

Site Number	Location	Name	Hwy	km
PH048	HWY 88:18 C1 29.441	Abutments Fort Vermilion Bridge	88:18	29.4
<b>Legal Description:</b>		<b>UTM Co-ordinates</b>		
1-29-108-13 W5		11U E 550921	N	6473794

<b>Current Monitoring:</b>	24-May-2024	<b>Previous Monitoring</b>	18-Jun-2023
<b>Instruments Read By:</b>	Mr. Niraj Regmi, G.I.T., and Mr. Nixson Mationg, Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs):	Pneumatic Piezometers (PN):	Vibration Wire Piezometers (VW):	Standpipe Piezometers (SP):
SI-3 SI13-2 SI24-7*	PN13-2A PN13 2B	VW24-7A* VW24-7B*	SP13-5
<b>Load Cell (LC):</b> N/A	<b>Strain Gauges:</b> N/A	<b>SAAs:</b> N/A	<b>Others:</b>

Readout Equipment Used			
<b>Slope Inclinometers:</b> RST Digital Inclinometer probe with a 2 feet wheelbase and a RST Pocket PC readout	<b>Pneumatic Piezometers:</b> RST C108 pneumatic piezometer reader	<b>Vibration Wire Piezometers:</b> Geokon 404 VW Readout	<b>Standpipe Piezometers:</b> DGSI Dipmeter
<b>Load Cell:</b>	<b>Strain Gauges:</b>	<b>SAAs:</b>	<b>Others:</b>
<b>Note:</b> * Read on June 25, 2024. SI13-2 will also be cut down to match the new headslope grading.			

Discussion	
<b>Zones of New Movement:</b>	None
<b>Interpretation of Monitoring Results:</b>	<p>Slope inclinometer SI-3 continued to show no discernible movement.</p> <p>Slope inclinometer SI13-2 showed a rate of movement of 17.6 mm/yr over 0.0 m to 4.1 m depth since the spring of 2023 readings. The overall rate of movement in SI13-2 (since initialization) is 18.2 mm/year. SI13-2 has shown a cumulative movement of 206.5 mm over this shallow zone.</p> <p>The movement in SI13-2 has been somewhat cyclical with a higher movement rate in the spring and a slower movement rate in the fall (based on historic monitoring events prior to 2021). The movement pattern will be reviewed once this inclinometer is lowered following regrading of the north headslope.</p> <p>SI24-7 was initialized during the June 25, 2024, site visit; no movement zones have been determined yet.</p> <p>Pneumatic piezometer PN13-2A showed an increase in groundwater level of 0.14 m since the spring of 2023 readings, while PN13-2B</p>

	<p>showed a decrease in groundwater level of 0.33 m since the spring of 2023 readings. Vibrating wire piezometers VW23-7A and VW23-7B showed decrease of 1.41 m and 1.51 m, respectively, since the previous readings on May 31, 2024. The May 31, 2024 readings were taken 1 day after installation, so the groundwater level may not have been stabilized. These preliminary readings indicate hydrostatic groundwater conditions in the bedrock.</p> <p>Standpipe piezometer SP13-5 showed a decrease in groundwater level of 0.01 m since the spring of 2023 readings.</p>
<b>Future Work:</b>	The instruments will be read again in the spring of 2025.
<b>Instrumentation Repairs:</b>	No instrument repairs are required at this time.
<b>Additional Comments:</b>	<p>Following the spring of 2024 reading, slope inclinometer SI24-7, and two vibrating wire piezometers VW24-7A and VW24-7B were installed as part of north headslope improvements being undertaken as part of a large bridge repair contract. This replaced the damaged SI15-4. The logging of the test hole and installation of the instrumentation was done by Beairsto &amp; Associates Engineering &amp; Survey (BARE). The test hole log for BH-01 is attached which was renamed SI24-7 by Thurber when these instruments were read on June 25, 2024.</p>

<b>Attachments:</b>	<ul style="list-style-type: none"> <li>▪ Table PH048-1 Spring 2024 – HWY 88:18 Fort Vermilion Bridge, Slope Inclinometer Reading Summary</li> <li>▪ Table PH048-2 Spring 2024 – HWY 88:18 Fort Vermilion Bridge, Pneumatic Piezometer Instrumentation Reading Summary</li> <li>▪ Table PH048-3 Spring 2024 – HWY 88:18 Fort Vermilion Bridge, Standpipe Piezometer Instrumentation Reading Summary</li> <li>▪ Statement of Limitations and Conditions</li> <li>▪ APPENDIX A - PH048 SPRING 2024 <ul style="list-style-type: none"> <li>□ Field Inspector’s report</li> <li>□ Site Plan Showing Approximate Instrument Locations (Drawing No. 32121 PH048)</li> <li>□ SI Reading Plots</li> <li>□ Figure PH048-1 (Piezometric Depths)</li> <li>□ BARE Test Hole BH-01 Log for SI24-7</li> </ul> </li> </ul>
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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.  
Roger Skirrow, M.Sc., P. Eng.  
Senior Geotechnical Engineer

Lucas Green, P.Eng.  
Geotechnical Engineer

**Table PH048-1 Spring 2024 – Hwy 88:18 Fort Vermilion Bridge Slope Inclinometer Instrumentation Reading Summary**

Date Monitored: May 24, 2024

<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>CURRENT RATE OF MOVEMENT (mm/yr)</b>	<b>CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)</b>
SI-3	October 25, 2005	No discernible movement	N/A	Operational	June 16, 2022	N/A	N/A	N/A
SI13-2	January 16, 2013	206.5 mm over 0 m to 4.1 m depth in 116° direction	108.4 mm/yr in February 2013	Operational	June 18, 2023	16.4	17.6	-5.4
SI13-4	January 16, 2013	N/A	N/A	<i>Damaged by river ice after Fall 2013</i>	September 26, 2013	N/A	N/A	N/A
SI15-4 (replaced SI13-4)	July 5, 2014	N/A	N/A	<i>Broken at 1.5 m depth, Blocked at 6.7 m depth</i>	October 4, 2016	N/A	N/A	N/A
SI13-6	January 16, 2013	No discernible movement	N/A	<i>Destroyed by vehicle traffic</i>	October 1, 2017	N/A	N/A	N/A
SI24-7 (replaced SI15-4)	June 25, 2024	<i>This was the initial reading</i>	N/A	Operational	N/A	N/A	N/A	N/A

