Stantec

Memo

To:	Amy Driessen Alberta Transportation	From:	Leslie Cho and Xiteng Liu Stantec Consulting Ltd.
File:	123315222	Date:	June 2, 2022

Reference: North Central Region, Edson/Stony Plain, Site NC031 – Highway 22:32 Deer Lodge Slide, Spring 2022 Instrumentation Monitoring Report

1.0 OBSERVATIONS

1.1 FIELD PROGRAM AND INSTRUMENTATION STATUS

The Spring 2022 reading cycle consisted of instrument readings of one slope inclinometer (SI-1R), one standpipe piezometer (SP1) and two vibrating wire piezometers (VW14-01 and VW14-02). **Figure 1** attached provides a schematic of the site. The instruments were read by Mahendran Senthooran, M.Eng., EIT and Akintola Fakinlede, M.Sc., Engineering Technologist on May 4, 2022.

The slope inclinometers (SI) were measured using an RST MEMS digital inclinometer probe with 0.5 m increments and RST handheld PC. The standpipe piezometers (SP) were measured using a Heron Instruments water tape. The vibrating wire piezometers (VW) were read with an RST VW2106 readout box.

GPS coordinates of all instruments were obtained using a Garmin eTrex 22x handheld GPS unit.

2.0 INSTRUMENTATION READINGS

2.1 GENERAL

The SI plots are provided in the attachments and summarized in the following sections. Displacement-time plots in the resultant x-direction (i.e. slope movement direction) along with movement rates, total cumulative movement, maximum movement rates, and incremental movements since initializing each SI are provided in **Table NC031-1** and the attachments.

Piezometer information is summarized in **Table NC031-2**.

2.2 ZONES OF MOVEMENT

No new zones of movement were observed in the SI-1R during the Spring 2022 reading cycle.

2.3 MONITORING RESULTS

2.3.1 SLOPE INCLINOMETERS

SI-1R has a movement zone between 4.8 m to 5.8 m. Little to no movement was recorded between 2016 and 2021; however, the slope movement seems to have resumed with the current rate of movement within the movement zone is 4 mm/year and total cumulative movement of 82 mm.

Reference: **North Central Region, Edson/Stony Plain, Site NC031 – Highway 22:32 Deer Lodge Slide, Spring 2022 Instrumentation Monitoring Report**

2.3.2 Piezometers

The water levels at both **VW14-01** and **VW14-02** appeared similar as the previous reading with changes in water level less than 0.1 m. The current water level is at 2.6 m and 1.6 m below ground surface (bgs) in VW14-01 and VW14-02, respectively.

The water levels at the standpipe SP1 increased by 2.0 m compared to the previous reading taken in Fall 2021. The current water level is at 0.5 m bgs. This is the highest reading which have been recorded so far. The rise of water level in SP1 may be associated with the slope movement recorded in SI-1R.

3.0 RECOMMENDATIONS

Consideration for additional reading in Fall 2022 should be given to confirm movement in the SI and groundwater levels. Otherwise, confirmation of movement can be taken during the next reading cycle in Spring 2023.

3.1 INSTRUMENTATION REPAIRS

No instruments require repair at this time.

Reference: **North Central Region, Edson/Stony Plain, Site NC031 – Highway 22:32 Deer Lodge Slide, Spring 2022 Instrumentation Monitoring Report**

Table NC031-1: Spring 2022 Slope Inclinometer Reading Summary

Instrument Name	Date Initialized	Coordinates (1) (UTM 11U, NAD1983) (m)		Total Cumulative Resultant Movement and Depth of Movement to Date (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)
		Northing	Easting							
S1-1R	Sept. 1, 2006	5968411	622194	82 over 4.8 m to 5.8m depth in 356º direction	29 in Oct. 2007	Operational	September 08, 2021	2	4	4
S1-2R	Sept. 1, 2006	-	-	60.1 over 3.2 m to 5.2m depth in 354º direction	19.7 in Oct. 2007	Non-Operational	Sept 22, 2016	Damaged in Fall 2017		

(1) Updated May 04, 2022, with approximate accuracy of ± 3 m.

Table NC031-2: Spring 2022 Piezometer Reading Summary

Instrument Name	Date Initialized	Coordinates (1) (UTM 11U, NAD1983) (m)		Bottom/Tip Depth (m)	Current Status	Maximum Water Level [Elevation] (m bgs)	Measured Water Level (Spring 2022) (m bgs) (Elevation)	Previous Water Level, (Fall 2021) (m bgs) (Elevation)	Change in Water Level (m)
		Northing	Easting						
VW14-01	2014	5968400	622161	3.1	Operational	2.4 [730.7 m] (Sept. 2019)	2.6 (730.4 m)	2.6 (730.4 m)	0.0
VW14-02	2014	5968421	622162	2.0	Operational	0.2 [733.8 m] (June 2017)	1.6 (732.4)	1.6 (732.4)	0.0
SP1	Sept. 1, 2006	5968414	622194	4.2	Operational	0.5 [736.1 m] (May 2022)	0.5 (736.1)	2.5 (N/A)	2.0

(1) Updated May 04, 2022, with approximate accuracy of ± 3 m.

Reference: **North Central Region, Edson/Stony Plain, Site NC031 – Highway 22:32 Deer Lodge Slide, Spring 2022 Instrumentation Monitoring Report**

4.0 CLOSING

We trust this instrumentation report meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

Stantec Consulting Ltd.

