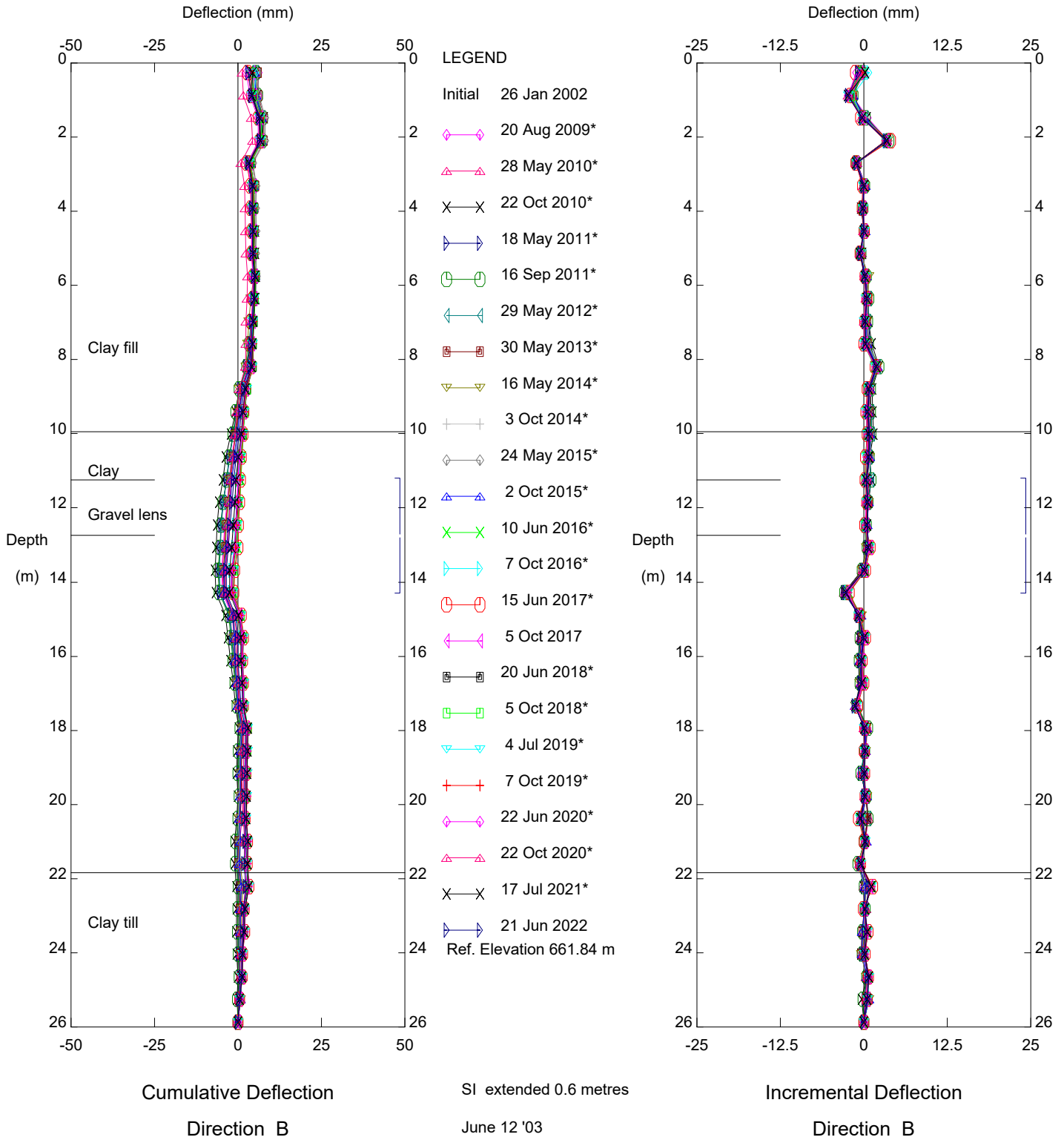


GP012B Ksituan River Crossing, Inclinometer SI-3

Alberta Transportation

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

Thurber Engineering Ltd



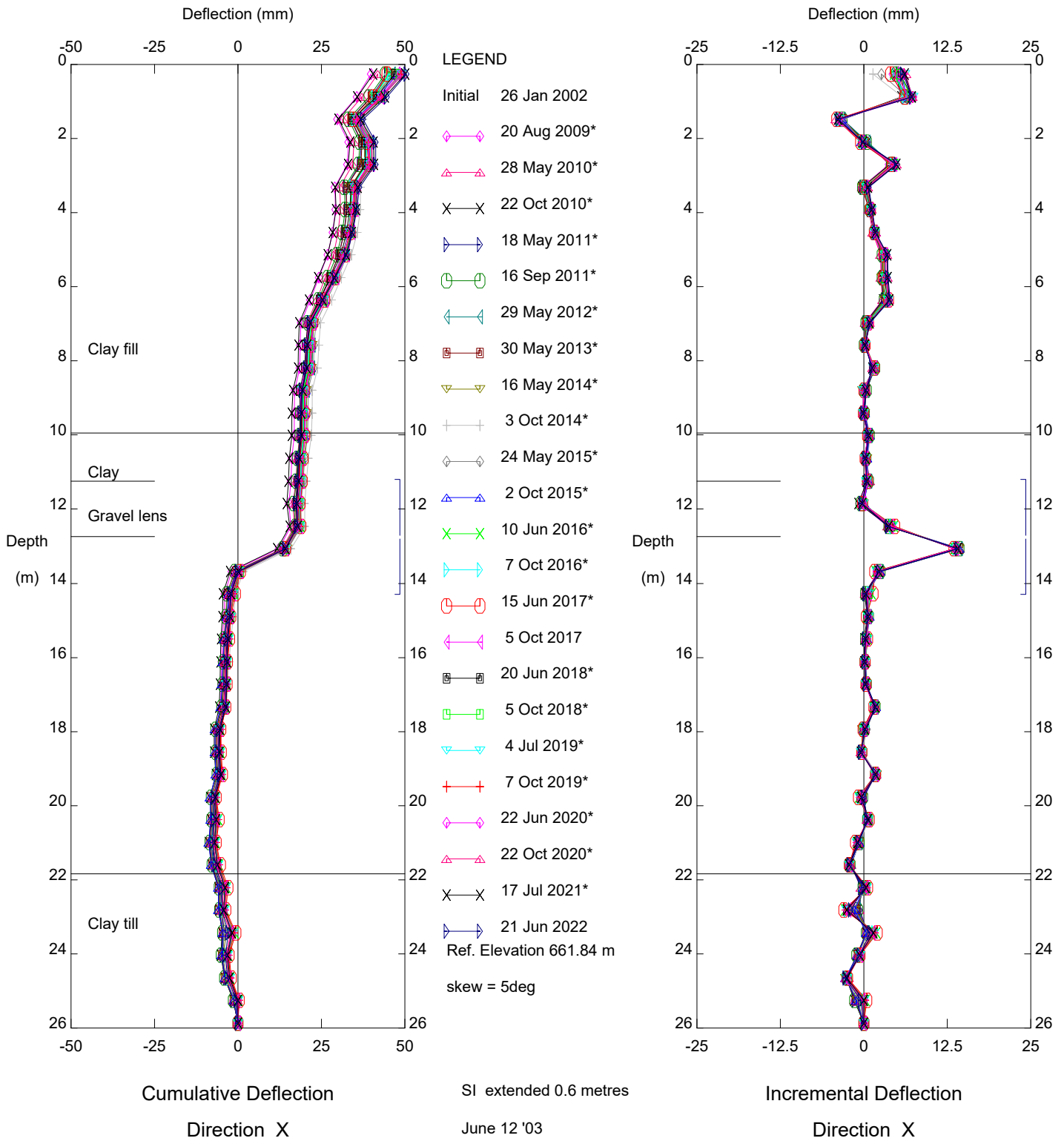
GP012B Ksituan River Crossing, Inclinometer SI-3

