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14 April 2023

Ms. Melody A. Adams
PNW/BC Area Project Manager
WM
7227 NE 55th Avenue
Portland, Oregon 97218

**Subject: 2022 Annual Geotechnical Monitoring Report**

**Riverbend Landfill**

**McMinnville, Oregon**

Dear Ms. Adams:

Geosyntec is pleased to present this summary of the 2022 geotechnical monitoring program for the mechanically stabilized earth (MSE) berm at the Riverbend Landfill (the Site). Monitoring of the geotechnical instrumentation at the Site was performed in general accordance with the MSE Berm Stability Monitoring Plan (SMP, Geosyntec 2015). This report presents a summary of the monitoring instrumentation, a summary and assessment of the geotechnical monitoring measurements in 2022, and recommendations for future monitoring.

The instrumentation readings were collected by Riverbend Landfill Co. personnel throughout 2022. The interpretation of the readings and this letter report were prepared by Zachary Tanguay (Geosyntec). The report was reviewed by Nicholas Yafrate (Geosyntec) in accordance with the quality assurance policies of Geosyntec.

## SUMMARY OF MSE BERM CONSTRUCTION AND LANDFILL ACTIVITY

The location of the MSE Berm is shown in Figure 1. The MSE Berm was constructed in two phases. Phase 1A of MSE Berm construction, which began in November 2013 and was completed in September 2014, includes the MSE Berm between stations 9+25 and 21+18 with final elevations[1] ranging between 184 ft and 172 ft. Construction of the remainder of the MSE Berm (Phase 1B, stations 0+00 to 9+25 with final elevations ranging between 158 ft and 186 ft) began in August 2015 and was completed in October 2015.

Landfill activity in 2022 included construction of final cover within the instrument influence zones in July through mid-November. Waste placement activities were not performed within the instrument influence zones in 2022. The maximum elevation within the influence zone is

[1] Elevations in this report reference the site-specific vertical datum. As-built survey of instrumentation was by Leland A. MacDonald, LLC of McMinnville, OR.

approximately 270 ft and did not change between the two most recent topographical surveys completed on 27 January 2022 and on 29 January 2023.

## SUMMARY OF GEOTECHNICAL MONITORING INSTRUMENTATION

Geotechnical monitoring instrumentation associated with the MSE Berm was installed in two phases during 2013 and 2014 at the locations shown in Figure 1. A summary of the installation information of slope inclinometers (SIs), extensometers (EXs), and vibrating wire piezometers (PZs) is presented in Table 1. The first phase of instrumentation was installed in September 2013 prior to MSE Berm construction and included the inclinometers and extensometers installed at locations I-1A and I-2A along the proposed exterior toe alignment of the MSE Berm (Geosyntec 2013b). The second phase of instrumentation was installed in June 2014 after construction of the MSE Berm was nearly complete and included the inclinometers, extensometers, and vibrating wire piezometers at locations I-1B and I-2B (Geosyntec 2014). Instrument cluster I-1B was installed through the reinforced fill zone immediately adjacent to the perimeter swale on top of the MSE Berm, and instrument cluster I-2B was installed through the engineered clay fill between the perimeter swale and the road on top of the MSE Berm. The instrumentation is sensitive to landfill activities occurring within approximately 400-ft, as depicted in Figure 1. Monitoring began in 2013; a summary of the monitoring data is included in the attached tables.

## SUMMARY OF 2022 MONITORING MEASUREMENTS

The geotechnical instrument measurement frequency in 2022 was established based on activity within the influence zone of the instruments in general accordance with the SMP and recommendations in Geosyntec's 19 April 2019 memorandum *Recommended Geotechnical Stability Monitoring Frequency*. Measurements were obtained once every two weeks during construction activities, and quarterly during other times of the year. Plots of measurements obtained in 2022 are presented in Attachment A.

### Inclinometer Measurements

Inclinometer measurements represent horizontal displacements of the SI casing at 24-inch vertical intervals perpendicular (A-Direction) and parallel (B-Direction) to the MSE Berm. Measurements from each inclinometer are graphically presented in Attachment A as both incremental displacement (i.e., tilt change) and cumulative displacement (i.e., profile change) versus depth. Incremental plots compare the current reading (i.e., measurement) to the reference reading at each discrete measurement depth and indicate the strain at that depth since the reference reading. The incremental plots presented in Attachment A represent the incremental displacement that occurred in 2022 between the final readings provided in the 2021 annual report (obtained on 5 January 2022) and the final readings obtained in 2022 on 16 December 2022. The cumulative displacement plots show the sum of the incremental displacements between the initial reading, immediately after installation, and the 16 December 2022 reading, from the deepest measurement depth to the

shallowest. The cumulative plots represent the change in shape of the inclinometer since installation.

The maximum incremental displacements and strains observed in each inclinometer since inclinometer installation are presented in Table 2. The largest incremental displacement observed was 0.012 inches in SI-1A in the A-Direction at an elevation of 124 ft, within the grey clay layer. This displacement was measured during and after construction activity within the zone of influence. Plots of incremental displacement (tilt change) versus time, presented for each inclinometer in Attachment A, were used to assess changes in the rate of displacement. Minor increases and decreases in displacement rate occurred throughout 2022.

Displacement rates increased at SI-1A, SI-2A, and SI-2B during final cover construction. However, displacement rates in 2022 were significantly less than those observed during periods of waste placement (e.g., in 2016). Geosyntec compared the incremental displacement rates in 2022 to the recommended alert thresholds provided in Geosyntec's 11 October 2016 memorandum *Recommendations Regarding Recent Slope Stability Measurements.* Exceedances of these thresholds would indicate elevated displacements and trigger additional monitoring or operational action. The measured displacement rates in 2022 did not exceed the thresholds, and Geosyntec did not observe significant changes in the inclinometer displacement rates.

Cumulative (total) strains were calculated as the incremental displacement relative to the initial reading (i.e., since the inclinometer installation) for each measurement interval. Strain at the elevations with the largest incremental displacement since installation is presented for each inclinometer in Table 2. The total magnitude of strain presented in Table 2 ranges from 0.06% in SI-2A (B-direction) at an elevation of 117 ft to 1.78% in SI-1A (A-direction) at an elevation of 124 ft. The calculated maximum change in strain in 2022 ranged from 0.00% in SI-1B (A-Direction) at an elevation of 111 ft and SI-2B (B-direction) at an elevation of 160 ft to 0.05%, which was measured at SI-1A (A-direction) at an elevation of 124 ft.

As shown in the tilt change versus time plots in Attachment A, the rate of displacement measured by the inclinometers did not increase significantly throughout 2022.

Throughout the monitoring period, minor instances of measurement fluctuation were observed. The measurement fluctuation may be due to aging equipment (e.g., inclinometer casings, inclinometer probe, etc.), dirt or other debris in the inclinometer casing grooves, and/or changes in monitoring technicians performing the events. These fluctuations are not indicative of actual soil or MSE Berm displacement.

**Extensometer Measurements**

Extensometer measurements, presented in Attachment A, show the vertical displacement of the soil around each inclinometer at 10-foot vertical intervals. Maximum vertical displacements, calculated relative to the initial sensing ring elevation measured after installation, are provided in Table 3 for each extensometer; the initial sensing ring elevation survey was performed on 27 September 2013 for EX-1A and EX-2A, and on 23 and 24 June 2014 for EX-1B and EX-2B, respectively.

Positive displacement values represent downward displacement (i.e., settlement). The magnitude of vertical displacements since the extensometer installation range from 0.8inch of upward displacement at EX-1A to 6.5 inches of downward displacement at EX-1B. The magnitude of vertical displacements in 2022 ranged from 0.2 inches of upward displacement at EX-1A to 0.5 inches at EX-2B.