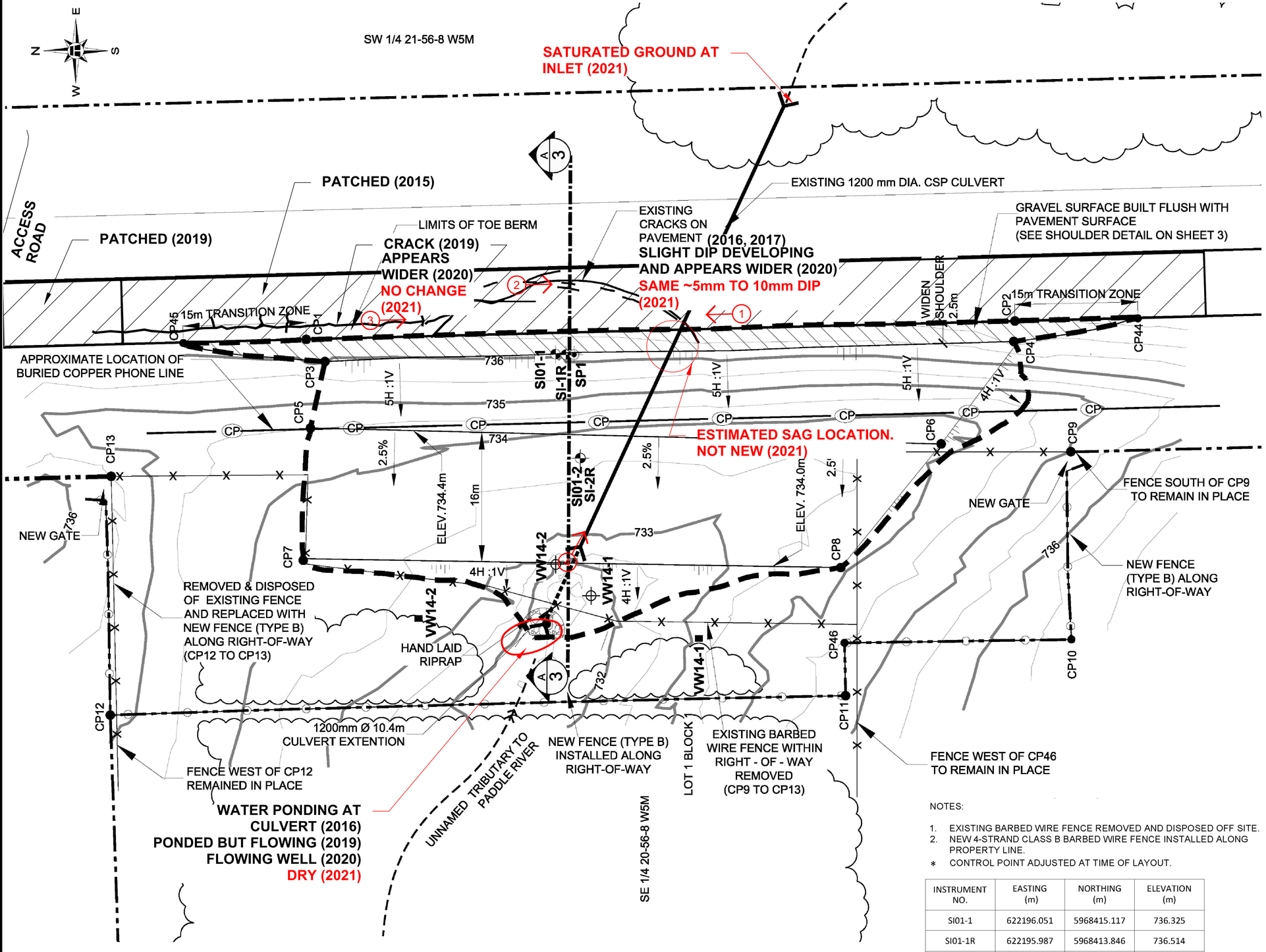
PROFESSIONAL ENGINEER ALBERTA
LESLIE CHO
2022-06-02
ID# 139079

Leslie Cho M.Eng., P.Eng.
Associate, Geotechnical Engineer
Phone: 780-917-7403
leslie.cho@stantec.com

Xiteng Liu M.Sc., P.Eng., PMP
Principal, Senior Geotechnical Engineer
Phone: 780-917-7247
xiteng.liu@stantec.com

Attachment: Figure 1 – Site Plan
SI-1R - Slope Inclinometer Plots
Piezometer data - Depth vs Time Plot

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature ID 78675
Date 2022-06-02
PERMIT NUMBER: P 0258
The Association of Professional Engineers and Geoscientists of Alberta



CONTROL POINT	EASTING (m)	NORTHING (m)	ELEVATION (m)
CP1 *	622197.842	5968445.499	736.370
CP2 *	622200.084	5968359.093	737.360
CP3 *	622195.134	5968443.221	736.340
CP4 *	622197.658	5968359.225	737.300
CP5	622187.030	5968444.997	734.400
CP6	622185.091	5968368.076	734.400
CP7	622170.902	5968445.871	733.812
CP8	622170.016	5968380.318	734.000
CP9	622184.152	5968352.271	735.666
CP10*	622161.251	5968352.202	736.760
CP11*	622154.395	5968379.736	734.780
CP12*	622152.026	5968469.401	735.150
CP13	622181.142	5968469.288	735.598
CP44*	622200.405	5968344.096	737.730
CP45*	622197.402	5968460.492	736.290
CP46*	622160.831	5968379.865	734.500

