



**THURBER** ENGINEERING LTD.

December 1, 2022

File No.: 32121

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

Attention: Mr. Max Shannon

**ALBERTA TRANSPORTATION GRMP (CON0022164)  
PEACE REGION (PEACE RIVER DISTRICT)  
INSTRUMENTATION MONITORING RESULTS – FALL 2022**

**SECTION C**

**SITE SH016: HWY 49:12, LITTLE SMOKY RIVER BRIDGE**

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'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**

In the spring of 2021, Thurber Engineering Ltd (Thurber) completed a geotechnical investigation at the western end of the Hwy 49:02 Little Smoky River bridge to assess landslide movement affecting the bridge foundations and piers. As part of the investigation, three slope inclinometers (SI21-7, SI21-8, and SI21-9) and six vibrating wire piezometers (VW21-7A/B, VW21-8A/B and VW21-9A/B) were installed in three separate test holes. These instruments were monitored by Thurber over a period from June 16, 2021, through October 12, 2021 as part of a foundation monitoring and assessment program. The instruments were subsequently added to the Geohazard monitoring program for the fall of 2022 readings cycle.

The SIs and vibrating wire piezometers were read on October 6, 2022 by, by Mr. Niraj Regmi, G.I.T., and Mr. Kyle Crooymans, both of Thurber. SI21-7, SI21-8 and SI21-9 were found to be sheared off at 13.4 m, 11.0 m, and 16.5 m below the tops of their respective instrument casings. The vibrating wire piezometers were all still found to be functional, and were read using a GEOKON GK 404 vibrating wire readout.

In addition to the instruments listed above, there are fibre optic monitoring cables installed in the same three test holes as the SIs and VW piezometers. The fibre optic cables were monitored as



part of the foundation assessment in conjunction with the University of Alberta. However, they are not included in the scope of the current instrument readings.

## **2. DATA PRESENTATION**

### **2.1 General**

All of the active SIs at this site have sheared off. Historic SI plots for A and B directions are included in Appendix A. Where movement was recorded, resultant movement (X direction, if applicable) and a rate of movement are also provided.

Plots of the piezometric elevations and depths are also provided in Appendix A.

Slope inclinometer and piezometer reading summary tables are provided below.

### **2.2 Zones of Movement**

As noted above, all of the SIs at this site have sheared off. Zones of previously observed movements are summarized in Table SH016-1 below. Table SH016-1 below 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 SH016-1  
FALL 2022 – HWY 49:12, LITTLE SMOKY RIVER BRIDGE  
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 6, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)</b>	<b>MAXIMUM RATE OF MOVEMENT (mm/yr)</b>	<b>CURRENT STATUS</b>	<b>DATE OF PREVIOUS READING</b>	<b>INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)</b>	<b>AVERAGE RATE OF MOVEMENT OVER MONITORING PERIOD (mm/yr)</b>	<b>CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)</b>
<i>SI21-7</i>	<i>June 14, 2021</i>	<i>7.2 mm over 11.6 m to 13.5 m in 91° direction</i>	<i>25.7 in July 2021</i>	<i>Sheared at 13.4 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>21.8</i>	<i>N/A</i>
<i>SI21-8</i>	<i>June 14, 2021</i>	<i>7.5 mm over 9.3 m to 11.1 m in 86° direction</i>	<i>35.6 in July 2021</i>	<i>Sheared at 11.0 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>22.7</i>	<i>N/A</i>
<i>SI21-9</i>	<i>June 14, 2021</i>	<i>9.3 mm over 15.3 m to 16.5 m in 61° direction</i>	<i>32.0 in July 2021</i>	<i>Sheared at 16.5 m below top of casing</i>	<i>October 12, 2021</i>	<i>N/A</i>	<i>28.8</i>	<i>N/A</i>

Drawing 32121-SH016 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



**TABLE SH016-2  
FALL 2022 – HWY 49:12, LITTLE SMOKY RIVER BRIDGE  
VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 6, 2022

<b>INSTRUMENT</b>	<b>DATE INITIALIZED</b>	<b>GROUND ELEVATION (m)</b>	<b>TIP DEPTH (m)</b>	<b>CURRENT STATUS</b>	<b>MAXIMUM GROUNDWATER ELEVATION (m)</b>	<b>CURRENT GROUNDWATER ELEVATION (m)</b>	<b>PREVIOUS GROUNDWATER ELEVATION* (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
VW21-7A	June 10, 2021	492.42	5.00	Operational	489.82 on October 6, 2022	489.82	489.59	0.23
VW21-7B	June 20, 2021	492.42	12.00	Operational	489.35 on October 6, 2022	489.35	489.17	0.18
VW21-8A	June 16, 2021	493.89	5.00	Operational	491.63 on October 6, 2022	491.63	490.98	0.65
VW21-8B	June 16, 2021	493.89	14.00	Operational	480.43 on October 6, 2022	480.43	480.14	0.29
VW21-9A	June 16, 2021	500.36	9.80	Operational	494.09 on June 16, 2021	493.75	493.59	0.16
VW21-9B	June 16, 2021	500.36	19.04	Operational	491.89 on October 6, 2022	491.89	491.85	0.04

Drawing 32121-SH016 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site

\* Previous groundwater elevation on October 12, 2021



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

Before shearing off, all of the SIs showed a distinct shear zone towards the bottom of a layer of disturbed clay shale underlying the upper clay fill. SI21-7, SI21-8 and SI21-9 showed average rates of movement over the monitoring period of June 14, 2021 to October 12, 2021 of 21.8 mm/yr, 22.7 mm/yr and 28.8 mm/yr, respectively.

The vibrating wire piezometers all showed increases in groundwater level compared to the previous readings on October 12, 2021, ranging from 0.04 m in VW21-9B to 0.65 m in VW21-8A. All of the piezometers, except for VW21-9A, recorded the highest groundwater levels measured since the initialization of their respective instruments during the current readings cycle. The vibrating wire piezometer readings are plotted on Figure SH016-1 (by elevation) and Figure SH016-2 (by depth) in Appendix A.

### **4. RECOMMENDATIONS**

#### **4.1 Future Work**

The instruments should be read again in the spring of 2023. Thurber has reached out to the University of Alberta to see if the fibre optic cables can be read, however we have not received a response to date. A program involving precise surveying of monitoring points installed at various locations on the bridge and bridge foundations was proposed to AT's bridge group to assist in tracking bridge movements and timing for adjustments to the foundations. If this program is conducted, the tops of the 3 sheared SI's could also be monitored to gauge ground movements at those locations.

#### **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.  
Don Proudfoot, M.Eng., P. Eng.  
Principal | Senior Geotechnical Engineer

Bruce Nestor, P.Eng.  
Geotechnical Engineer  
*/s/*

### Attachments:

- Statement of Limitations and Conditions
- Appendix A
  - Field Inspector's report
  - Site Plan Showing Approximate Instrument Locations (Drawing No. 32121-SH016-1)
  - Historic SI Reading Plots
  - Figure SH016-1 (Vibrating Wire Piezometer Elevations)
  - Figure SH016-2 (Vibrating Wire Piezometer 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 (CON0022164)  
PEACE REGION (PEACE RIVER DISTRICT)  
INSTRUMENTATION MONITORING RESULTS**

**FALL 2022**

**APPENDIX A  
DATA PRESENTATION**

**SITE SH016: HWY 49:12, LITTLE SMOKY RIVER BRIDGE**

**ALBERTA TRANSPORTATION  
PEACE REGION (PEACE RIVER DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (SH016)  
FALL 2022**