**Piezometer Measurements**

Vibrating wire piezometers were installed between 19 June and 23 June 2014 in the foundation soils at instrument clusters I-1B and I-2B. Piezometer measurements are presented in Attachment A. Three piezometers were installed at each location: (i) one piezometer was installed at the mid clay depth (PZ-1B-1 and PZ-2B-1) to assess consolidation induced pore pressures; (ii) one piezometer was installed at a critical surface (PZ-1B-2, and PZ-2B-2) to assess possible shear induced pore pressures in the underlying clay layer; and (iii) one piezometer was installed in the sand layer (PZ-1B-3 and PZ-2B-3) to assess changes in the phreatic groundwater elevation. Consolidation and shear-induced pore pressure cannot be distinguished directly through pore pressure measurements; however, in combination with the extensometer and inclinometer measurements, an assessment of the cause of the pore pressures can be made. Piezometers in the sand beneath the clay can be used to assess whether pore pressure changes measured in the clay are the result of loading or are due to changes in the groundwater table elevation. Piezometer measurements at I-1B and I-2B indicate fluctuations in pore water pressures in the clay and sand layers that are consistent with historic seasonal fluctuations observed at the Site.

## SUMMARY AND CONCLUSIONS

Instrumentation monitoring activities at the Riverbend Landfill in 2022 were initially performed quarterly and the frequency was later increased between May to late September, when the construction activities occurred within the influence zone. Significant changes in displacement rate were not observed in the inclinometers. Extensometer and piezometer measurements obtained throughout 2022 indicated minor settlement and small changes in pore pressure.

The results of monitoring performed in 2022 do not indicate stability concerns. Geosyntec recommends that monitoring continue according to the recommendations of the SMP and the April 2019 memorandum. If landfill activities resume within the instrument influence zones, Geosyntec should be notified, and activity monitoring should be performed according to the above-referenced documents.

Sincerely,

Zachary B Tanguay

Nicholas J Yafrate

Zachary Tanguay, P.E.

Licensed in ME

Engineer

Nicholas Yafrate, P.E.

Licensed in AL, GA, LA, MA, ME, MS, NC, NH, OR, PA

Principal Engineer

EXPIRES: 30 June 2024

Attachments:

Tables

Figure 1

Attachment A – Monitoring Plots

CC: Nicholas Godfrey, WM

**REFERENCES**

Geosyntec (2012a). *Phase 1 MSE Berm Updated Permit Design Report*, Riverbend Landfill Co., 22 March 2012.

Geosyntec (2012b). *Response to 18 December 2012 Comments by Mr. Doug Lindquist (Hart Crowser)*, Riverbend Landfill Co., 26 December 2012

Geosyntec (2013a). *Phase 1 MSE Berm Stability Monitoring Plan (SMP)*, Riverbend Landfill Co., July 2013.

Geosyntec (2013b). *2013 MSE Berm Instrumentation Installation Summary*, Riverbend Landfill Co., 20 November 2013.

Geosyntec (2014). *2014 MSE Berm Instrumentation Installation Summary*, Riverbend Landfill Co., 8 October 2014.

Geosyntec (2016). *Recommendations Regarding Recent Slope Stability Measurements* [Memorandum], Waste Management, 11 October 2016.

Geosyntec (2019). *Recommended Geotechnical Stability Monitoring Frequency* [Memorandum], Waste Management, 19 April 2019.

# Table 1: Summary of Inclinometers, Extensometers and Piezometers
# Riverbend Landfill- McMinnville, Oregon

| Instrument Cluster | Location | | Inclinometer | | | Extensometer | | | Vibrating Wire Piezometers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Northing, Easting (ft) | Ground Surface Elevation (ft MSL) | Instrument | Depth[1] (ft) | Bottom Elevation (ft MSL) | Instrument | Depth[1] (ft) | Bottom Elevation (ft MSL) | Instrument | Tip Elevation (ft MSL) | Depth (ft) |
| **I-1A** | N 3100.4, E 3921.1 | 149.9 | SI-1A | 105.0 | 44.9 | EX-1A | 103.3 | 46.6 | N/A | | |
| **I-1B** | N 3094.8, E 3972.7 | 179.2 | SI-1B | 140.0 | 39.2 | EX-1B | 138.3 | 40.9 | PZ-I1B-1 | 119.7 | 59.5 |
| | | | | | | | | | PZ-I1B-2 | 108.2 | 71.0 |
| | | | | | | | | | PZ-I1B-3 | 93.2 | 86.0 |
| **I-2A** | N 2583.2, E 3940.6 | 138.5 | SI-2A | 79.7 | 58.8 | EX-2A | 78.2 | 60.3 | N/A | | |
| **I-2B** | N 2688.4, E 3989.6 | 171.9 | SI-2B | 112.5 | 59.4 | EX-2B | 110.7 | 61.2 | PZ-I2B-1 | 129.4 | 42.5 |
| | | | | | | | | | PZ-I2B-2 | 119.4 | 52.5 |
| | | | | | | | | | PZ-I2B-3 | 86.9 | 85.0 |

Note:
(1) Depth is the depth below ground surface.
(2) Elevations in this report reference the site specific vertical datum used to design and construct the Phase 1A MSE Berm. Elevations are from the time of installation.

# Table 2: Inclinometer Maximum Total Incremental Displacement and Strain
# Riverbend Landfill- McMinnville, Oregon

| Inclinometer | Ground Surface Elevation (ft) | Elevation of Maximum Displacement(1) (ft) | Incremental Displacement from Time of Installation to December 2021 (in.) | Incremental Displacement from Time of Installation through December 2022 (in.) | Incremental Displacement in 2022(2) (in.) | Total Strain from Time of Installation through December 2022(3) (%) | Change in Strain in 2022(3) (%) | Geotechnical Layer (Stratum) |
|---|---|---|---|---|---|---|---|---|
| SI-1A: A-Direction | 149.9 | 124 | 0.414 | 0.426 | 0.012 | 1.78 | 0.05 | Grey Clay |
| SI-1A: B-Direction | 149.9 | 76 | 0.024 | 0.021 | -0.003 | 0.09 | 0.01 | Sand |
| SI-1B: A-Direction | 179.2 | 111 | 0.376 | 0.377 | 0.001 | 1.57 | 0.00 | Grey Clay |
| SI-1B: B-Direction | 179.2 | 167 | 0.054 | 0.056 | 0.002 | 0.23 | 0.01 | Engineered Fill |
| SI-2A: A-Direction | 138.5 | 117 | 0.066 | 0.074 | 0.008 | 0.31 | 0.03 | Brown Clay |
| SI-2A: B-Direction | 138.5 | 117 | 0.017 | 0.015 | -0.002 | 0.06 | 0.01 | Brown Clay |
| SI-2B: A-Direction | 171.9 | 122 | 0.068 | 0.072 | 0.004 | 0.30 | 0.02 | Brown Clay |
| SI-2B: B-Direction | 171.9 | 160 | 0.080 | 0.081 | 0.001 | 0.34 | 0.00 | Engineered Fill |

Notes:

(1) Elevations presented are the elevations at which the most incremental displacement has occurred since installation of the inclinometer.

(2) Incremental displacement in this column corresponds to the incremental displacement on the tilt change versus time plots presented in Attachment A.

(3) Strain is calculated as the incremental displacement between any two points divided by the vertical distance between those two points (i.e. 2 vertical feet).

(4) Measurements within the top 10 to 12 feet of the inclinometers are generally disregarded because they are influenced by surface effects (e.g. construction equipment, freeze thaw, etc.) and therefore are not included in the above table.

(5) Elevations in this report reference the site specific vertical datum used to design and construct the Phase 1A MSE Berm. Elevations are from the time of installation.