Drawing 32121-PH048 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

**Table PH048-2 Spring 2024 – Hwy 88:18 Fort Vermilion Bridge Pneumatic Piezometer Instrumentation Reading Summary**

Date Monitored: May 24, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER LEVEL BGS (m)	PREVIOUS WATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN13-1A (35108)	January 15, 2013	22.0	N/A	Non-operational	Dry since initialization	0.0 (May 23, 2015)	Dry (May 23, 2015)	Dry (December 18, 2014)	N/A
PN13-1B (35104)	January 15, 2013	9.0	N/A	Non-operational	3.20 on May 31, 2013	N/A	N/A	4.37 (June 29, 2019)	N/A
PN13-2A (35109)	January 15, 2013	6.0	N/A	Active	3.35 on May 24, 2024	26.0	3.35	3.49	0.14
PN13-2B (35103)	January 15, 2013	25.0	N/A	Active	15.33 on June 16, 2022	73.6	17.50	17.17	-0.33
PN13-4A (35107)	January 15, 2013	10.0	N/A	Damaged by ice after Fall 2013	1.11 on May 31, 2013	N/A	N/A	N/A	N/A
PN13-4B (35102)	January 15, 2013	28.0	N/A	Damaged by river ice after Fall 2013	1.57 on May 31, 2013	N/A	N/A	N/A	N/A
PN13-6A (33274)	January 15, 2013	15.0	N/A	Damaged by river ice after Fall 2013	2.28 on February 21, 2013	N/A	N/A	N/A	N/A
PN13-6B (30459)	January 15, 2013	38.0	N/A	Damaged by river ice after Fall 2013	2.58 on September 26, 2013	N/A	N/A	N/A	N/A

Drawing 32121-PH048 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes: PN - pneumatic piezometer. BGS - below ground surface.

**Table PH048-3 Spring 2024 – Hwy 88:18 Fort Vermilion Bridge Standpipe Piezometer Instrumentation Reading Summary**

Date Monitored: May 24, 2024

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP DEPTH (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER LEVEL BGS (m)</b>	<b>MEASURED WATER LEVEL BGS (m)</b>	<b>PREVIOUS READING BGS (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
SP13-5	May 31, 2013	14.95	N/A	Active	13.20 on June 16, 2022	14.86	14.85	-0.01

Drawing 32121-PH048 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Notes:

- SP - standpipe (for water level monitoring, 1" diameter PVC).
- BGS - below ground surface.

**Table PH048-3 - SPRING 2024 – Hwy 88:18 Fort Vermillion Bridge Vibrating Wire Piezometer Instrumentation Reading Summary**

Date Monitored: June 25, 2024

<b>INSTRUMENT</b>	<b>DATE INITIALIZED</b>	<b>GROUND ELEVATION (m)</b>	<b>TIP DEPTH (m)</b>	<b>CURRENT STATUS</b>	<b>MAXIMUM GROUNDWATER DEPTH (m)</b>	<b>CURRENT GROUNDWATER DEPTH (m)</b>	<b>PREVIOUS GROUNDWATER DEPTH (May 31, 2024)* (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
VW24-7A	May 31, 2024	N/A	19.13	Operational	8.08 on May 31, 2024	9.49	8.08	-1.41
VW24-7B	May 31, 2024	N/A	12.42	Operational	7.72 on May 31, 2024	9.23	7.72	-1.51

Drawing 32121-PH048 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

\* - Taken by BARE during and following installation.



## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

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

### 2. COMPLETE REPORT

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

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

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- 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.
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**THURBER** ENGINEERING LTD.

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

**SPRING 2024**

**APPENDIX A  
DATA PRESENTATION**

**SITE PH048: HWY 88:18, FORT VERMILION BRIDGE**

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS  
PEACE REGION (PEACE RIVER DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (PH048)  
SPRING 2024**

<b>Location:</b> Abutments Fort Vermillion Bridge (HWY 88:18 C1 29.441) <b>File Number:</b> 32121 <b>Probe:</b> RST SI SET 8R <b>Cable:</b> RST SI SET 8R	<b>Readout:</b> RST PN C108 U <b>Casing Size:</b> 3.34" / 2.75 Ø <b>Temp:</b> 21 <b>Read by:</b> NRM/NKR
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**SLOPE INCLINOMETER (SI) READINGS**

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Magn. North A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Size (")	Remarks
	Northing (m)	Easting (m)					A+	A-	B+	B-			
SI-3	6473794	550921	24-May	1.03	146 to 4	25	769	-758	137	-142	8R/8R	3.34"	
SI13-2	6474324	550948	24-May	1.05	102 to 2	130	-95	106	179	-180	8R/8R	3.34"	
SI24-7	6474298	550949	25-Jun-24	0.84	130 to 2	186	-255	267	311	-310	8R/8R	2.75"	

**VIBRATING WIRE PIEZOMETER (VW) READINGS**

VW #	Serial Number	GPS Location (UTM 11)		Date	Reading Dg	Temperature (deg C)
		Easting (m)	Northing (m)			
VW24-7A	VW184660	550949	6474298	25-Jun-24	8305.4	5.8
VW24-7B	VW184679	550949	6474298	25-Jun-24	8311.4	6.0

