



THURBER ENGINEERING LTD.

July 28, 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 – SPRING 2022**

SECTION C

SITE PH048: HWY 88:18, FORT VERMILION BRIDGE

Dear Mr. Shannon:

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 (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

As part of a riverbank stabilization project, piles, and rip-rap placement on the south side of the river were completed at the Hwy 88:18 Fort Vermilion Bridge site from October 2014 to February 2015. Underpinning of the north-most pier and construction of a north abutment toe berm, bank restoration, and rip-rap placement were completed between November and December 2016.

Two slope inclinometers (SI-3 and SI13-2), two pneumatic piezometers (PN13-2A and PN13-2B) and one standpipe piezometer (SP13-5) were read at the site on June 16, 2022, by Mr. Niraj Regmi, G.I.T., and Mr. Jayden Del Cid, both of Thurber Engineering Ltd.

The SIs were read using an RST Digital Inclinometer probe with a 2 feet wheelbase and a RST Pocket PC readout. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The pneumatic piezometers were read using an RST C108 pneumatic piezometer reader. The standpipe piezometer was read using a Heron dipmeter.



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. Piezometer reading plots are also included in Appendix A.

Slope inclinometer and piezometer reading summary tables are provided below. These tables also include instruments deleted from the GRMP program, for 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 PH048-1. Table PH048-1 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 PH048-1
 SPRING 2022 – HWY 88:18 FORT VERMILION BRIDGE
 SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-3	October 25, 2005	No discernible movement	N/A	Operational	July 12, 2021	N/A	N/A	N/A
SI13-2	January 16, 2013	167.0 mm over 0 m to 4.1 m depth in 116° direction	108.4 mm/yr in February 2013	Operational	July 12, 2021	10.7	11.5	-13.3
SI13-4	January 16, 2013	N/A	N/A	<i>Damaged by river ice after Fall 2013</i>	<i>September 26, 2013</i>	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>	<i>October 4, 2016</i>	N/A	N/A	N/A
SI13-6	January 16, 2013	No discernible movement	N/A	<i>Destroyed by vehicle traffic</i>	<i>October 1, 2017</i>	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 2022 – HWY 88:18 FORT VERMILION BRIDGE
 PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 16, 2022

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	3.37 on June 2, 2014	23.4	3.61	3.83	0.22
PN13-2B (35103)	January 15, 2013	25.0	N/A	Active	15.33 on June 16, 2022	94.8	15.33	16.13	0.80
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 2022 – HWY 88:18 FORT VERMILION BRIDGE
 STANDPIPE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED WATER LEVEL BGS (m)	PREVIOUS READING BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP13-5	May 31, 2013	14.95	N/A	Active	13.40 on June 16, 2021	13.20	14.06	0.86

Drawing 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.



3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometer SI-3 continued to show no discernible movement.

Slope inclinometer SI13-2 showed a rate of movement of 11.5 mm/yr over 0.0 m to 4.1 m depth since the spring of 2021 readings. SI13-2 has shown a cumulative movement of 167.0 mm over this shallow zone. The movement has been somewhat cyclical (higher rate in spring, slower or negative in fall) and has an overall rate (since initialization) of 18.4 mm/year. The movement rate since the spring of 2020 is lower than the overall rate.

Pneumatic piezometers PN13-2A and PN13-2B showed increases in groundwater level of 0.22 m and 0.80 m, respectively, since the spring of 2021 readings. PN13-2B had the highest recorded water level since the instrument was initialized. PN13-2B showed a relatively large increase in water level since the spring reading. Pneumatic piezometer readings are summarized in Table PH048-2 above and are plotted on Figure PH048-1 in Appendix A.

Standpipe piezometer SP13-5 showed an increase in groundwater level of 0.86 m since the spring of 2021 readings and showed the highest recorded water level since the instrument was initialized. Standpipe piezometer readings are summarized in Table PH048-3 above and are plotted in Figure PH048-1 in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

According to AT's schedule, the instruments will be read again in the spring of 2023.

SI15-4 should be replaced so that potential movement can be monitored in the north bridge abutment to determine the effectiveness of the north headslope toe berm. Consideration should also be given to replacing SI13-6. If Alberta Transportation decides to mobilize a drilling contractor to site to replace either of the damaged instruments, consideration should also be given to adding new instruments to the site.