# Table 3: Extensometer Maximum Vertical Displacement Since Installation
# Riverbend Landfill- McMinnville, Oregon

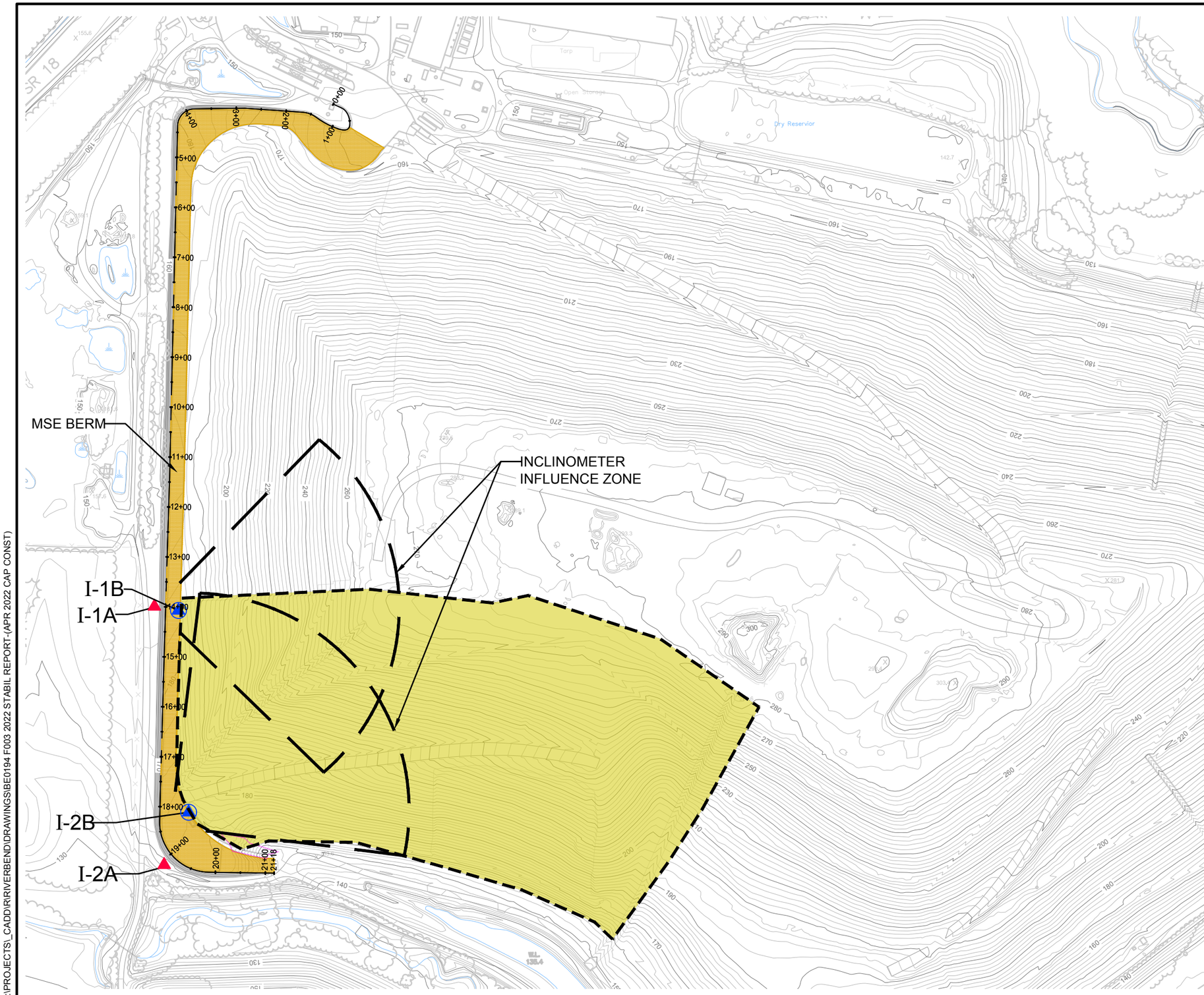
| Extensometer | Initial Ground Surface Elevation (ft) (2) | Sensing Ring (No.) | Elevation of Ring Installation (ft) | Elevation as of December 2021 (ft) | Elevation as of December 2022 (ft)(3) | Maximum Vertical Displacement Since Installation (in)(1) | Maximum Vertical Displacement in 2022 (in) |
|---|---|---|---|---|---|---|---|
| EX-1A | 149.9 | 3 | 75.14 | 75.19 | 75.21 | -0.8 | -0.2 |
| EX-1B | 179.2 | 14 | 182.28 | 181.74 | 181.74 | 6.5 | 0.0 |
| EX-2A | 138.5 | 8 | 139.31 | 139.19 | 139.19 | 1.4 | 0.0 |
| EX-2B | 171.9 | 10 | 162.08 | 161.87 | 161.83 | 3.0 | 0.5 |

Note:

(1) Vertical displacement is calculated as the difference between the initial elevation and the current elevation reading. Positive values represent downward displacement (settlement) and negative values represent upward displacement.

(2) Elevations in this report reference the site specific vertical datum used to design and construct the Phase 1A MSE Berm. Initial ground surface elevations are from the time of installation.

(3) The calculated maximum vertical displacement in 2022 represents the displacement observed from early January 2022 to December 2022.




N

0 200' 400'

SCALE IN FEET

## LEGEND

- EXISTING GRADE 10 FT CONTOUR
- EXISTING GRADE 2 FT CONTOUR
- INCLINOMETER AND EXTENSOMETER
- INCLINOMETER AND EXTENSOMETER AND PIEZOMETER
- APPROXIMATE LIMIT OF 2022 CAP CONSTRUCTION
- BUILDING / STRUCTURE
- SURFACE WATER

NOTES:

1. I-1A AND I-2A WERE INSTALLED BETWEEN 21 SEPTEMBER 2013 AND 26 SEPTEMBER 2013, AND I-1B AND I-2B WERE INSTALLED BETWEEN 16 JUNE 2014 AND 23 JUNE 2014 BY GEOSYNTEC CONSULTANTS AND HARDCORE DRILLING.
2. THE EXISTING GRADES SHOWN ARE FROM A FIELD SURVEY PERFORMED 29 JANUARY 2023 AND PROVIDED TO GEOSYNTEC ON 06 MARCH 2023. AS THE SITE IS AN ACTIVE LANDFILL, TOPOGRAPHY MAY HAVE CHANGED SINCE THE SURVEY.

2022 GEOTECHNICAL MONITORING REPORT
MONITORING INSTRUMENT LOCATIONS
AND LANDFILL ACTIVITY
RIVERBEND LANDFILL
MCMINNVILLE, OREGON

Geosyntec consultants

Acton, MA | APRIL 2023

Figure: 1

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# ATTACHMENT A
# STABILITY MONITORING PLOTS

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WASTE MANAGEMENT

# Summary of Geotechnical Monitoring Measurements
## 2022
## Riverbend Landfill, McMinnville, Oregon
## Riverbend Landfill Incorporated / Waste Management

| I-1A | | I-2A | | I-1B | | I-2B | |
|---|---|---|---|---|---|---|---|
| Reading Date | Comment | Reading Date | Comment | Reading Date | Comment | Reading Date | Comment |
| 9-Nov-2021 | Reference Reading | 9-Nov-2021 | Reference Reading | 9-Nov-2021 | Reference Reading | 9-Nov-2021 | Reference Reading |
| 5-Jan-2022 | Activity Monitoring | 5-Jan-2022 | Post Activity Monitoring | 5-Jan-2022 | Post Activity Monitoring | 5-Jan-2022 | Post Activity Monitoring |
| 14-Apr-2022 | Activity Monitoring | 14-Apr-2022 | Post Activity Monitoring | 14-Apr-2022 | Post Activity Monitoring | 14-Apr-2022 | Post Activity Monitoring |
| 24-May-2022 | Activity Monitoring | 24-May-2022 | Activity Monitoring | 24-May-2022 | Activity Monitoring | 24-May-2022 | Activity Monitoring |
| 31-May-2022 | Activity Monitoring | 31-May-2022 | Activity Monitoring | 31-May-2022 | Activity Monitoring | 31-May-2022 | Activity Monitoring |
| 7-Jun-2022 | Activity Monitoring | 7-Jun-2022 | Activity Monitoring | 7-Jun-2022 | Activity Monitoring | 7-Jun-2022 | Activity Monitoring |
| 22-Jul-2022 | Activity Monitoring | 22-Jul-2022 | Activity Monitoring | 22-Jul-2022 | Activity Monitoring | 22-Jul-2022 | Activity Monitoring |
| 5-Aug-2022 | Activity Monitoring | 5-Aug-2022 | Activity Monitoring | 5-Aug-2022 | Activity Monitoring | 5-Aug-2022 | Activity Monitoring |
| 19-Aug-2022 | Activity Monitoring | 19-Aug-2022 | Activity Monitoring | 19-Aug-2022 | Activity Monitoring | 19-Aug-2022 | Activity Monitoring |
| 26-Aug-2022 | Activity Monitoring | 26-Aug-2022 | Activity Monitoring | 26-Aug-2022 | Activity Monitoring | 26-Aug-2022 | Activity Monitoring |
| 9-Sep-2022 | Activity Monitoring | 9-Sep-2022 | Activity Monitoring | 9-Sep-2022 | Activity Monitoring | 9-Sep-2022 | Activity Monitoring |
| 30-Sep-2022 | Activity Monitoring | 30-Sep-2022 | Activity Monitoring | 30-Sep-2022 | Activity Monitoring | 30-Sep-2022 | Activity Monitoring |
| 10-Oct-2022 | Activity Monitoring | 10-Oct-2022 | Activity Monitoring | 10-Oct-2022 | Note 5 | 10-Oct-2022 | Activity Monitoring |
| 1-Nov-2022 | Activity Monitoring | 1-Nov-2022 | Activity Monitoring | 1-Nov-2022 | Note 5 | 1-Nov-2022 | Activity Monitoring |
| 18-Nov-2022 | Activity Monitoring | 18-Nov-2022 | Activity Monitoring | 18-Nov-2022 | Activity Monitoring | 18-Nov-2022 | Activity Monitoring |
| 2-Dec-2022 | Post Activity Monitoring | 2-Dec-2022 | Post Activity Monitoring | 2-Dec-2022 | Post Activity Monitoring | 2-Dec-2022 | Post Activity Monitoring |
| 16-Dec-2022 | Post Activity Monitoring | 16-Dec-2022 | Post Activity Monitoring | 16-Dec-2022 | Post Activity Monitoring | 16-Dec-2022 | Post Activity Monitoring |