**PNEUMATIC PIEZOMETER (PN) READINGS**

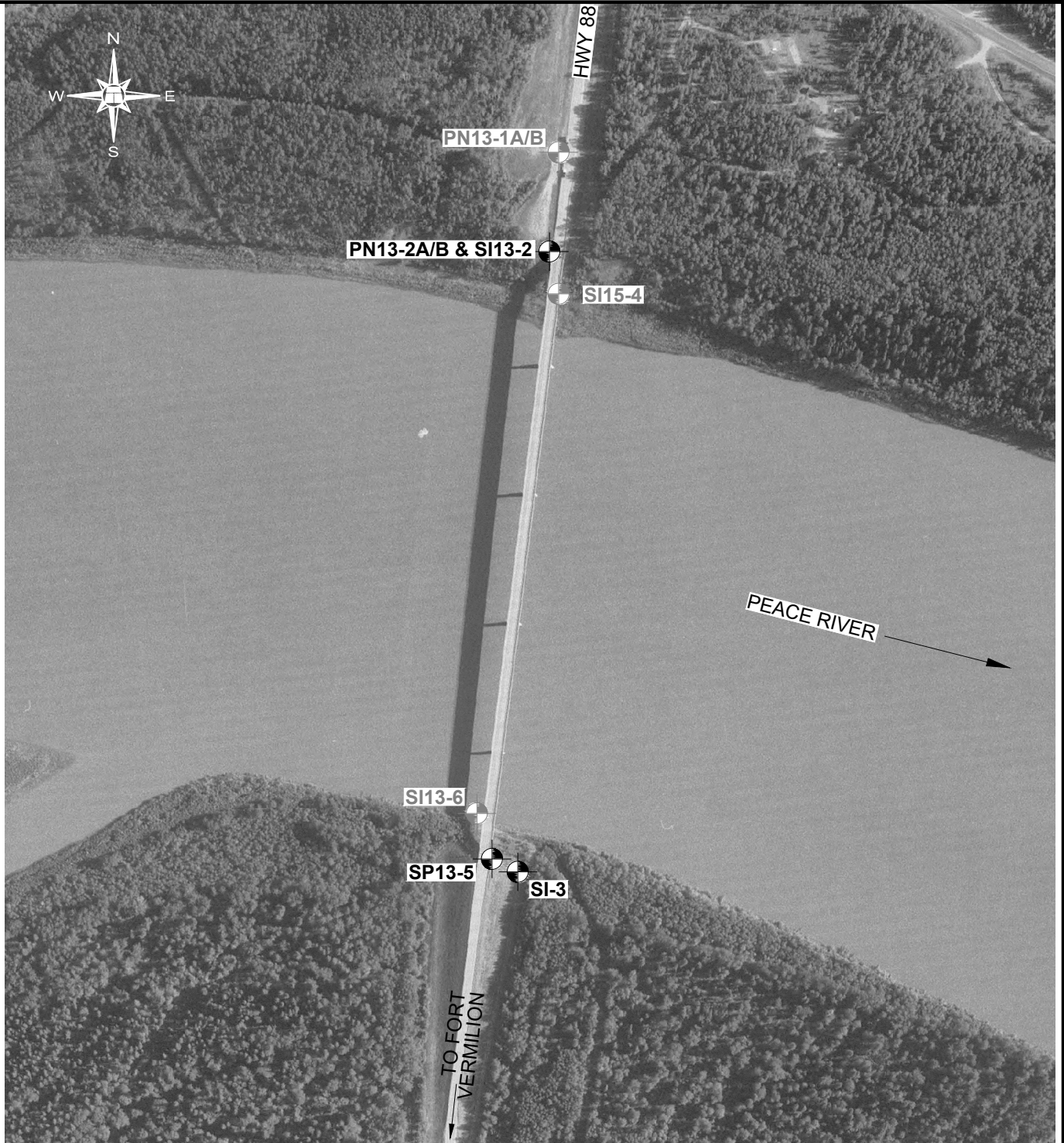
PN#	GPS Location		Date	Reading kPa	Tip Depth Below Ground Surface (m)	Identification Number
	Northing (m)	Easting (m)				
PN13-2A	6474324	550948	24-May	26	6	35109
PN13-2B	6474324	550948	24-May	73.6	25	35103

**STANDPIPE PIEZOMETER READINGS**



SP#	GPS Location		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Northing (m)	Easting (m)				
SP13-5	6473805	550899	24-May	0.15*	15	15.58

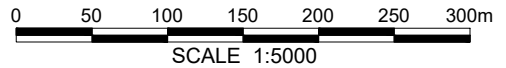
**INSPECTOR REPORT**

SP13-5 Standpipe broken by lawnmower, see photo.



**LEGEND**

-  INSTRUMENT LOCATION
-  INSTRUMENT LOCATION (NOT IN USE)