Alberta Transportation

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



Thurber Engineering Ltd

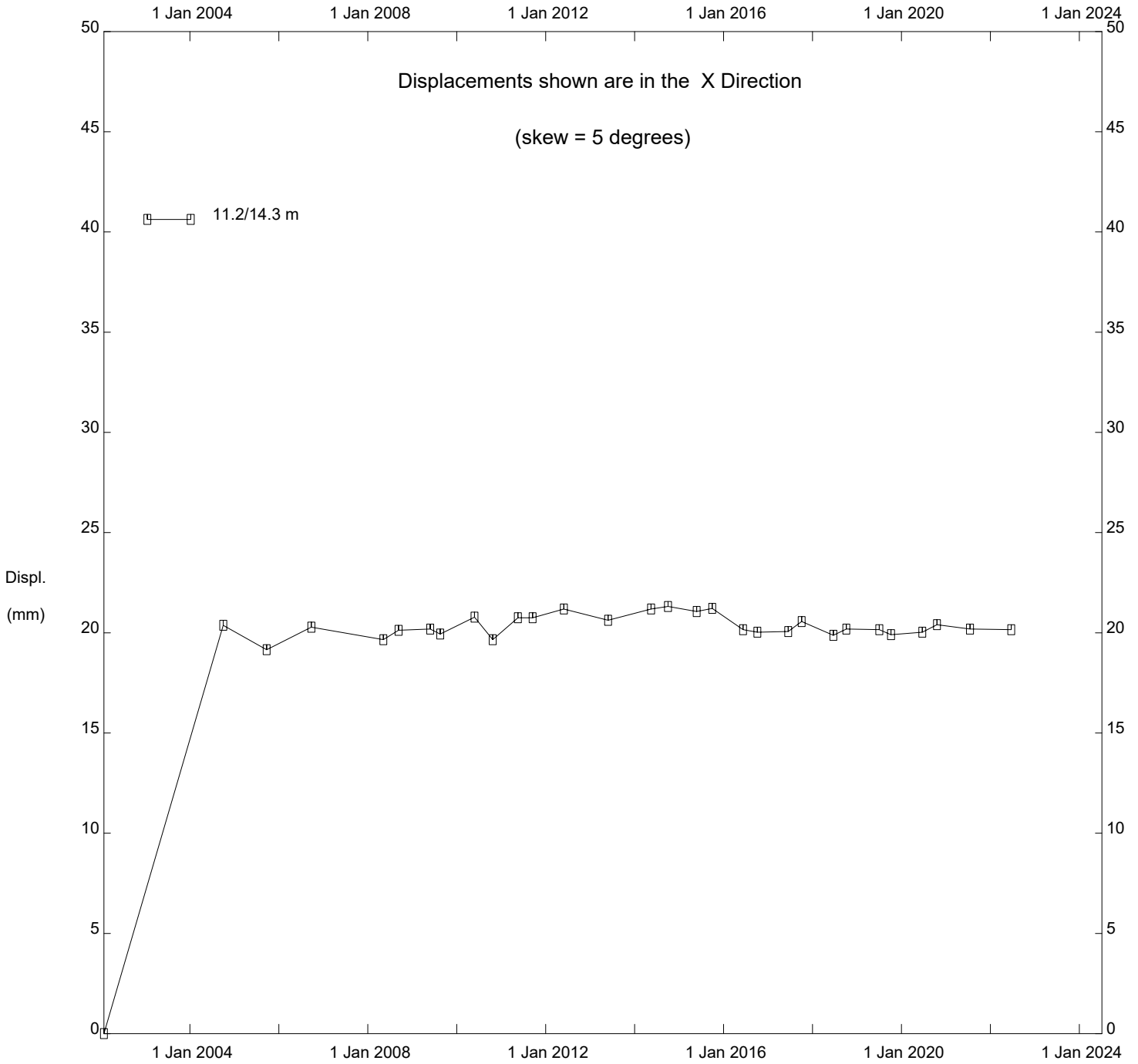


GP012B Ksituan River Crossing, Inclinometer SI-3

Alberta Transportation

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