LEGEND

- SLOPE INCLINOMETER LOCATION (SI)
- APPROXIMATE STANDPIPE PIEZOMETER LOCATION (SP)
- VIBRATING WIRE PIEZOMETER TIP LOCATION (VW)
- TREE LINE (APPROX.)
- EXISTING GROUND SURFACE CONTOUR - SURVEYED ON OCTOBER 13, 2015 (CONTOUR INTERVAL = 0.5m)
- CRACK ON HIGHWAY
- PROPERTY LINE
- APPROXIMATE BURIED COPPER PHONE LINE
- APPROXIMATE FENCE LINE (EXISTING)
- FENCE LINE (TYPE B) (NEW)
- CONTROL POINT
- VIBRATING WIRE PIEZOMETER LEADS STEEL PROTECTOR (APPROX.)
- PHOTO NUMBER AND DIRECTION

NOTES:

1. EXISTING BARBED WIRE FENCE REMOVED AND DISPOSED OFF SITE.
2. NEW 4-STRAND CLASS B BARBED WIRE FENCE INSTALLED ALONG PROPERTY LINE.

* CONTROL POINT ADJUSTED AT TIME OF LAYOUT.

INSTRUMENT NO.	EASTING (m)	NORTHING (m)	ELEVATION (m)
SI01-1	622196.051	5968415.117	736.325
SI01-1R	622195.987	5968413.846	736.514
SP1	622195.987	5968413.846	736.514
SI01-2	622183.351	5968412.101	734.319
SI-2R	622183.360	5968412.034	734.412
VW14-1 TIP	622166.586	5968410.779	-
VW14-1 CASING	622161.356 (APPROX.)	5968397.620 (APPROX.)	-
VW14-2 TIP	622170.402	5968415.079	-
VW14-2 CASING	622163.808 (APPROX.)	5968431.793 (APPROX.)	-

NOTES

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK
2. 2021 OBSERVATIONS SHOWN IN RED

REFERENCE

THURBER ENGINEERING LTD, JOB No.15-16-322, PLAN No. RD19252-C
DATE NOVEMBER 25, 2015.

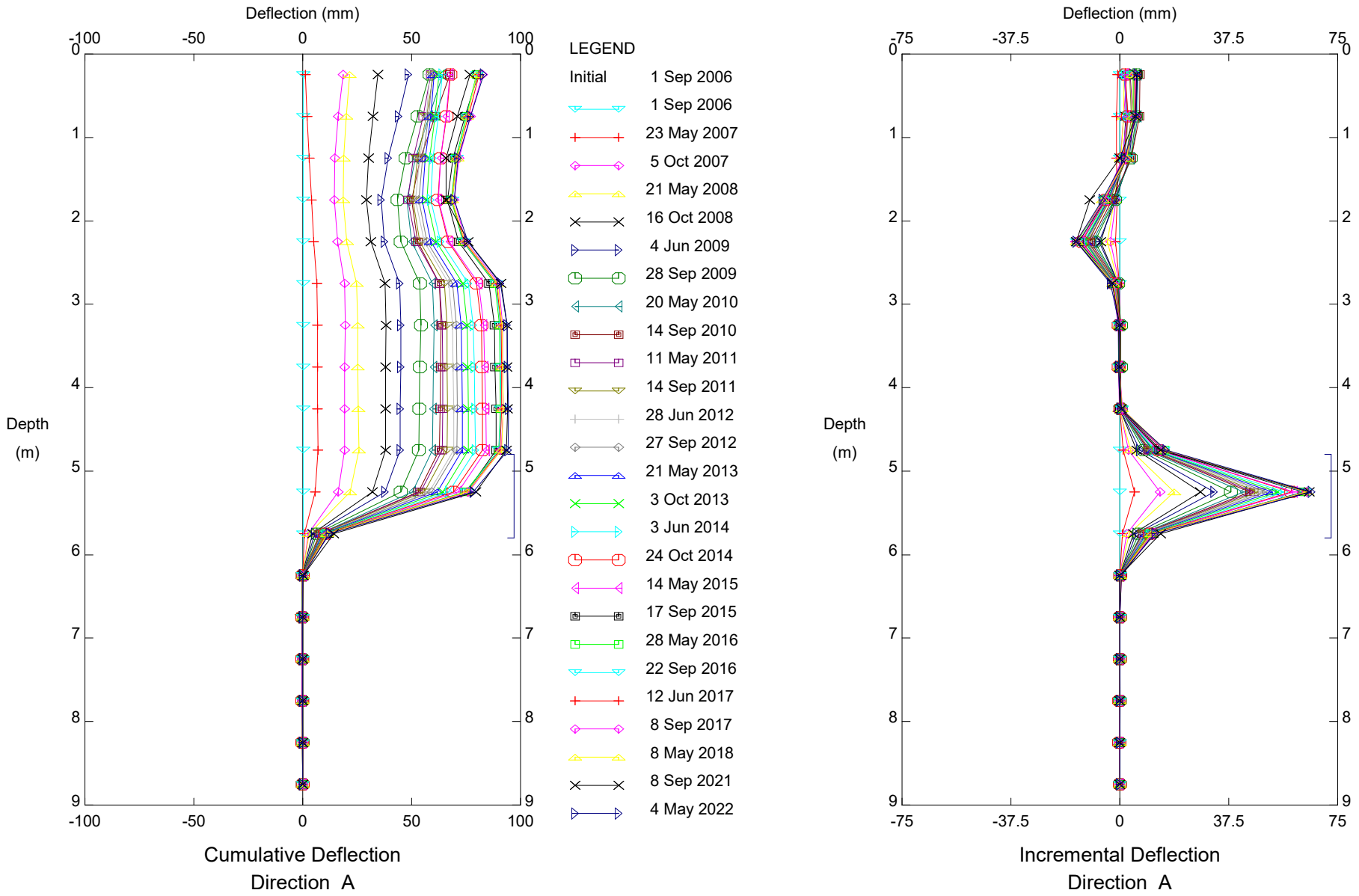
Stantec
STANTEC CONSULTING
400-10220 103 AVENUE NW
EDMONTON, ALBERTA, CANADA
T5J 0K4

ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC31 DEER LODGE
SITE PLAN

DRAWN	WW/MK	CHECK	CM	APPROVE	LC
DATE	03 SEPT. 2021	SCALE	AS SHOWN	PROJECT #	123315222

FIGURE - 1 -

Stantec Consulting Ltd - Edmonton

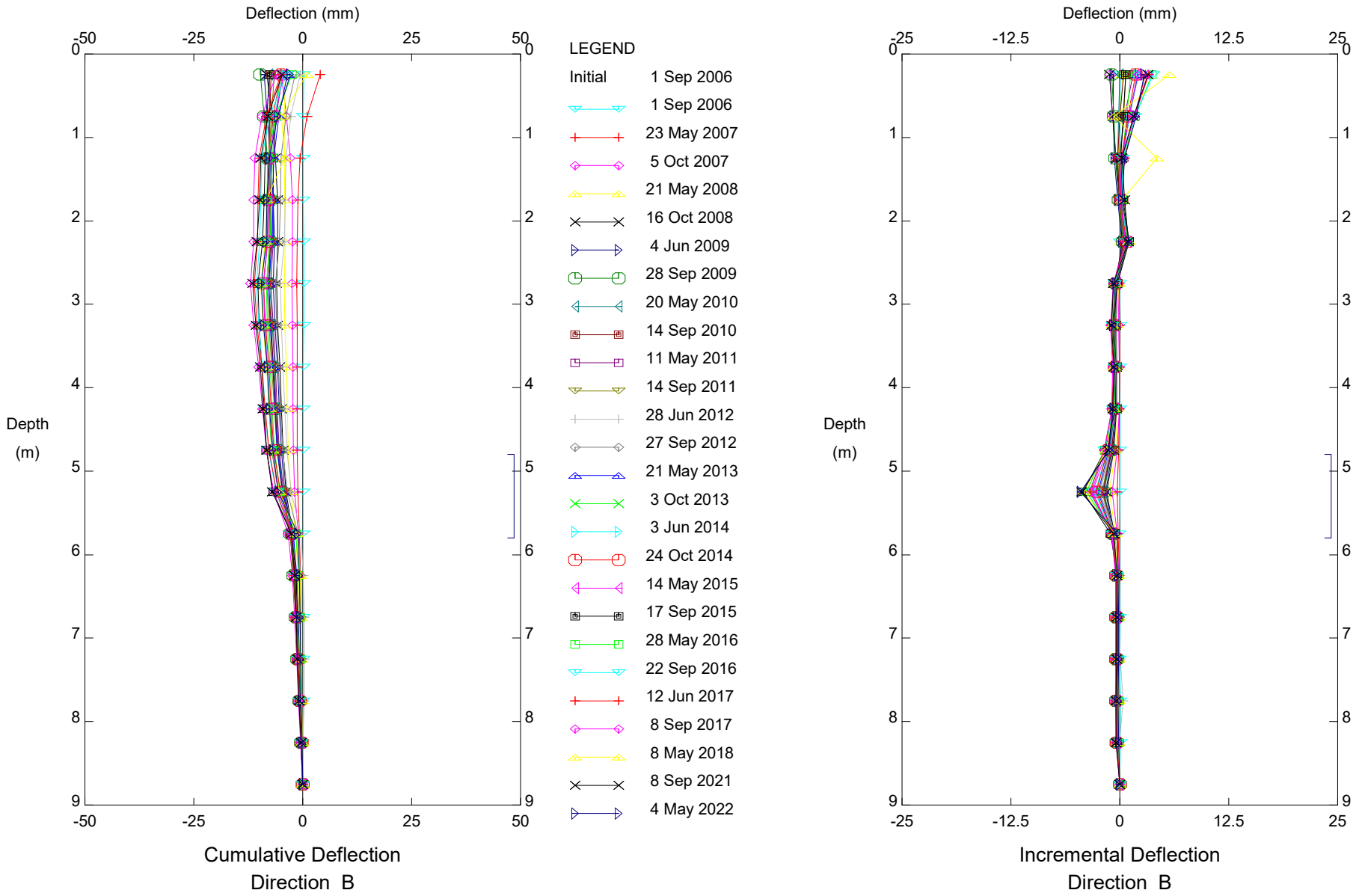


Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

Alberta Transportation