BASE PLAN PROVIDED BY AESRD

**PEACE REGION (PEACE RIVER DISTRICT)  
PH048: FORT VERMILION BRIDGE (SOUTH ABUTMENT)**

**SITE PLAN SHOWING INSTRUMENT LOCATIONS**

**DWG No. 32121-PH048**

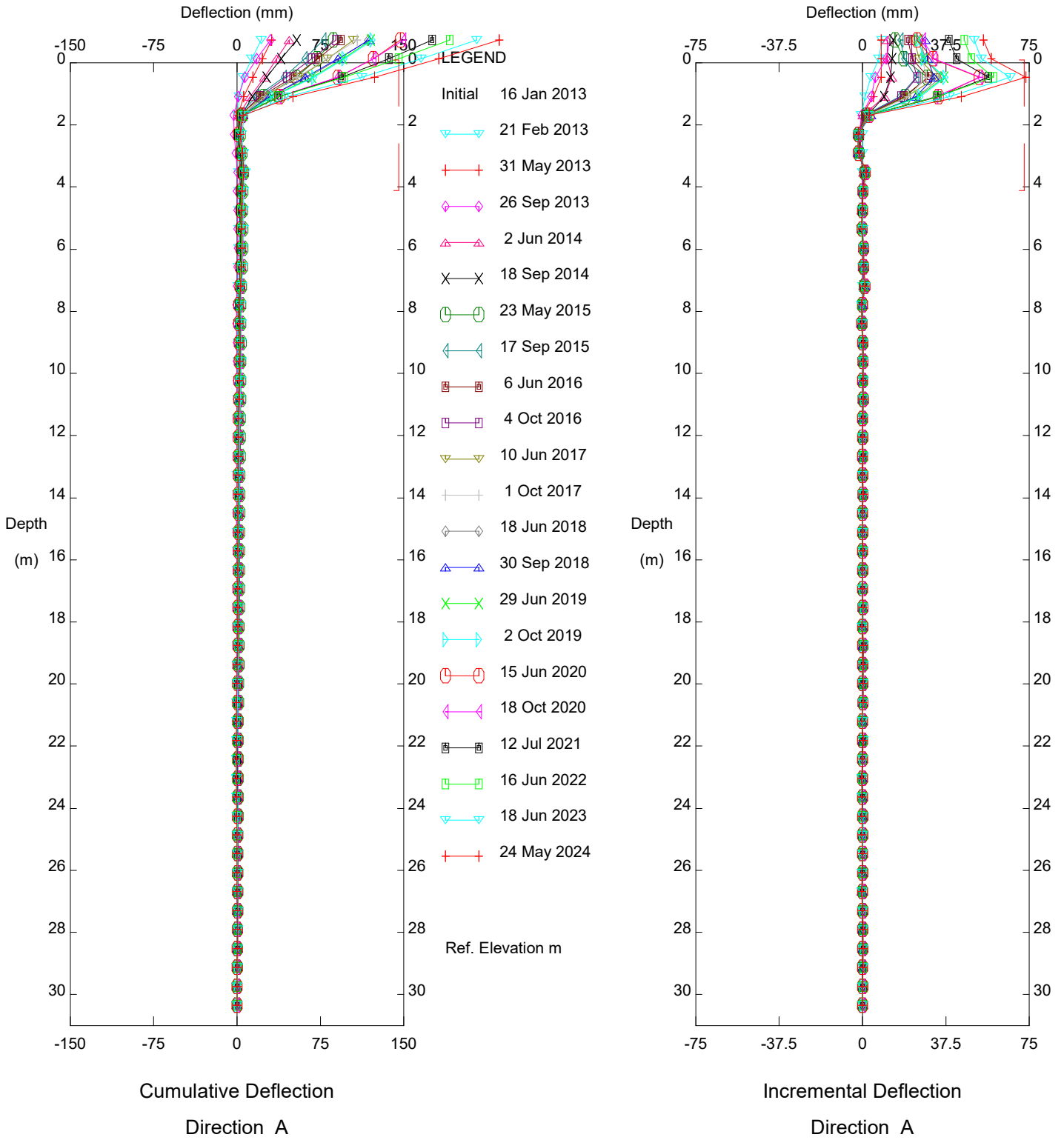


DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:5000
LAST UPDATED	SEPTEMBER 2021
FILE No.	32121