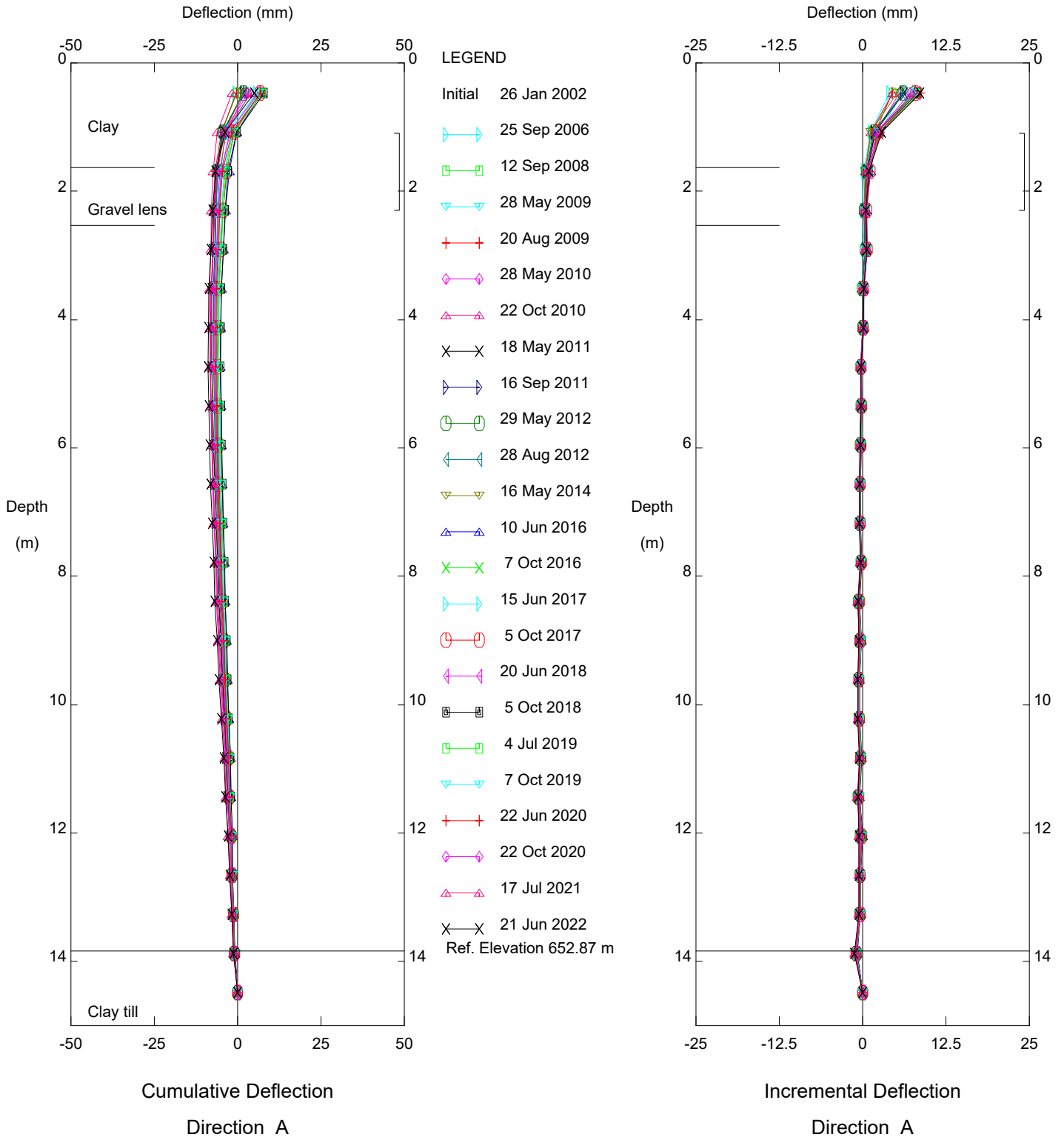
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinator SI-3

Alberta Transportation

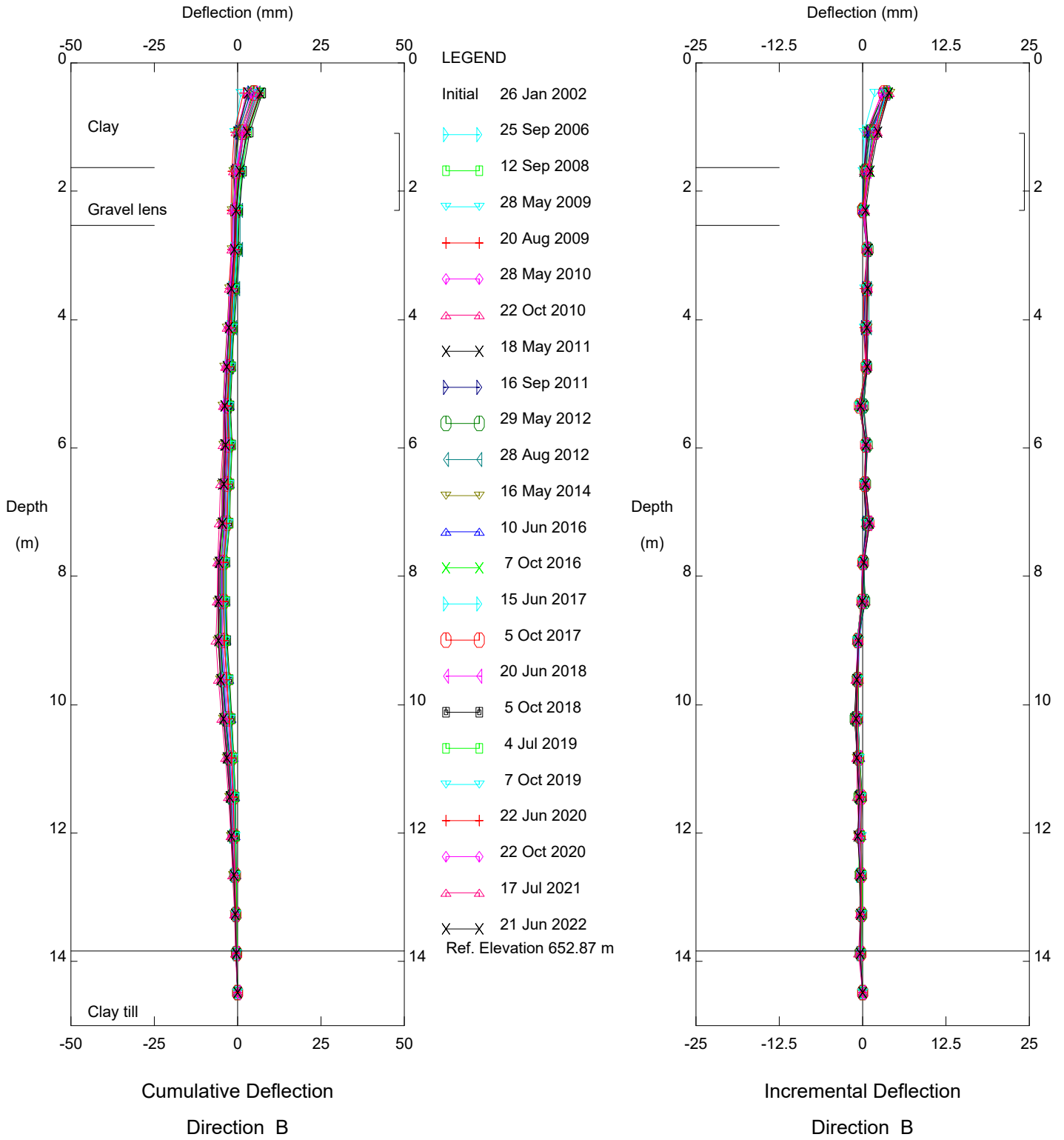
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinometer SI-6