SI13-2 is measuring some upper headslope fill rotation that has been occurring for a while at this site. Thurber has recommended in the past that the headslope fill be cut back to a flatter angle and some subdrains be installed to intercept some springs and lower the water level to help stabilize this upper headslope area.

The above-mentioned instrumentation installations and grading work is currently being considered as part of a bridge rehabilitation tender being prepared by GeoMetrix Group.

4.2 Instrumentation Repairs

No instrumentation 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.
Tarek Abdelaziz, Ph.D., P. Eng.
Principal | Senior Geotechnical Engineer

Bruce Nestor, P.Eng.
Geotechnical Engineer
/jf

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32121-PH048)
 - SI Reading Plots
 - Figure PH048-1 (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.

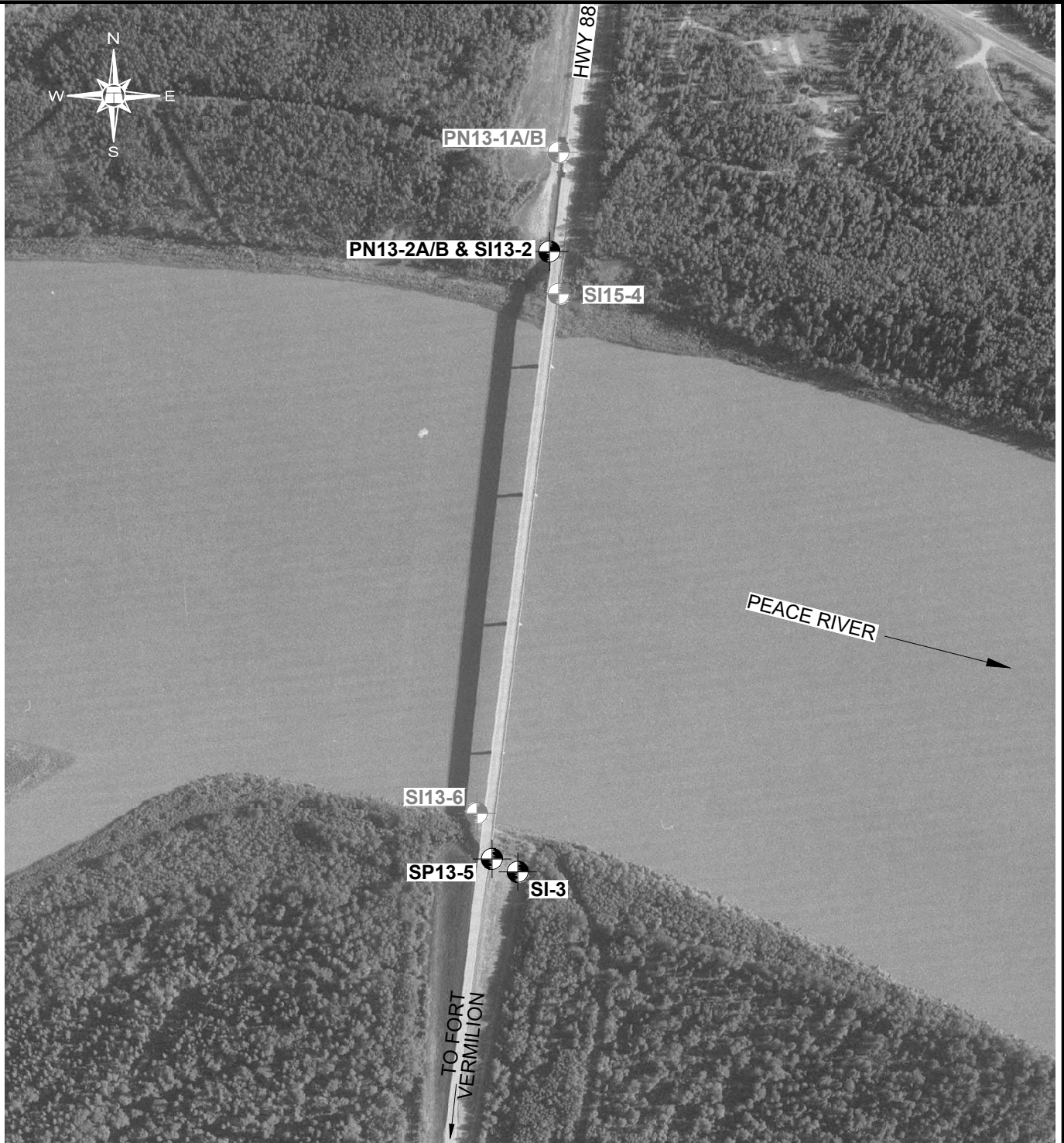