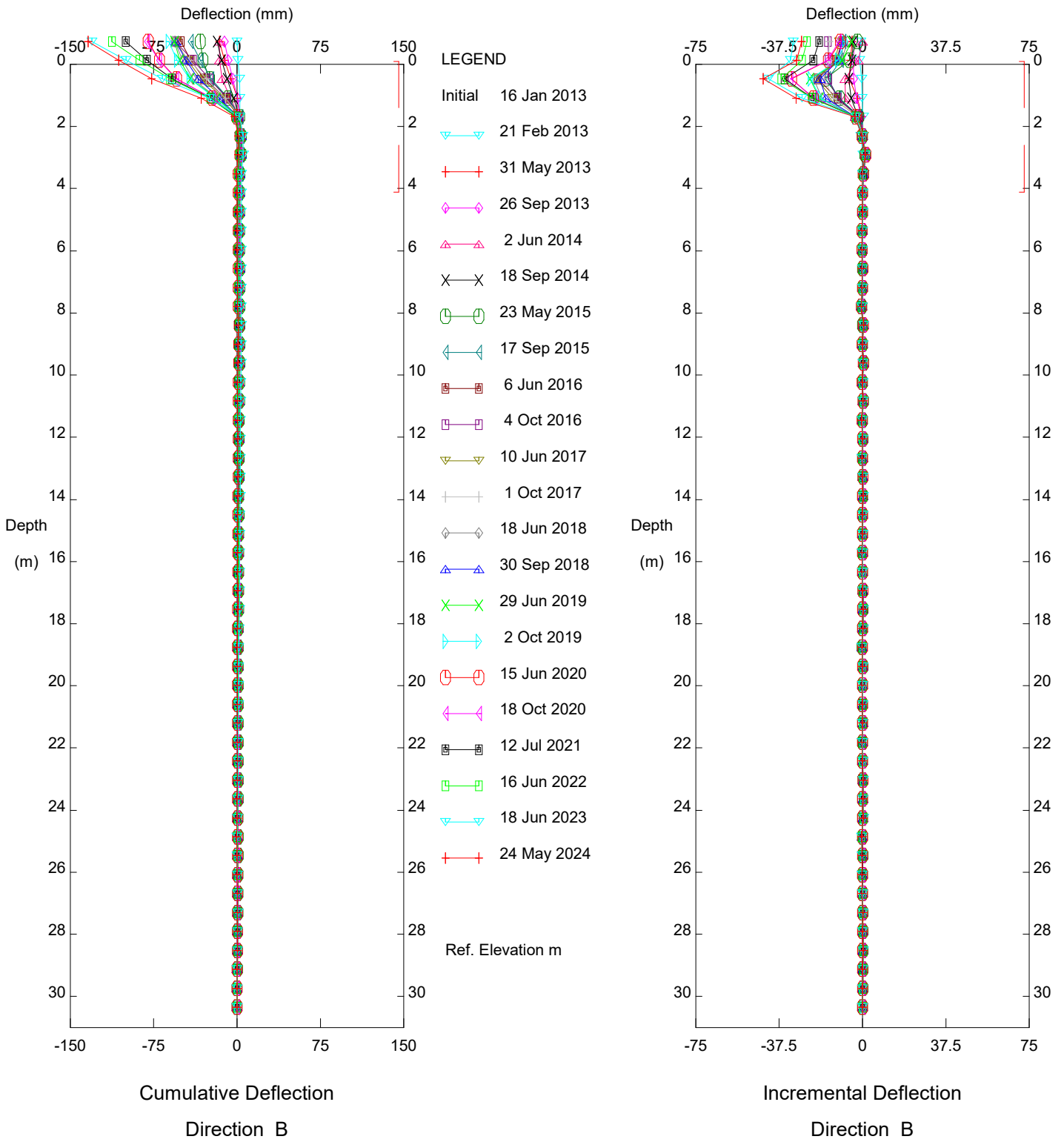


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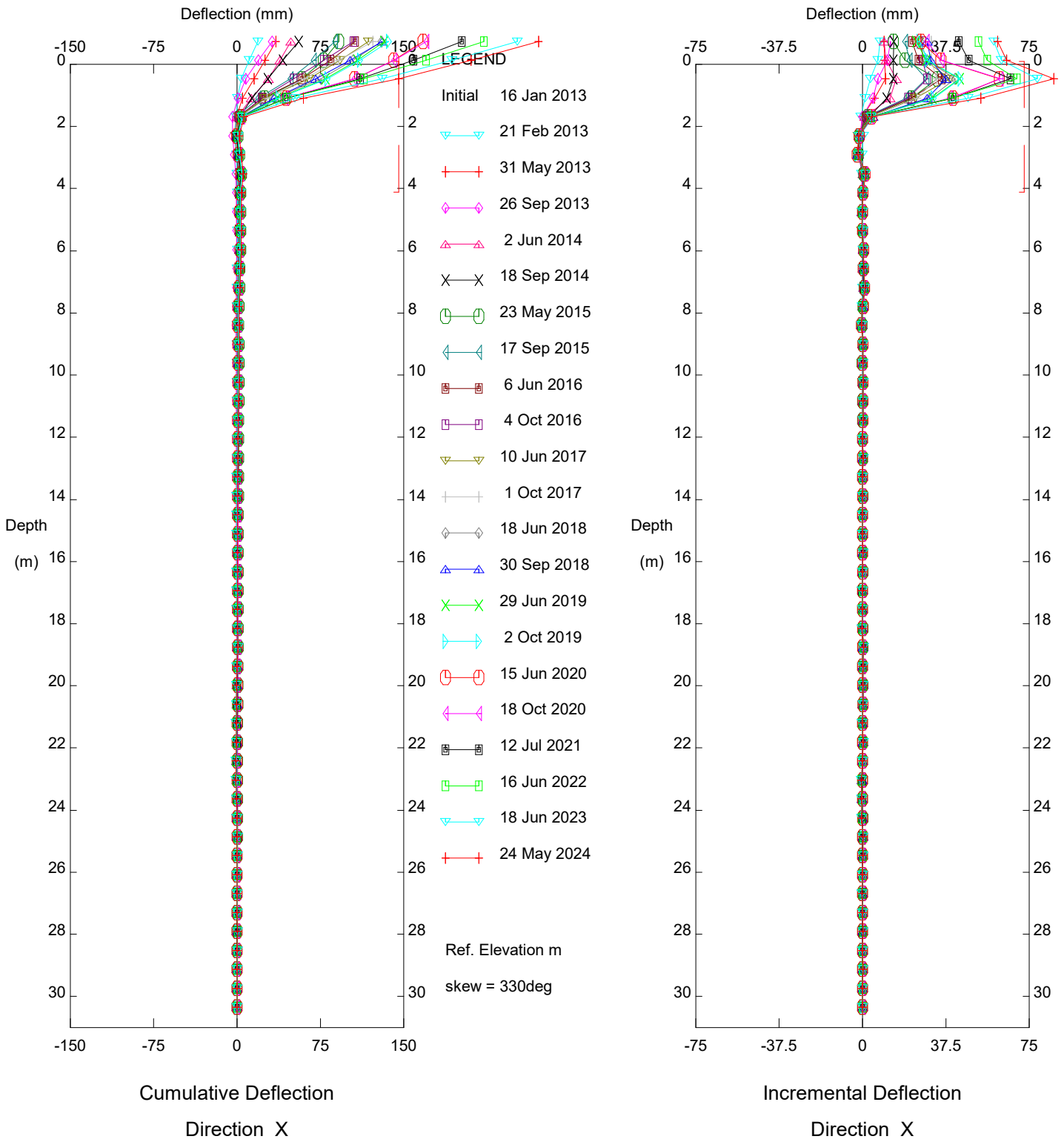