\\CD1001-C200\WORKGROUP\1233\ACTIVE\123315222\03_DATA\FIELD\INSTRUMENTATION\NC031\SI\SI01\N31SI-1R_M_ALL.GTL

Stantec Consulting Ltd - Edmonton

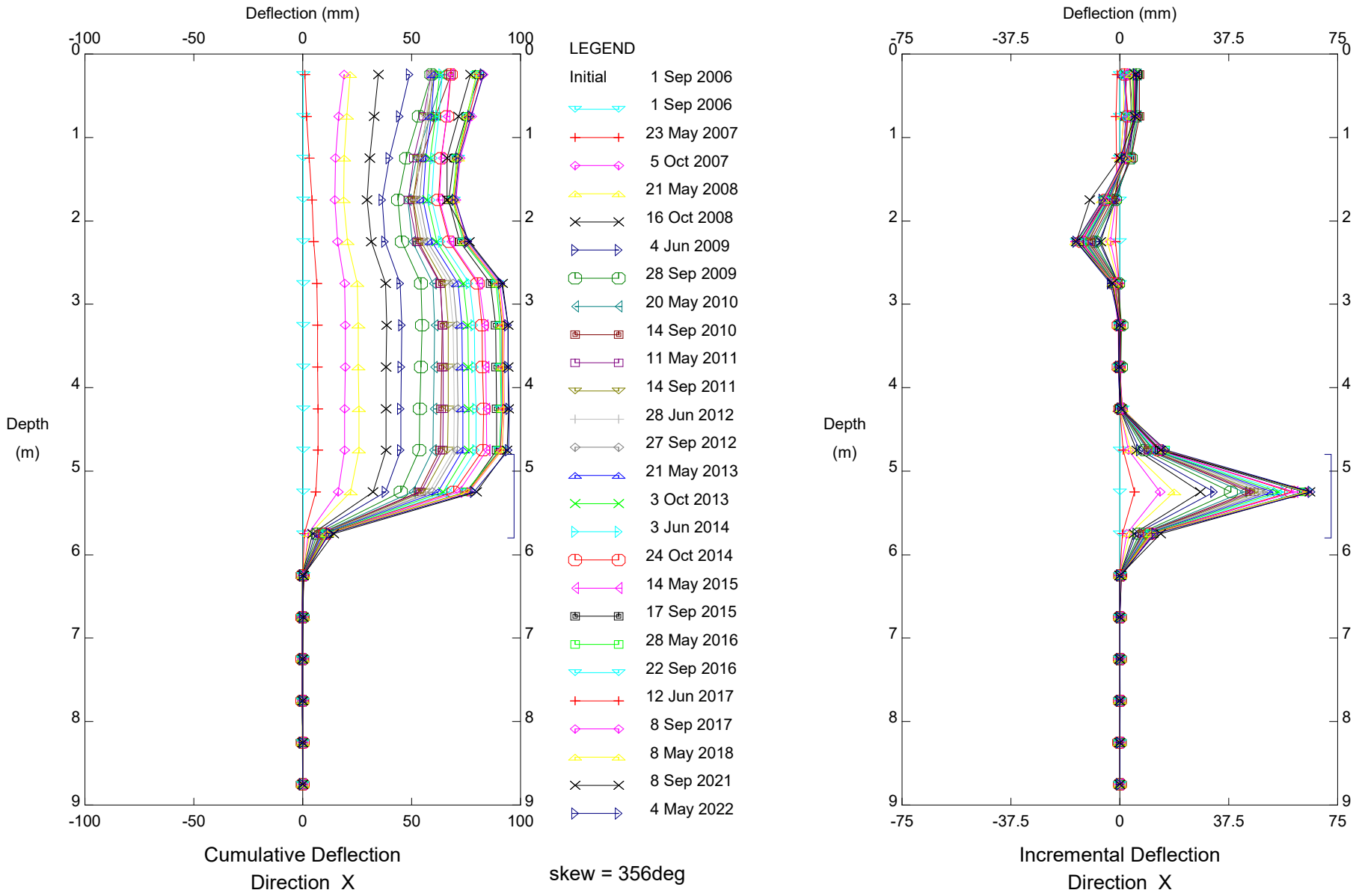


Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

Alberta Transportation

\\CD1001-C200\WORKGROUP\1233\ACTIVE\123315222\03_DATA\FIELD\INSTRUMENTATION\NC031\SI\SI01\N31SI-1R_M_ALL.GTL