<b>Location:</b> HWY 49:12 LITTLE SMOKY RIVER WEST BANK INSTABILITY <b>File Number:</b> 32121 <b>Probe:</b> RST SI SET 8R <b>Cable:</b> RST SI SET 8R	<b>Read Out:</b> VW GK404 S/N 364 <b>Casing Size</b> 2.75' dia. <b>Temp:</b> 2 <b>Read by:</b> NKR/KTC
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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	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
TH21-07	489600	6145510	6-Oct-22	0.87	64 to 2	75	242	-226	-218	220	8R	Sheared off at 44.0 ft
TH21-08	489593	6145503	6-Oct-22	0.74	68 to 2	95	-903	-886	-904	905	8R	Sheared off at 36.0 ft
TH21-09	489570	6145510	6-Oct-22	0.85	94 to 2	70	-24	43	-726	728	8R	Sheared off at 54.0 ft

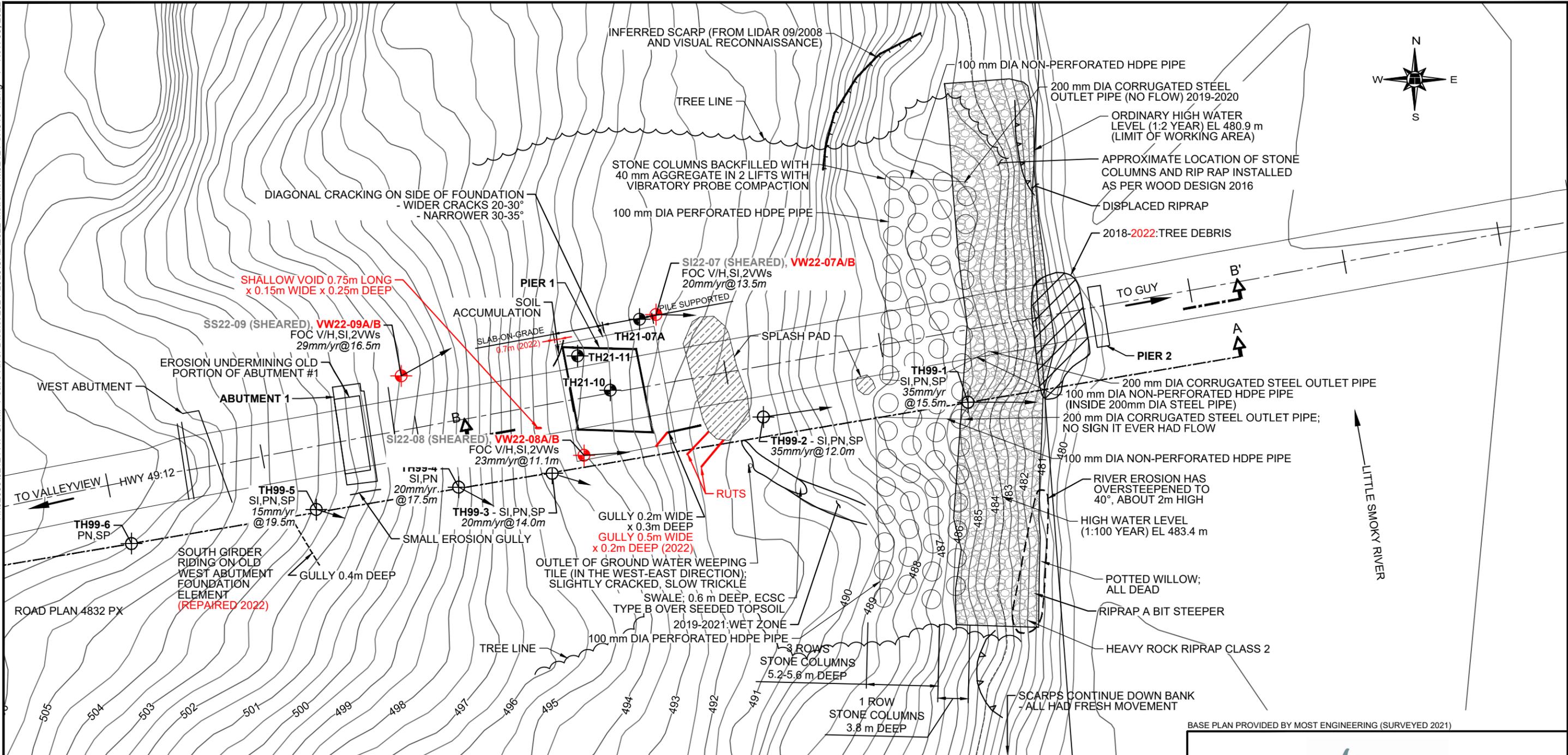
**VIBRATING WIRE PIEZOMETER (VW) READINGS**

Location	Serial	GPS Location (UTM 11)		Location	Date	Reading		Comments
		Easting (m)	Northing (m)			B Units	Temp °C	
TH21-07A	133742	489600	6145512	Stand Alone Location	6-Oct-22	8592.6	6.7	
TH21-07A	133747	489600	6145512	Stand Alone Location	6-Oct-22	8158.6	5.9	
TH21-08	133715	489593	6145503	Attached to SI21-08	6-Oct-22	8568.2	8.8	
TH21-08	133476	489593	6145503	Attached to SI21-08	6-Oct-22	9387.6	6.1	
TH21-09	133478	489570	6145510	Attached to SI21-09	6-Oct-22	9134.4	5.7	
TH21-09	133492	489570	6145510	Attached to SI21-09	6-Oct-22	8564.6	6.1	

**INSPECTOR REPORT**

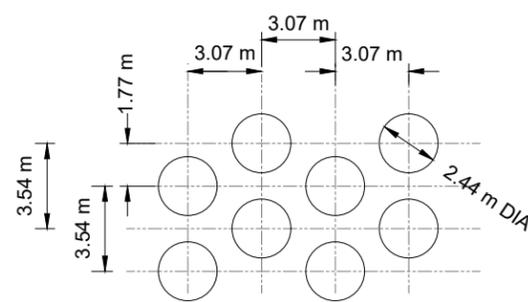
TH21-07 Readings start 6 1/4" off bottom.
TH21-08 Readings start 8" off bottom.
TH21-09 Readings start 7" off bottom.

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2022 Instrument\32121 SH016-1.dwg - 1 - Nov. 30, 2022



TO VALLEYVIEW HWY 49:12

LITTLE SMOKY RIVER



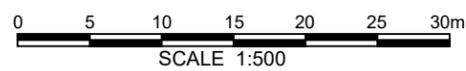
TYPICAL DETAIL OF STONE COLUMN SPACING  
SCALE 1:300

**LEGEND**

- APPROXIMATE INSTRUMENTATION LOCATION
- APPROXIMATE TEST HOLE LOCATION (THURBER, 2021)
- APPROXIMATE TEST HOLE LOCATION (THURBER, 1999)
- SI SLOPE INCLINOMETER
- FOC V/H FIBRE OPTIC CABLE: VERTICAL / HELICAL ORIENTATION
- PN PNEUMATIC PIEZOMETER
- SP STANDPIPE PIEZOMETER
- VW VIBRATING WIRE PIEZOMETER
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 0.5m)
- MOVEMENT VECTOR AND DEPTH (SCALED BY OVERALL MOVEMENT RATE)

**NOTES**

1. MAY 2022 OBSERVATIONS SHOWN IN RED.
2. DETAILS OF REPAIR BELOW PIER 1 PROVIDED BY AMEC FOSTER WHEELER.
3. HIGHWAY RIGHT OF WAY BOUNDARY IS 91 m FROM THE HIGHWAY CENTERLINE (OUTSIDE OF DRAWING LIMITS)



BASE PLAN PROVIDED BY MOST ENGINEERING (SURVEYED 2021)



PEACE REGION (PEACE RIVER DISTRICT)

