



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 PH052: HWY 2:68 DUNVEGAN NORTH SLIDE AND EROSION

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

In 2016, a cantilever tangent concrete pile wall was installed at the Hwy 2:68 Dunvegan North (10+800) site to repair a landslide that had caused distress to the southbound lane. During construction, slope inclinometers were installed in piles P12 (SI16-P12) and P21 (SI16-P21). Two vibrating wire piezometers (VW16-1 and VW16-2) were also installed to monitor groundwater levels upslope of the pile wall. The SIs and piezometers were read on June 19, 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 ft. wheelbase and an RST Pocket PC readout. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The vibrating wire piezometers were read using an RST VW2106 readout.

During the spring of 2019 readings, a reading error was noted from 10.8 m depth to 12.0 m depth ins SI16-P21. A downhole camera inspection in the fall of 2019 revealed that one of the casing joints was misaligned in this SI, which was causing the SI probe to come out of the grooves at this location. A 48 mm diameter SI casing was grouted inside the existing casing and the SI was reinitialized. The current and future readings for this SI will be compared to the



June 16, 2020 reading taken with the 48 mm diameter casing. When the 48 mm diameter casing was installed, it was found that there was a tight bend in the casing at roughly 12 m depth, which has affected the subsequent readings of this instrument.

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. Vibrating wire 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 the SIs since previous readings in the spring of 2021.

Zones of movements are summarized in Table PH052-1 below. Table PH052-1 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 PH052-1
 SPRING 2022 – HWY 2:68 DUNVEGAN NORTH SLIDE AND EROSION
 SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 19, 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)
SI16-P12	July 4, 2016	5.0 over 1.7 m to 17.5 m depth in 197° direction	3.3 on October 20, 2020	Active	July 13, 2021	0.3	0.3	-1.2
SI16-P21	July 4, 2016 (New initial reading of June 18, 2020)	6.3 over 1.7 m to 17.5 m depth in 252° direction	5.4 on July 13, 2021	Active	July 13, 2021	1.8	1.9	-3.5

Drawing 32123-PH052 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



**TABLE PH052-2
 SPRING 2022 – HWY 2:68 DUNVEGAN NORTH SLIDE AND EROSION
 VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: June 19, 2022

INSTRUMENT	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST RECORDED GROUNDWATER LEVEL (mBGS)	CURRENT GROUNDWATER ELEVATION (mBGS)	PREVIOUS GROUNDWATER ELEVATION (mBGS)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
VW16-1	April 9, 2016	458.80	467.73	Active	DRY	DRY	DRY	N/A
VW16-2	April 9, 2016	451.8	467.73	Active	456.40 on June 10, 2018	456.04	455.91	0.13

Drawing 32123-PH052 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site



3. INTERPRETATION OF MONITORING RESULTS

SI16-P12 showed a rate of movement of 0.3 mm/yr over the length of the pile from 1.7 m to 17.5 m depth since the spring of 2021 readings. The total pile head movement to date has been 5.0 mm.

SI16-P21 showed a rate of movement of 1.9 mm/yr over the length of the pile from 1.7 m to 17.5 m depth compared to the spring of 2021 readings. SI16-P21 has shown a total pile head movement of 6.3 mm since it was reinitialized. However, the current calculated movement likely contains some reading error due to a tight bend in the new casing at approximately 12 m depth.

Vibrating wire piezometer VW16-2 showed an increase in groundwater level of 0.13 m compared to the spring of 2021 readings. VW16-1 continued to be dry. The piezometer reading results are presented in Table PH052-2, and are plotted in Figures PH052-1 (by depth) and PH052-2 (by elevation) in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

The instruments should be read again in the spring of 2023.

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
/jf

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32123-PH052)
 - SI Reading Plots
 - Figure PH052-1 (Piezometric Elevations)
 - Figure PH052-2 (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 PH052: HWY 2:68 DUNVEGAN NORTH SLIDE AND EROSION

**ALBERTA TRANSPORTATION
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH052)
SPRING 2022**

Location: Dunvegan North Slide & Erosion (HWY 2:68 C1 10.839) File Number: 32123 Probe: RST set 5R Cable: RST set 5R	Readout: Casing Size 2.75 Temp: 15 Read by: NKR/JD
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SLOPE INCLINOMETER (SI) READINGS

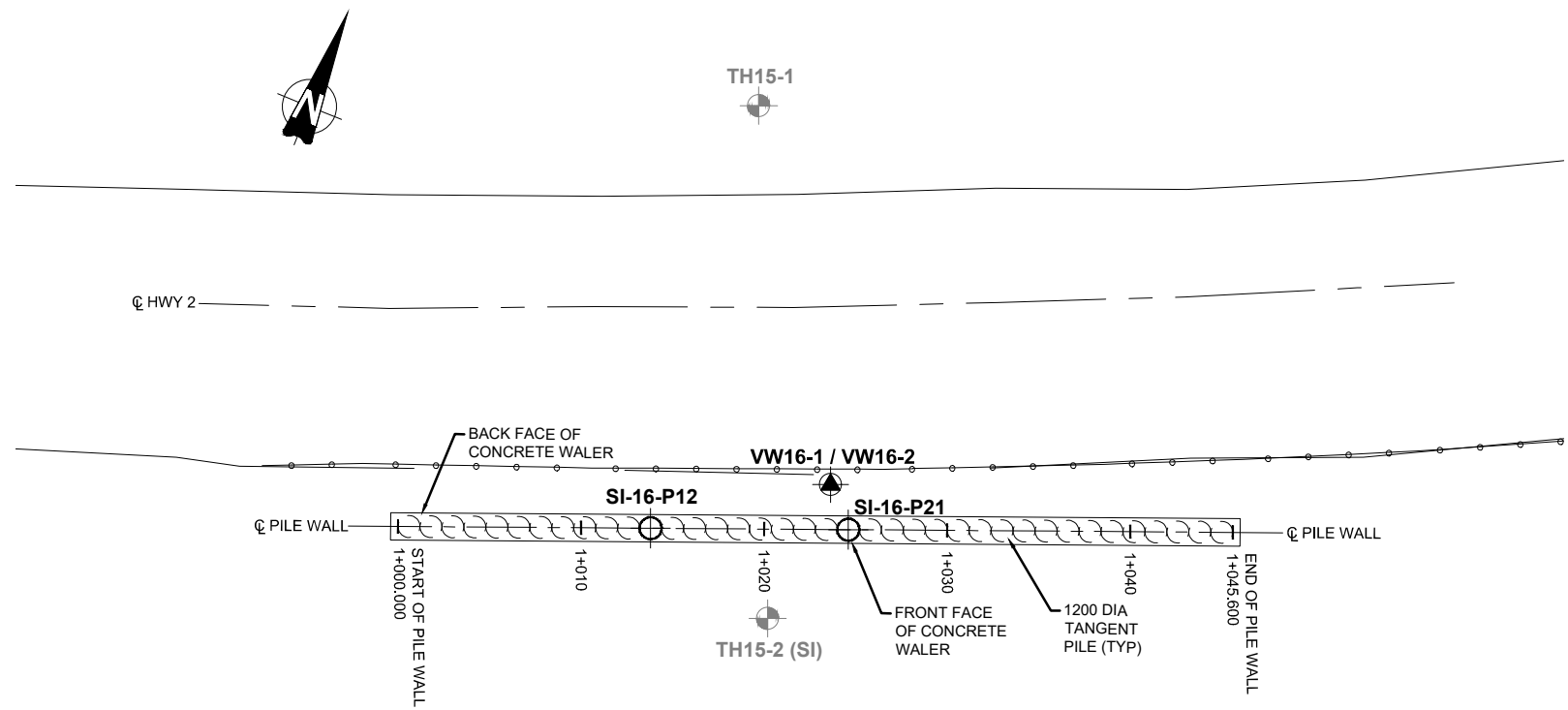
SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of Casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI16-P12	402452	6199542	19-Jun-22	0.48	58	170	597	-586	153	-167	5R/5R	
SI16-P21	402466	6199546	19-Jun-22	0.47	58	165	-1333	1342	-230	232	5R/5R	

