



THURBER ENGINEERING LTD.

July 14, 2023

File No.: 32123

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

Attention: Mr. Max Shannon

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022165)
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)
INSTRUMENTATION MONITORING RESULTS – SPRING 2023**

SECTION C

SITE GP014: HWY 733:04, BAD HEART RIVER

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 and Economic Corridors' 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

One slope inclinometer (SI98-7) and three pneumatic piezometers (PN-11A, PN-11B and PN-11C) were read at the Hwy 733:04 Bad Heart River site on June 26, 2023, by Mr. Niraj Regmi, G.I.T. and Mr. Omar Elshimi, both of Thurber Engineering Ltd.

The SI was read using an RST Digital Inclinometer probe with a 2 ft. 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 a RST C108 pneumatic piezometer readout.

2. DATA PRESENTATION

2.1 General

SI plots for A and B directions are included in Appendix A. Pneumatic piezometer plots are also provided in Appendix A.

Slope inclinometer and piezometer reading summary tables are provided below.



2.2 Zones of Movement

Zones of new movement were not observed in SI98-7 since the previous readings in the fall of 2022.



**TABLE GP014-1
 SPRING 2023 – HWY 733:04, BAD HEART RIVER
 SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 26, 2023

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)
SI98-7	October 4, 1998	No discernible movement	N/A	Operational	October 3, 2022	N/A	N/A	N/A

Drawing 32123-GP014 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



**TABLE GP014-2
 SPRING 2023 – HWY 733:04, BAD HEART RIVER
 PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 26, 2023

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN-11A	December 6, 2003	622.19	629.79	Operational	626.13 in May 2011	0.8	622.27	622.23	0.04
PN-11B	December 6, 2003	614.59	629.79	Operational	623.23 in May 2011	32.4	617.89	617.82	0.07
PN-11C	December 6, 2003	603.59	629.79	Operational	614.50 in August 2009	95.7	613.35	613.17	0.18

Drawing 32123-GP014 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometer SI98-7 continued to show no discernible movement.

Pneumatic piezometers PN-11A, PN-11B and PN-11C showed increases in groundwater level of 0.04 m, 0.07 m and 0.18 m, respectively, since the fall of 2022 readings. Pneumatic piezometer results are summarized in Table GP014-2 and are plotted in Figures GP014-1 (by elevation) and GP014-2 (by depth) in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

Since the instrumentation readings at this site show relatively minimum changes over several years of monitoring, we recommend reading the instrumentation at this site every two years; thus, the next set of readings should be in 2025.

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
/ak

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32123-GP014)
 - SI Reading Plots
 - Figure GP014-1 (Piezometric Elevations)
 - Figure GP014-2 (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 AND ECONOMIC CORRIDORS GRMP (CON0022165)
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2023

**APPENDIX A
DATA PRESENTATION**

SITE GP014: HWY 733:04, BAD HEART RIVER

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (GP014)
SPRING 2023**

Location: Bad Heart River (HWY 733:04 C1 7.530) File Number: 32123 Probe: RST SI Set 8R Cable: RST SI Set 8R	Readout: RST PN C108 Unit 4 Extension: 2.75" Temp: 24 Read by: NKR/OTE
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SLOPE INCLINOMETER (SI) READINGS