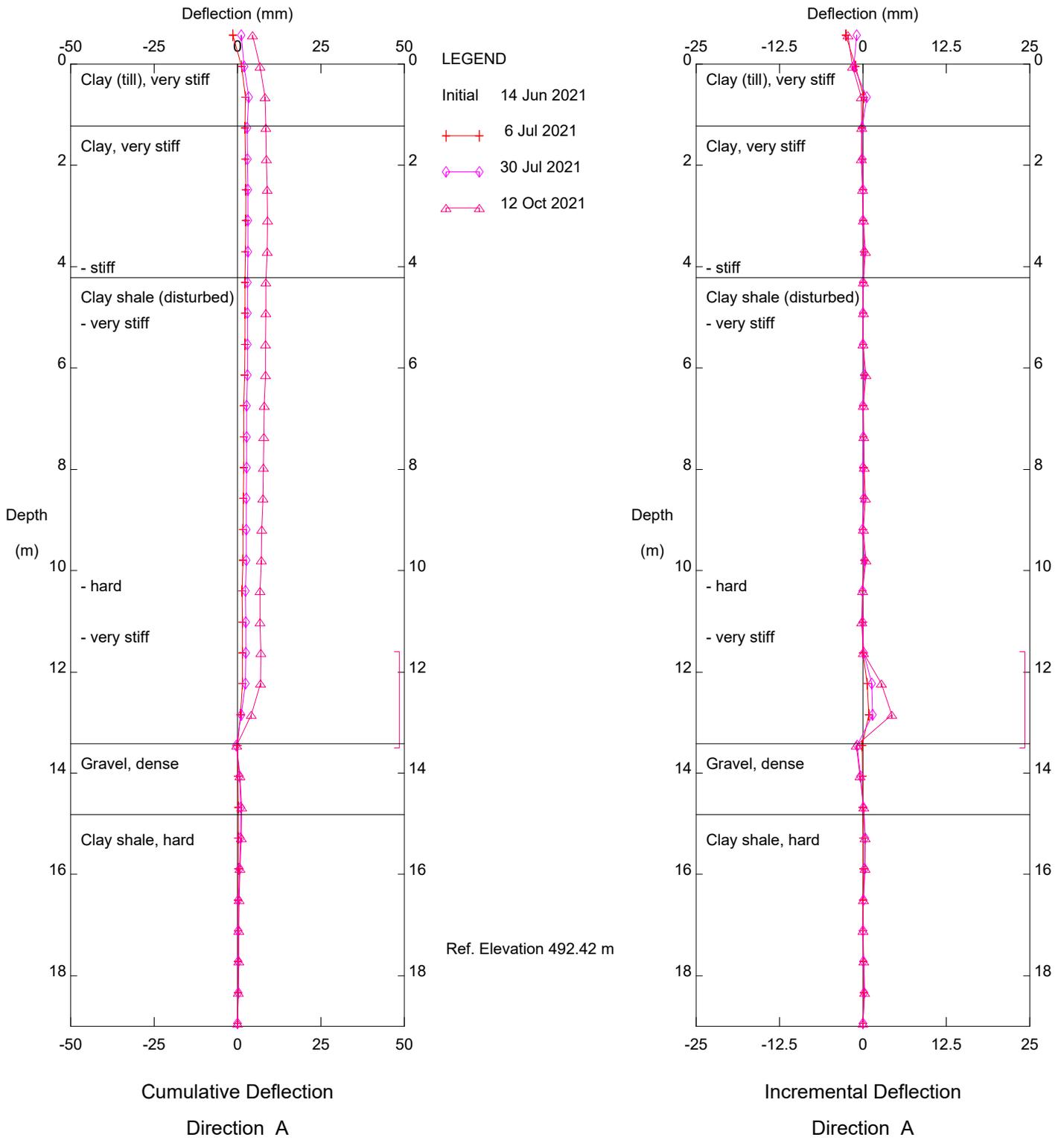
SH016: HWY 49:12 LITTLE SMOKY RIVER  
APPROXIMATE INSTRUMENT LOCATIONS

DWG No. 32121-SH016-1

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	RVC
SCALE	1:500
DATE	NOVEMBER 2022
FILE No.	32121