VIBRATING WIRE PIEZOMETER (VW) READINGS

VW #	Easting (m)	Northing (m)	Date	Reading (Dg/ ⁰ C)	Identification
VW16-1	402462	6199551	19-Jun-22	8847.2 / 5.1	36169
VW16-2			19-Jun-22	8597.8 / 7.3	36170




INSPECTOR REPORT

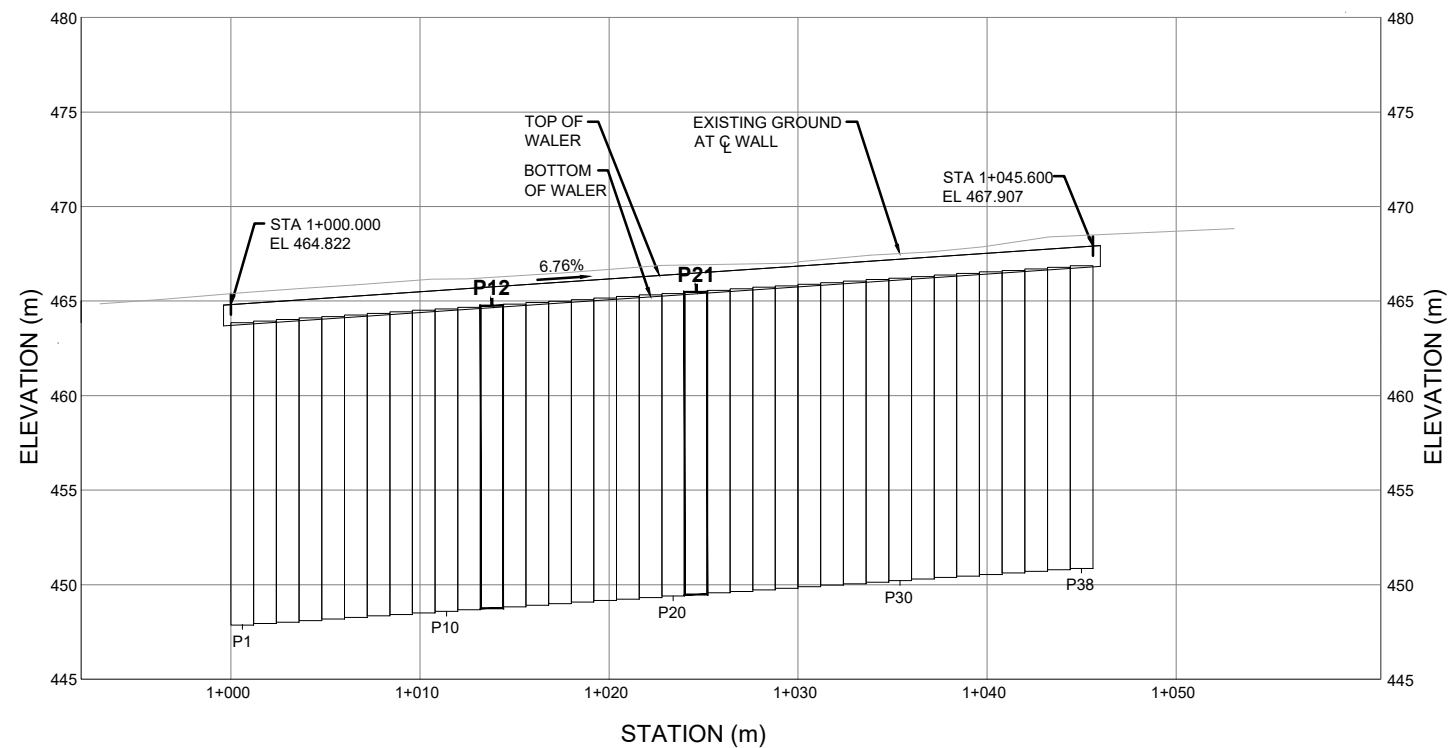
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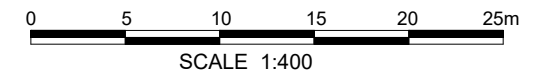
PLAN - PILE WALL

LEGEND

-  SLOPE INCLINOMETER
-  VIBRATING WIRE PIEZOMETER
-  TEST HOLE



ELEVATION - PILE WALL
SHOWN ALONG PILE WALL CENTRELINE



PEACE REGION
(GRANDE PRAIRIE DISTRICT NORTH)