Fort Vermillion Bridge (PH048), Inclinator SI13-2  
 Alberta Transportation



Fort Vermillion Bridge (PH048), Inclinator SI13-2

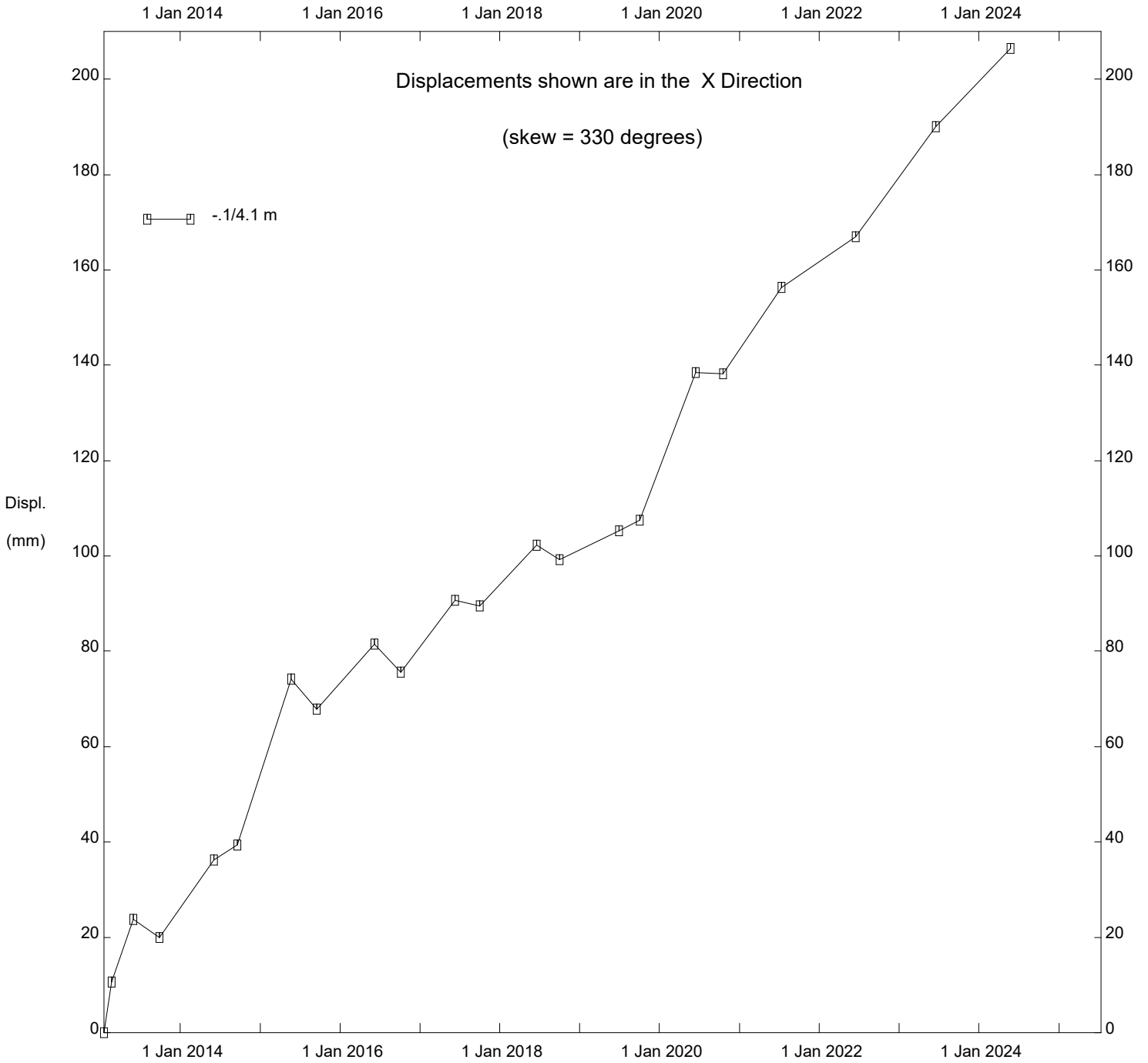
Alberta Transportation



Fort Vermillion Bridge (PH048), Inclinator SI13-2

Alberta Transportation

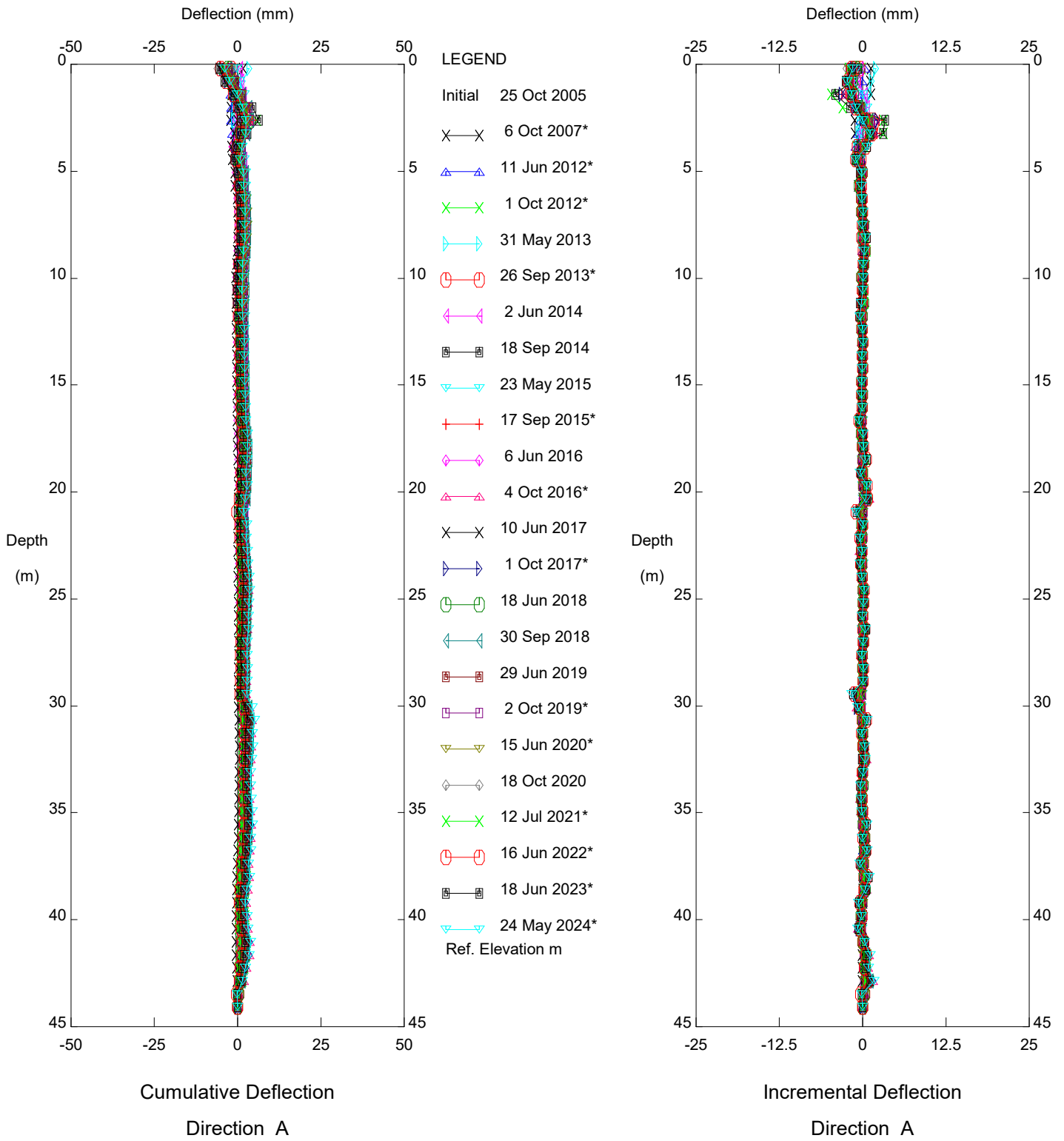
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Fort Vermillion Bridge (PH048), Inclinator SI13-2