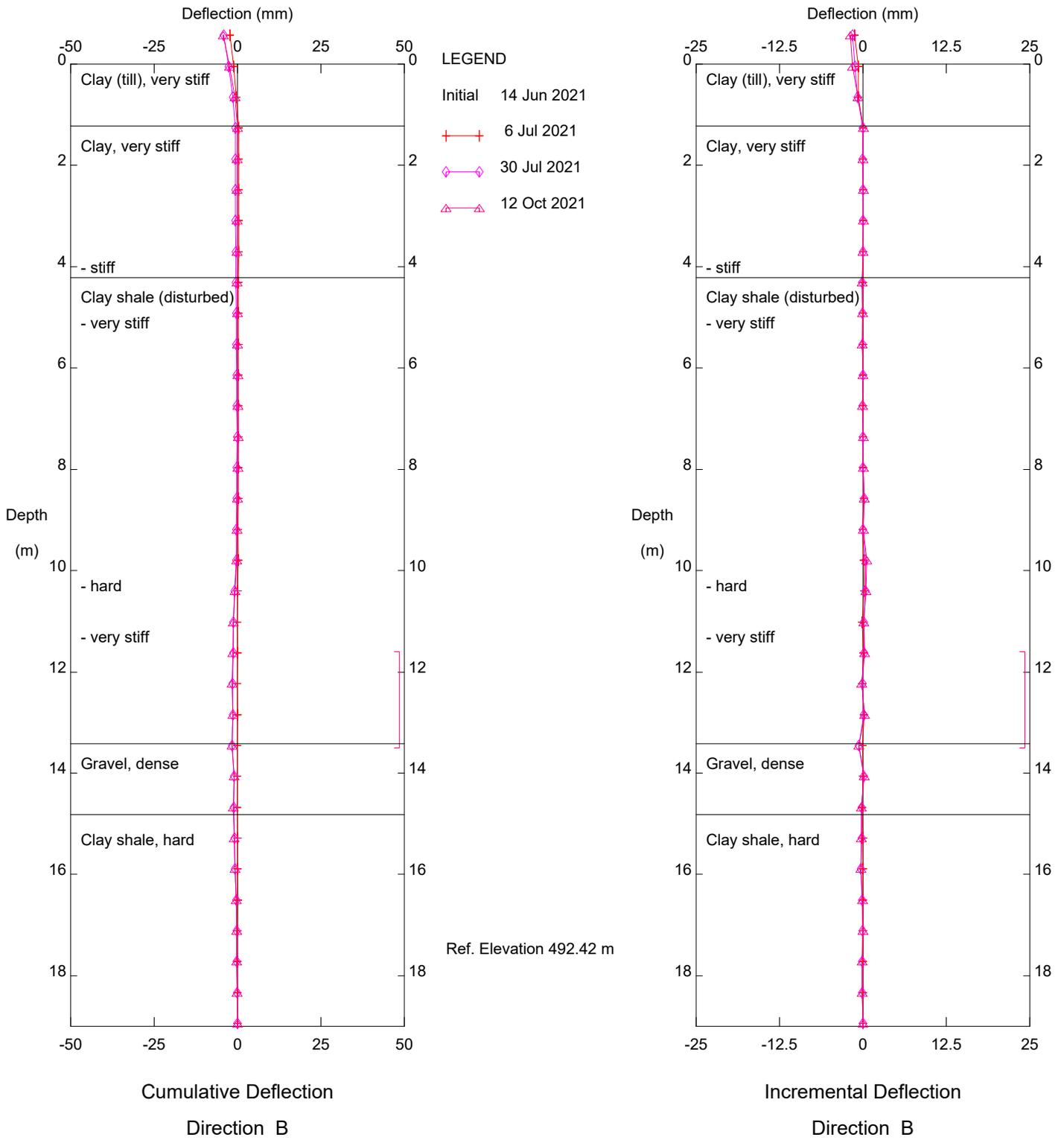
Thurber Engineering Ltd



Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-07

Alberta Transportation

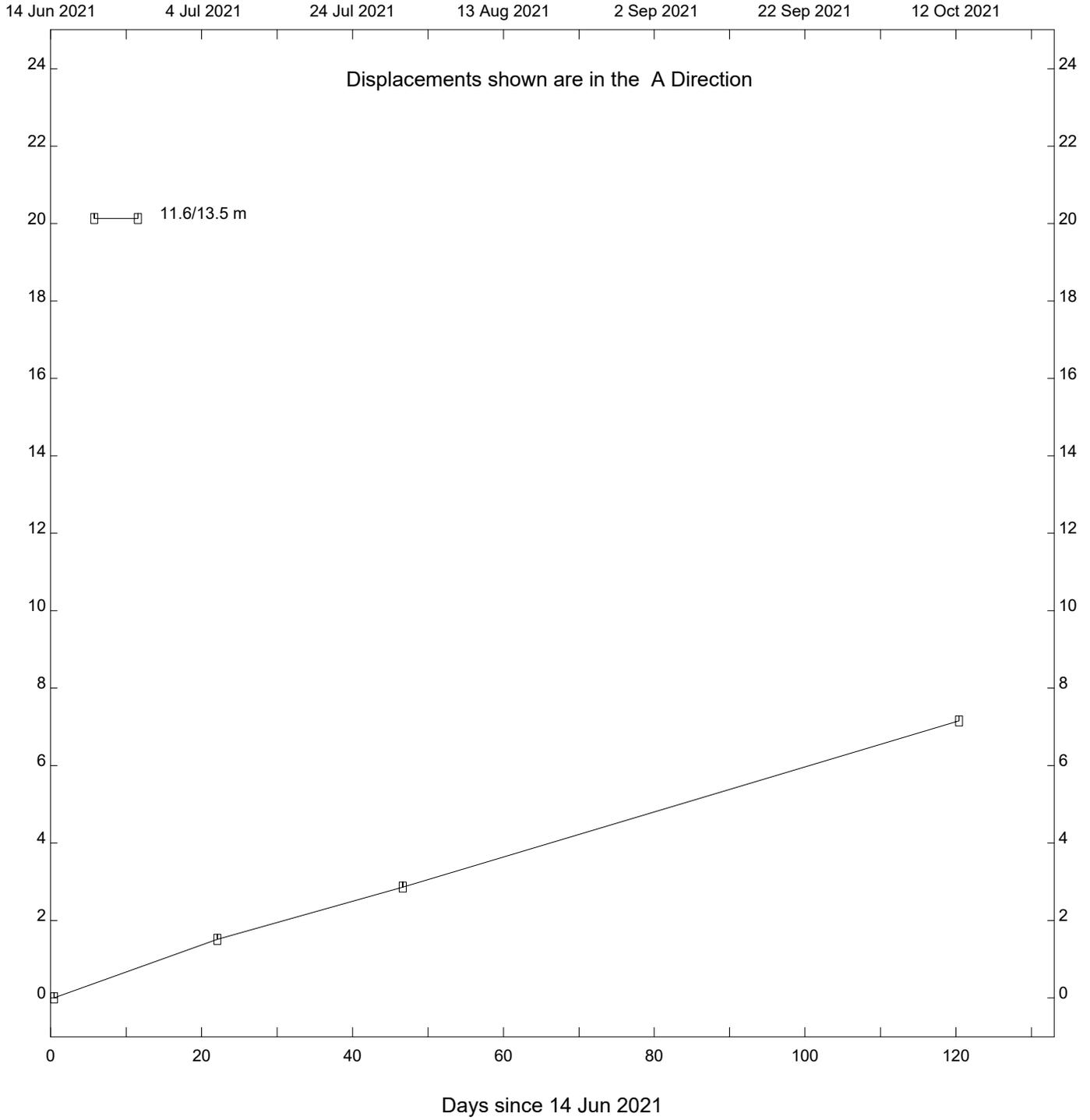
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Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-07

Alberta Transportation

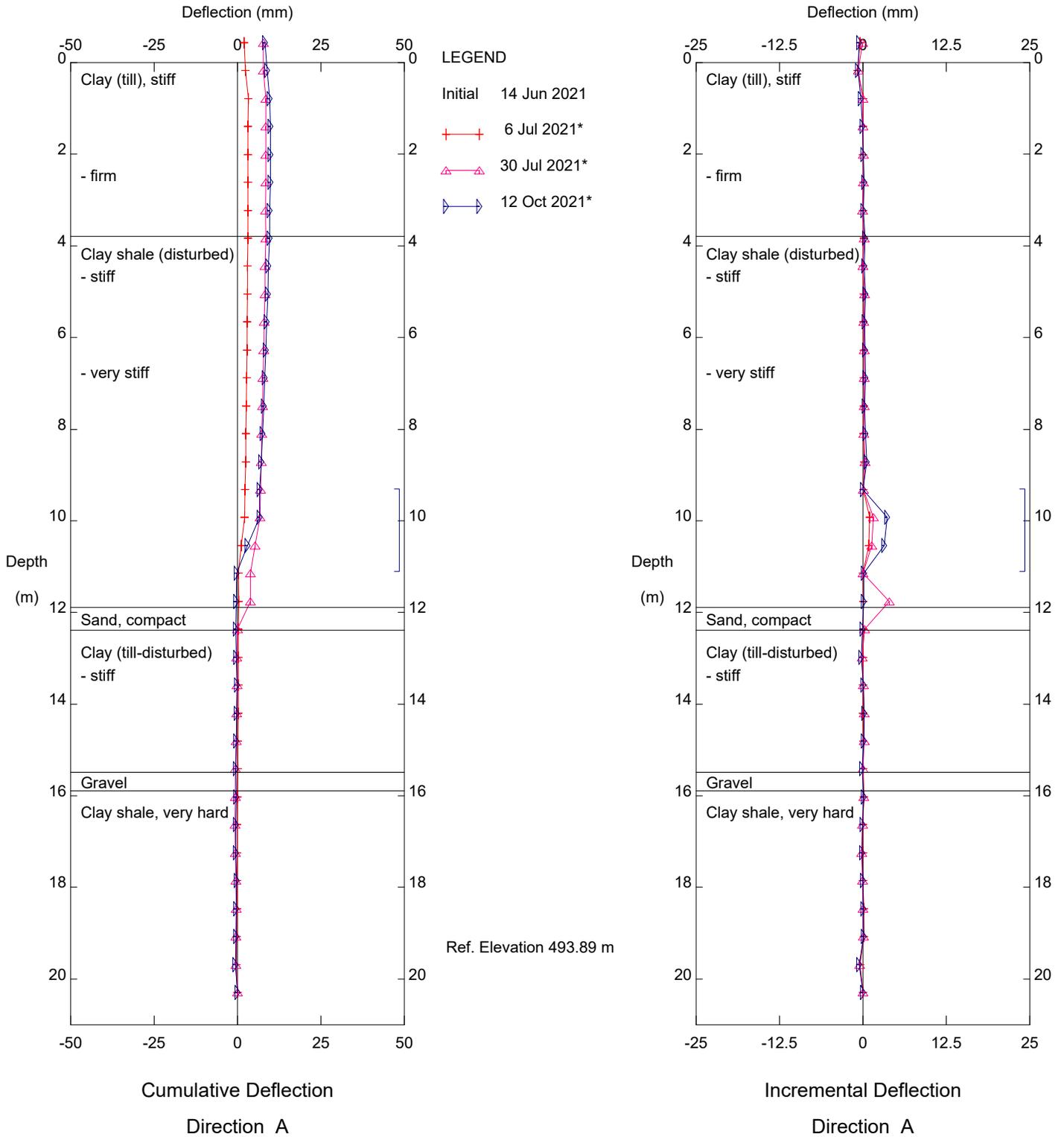
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Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-07