Notes:

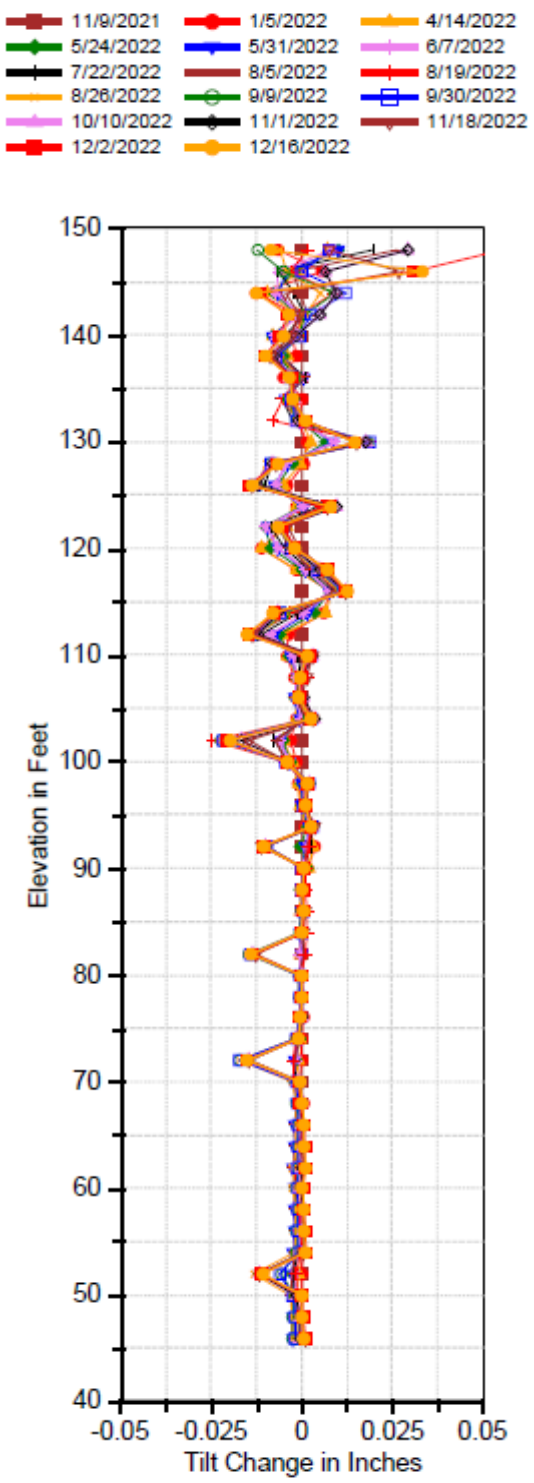
1. Incremental (Tilt) and cumulative (Profile) displacement plots are presented on the following pages. Incremental tilt readings are calculated from the reference reading at each discrete measurement depth. The reference reading is defined as the most recent reading of the previous reporting period. Cumulative profile plots represent the sum of the incremental displacements between the current reading and the initial reading from the bottom of the inclinometer up to each discrete depth.
2. Instrument cluster I-1A was installed on 24 September 2013 adjacent to (west of) the toe of the MSE Berm. Instrument cluster I-2A was installed on 26 September 2013 adjacent to (southwest of) the toe of the MSE Berm. Initial readings for SI-1A and SI-2A were taken on 27 September 2013.
3. Instrument cluster I-1B was installed on 23 June 2014 adjacent to liner anchor trench along the east side of the MSE Berm. Instrument cluster I-2B was installed on 23 June 2014 adjacent to the liner anchor trench along the inner (east) side of the MSE Berm. Initial readings for SI-1B and SI-2B were taken on 23 June 2014.
4. Directions 'A' and 'B' noted on the plots indicate the axis (i.e., plane) of measurement from which readings are taken. The 'A-Direction' measurements indicate displacements perpendicular to the MSE Berm. The 'B-Direction' measurements indicate displacements parallel to the MSE Berm.
5. Measurerments are not presented due to instrument measurement fluctuation.