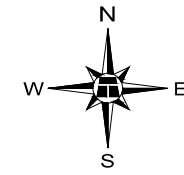
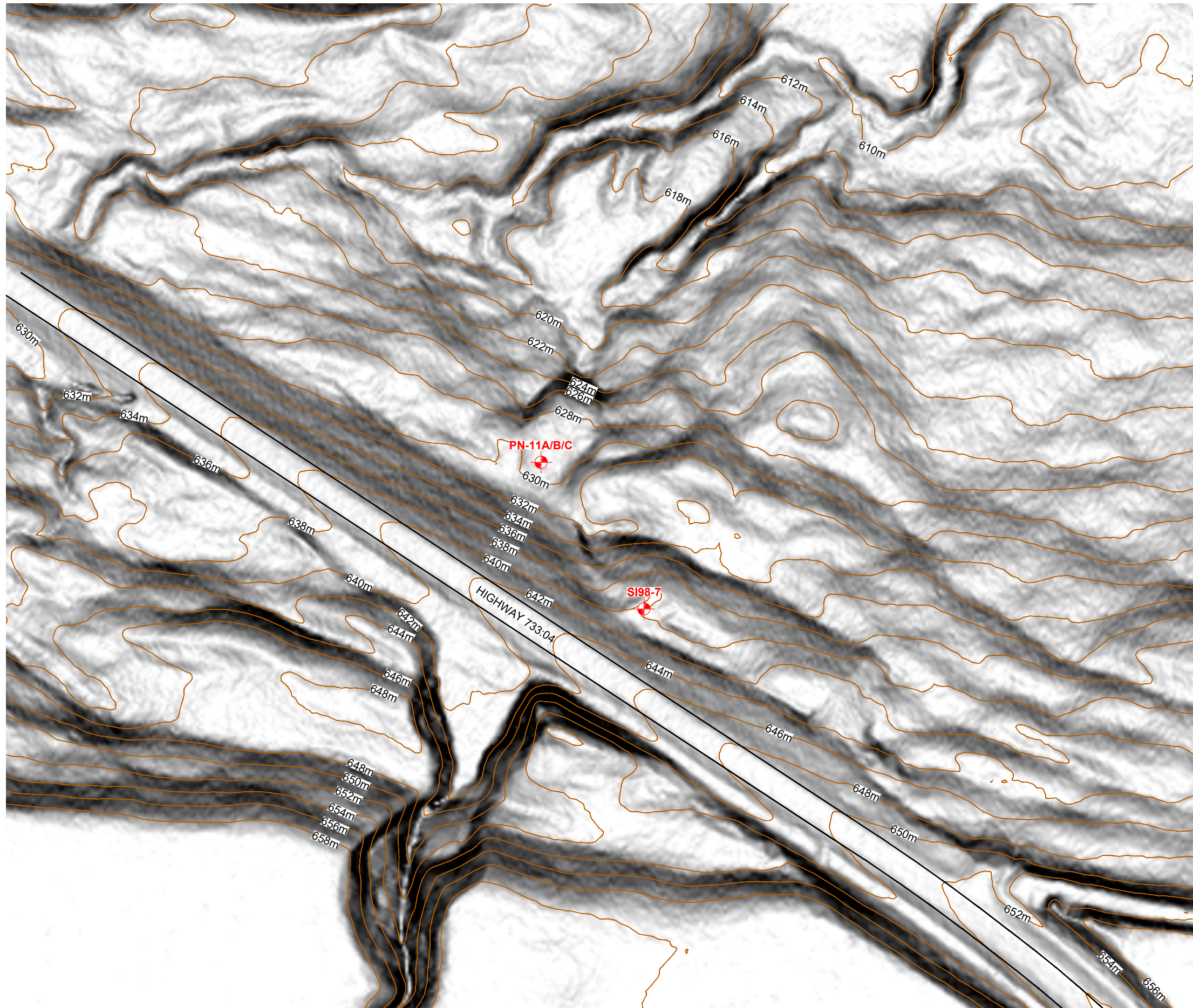
SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI98-7	412075.66	6154418.07	26-Jun-23	0.72	68 to 2	10	-298	308	-603	595	8R/8R	

PNEUMATIC PIEZOMETER (PN) READINGS



PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN-11A	412014.36	6154422.40	26-Jun-23	0.8	28832
PN-11B	412014.36	6154422.40	26-Jun-23	32.4	28897
PN-11C	412014.36	6154422.40	26-Jun-23	95.7	28898

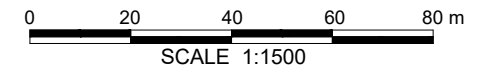
INSPECTOR REPORT

PN-11C Keeps bouncing when bypass open, bypass closed --> 95.7 kPa



LEGEND

-  APPROXIMATE INSTRUMENT LOCATION
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
-  GROUND SURFACE CONTOUR (2m INTERVAL)