Alberta Transportation

Thurber Engineering Ltd

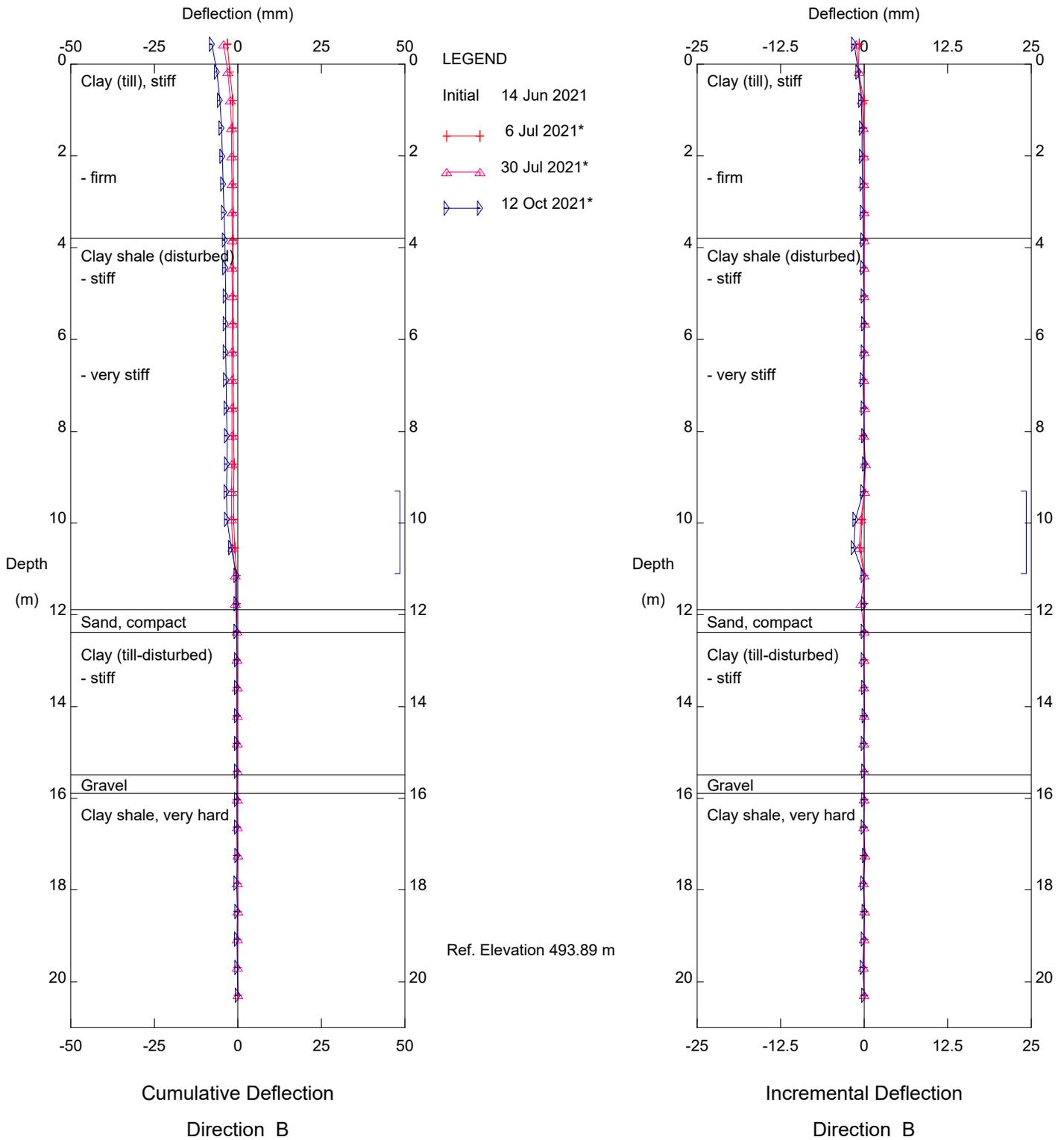


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-08

Alberta Transportation

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

Thurber Engineering Ltd

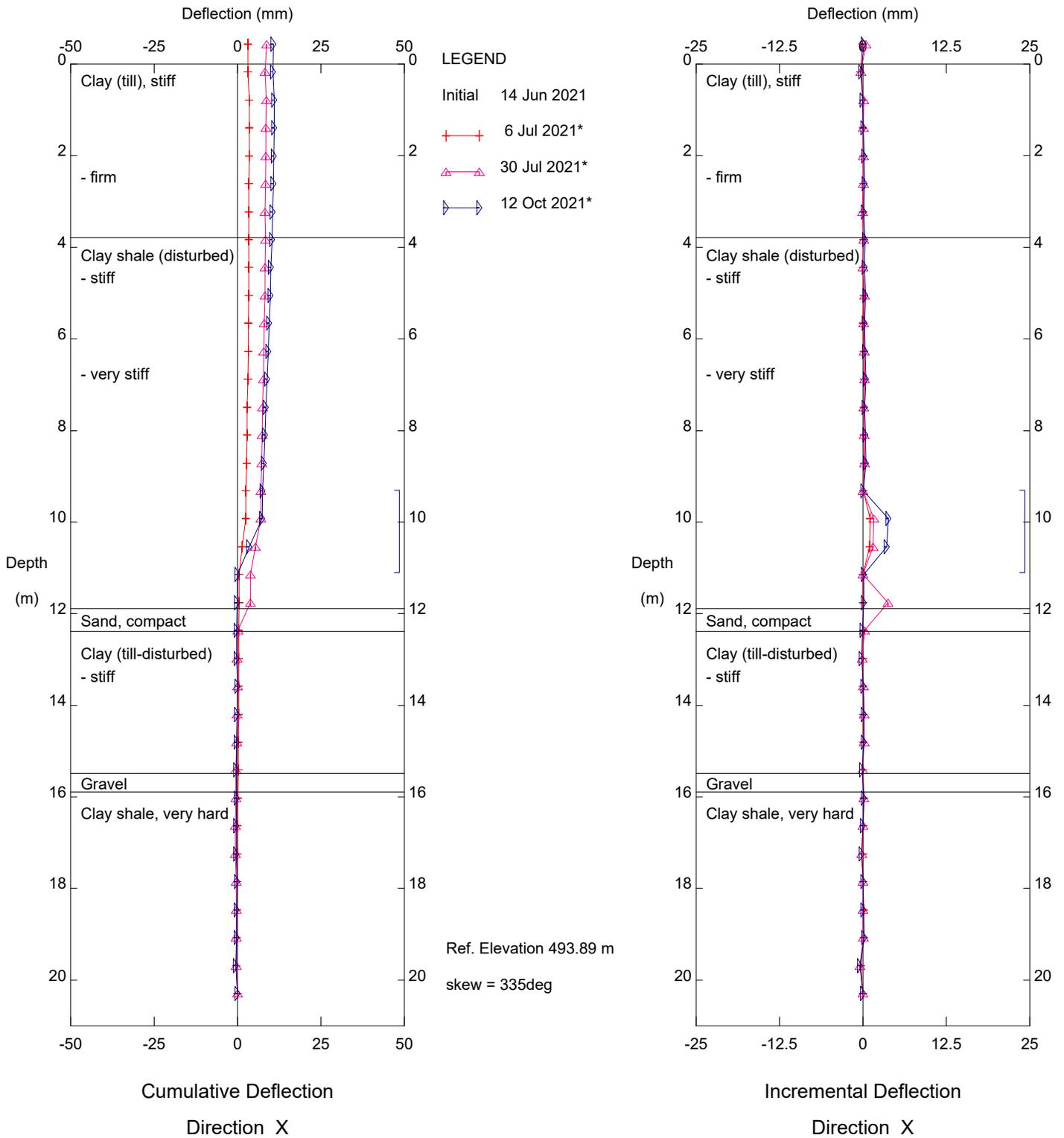


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-08

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