Alberta Transportation

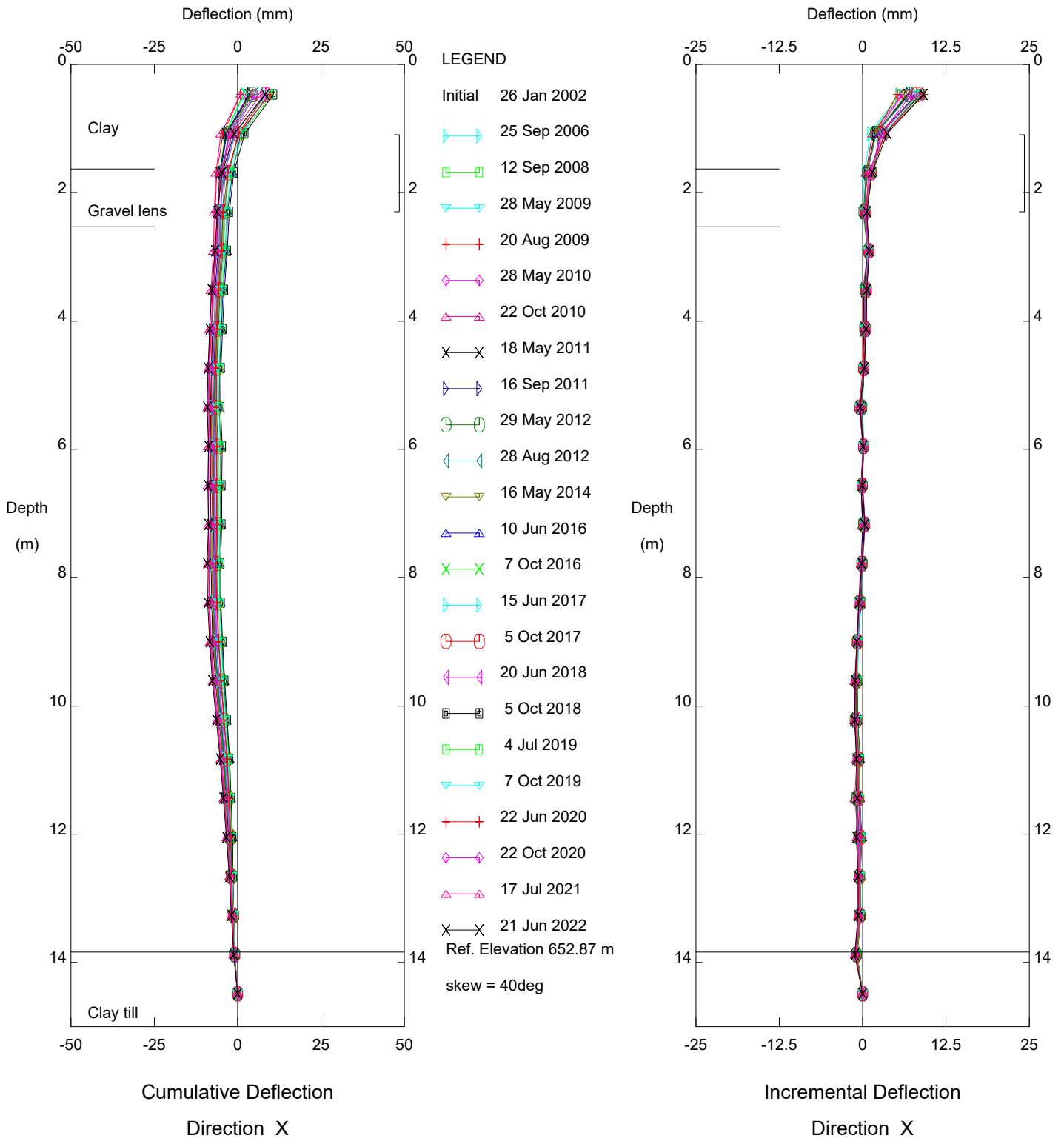
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinometer SI-6