BASE PLAN PROVIDED BY ALBERTA TRANSPORTATION



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

**GP014: HWY 733:04 BAD HEART RIVER
INSTRUMENT LOCATIONS**

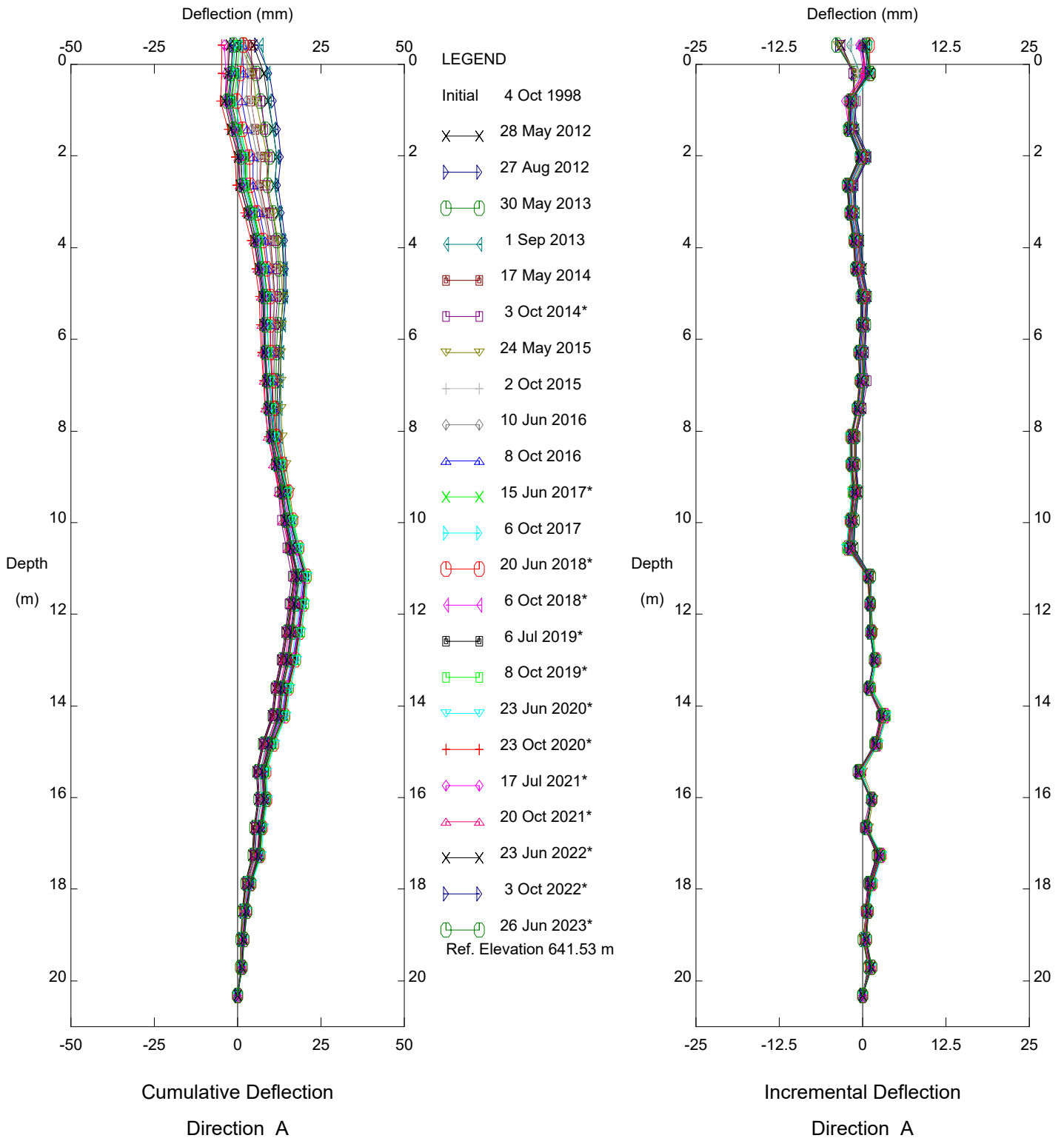
DWG No. 32123-GP014

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	RVC
SCALE	1:1500
DATE	AUGUST 2021
FILE No.	32123