**ALBERTA TRANSPORTATION GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2022

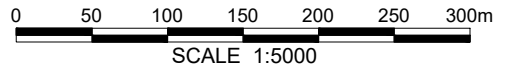
**APPENDIX A
DATA PRESENTATION**

SITE PH048: HWY 88:18, FORT VERMILION BRIDGE



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

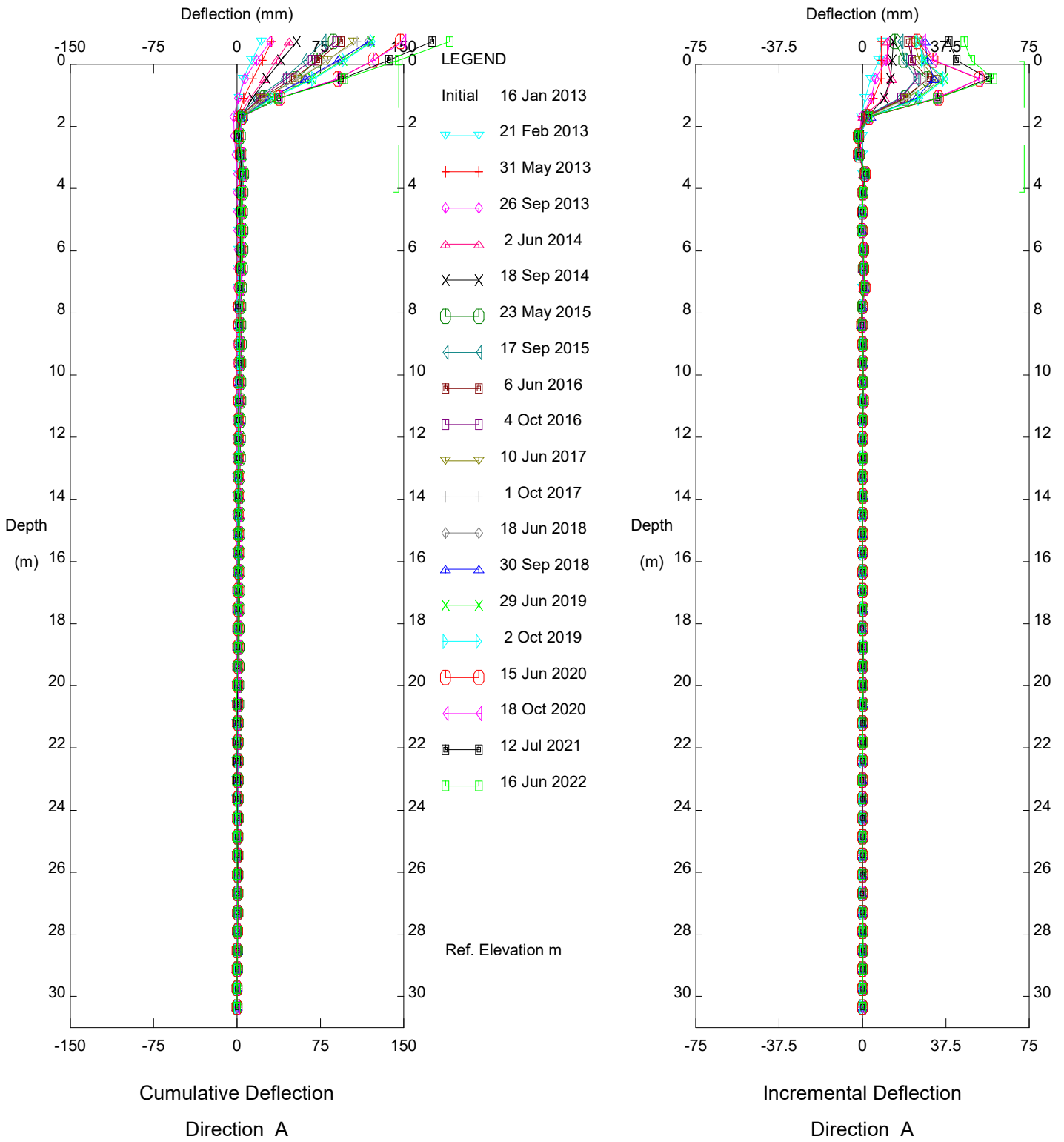
DWG No. 32121-PH048



DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:5000
LAST UPDATED	SEPTEMBER 2021
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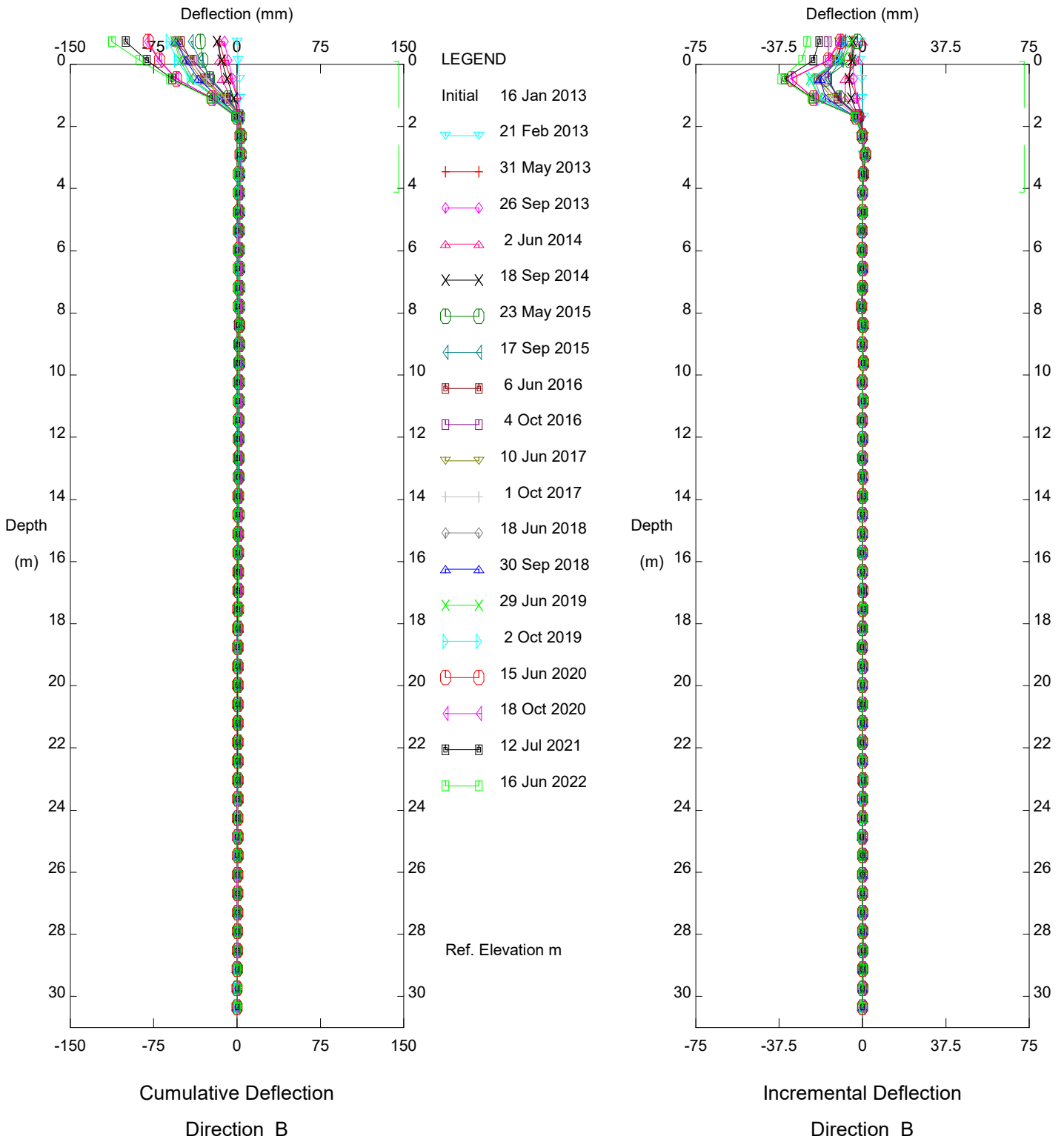