Stantec Consulting Ltd - Edmonton

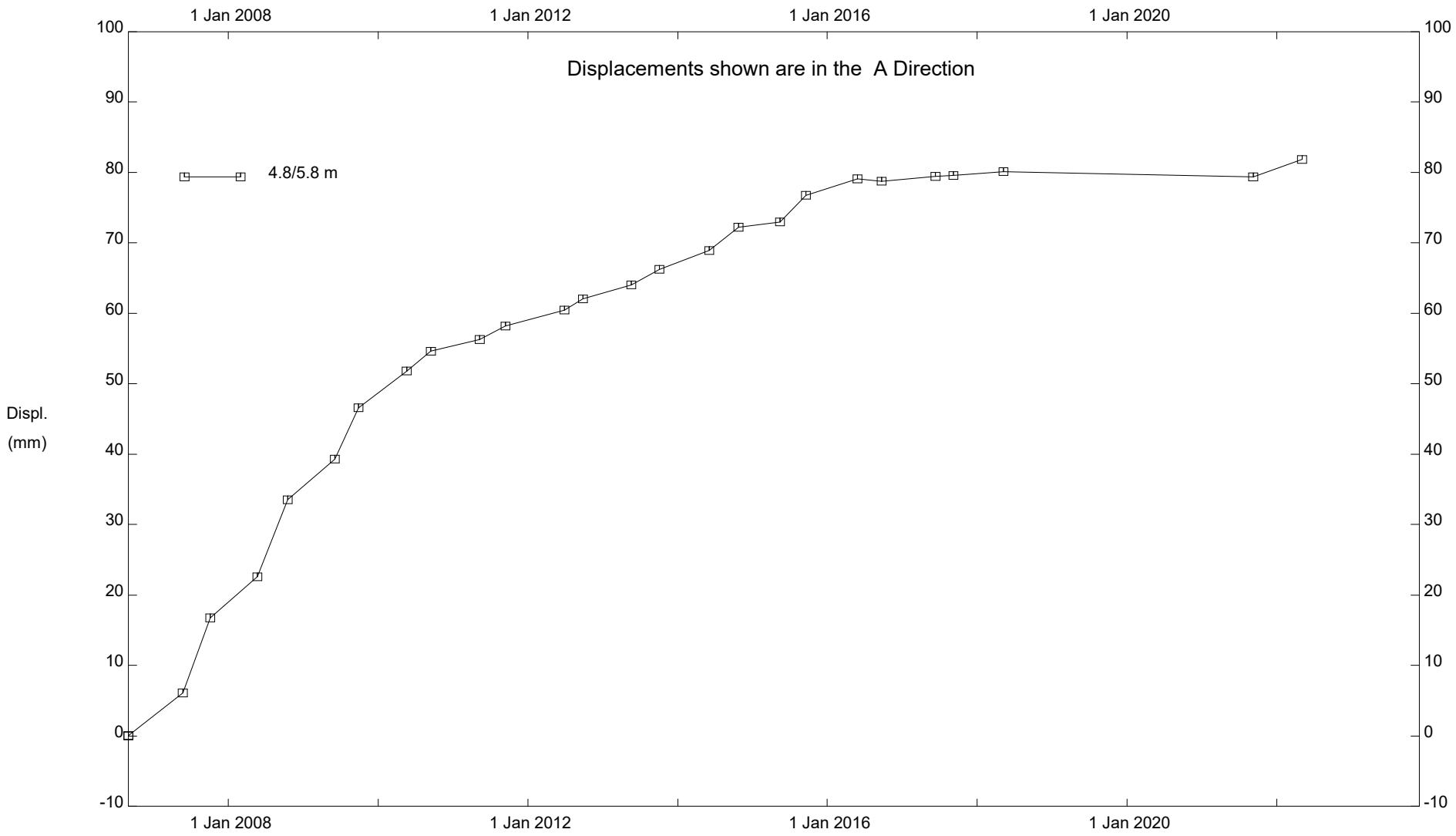


Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

Alberta Transportation

\\CD1001-C200\WORKGROUP\1233\ACTIVE\123315222\03_DATA\FIELD\INSTRUMENTATION\NC031\SI\SI01\N31SI-1R_M_ALL.GTL

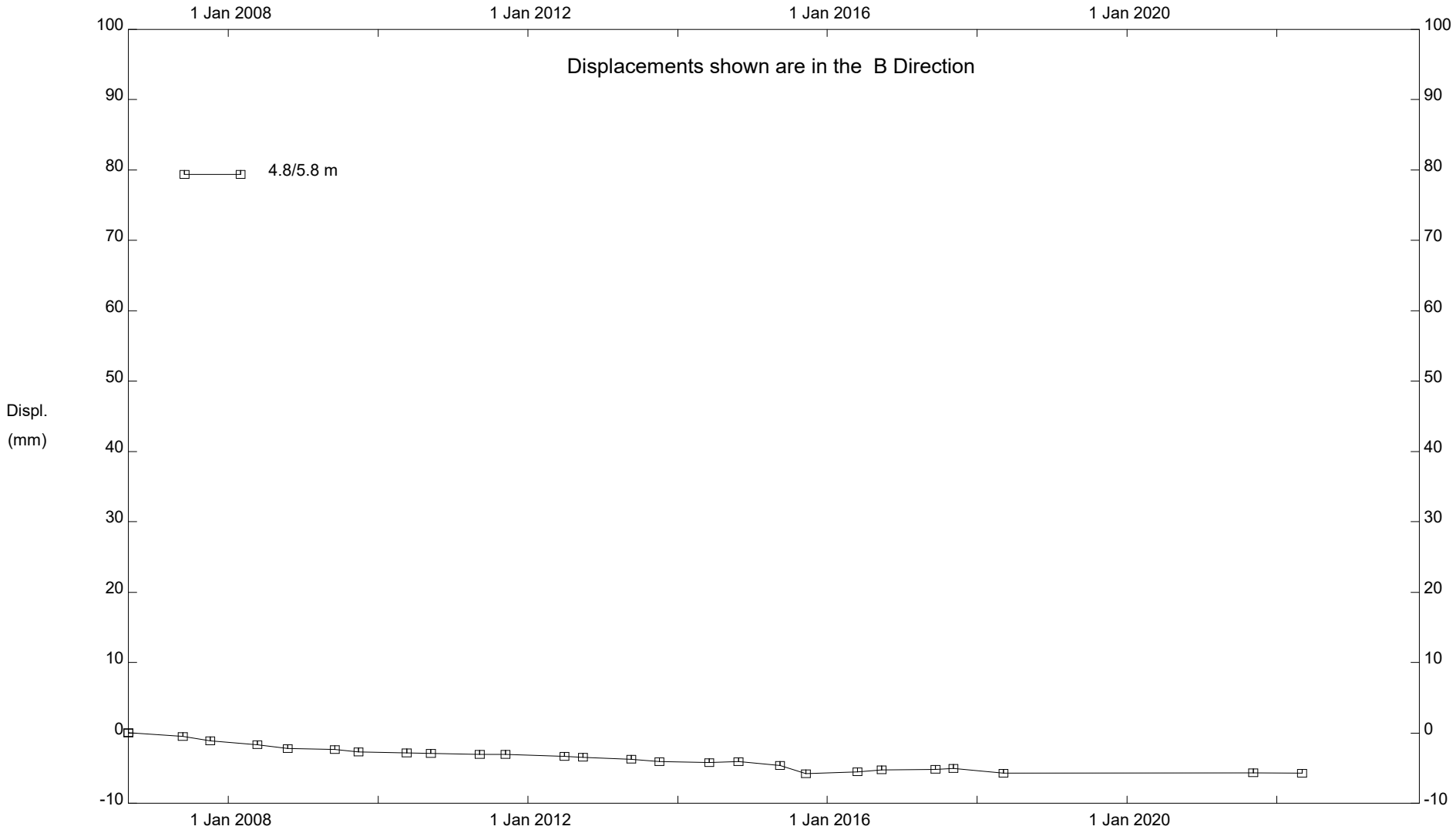
Stantec Consulting Ltd - Edmonton



Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