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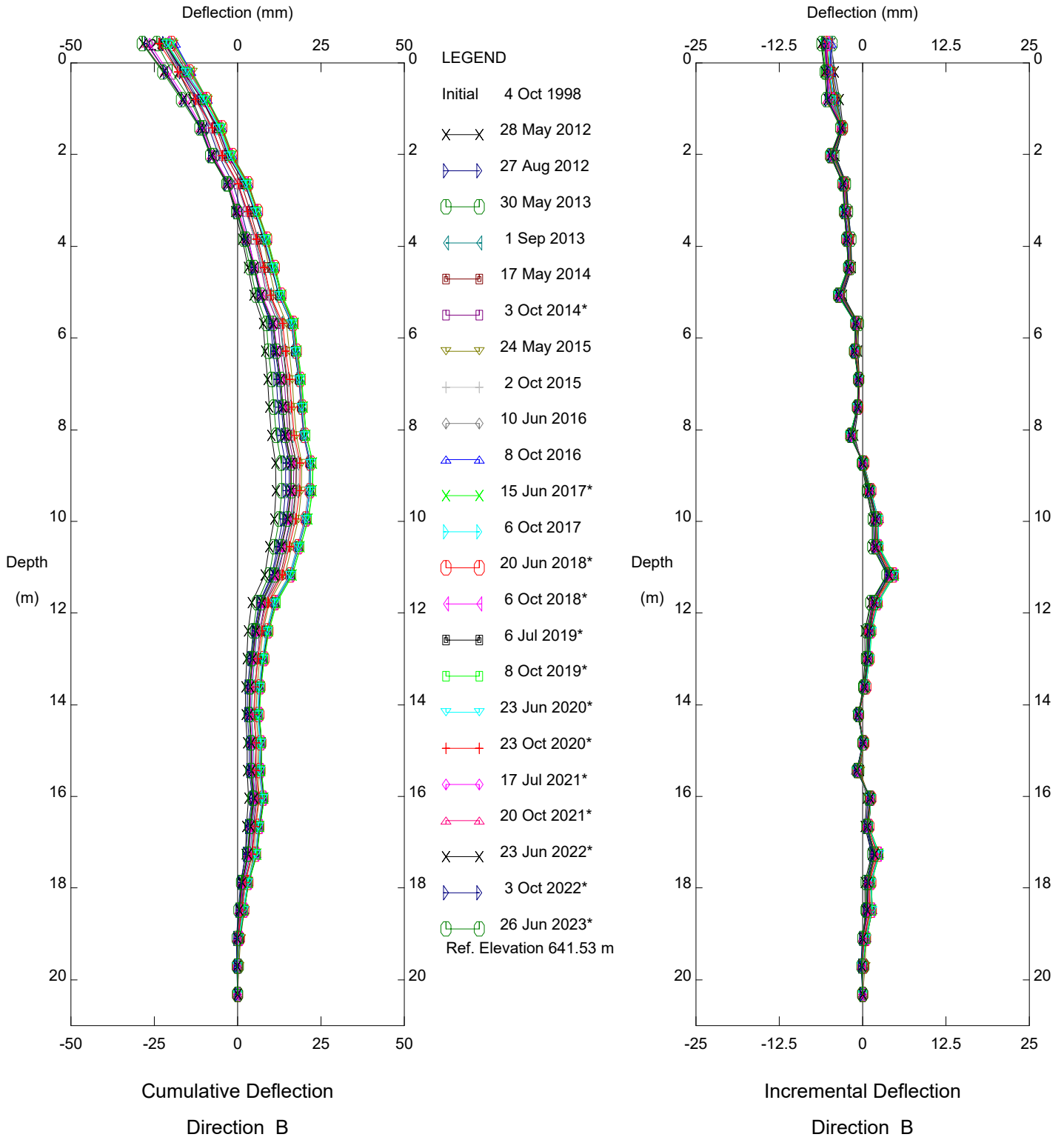