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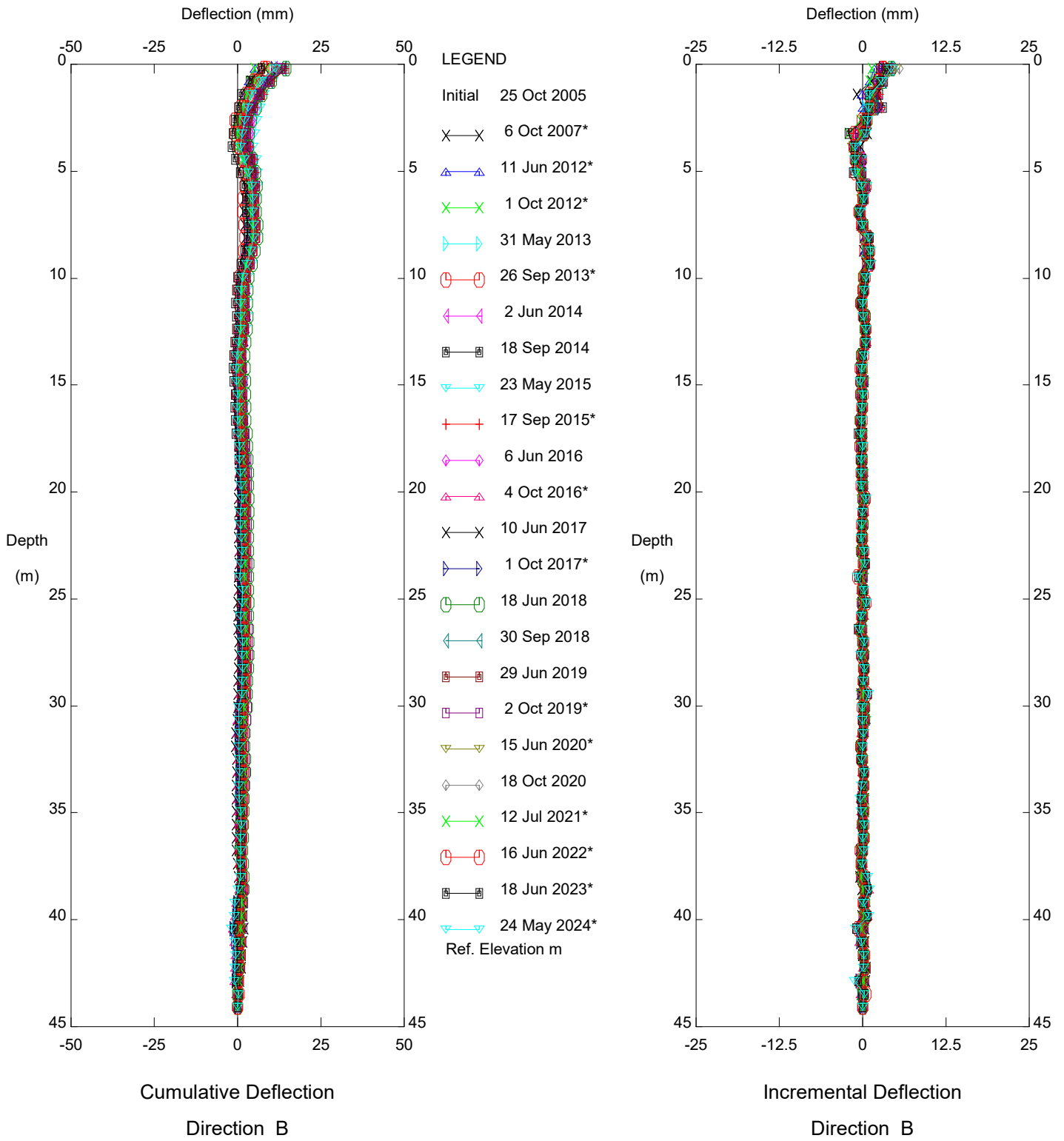
Fort Vermillion Bridge (PH048), Inclinator SI-3

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



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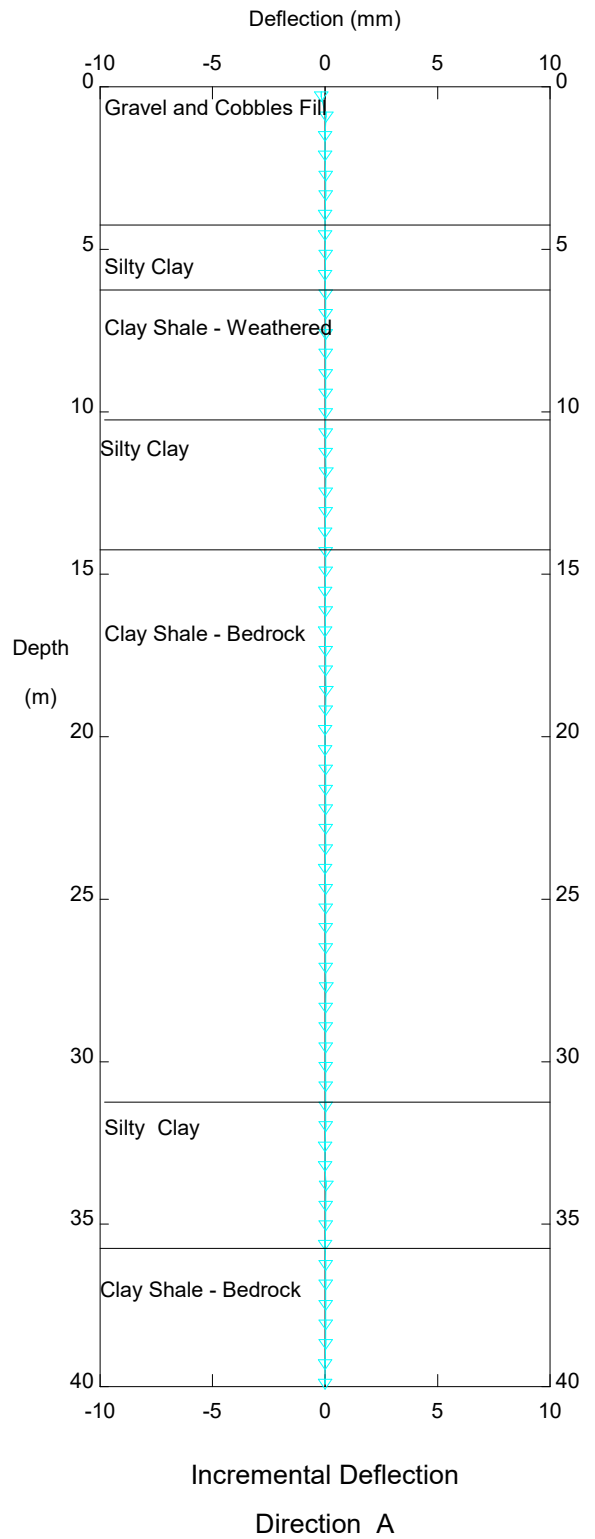
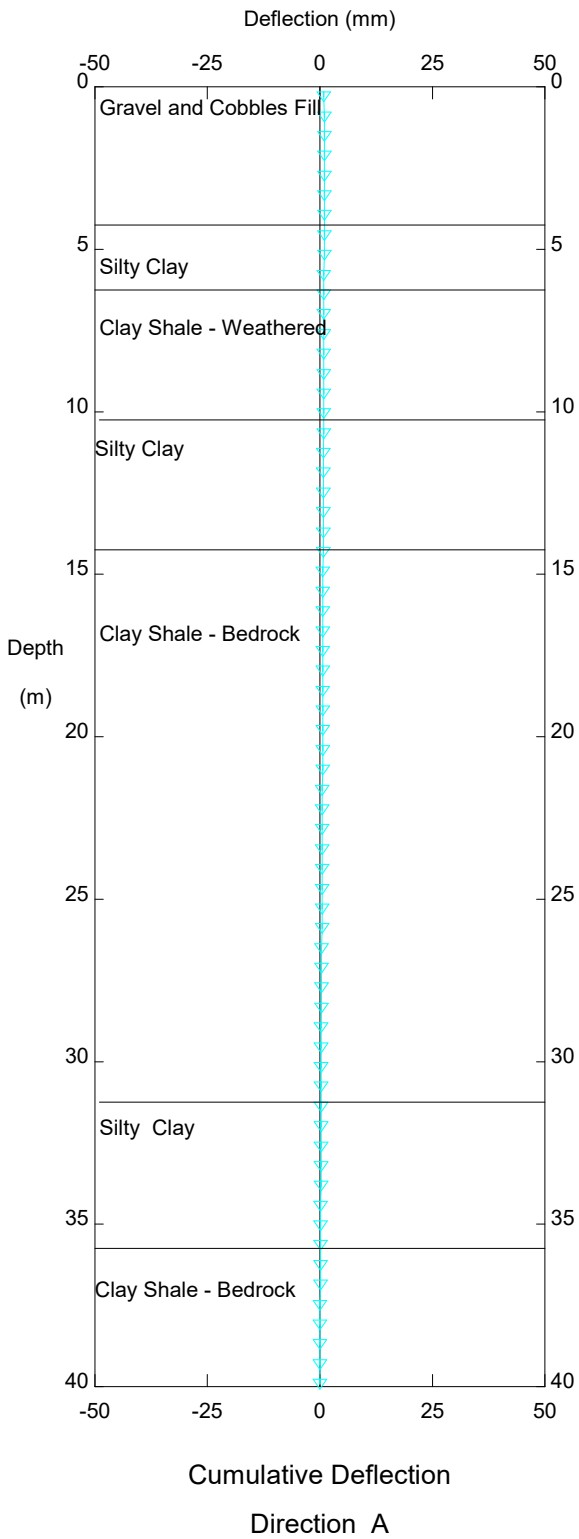