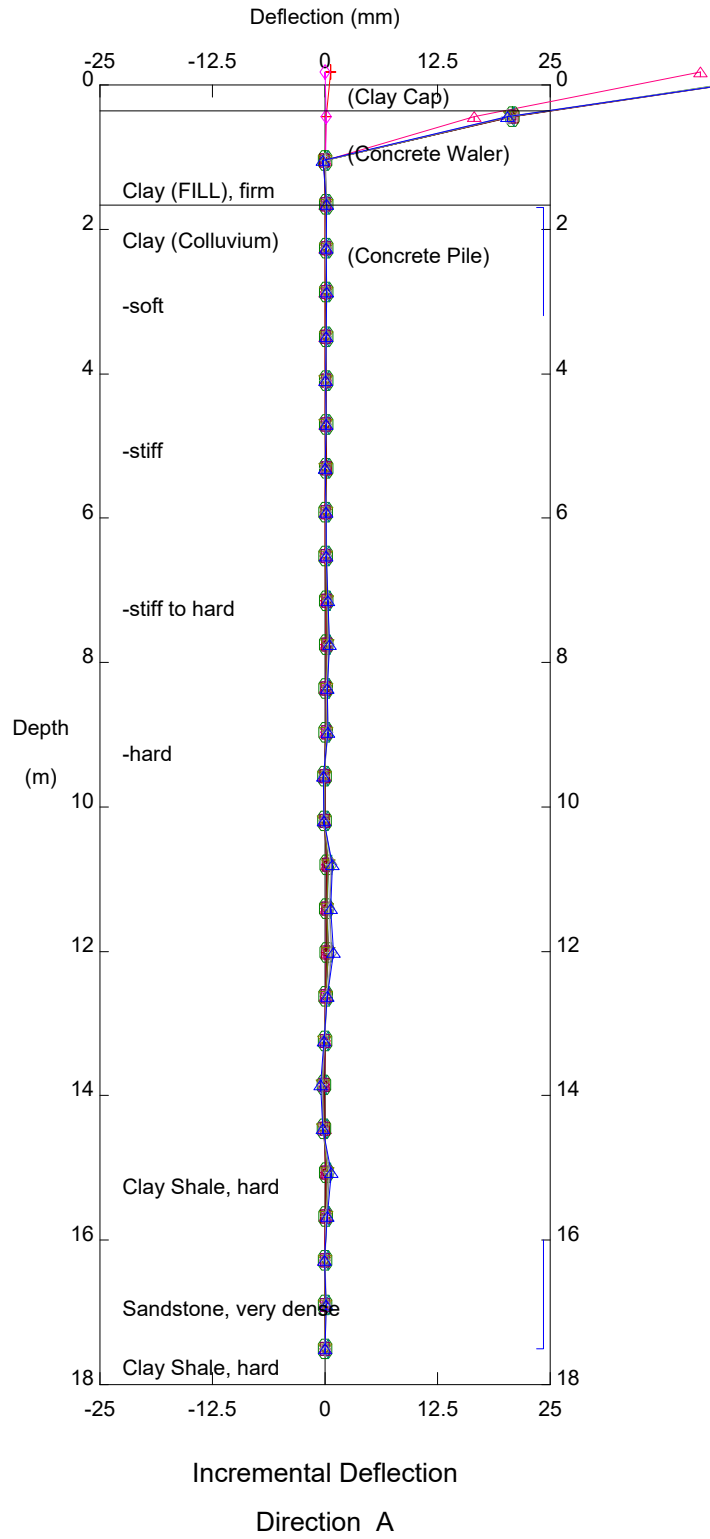
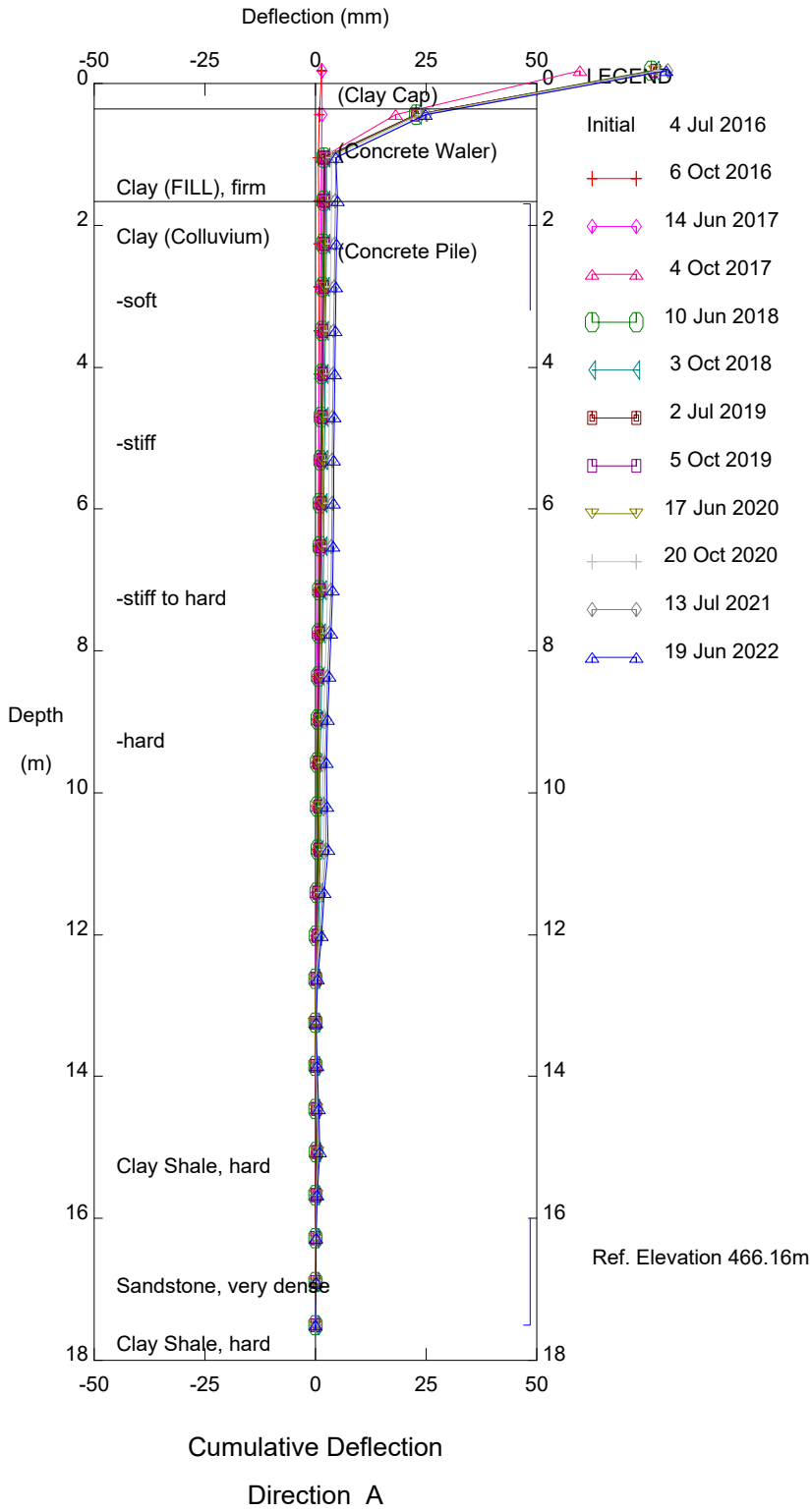
PH052: DUNVEGAN NORTH SLIDE AND EROSION