# RIVERBEND LANDFILL

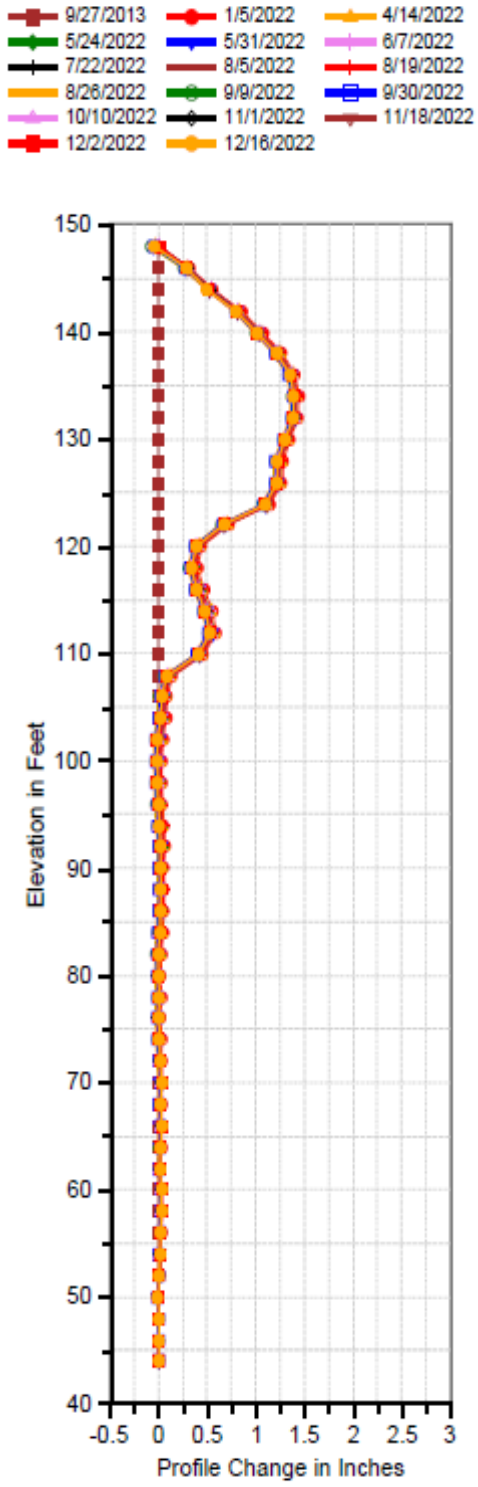
# INCLINOMETER SI-1A

Riverbend Landfill
Inclinometer Measurements

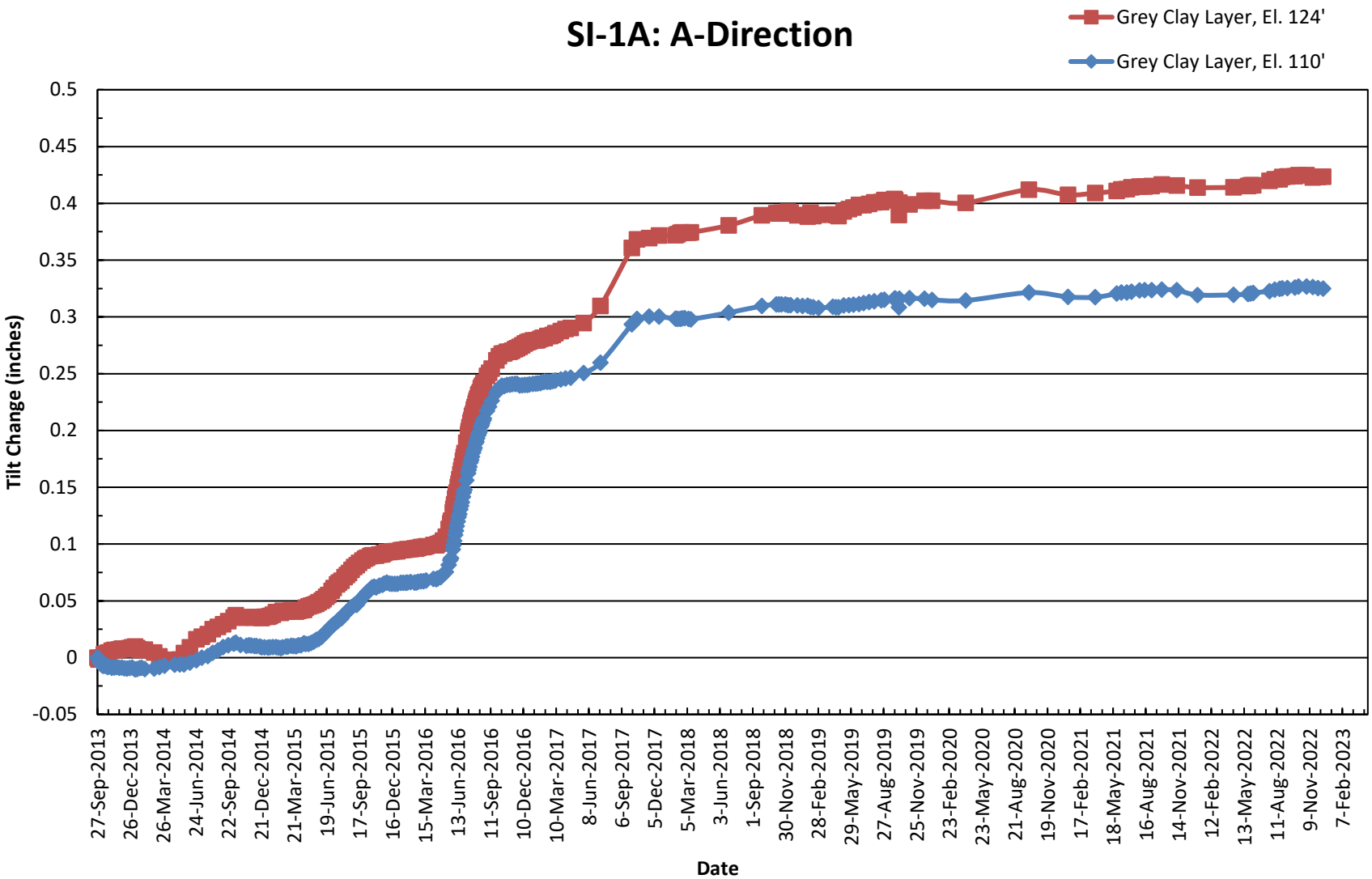
I-1A:A-Direction Incremental Tilt




I-1A:A-Direction Cumulative Profile



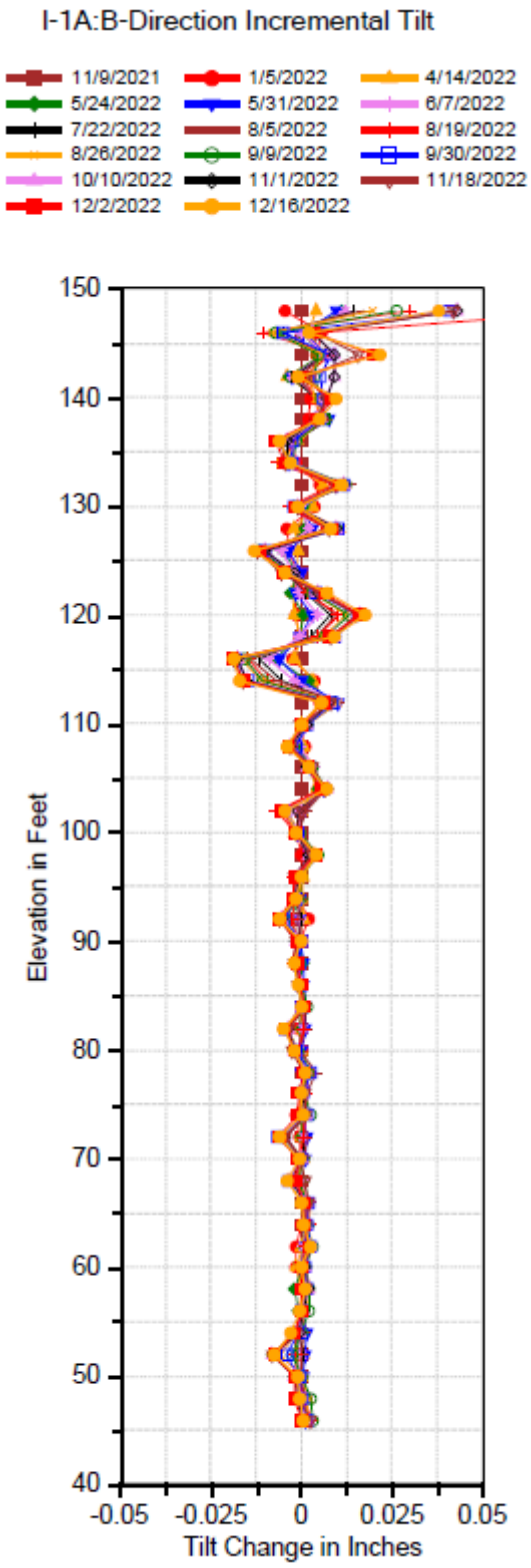
# Riverbend Landfill
# Inclinometer Measurements
# SI-1A: A-Direction