Thurber Engineering Ltd

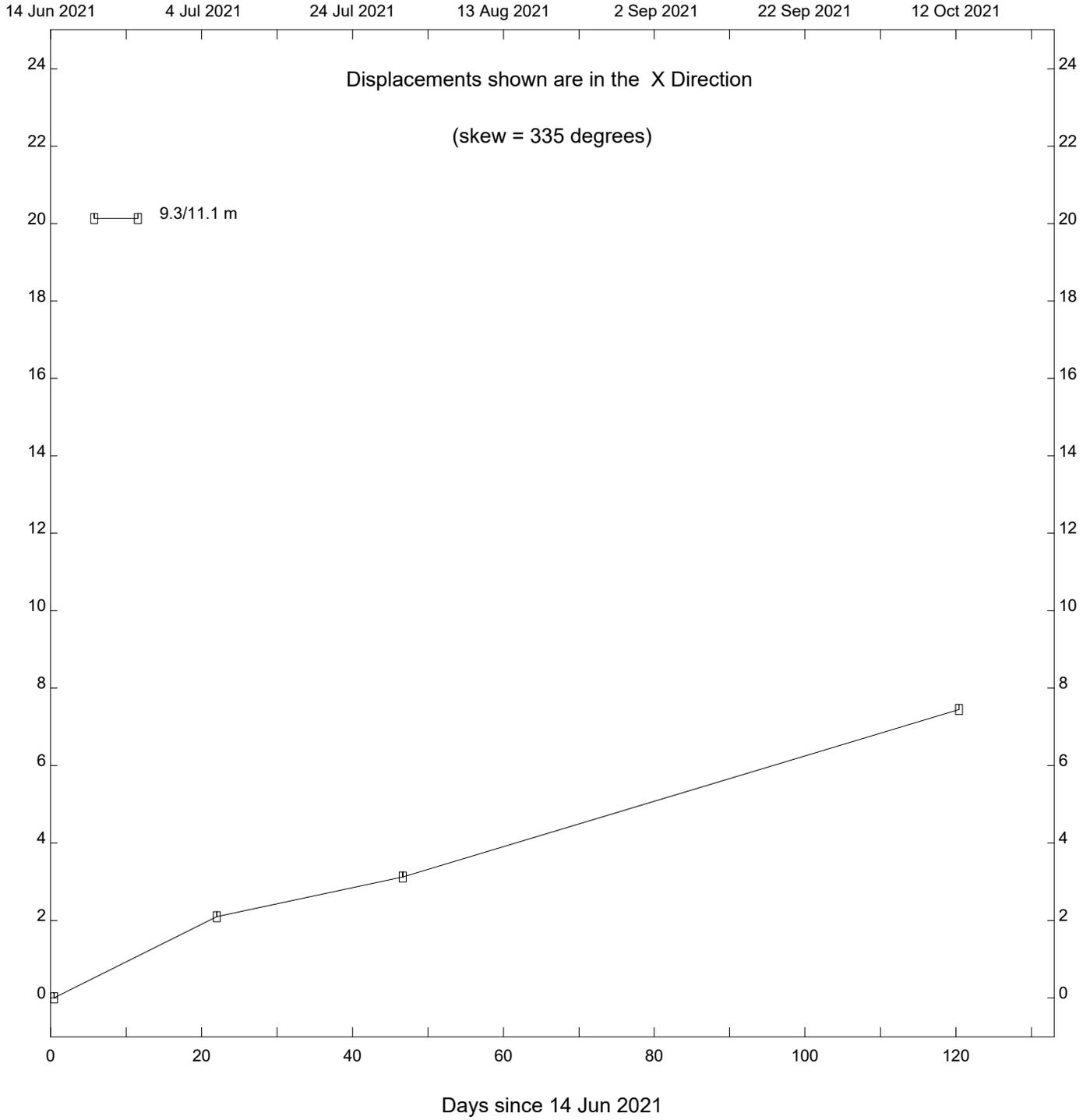


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-08

Alberta Transportation

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

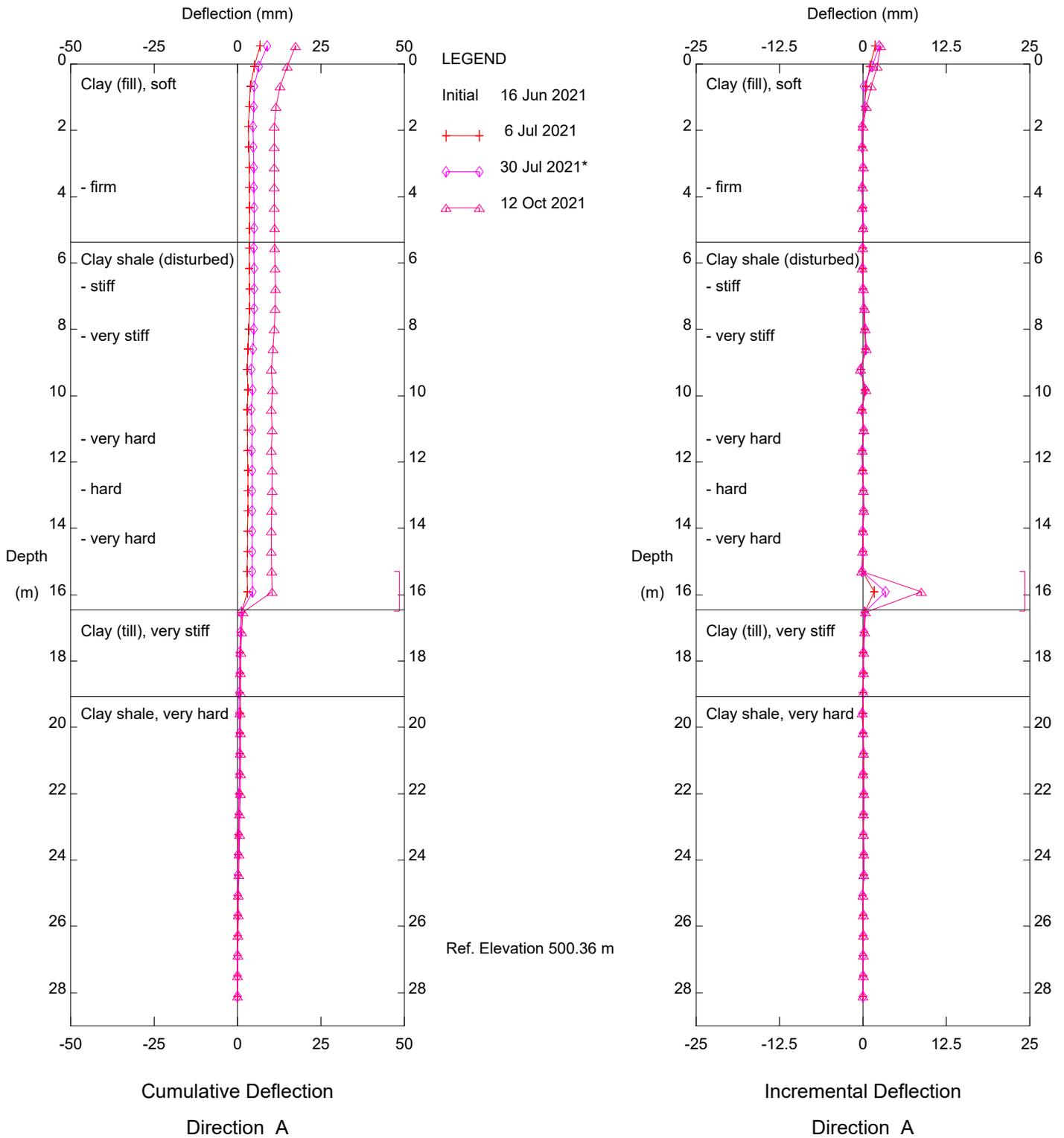
Thurber Engineering Ltd



Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-08

Alberta Transportation

Thurber Engineering Ltd

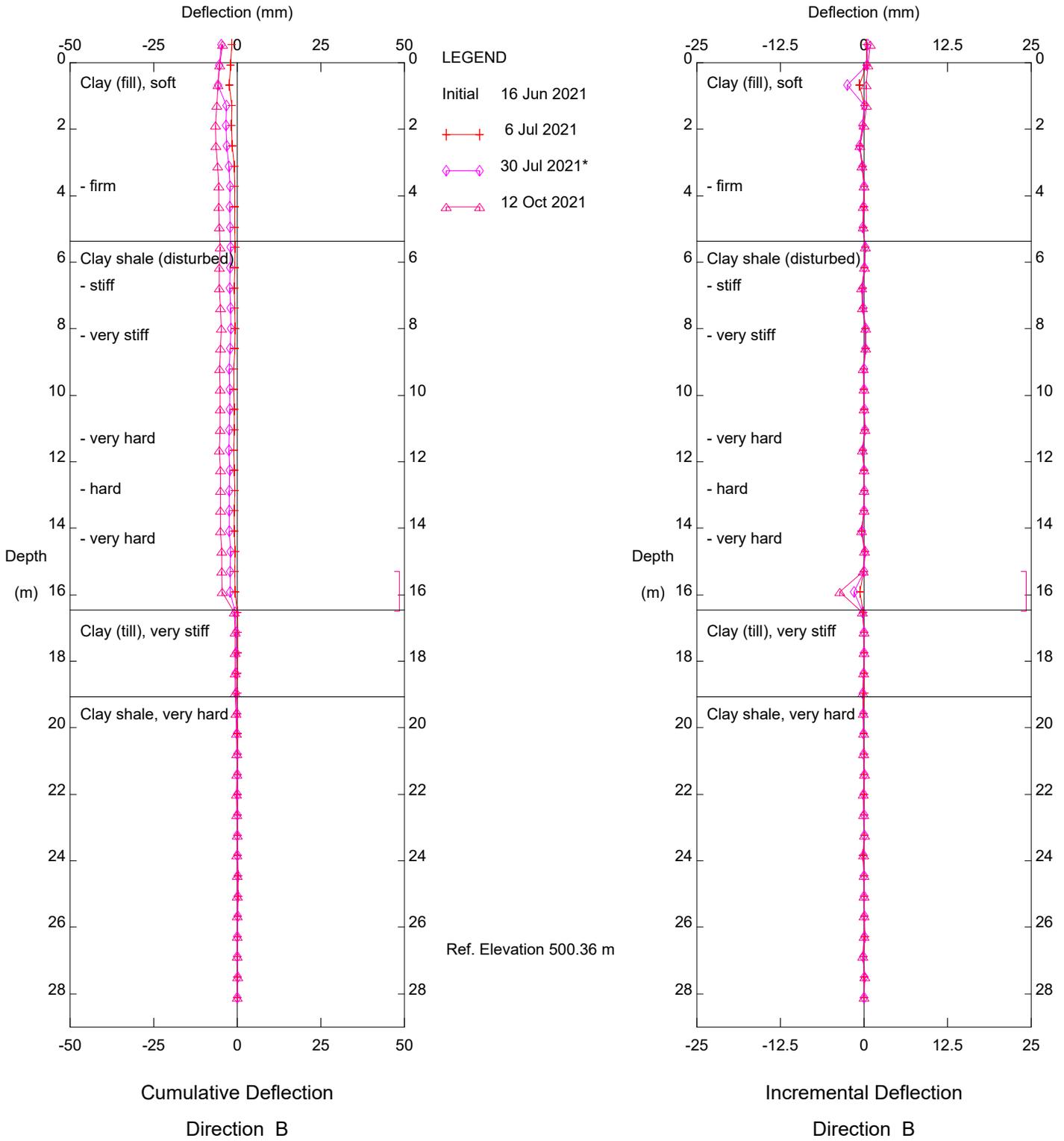