DWG No. 32123-PH052

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:400
DATE	AUGUST 2021
FILE No.	32123



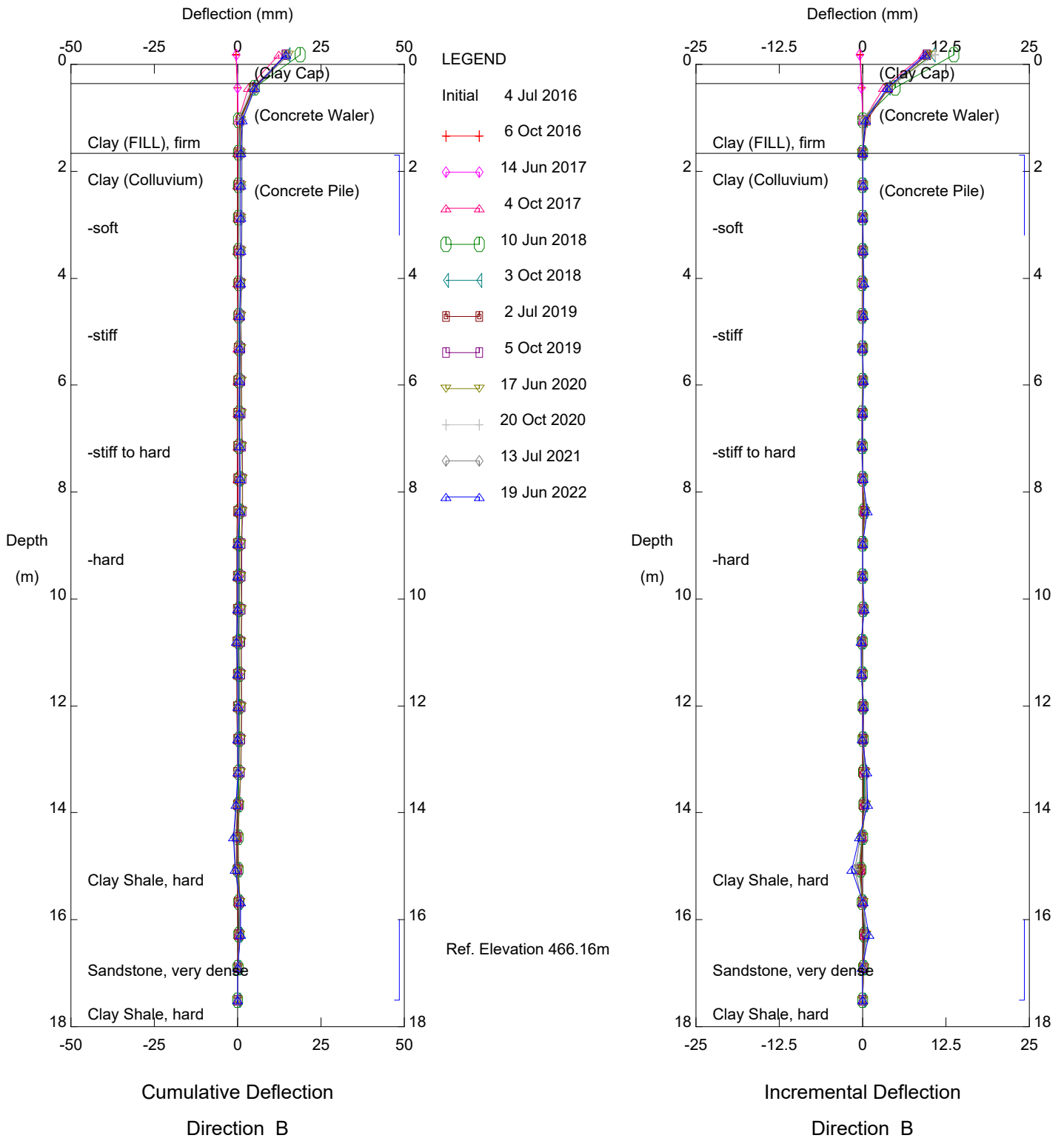
Thurber Engineering Ltd



Dunvegan North Slide (PH052), Inclinator SI16-P12