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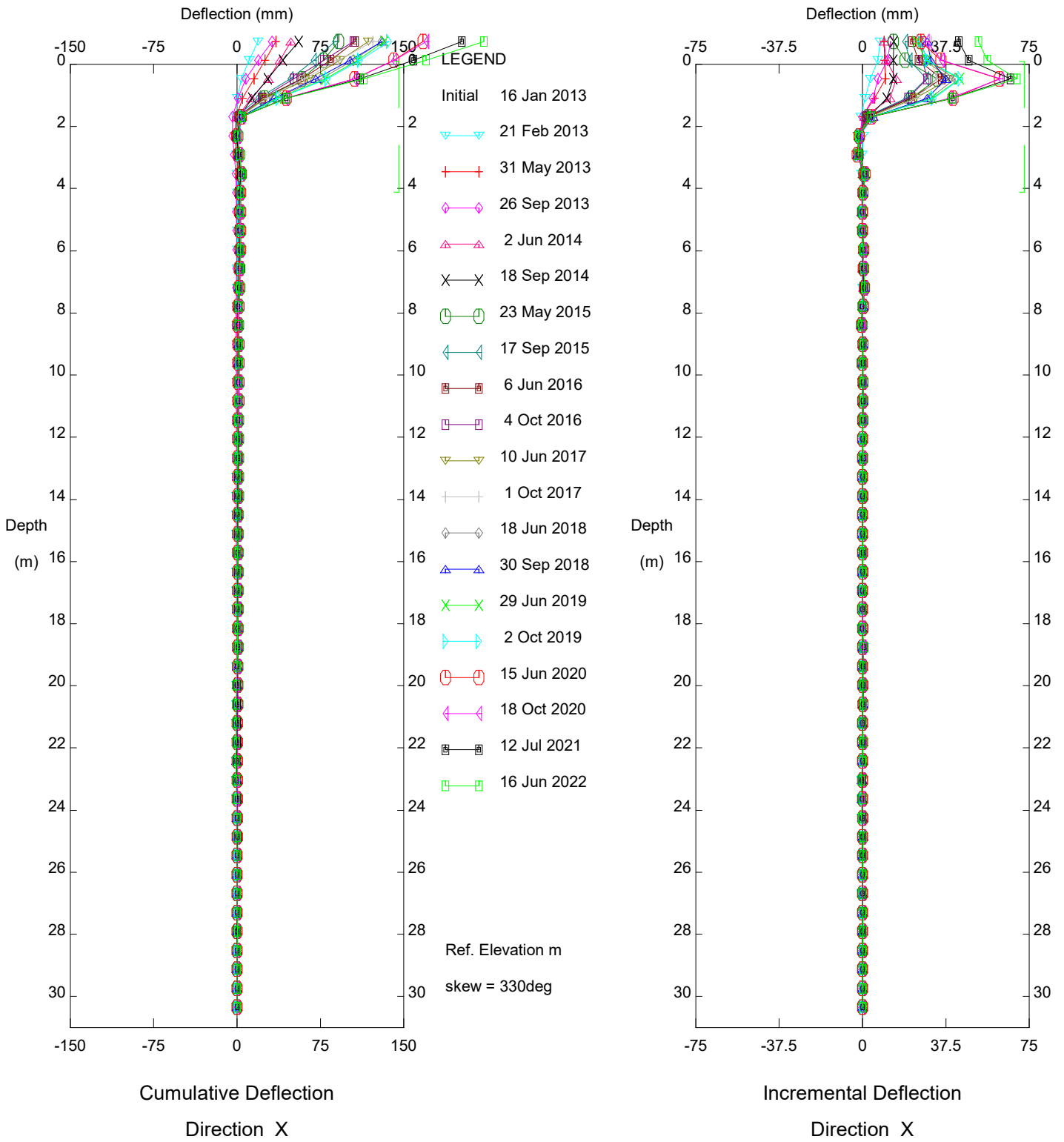
Fort Vermillion Bridge (PH048), Inclinator SI13-2