Alberta Transportation

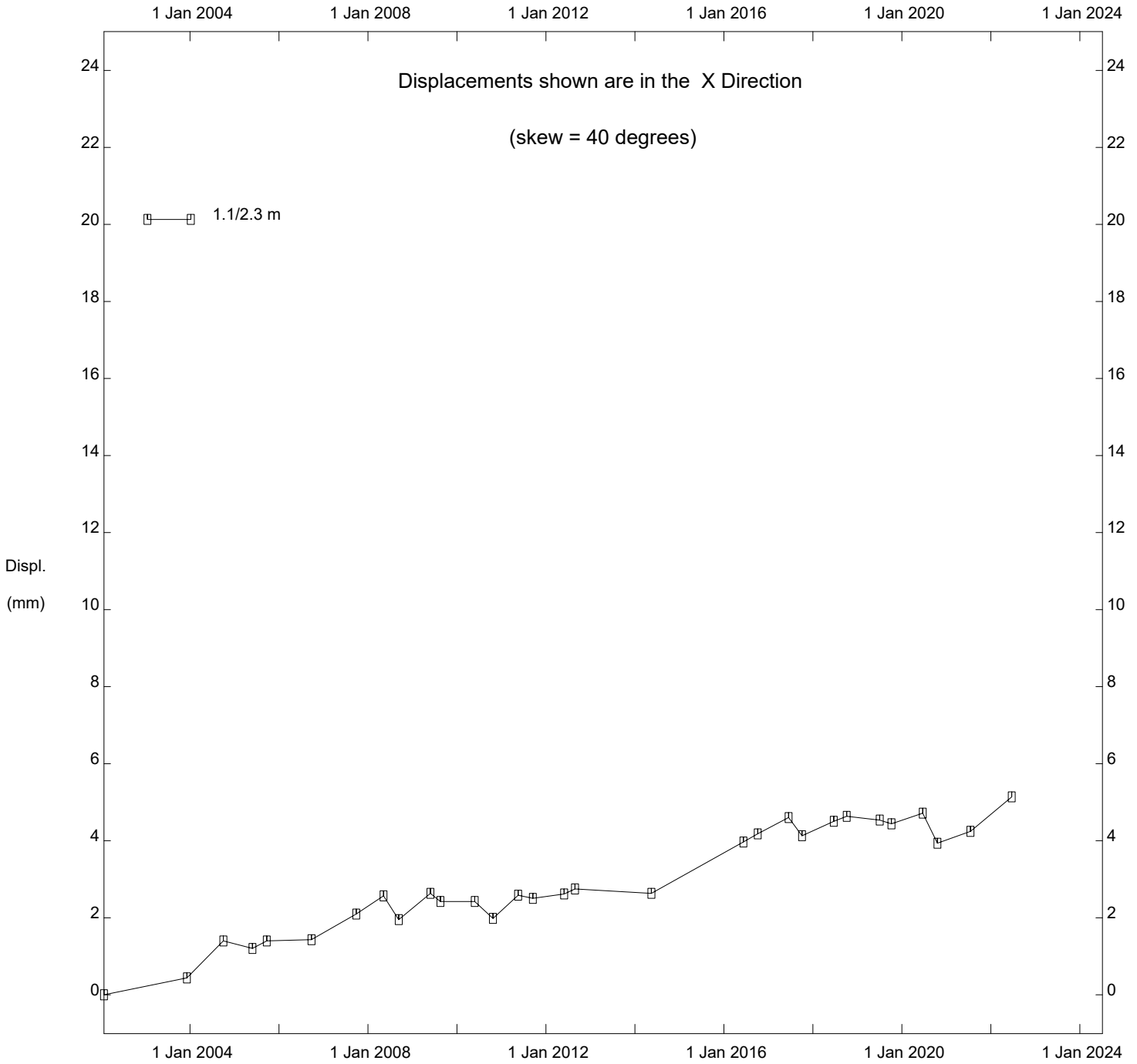
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinometer SI-6

Alberta Transportation

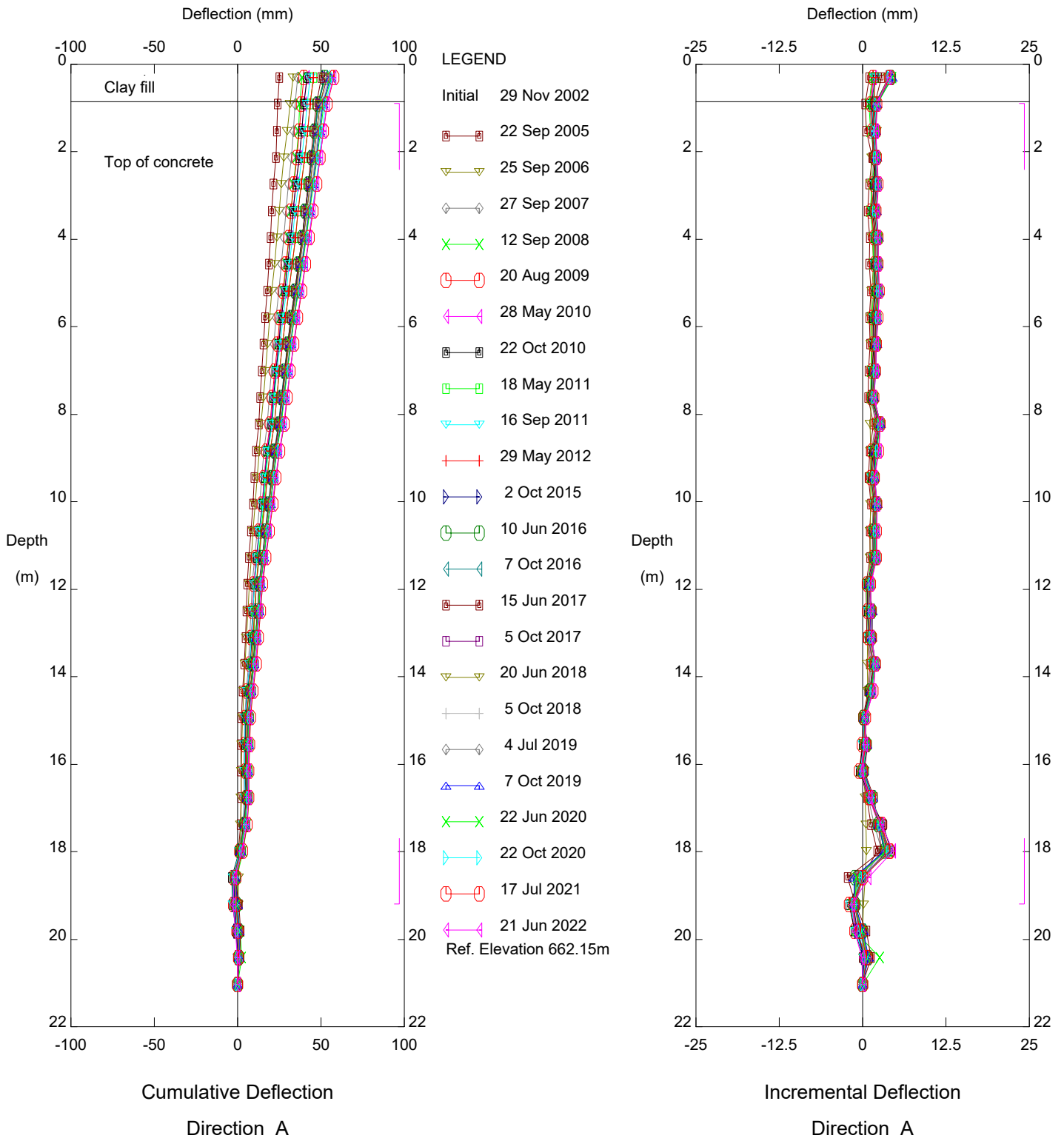
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GP012B Ksituan River Crossing, Inclinator SI-6