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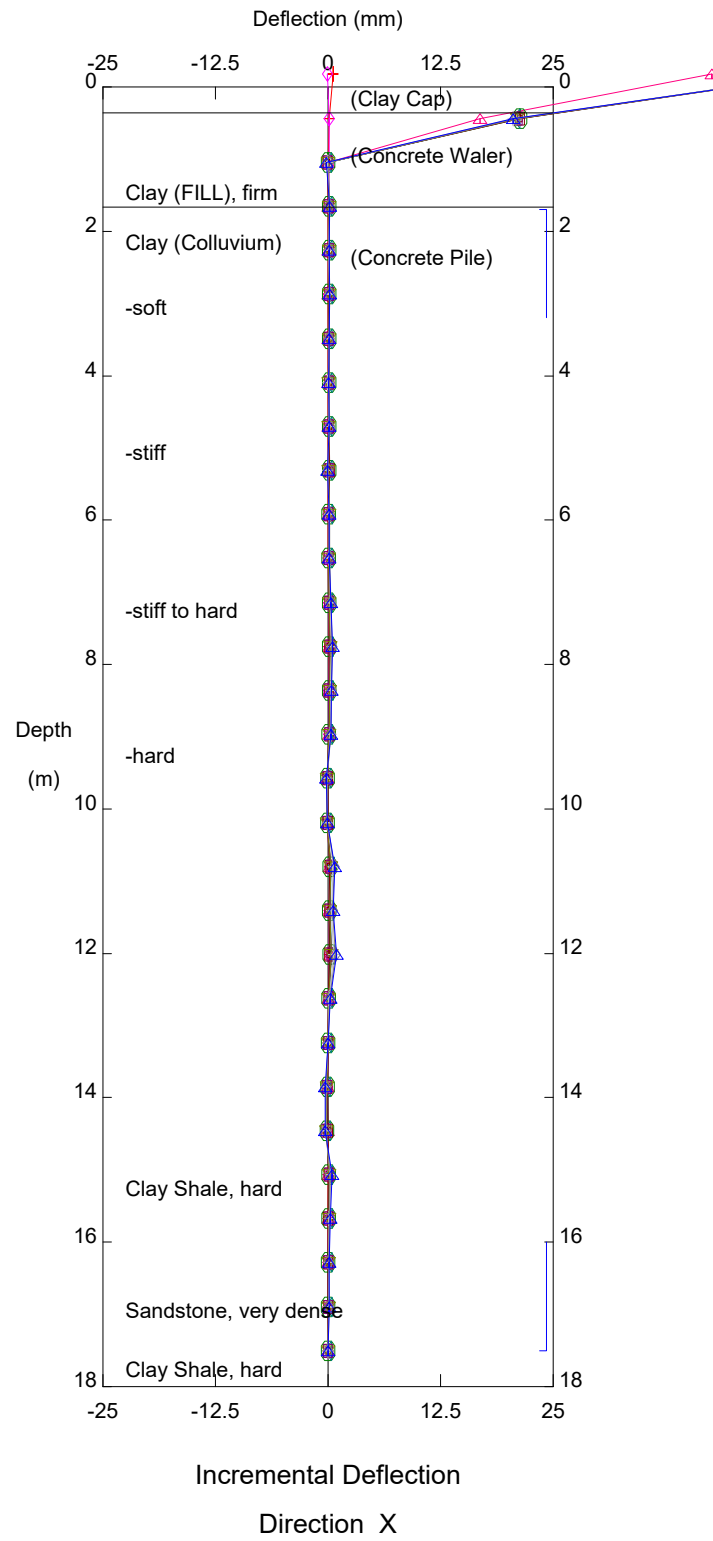
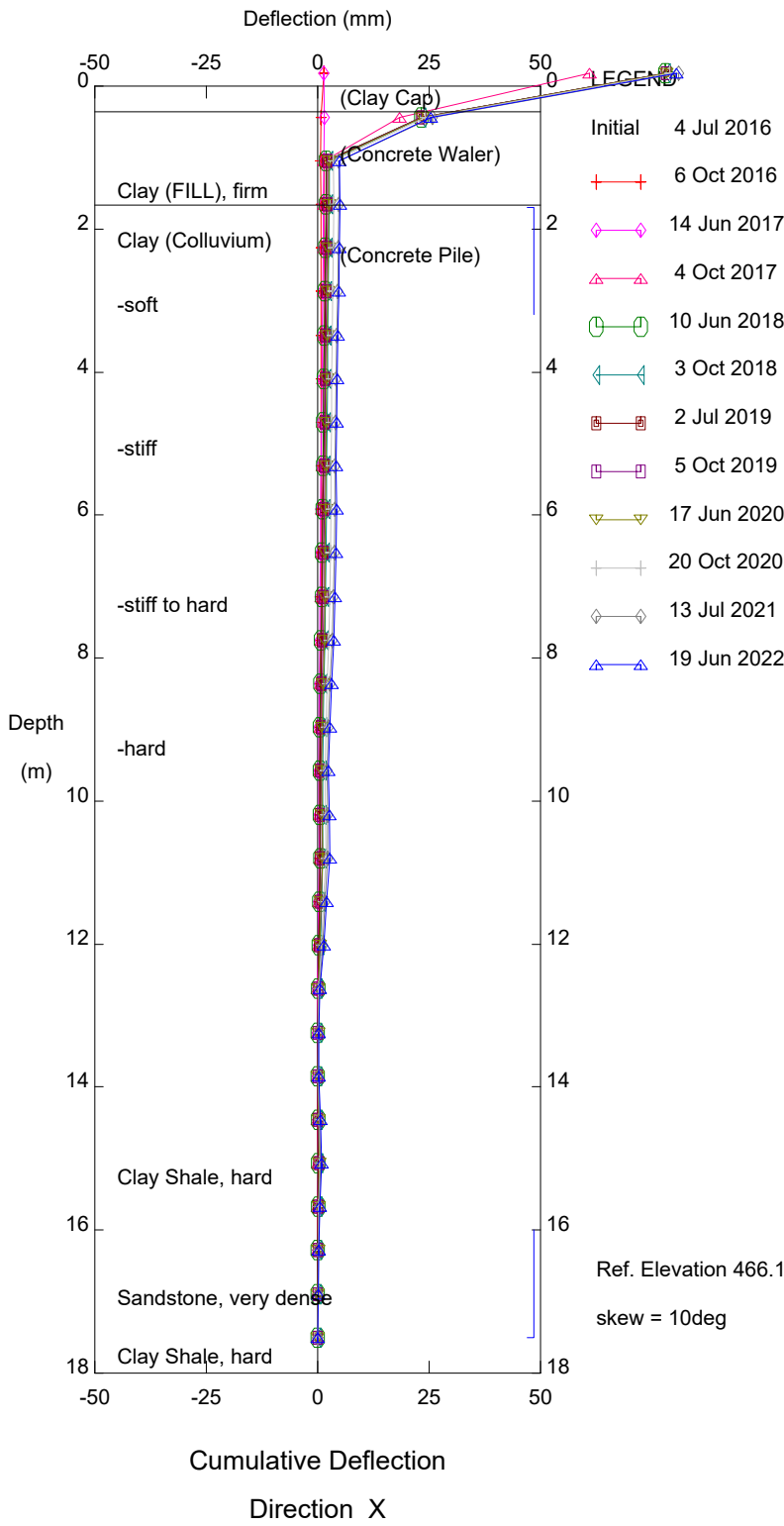
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Dunvegan North Slide (PH052), Inclinometer SI16-P12