Alberta Transportation



Fort Vermillion Bridge (PH048), Inclinometer SI13-2

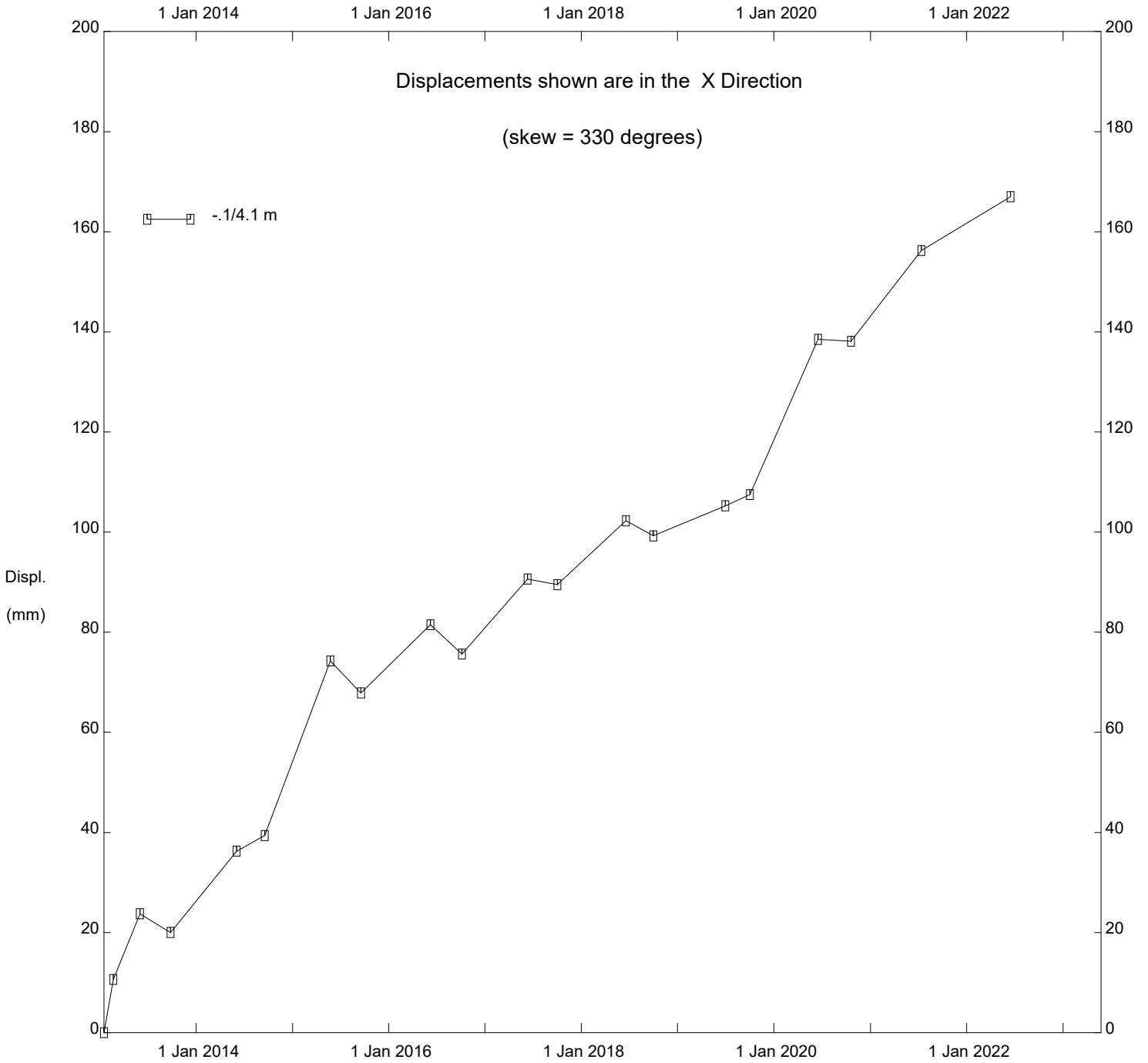
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Fort Vermillion Bridge (PH048), Inclinator SI13-2