GP014 Bad Heart River South Slide, Inclinometer SI98-7

Alberta Transportation

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

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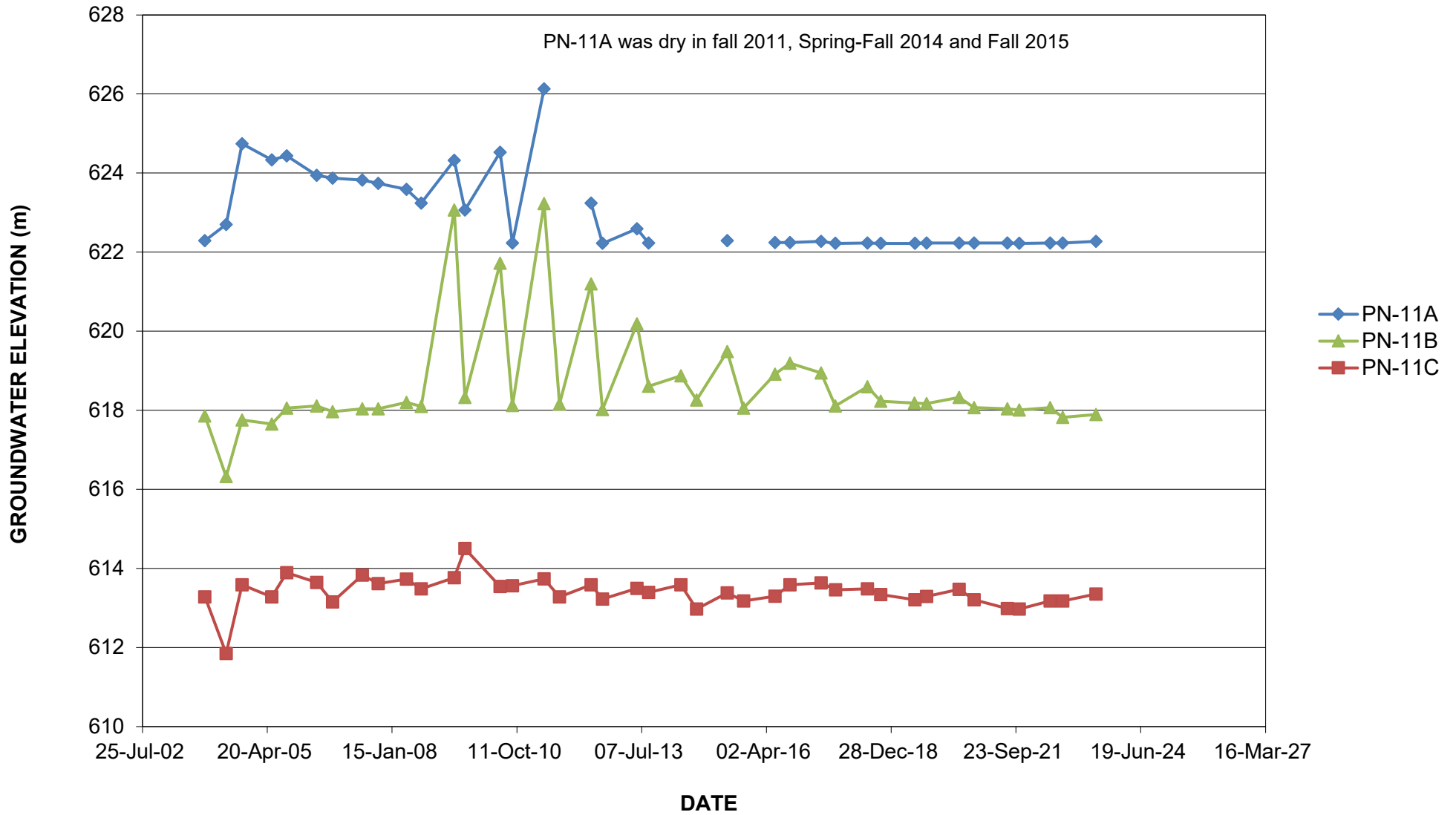


GP014 Bad Heart River South Slide, Inclinometer SI98-7

Alberta Transportation

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

**FIGURE GP014-1
PIEZOMETRIC ELEVATIONS FOR HWY 733:04, BAD HEART RIVER**



**FIGURE GP014-2
PIEZOMETRIC DEPTHS FOR HWY 733:04, BAD HEART RIVER**