Alberta Transportation

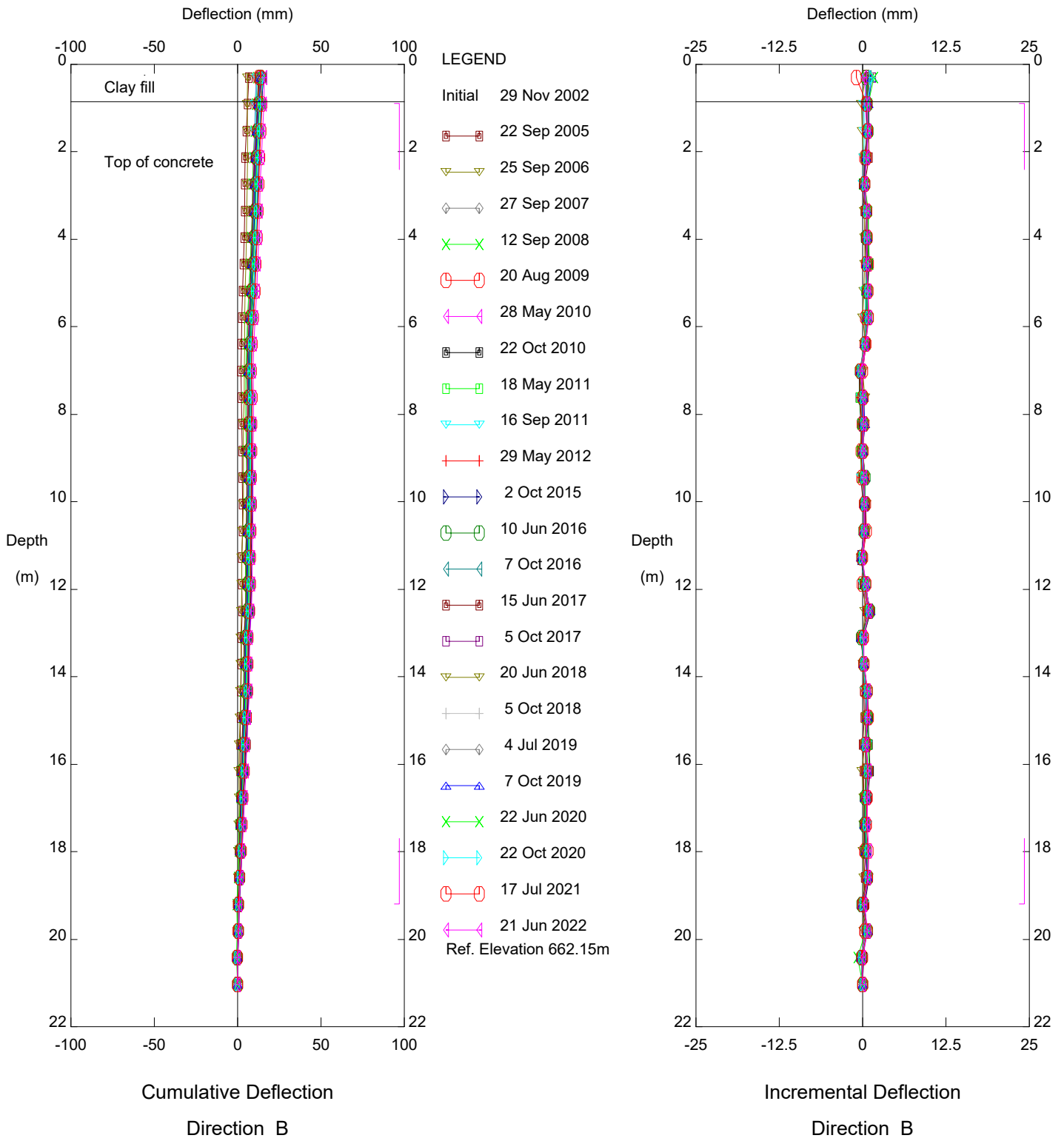
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinometer SI-8