Fort Vermillion Bridge (PH048), Inclinator SI-3

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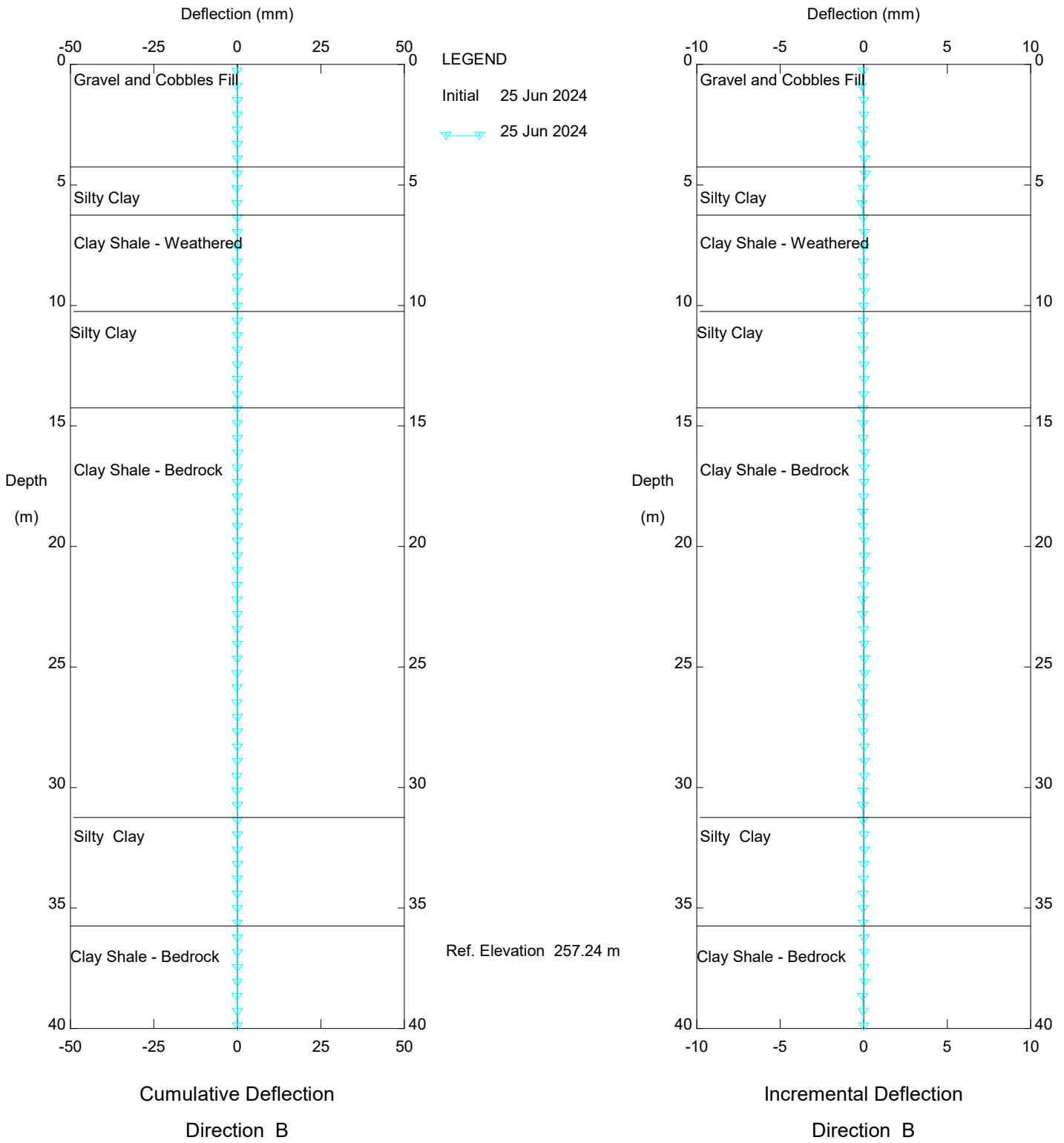
Sets marked \* include zero shift and/or rotation corrections.

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PH048-1, Inclinator SI 24-7

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PH048-1, Inclinator SI 24-7

**FIGURE PH048-1  
PIEZOMETER DATA FOR HWY 88:18: FORT VERMILION BRIDGE**