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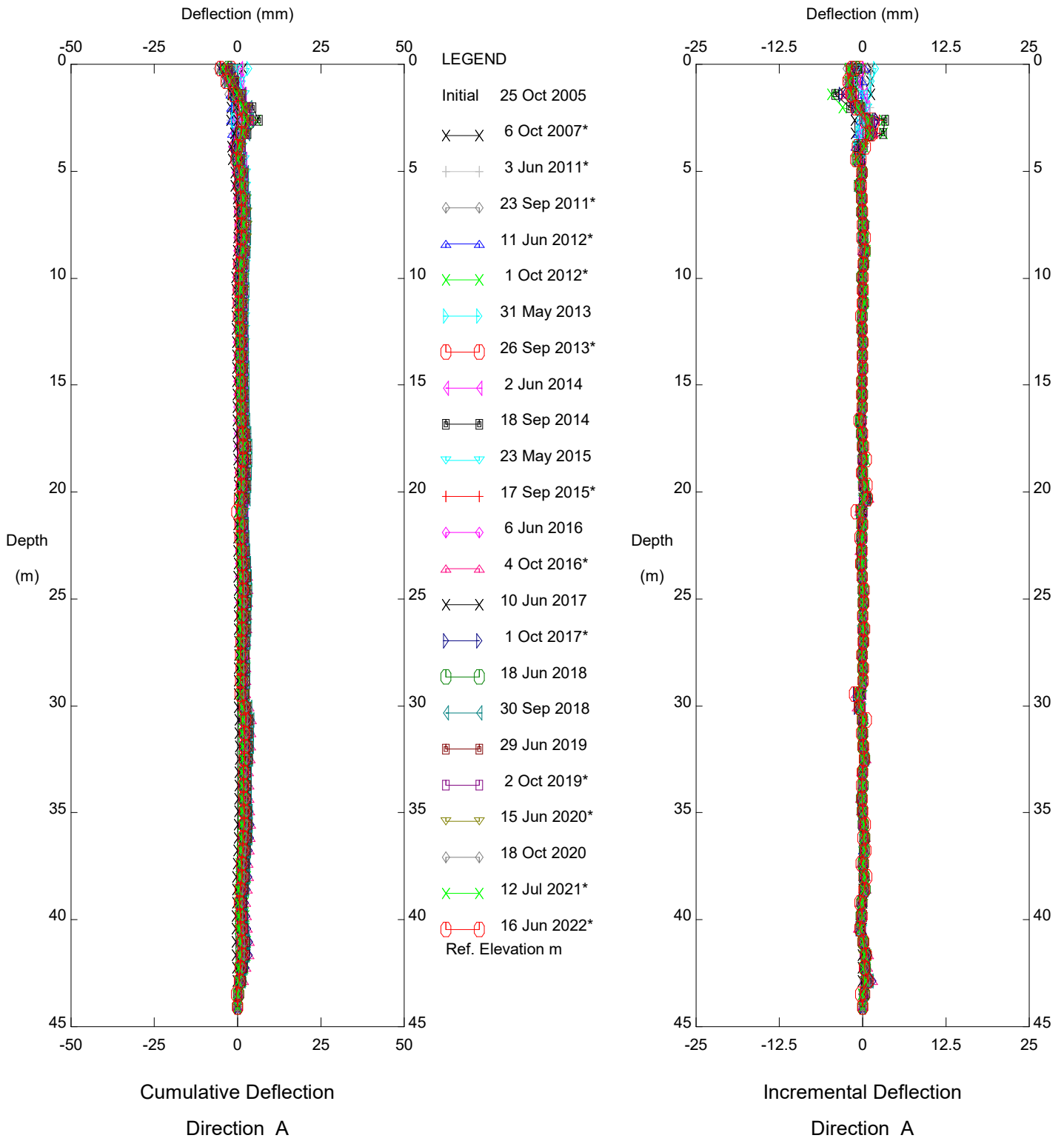
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Fort Vermillion Bridge (PH048), Inclinator SI13-2