Alberta Transportation

Thurber Engineering Ltd

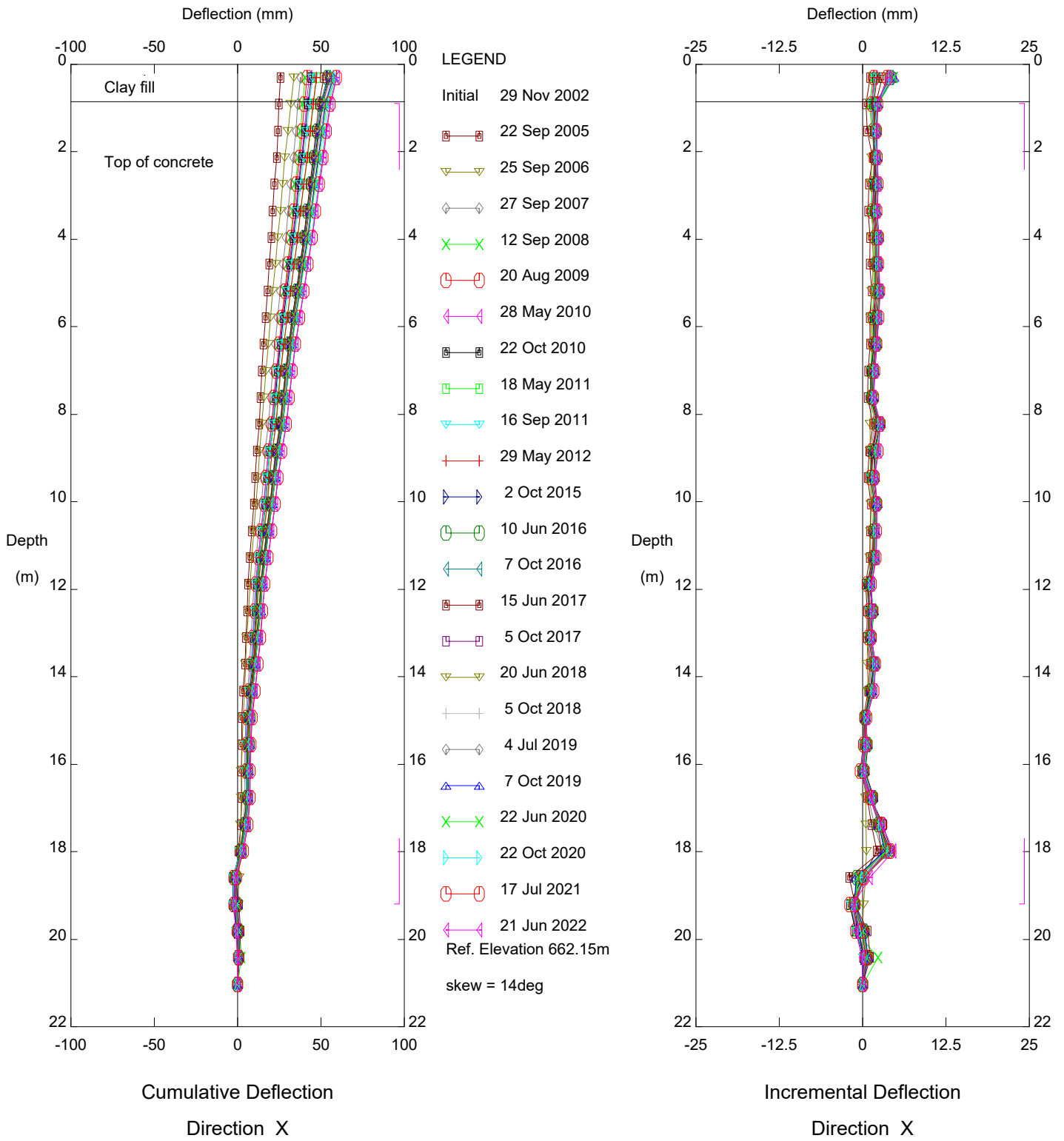


GP012B Ksituan River Crossing, Inclinometer SI-8

Alberta Transportation



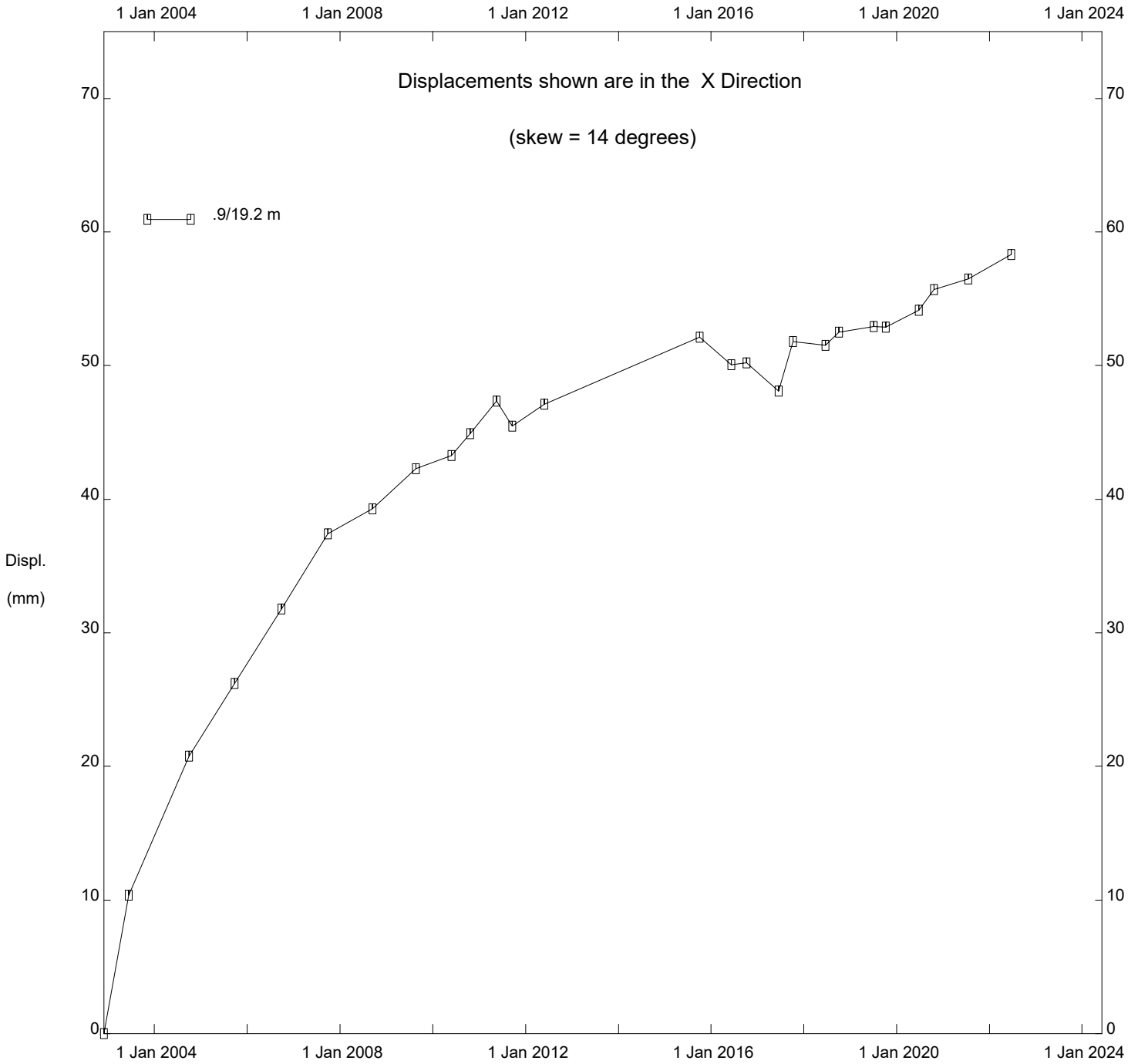
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinometer SI-8