Alberta Transportation

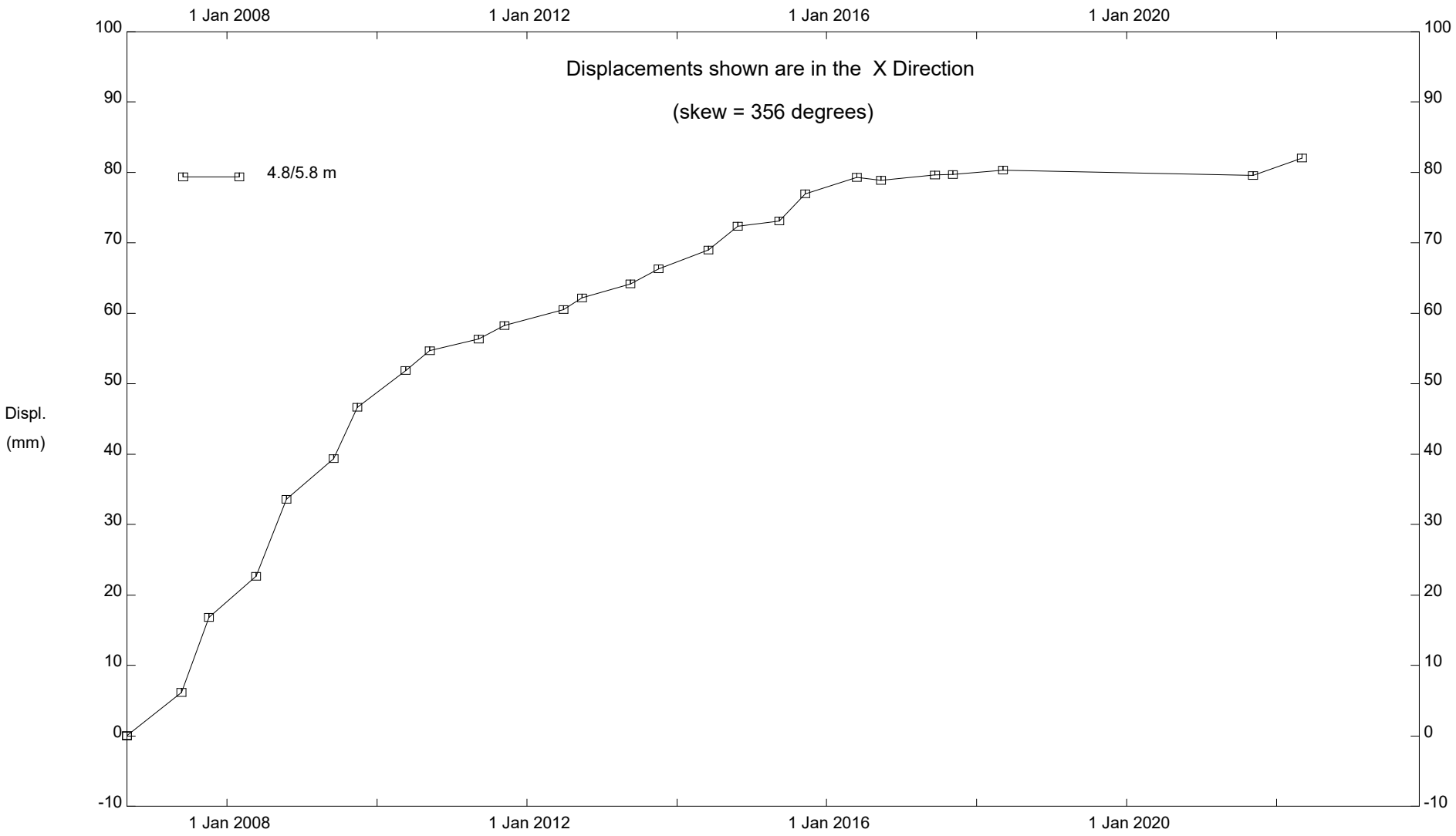
Stantec Consulting Ltd - Edmonton



Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

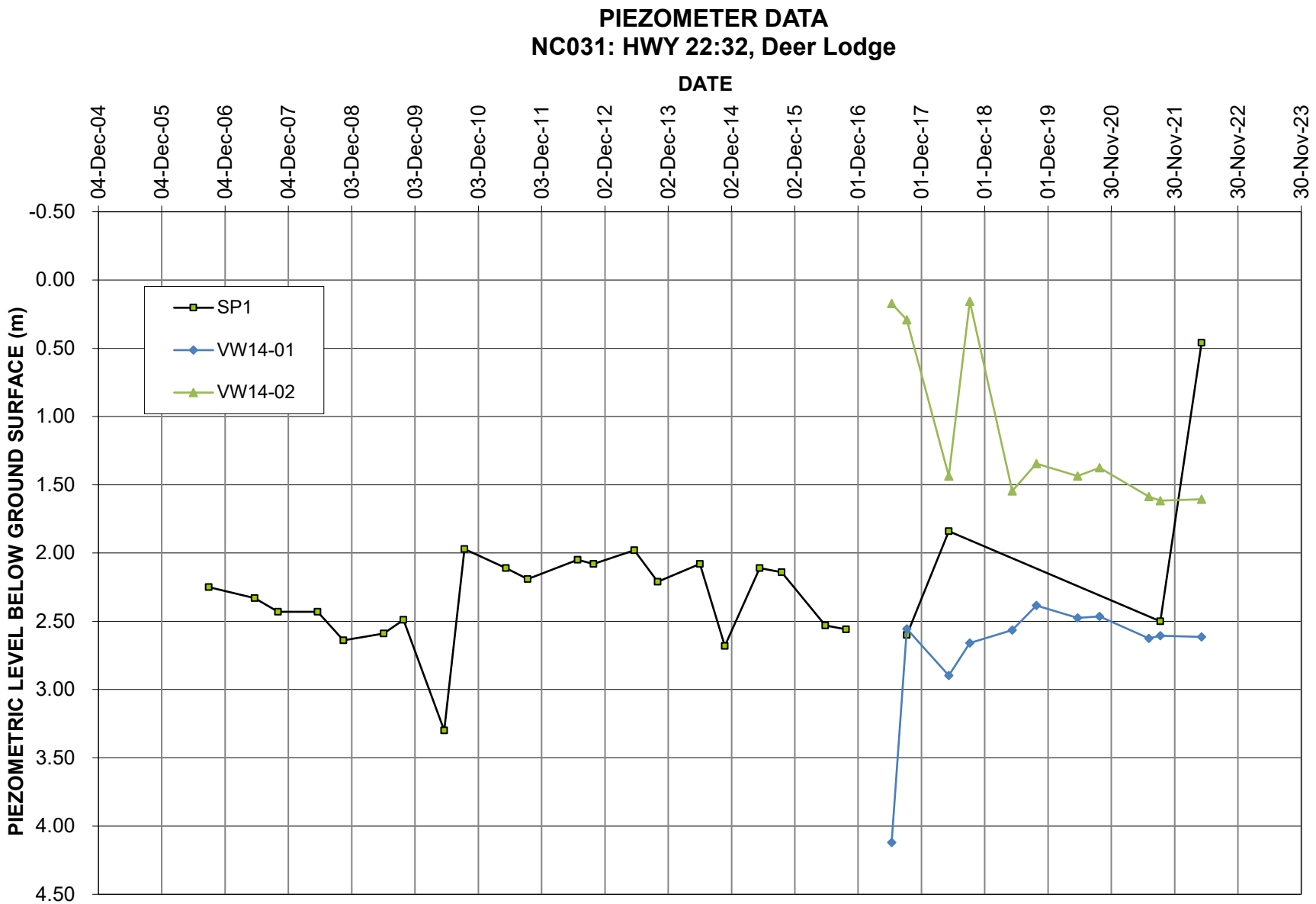
Alberta Transportation

Stantec Consulting Ltd - Edmonton



Hwy 22:32 Deer Lodge(km29.9) (NC031), Inclinometer SI-1R

Alberta Transportation


PIEZOMETER DATA
NC031: HWY 22:32, Deer Lodge
DATE
04-Dec-04
04-Dec-05
04-Dec-06
04-Dec-07
03-Dec-08
03-Dec-09
03-Dec-10
03-Dec-11
02-Dec-12
02-Dec-13
02-Dec-14
02-Dec-15
01-Dec-16
01-Dec-17
01-Dec-18
01-Dec-19
30-Nov-20
30-Nov-21
30-Nov-22
30-Nov-23
PIEZOMETRIC LEVEL BELOW GROUND SURFACE (m)
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
SP1
VW14-01
VW14-02