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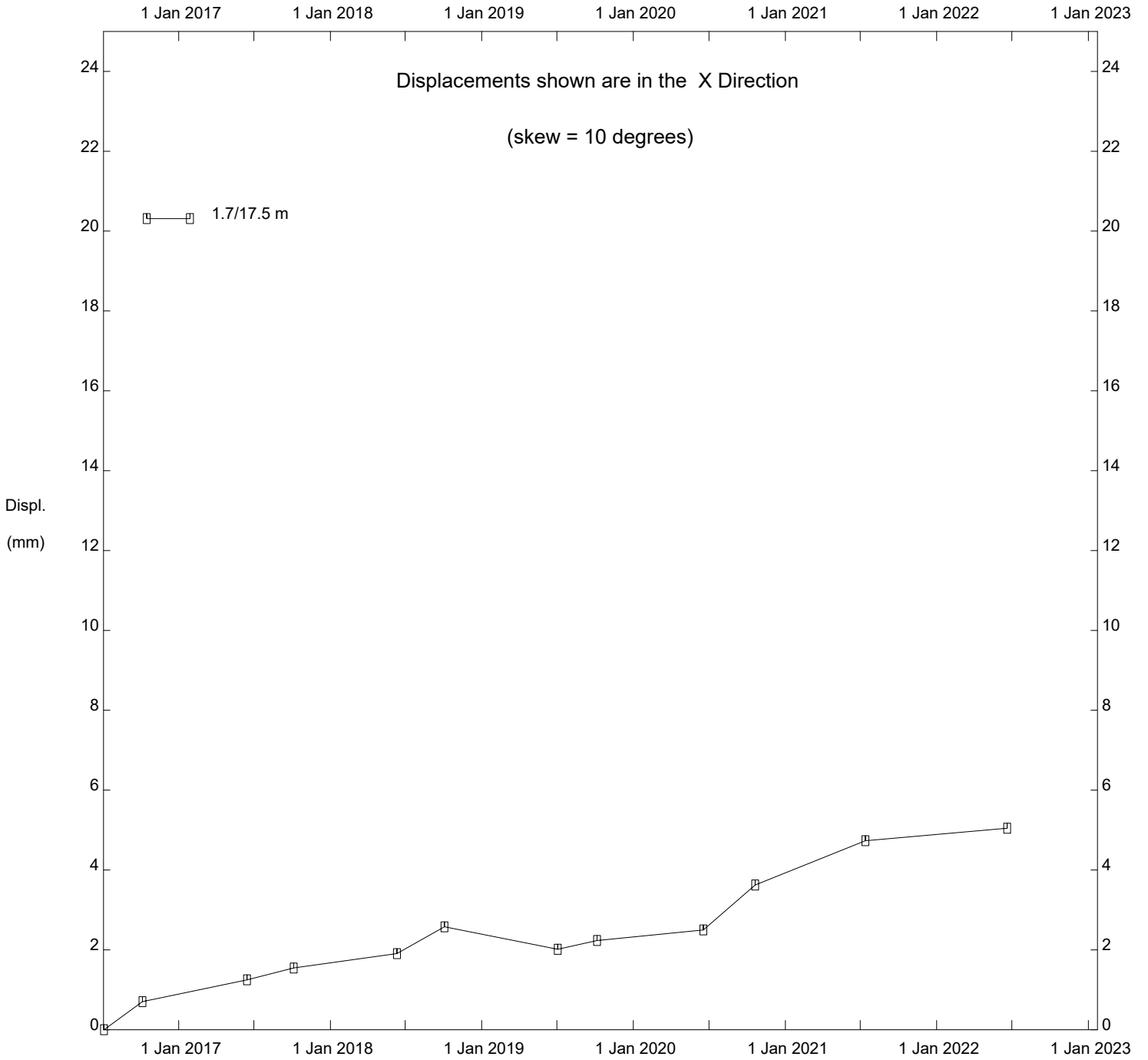
Thurber Engineering Ltd



Dunvegan North Slide (PH052), Inclinator SI16-P12

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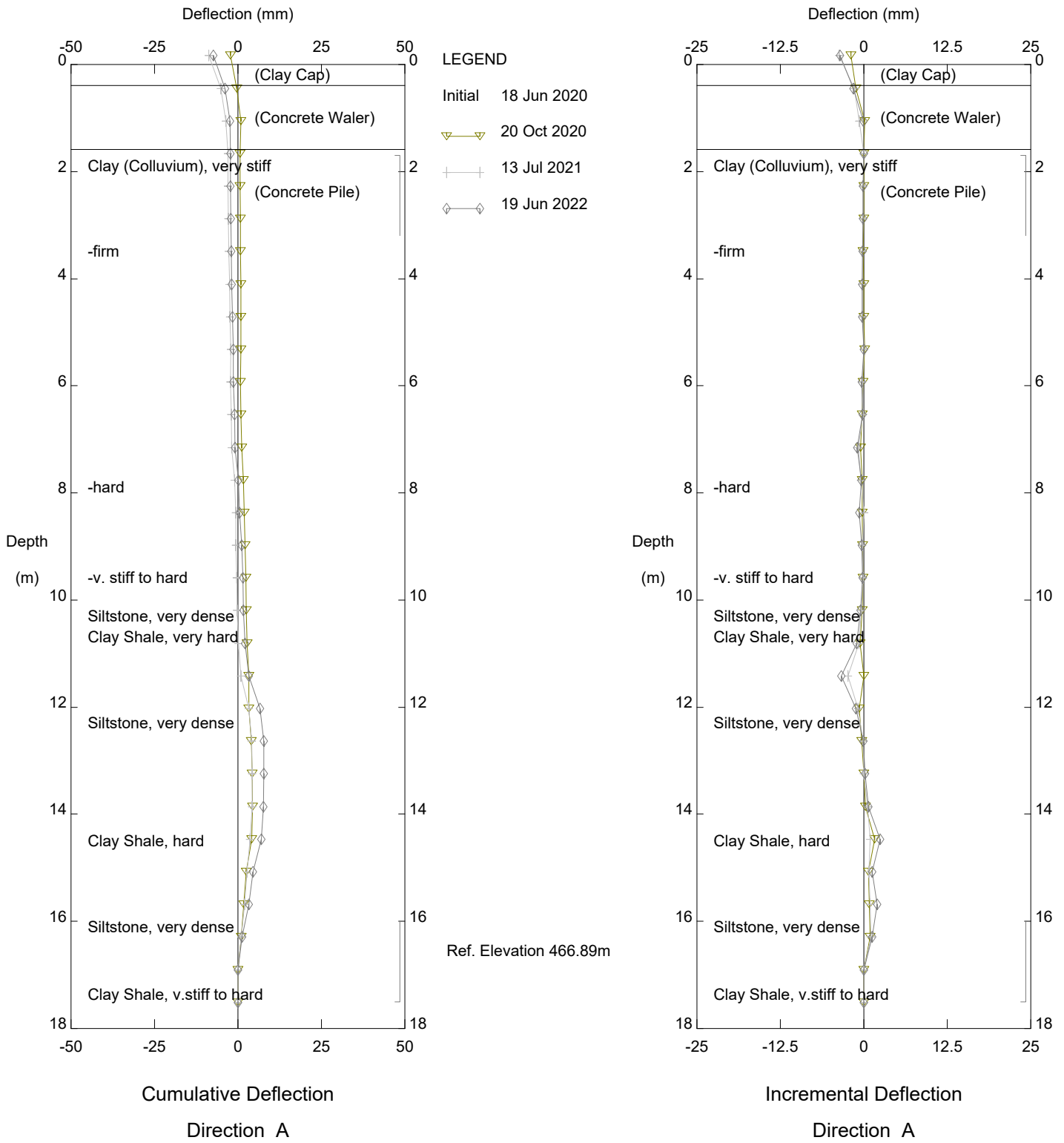
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Dunvegan North Slide (PH052), Inclinometer SI16-P12