Alberta Transportation

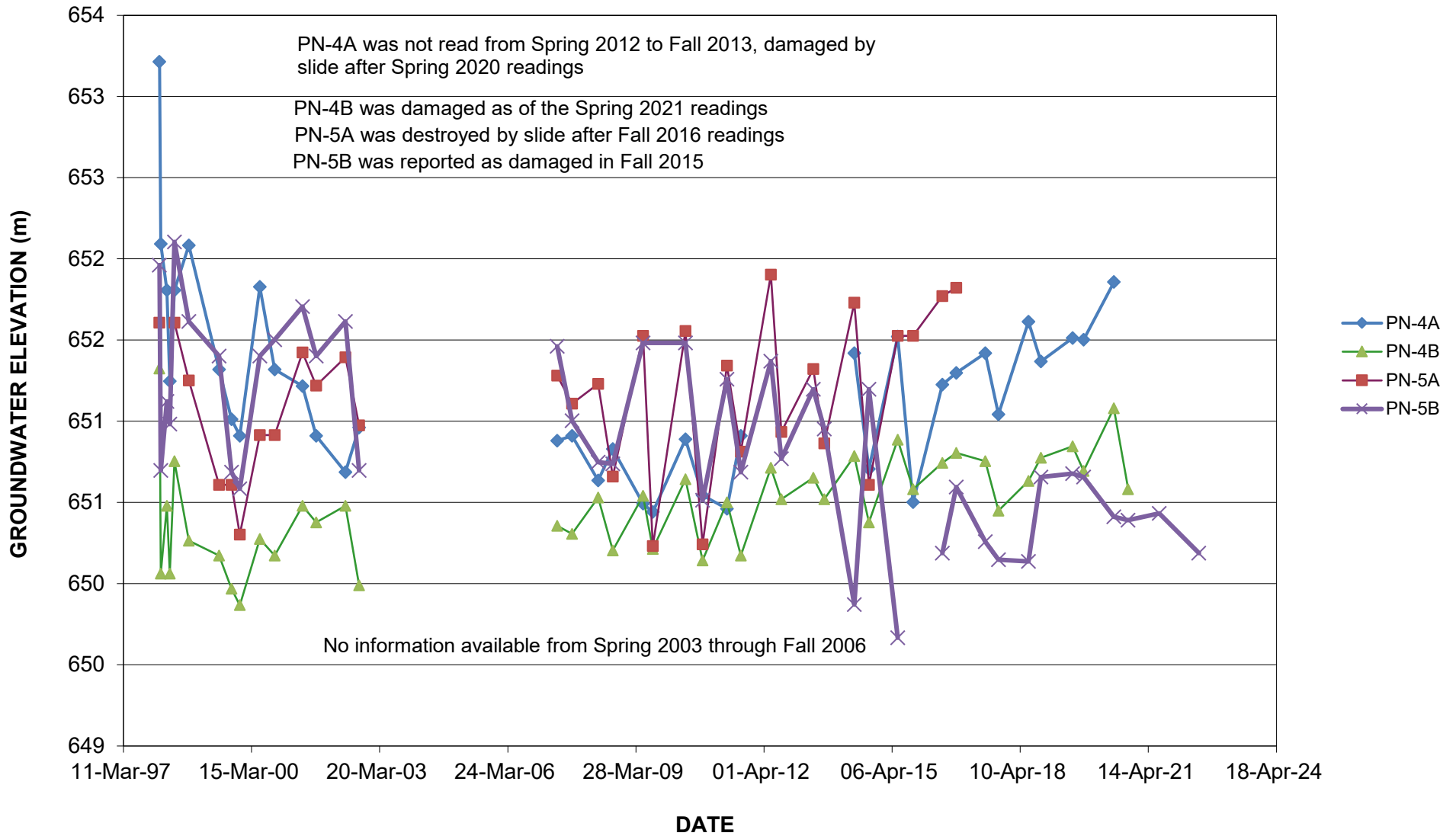
Thurber Engineering Ltd



GP012B Ksituan River Crossing, Inclinator SI-8

Alberta Transportation

**FIGURE GP012B-1  
PIEZOMETRIC ELEVATIONS FOR HWY 49:04, KSITUAN PILE WALL**



**FIGURE GP012B-2  
PIEZOMETRIC DEPTHS FOR HWY 49:04, KSITUAN PILE WALL**