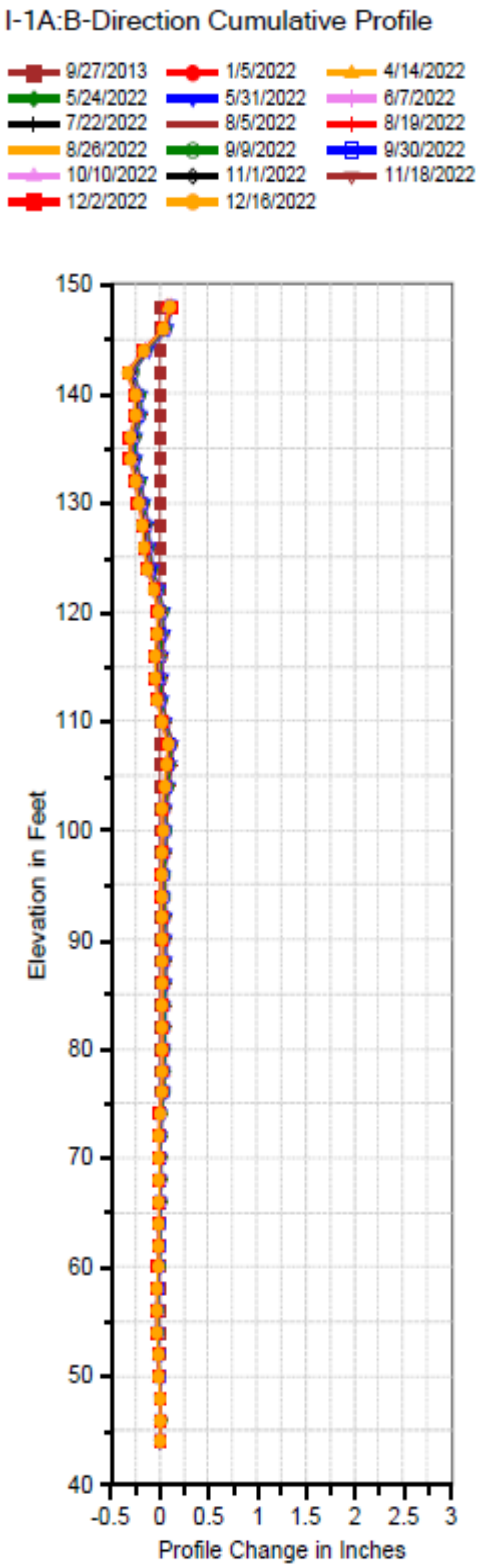



**Note:**

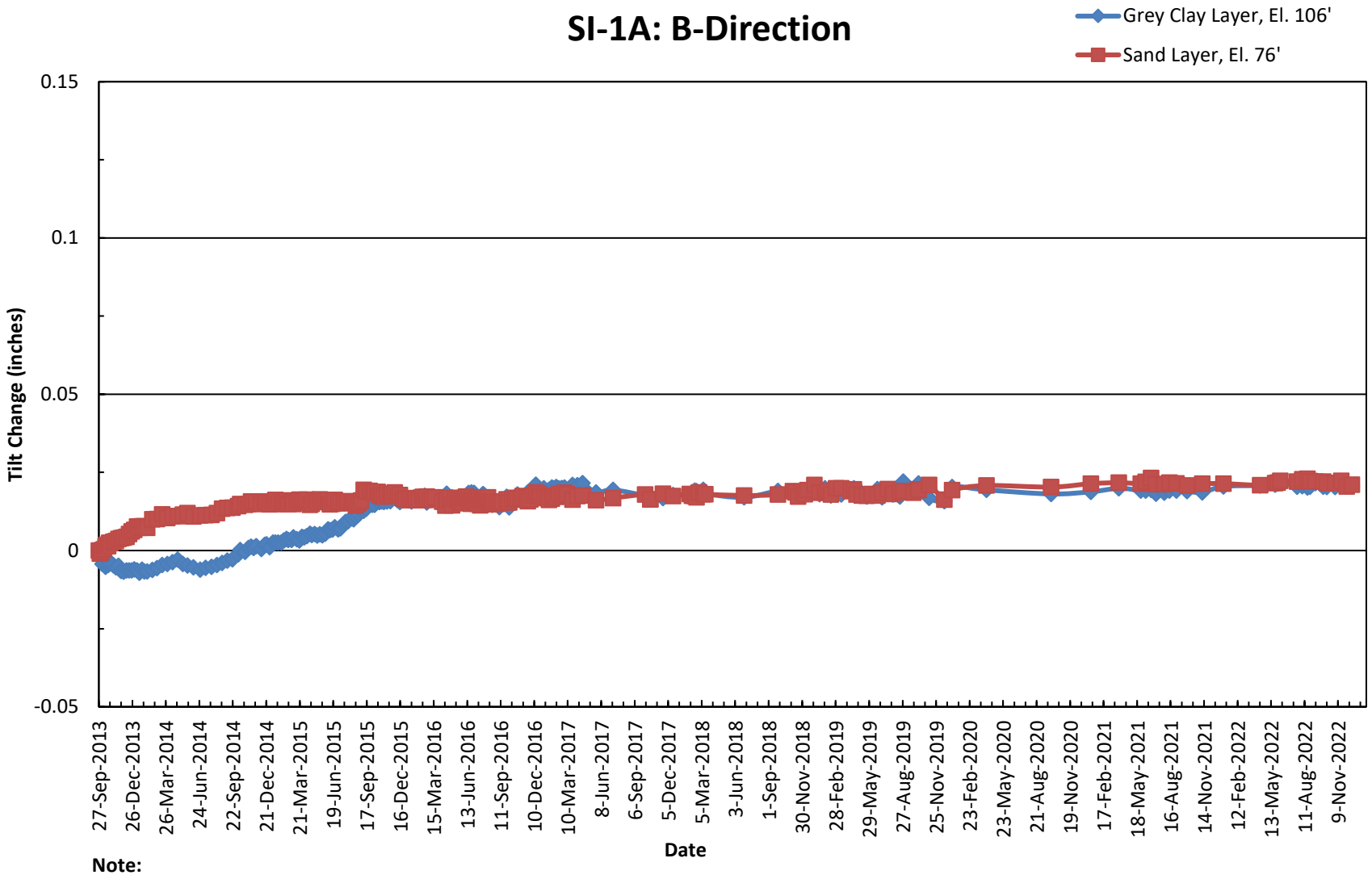
**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