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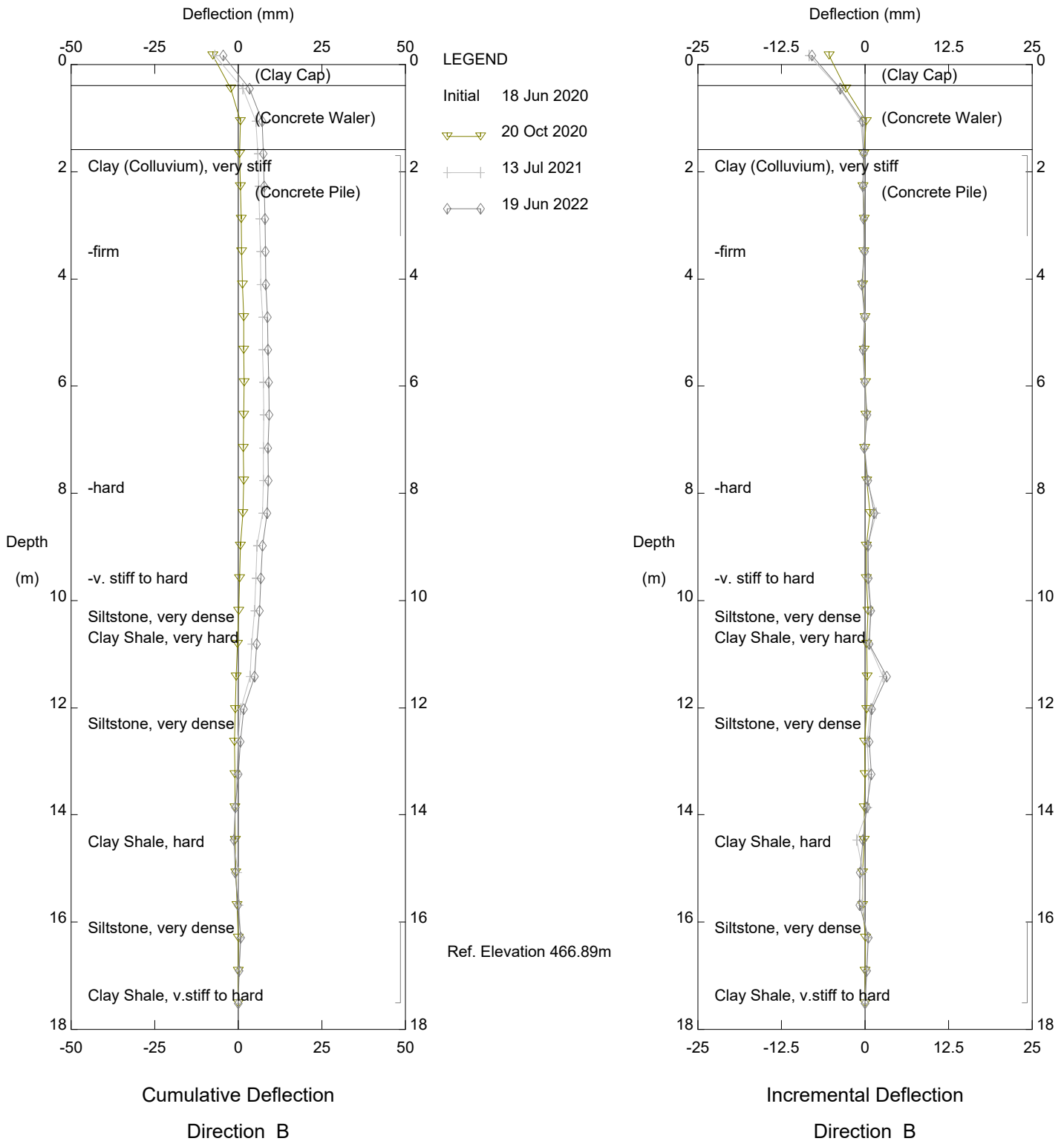
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Dunvegan North Slide (PH052), Inclinometer SI16-P21