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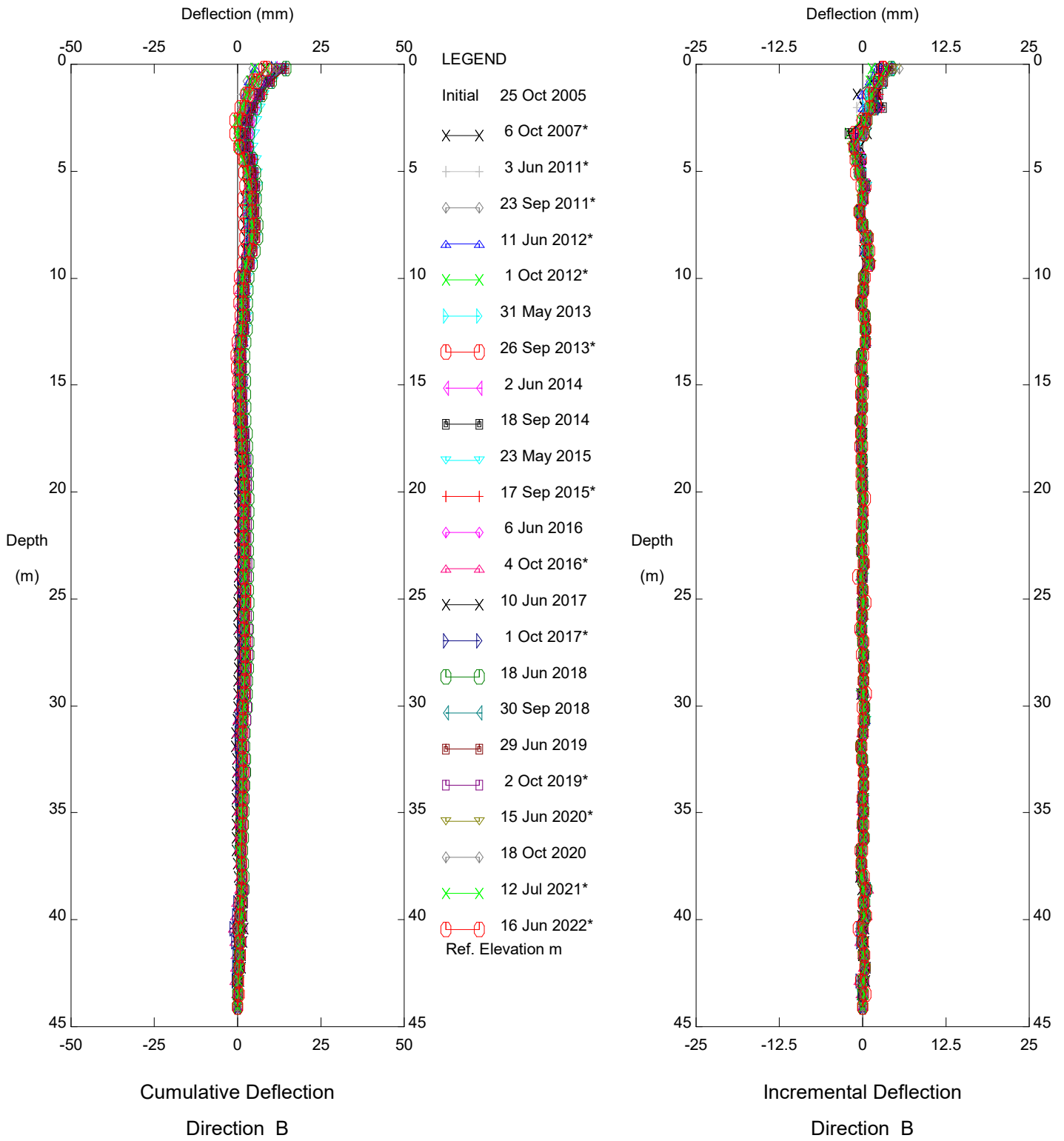


Fort Vermillion Bridge (PH048), Inclinator SI-3

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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.

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