Riverbend Landfill
Inclinometer Measurements



# Riverbend Landfill
# Inclinometer Measurements
# SI-1A: B-Direction

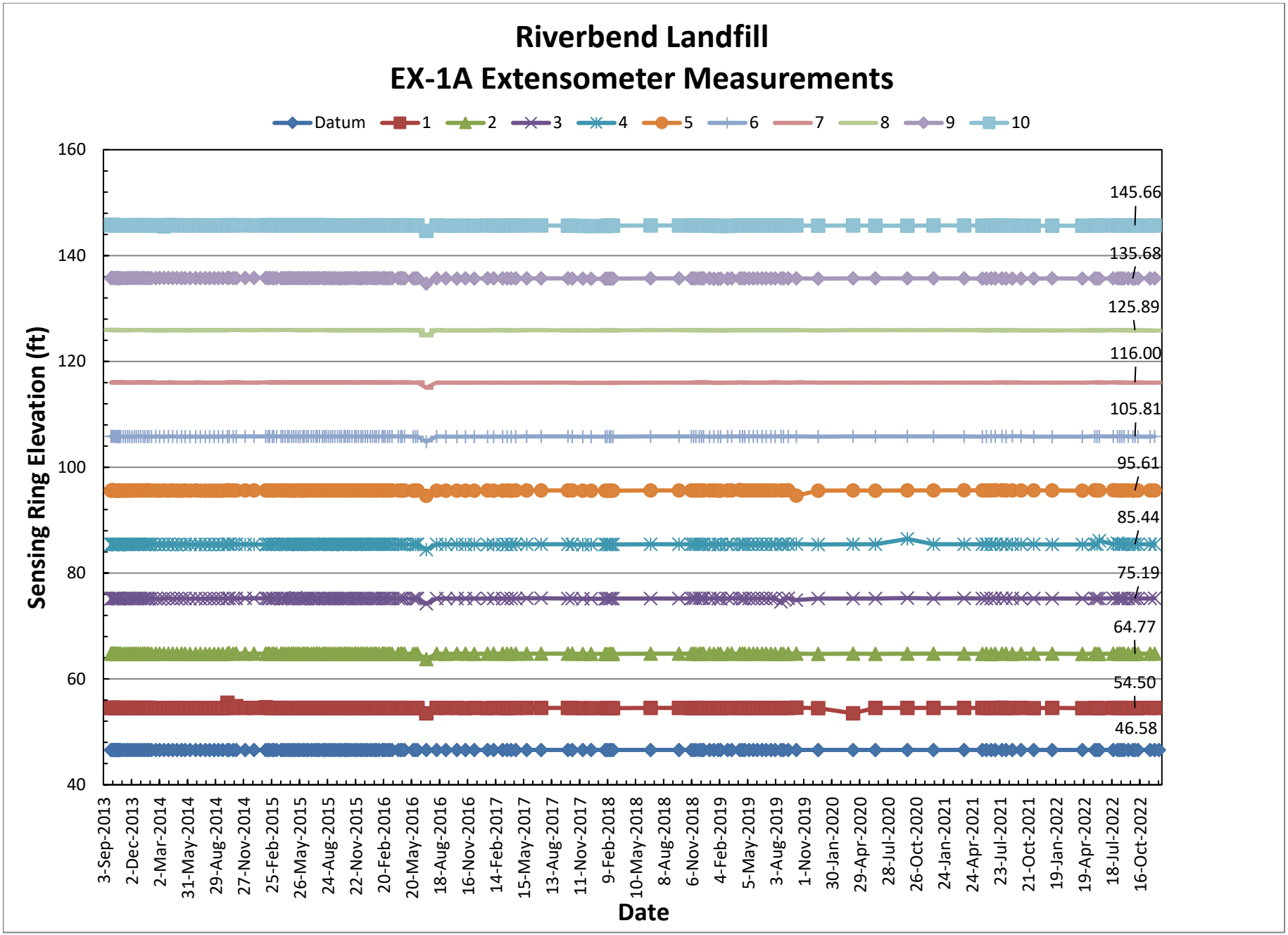



**Note:**

**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

# RIVERBEND LANDFILL

# EXTENSOMETER EX-1A

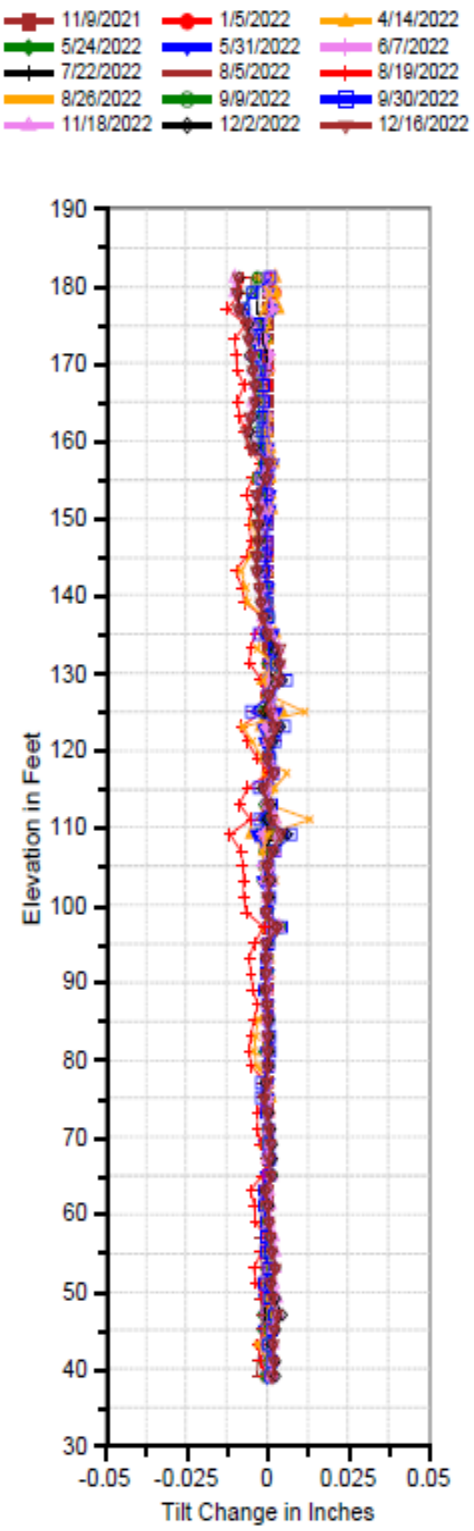

Riverbend Landfill
EX-1A Extensometer Measurements
Datum
1
2
3
4
5
6
7
8
9
10
Sensing Ring Elevation (ft)
160
140
120
100
80
60
40
145.66
135.68
125.89
116.00
105.81
95.61
85.44
75.19
64.77
54.50
46.58
3-Sep-2013
2-Dec-2013
2-Mar-2014
31-May-2014
29-Aug-2014
27-Nov-2014
25-Feb-2015
26-May-2015
24-Aug-2015
22-Nov-2015
20-Feb-2016
20-May-2016
18-Aug-2016
16-Nov-2016
14-Feb-2017
15-May-2017
13-Aug-2017
11-Nov-2017
9-Feb-2018
10-May-2018
8-Aug-2018
6-Nov-2018
4-Feb-2019
5-May-2019
3-Aug-2019
1-Nov-2019
30-Jan-2020
29-Apr-2020
28-Jul-2020
26-Oct-2020
24-Jan-2021
24-Apr-2021
23-Jul-2021
21-Oct-2021
19-Jan-2022
19-Apr-2022
18-Jul-2022
16-Oct-2022
Date