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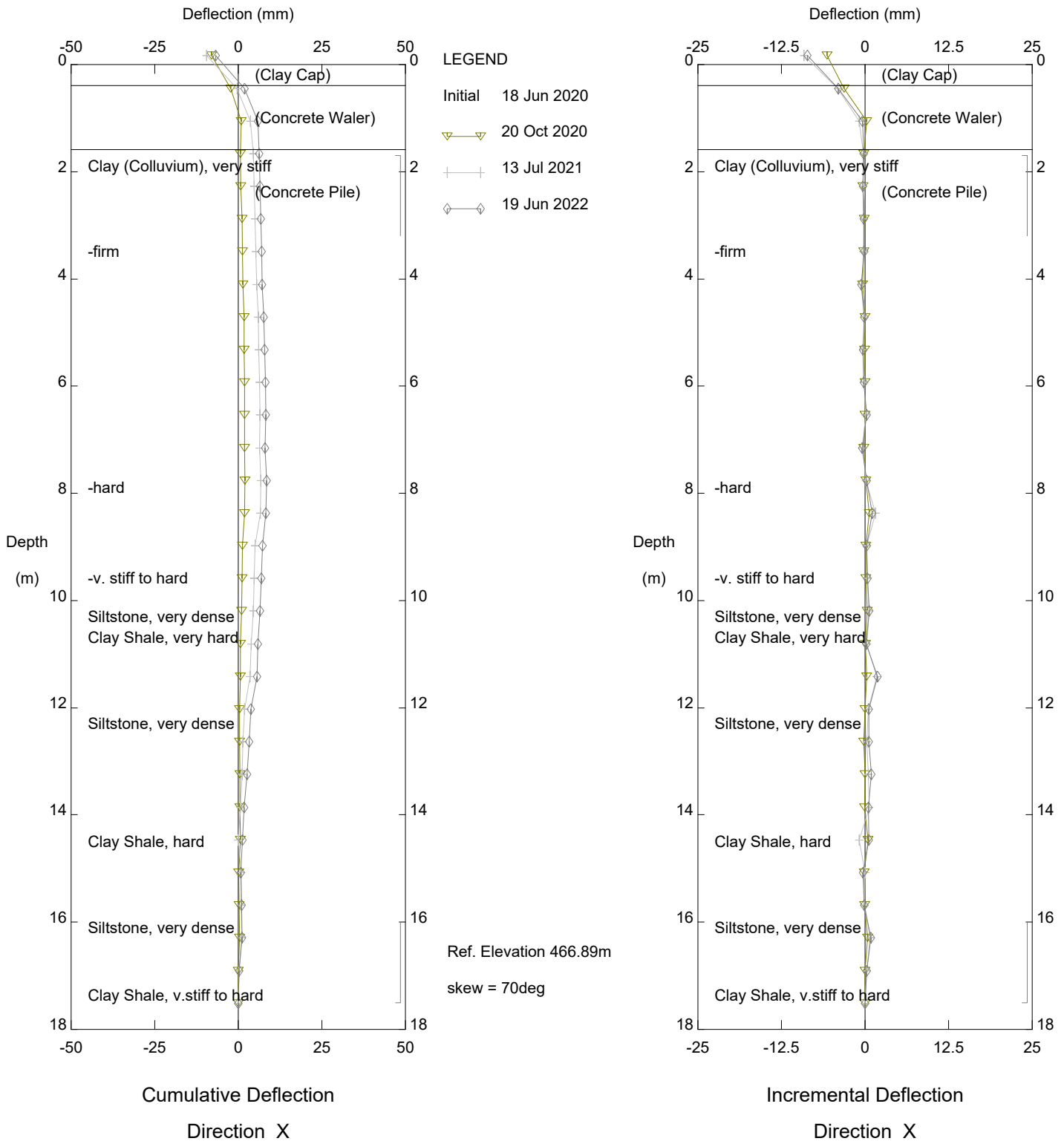
Thurber Engineering Ltd



Dunvegan North Slide (PH052), Inclinometer SI16-P21

Alberta Transportation

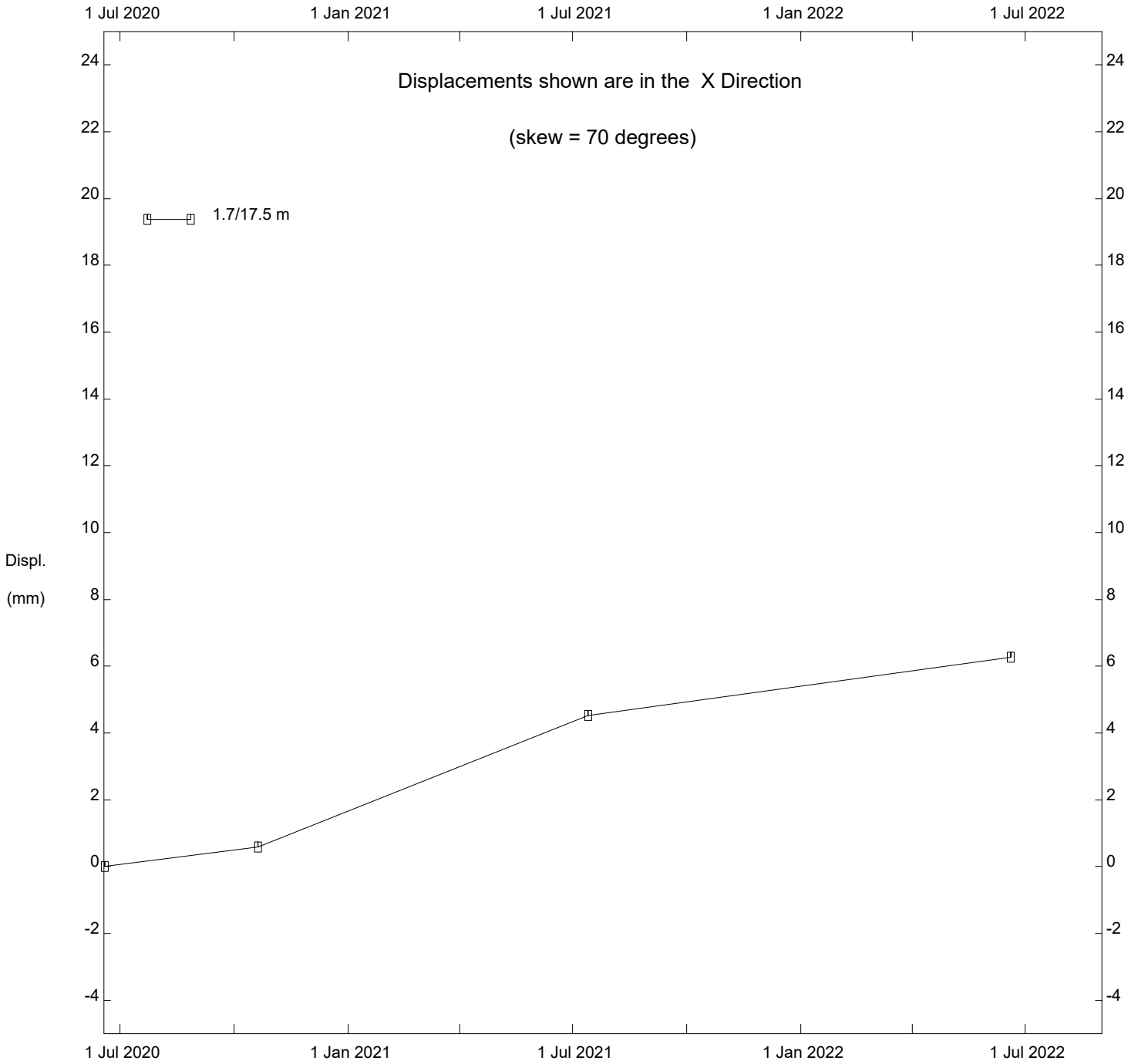
Thurber Engineering Ltd



Dunvegan North Slide (PH052), Inclinometer SI16-P21

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Dunvegan North Slide (PH052), Inclinator SI16-P21

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**FIGURE PH052-2
PIEZOMETRIC ELEVATIONS FOR HWY 2:68 DUNVEGAN NORTH 10+800 SLIDE**