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-09

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

Thurber Engineering Ltd

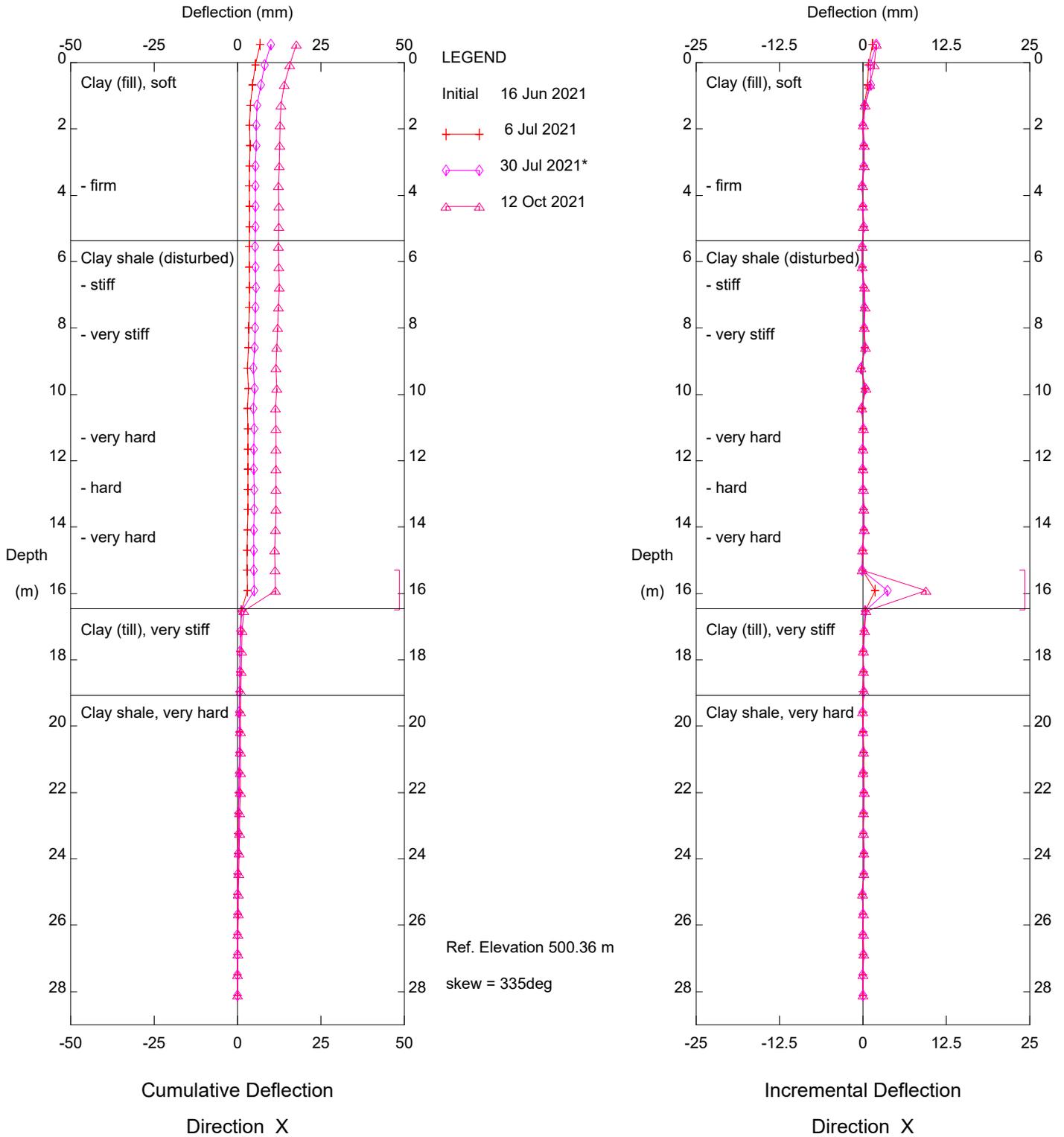


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-09

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

Thurber Engineering Ltd

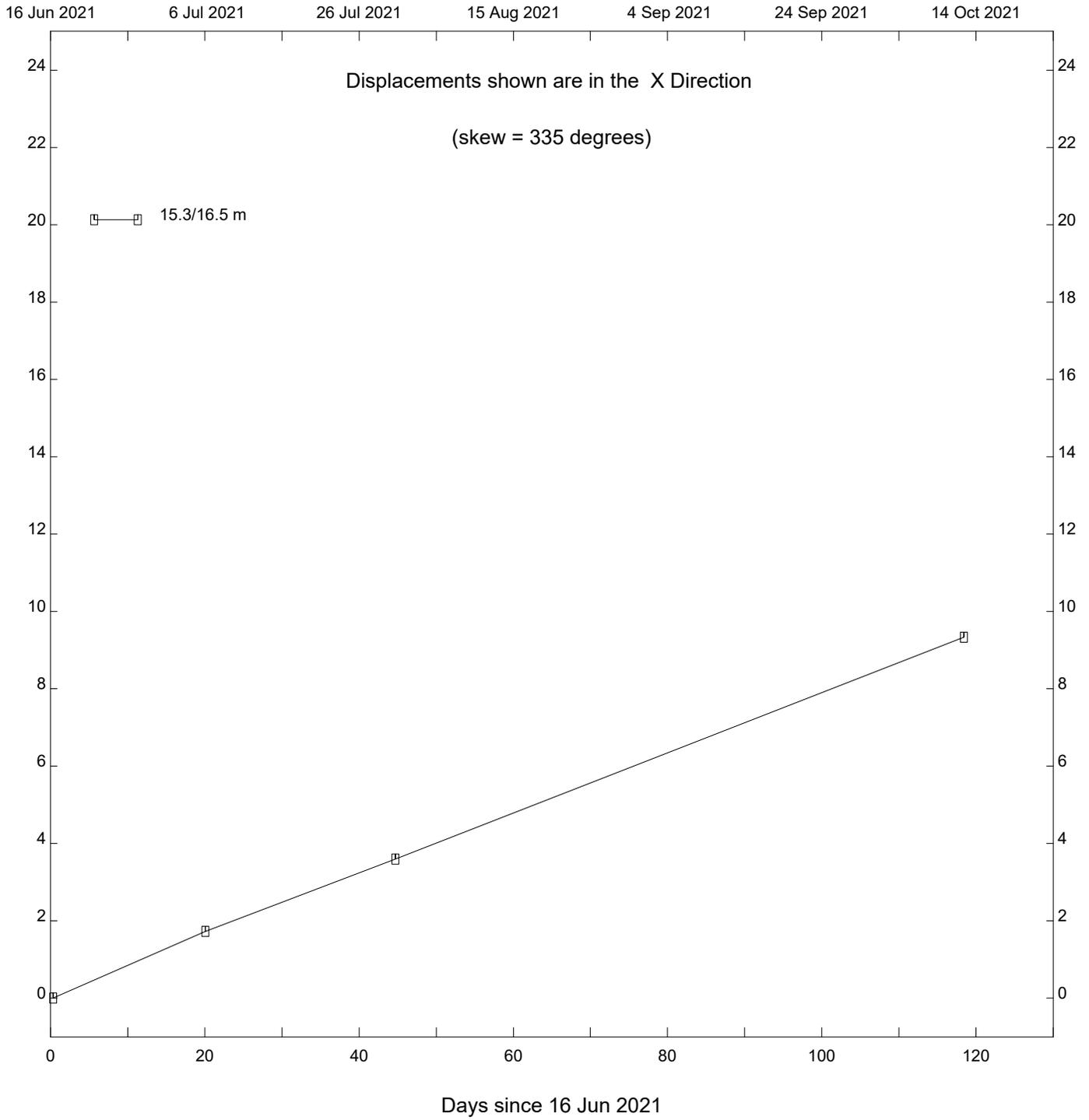


Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-09

Alberta Transportation

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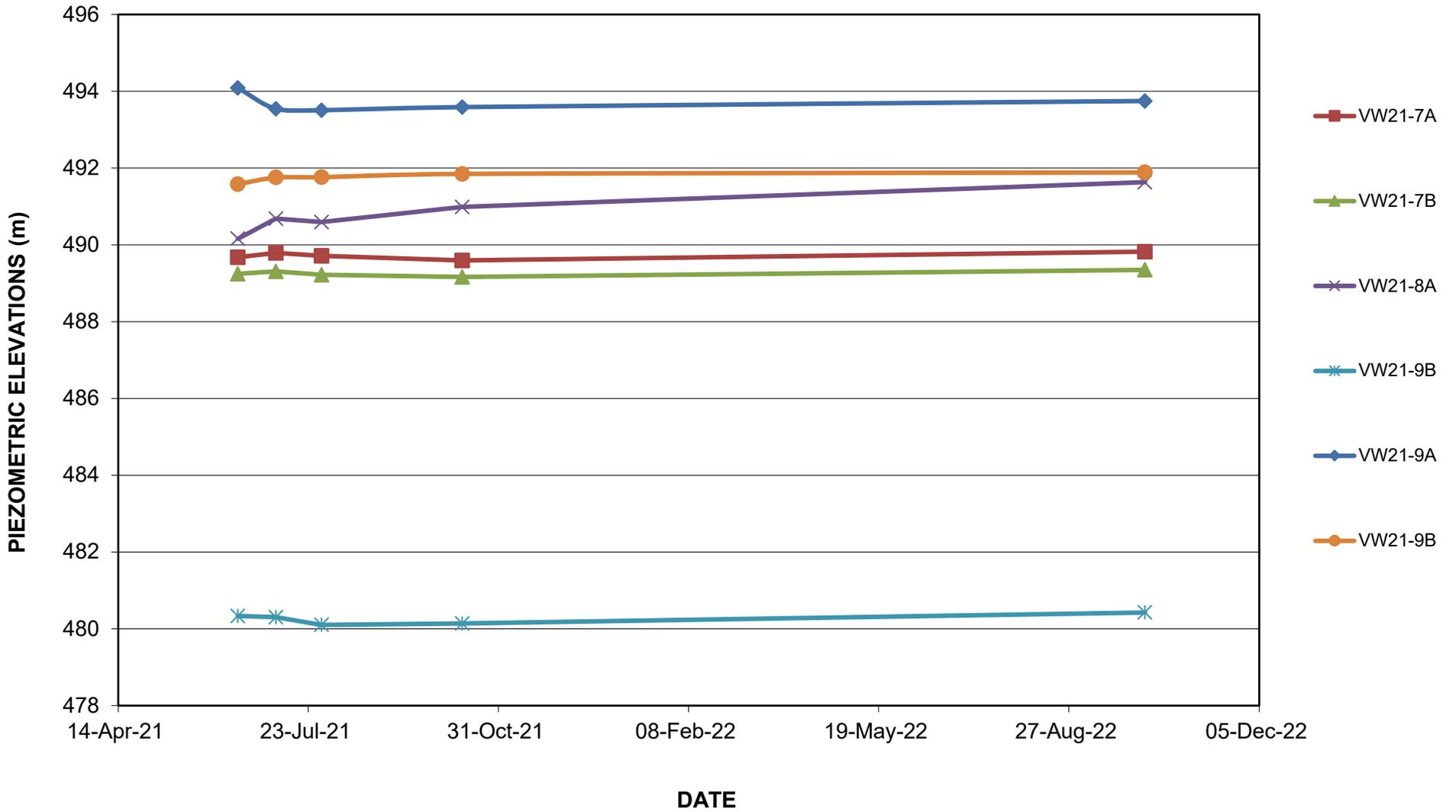
Thurber Engineering Ltd



Hwy 49:12 Little Smoky River Bridge, Inclinometer SI21-09

Alberta Transportation

**FIGURE SH016-1**  
**HWY 49:12 LITTLE SMOKY RIVER PIEZOMETRIC ELEVATIONS**



**FIGURE SH016-2  
HWY 49:12 LITTLE SMOKY RIVER PIEZOMETRIC DEPTHS**