# RIVERBEND LANDFILL

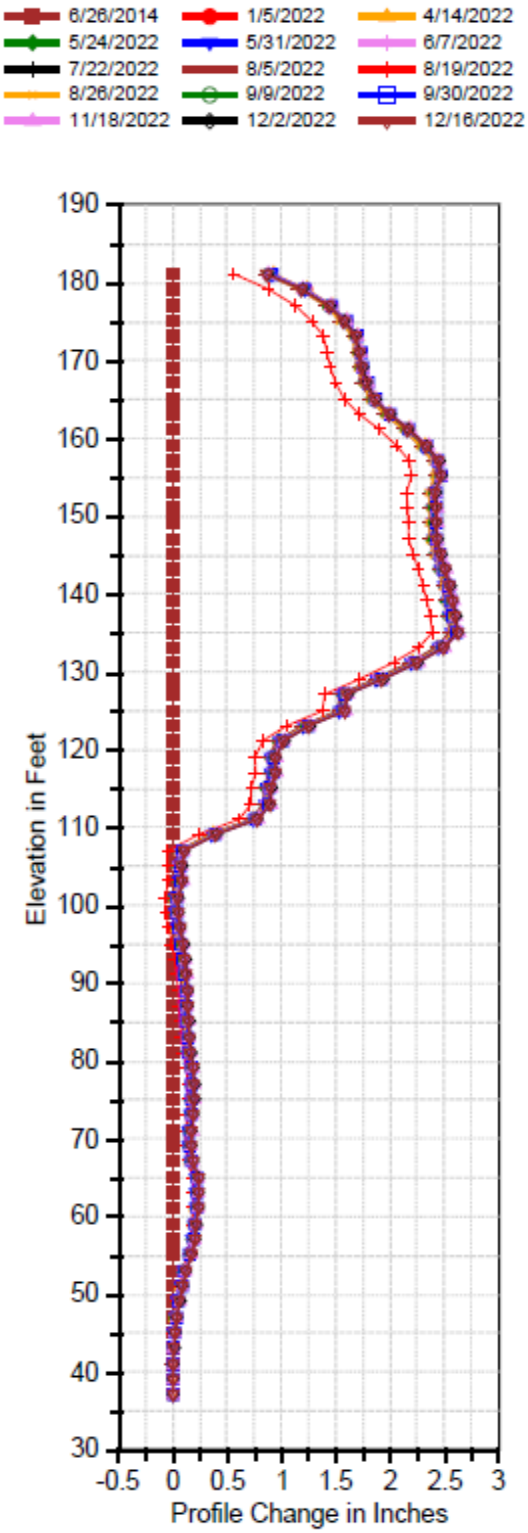
# INCLINOMETER SI-1B

Riverbend Landfill
Inclinometer Measurements

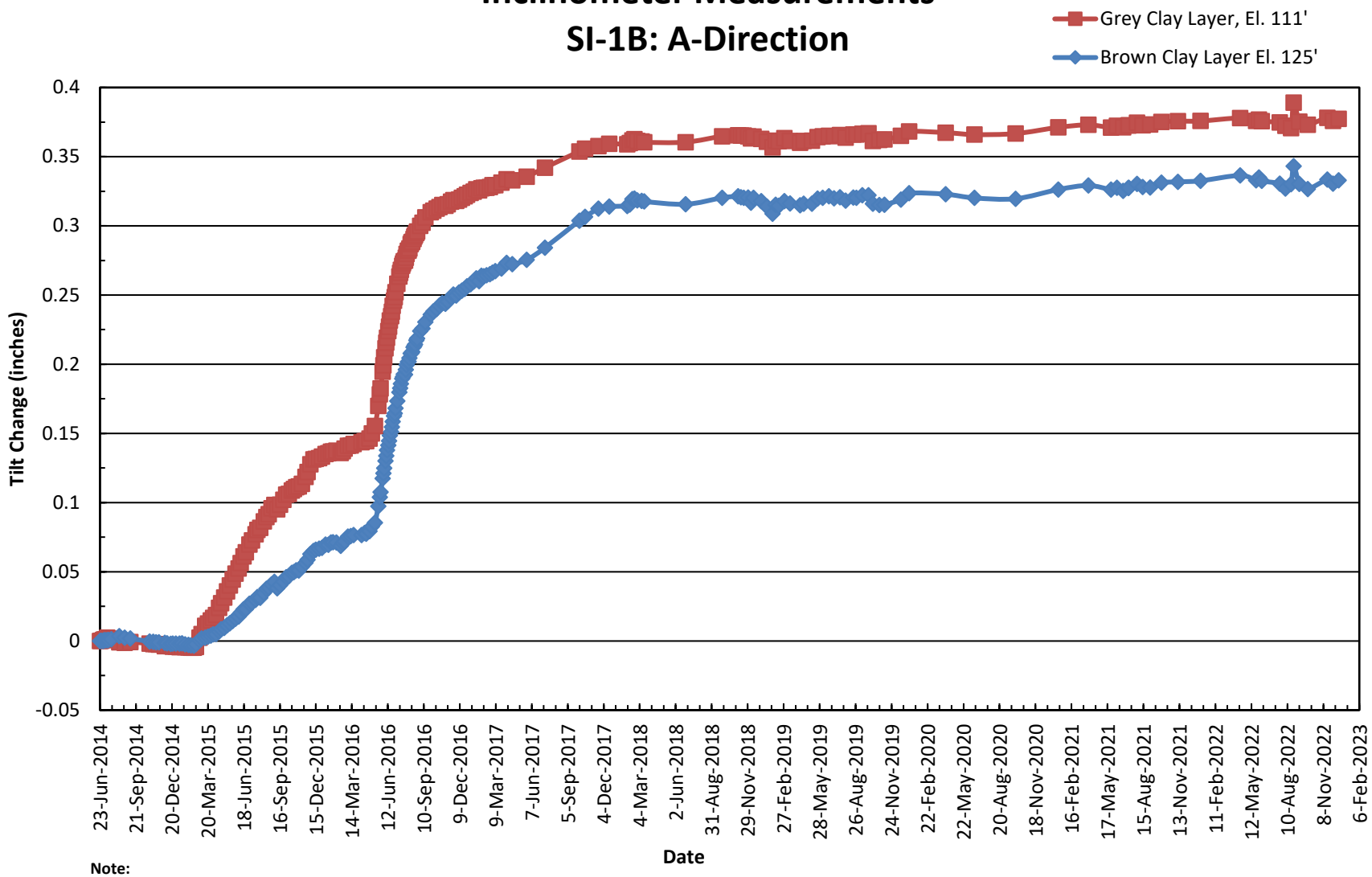
I-1B:A-Direction Incremental Tilt




I-1B:A-Direction Cumulative Profile



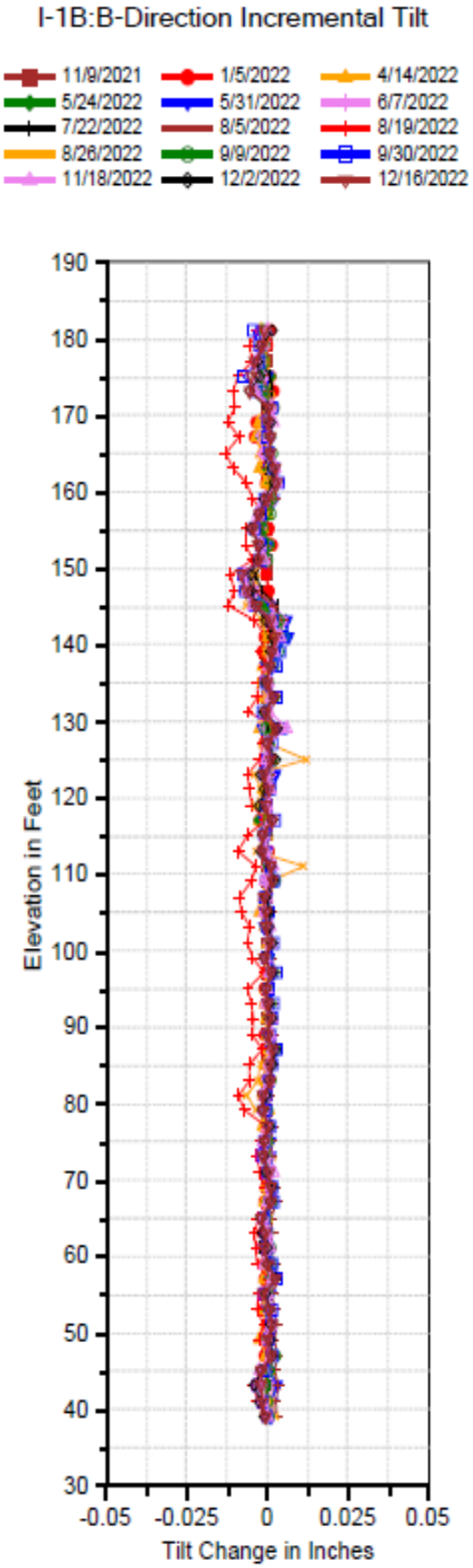
# Riverbend Landfill
# Inclinometer Measurements
# SI-1B: A-Direction

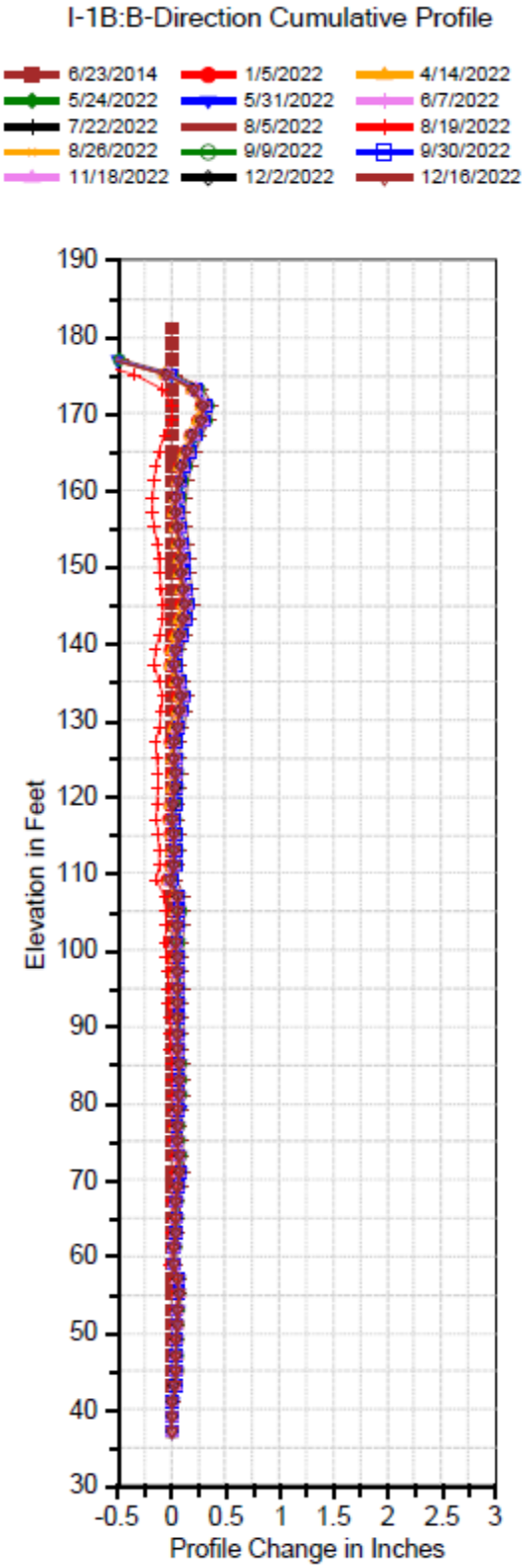



**Note:**

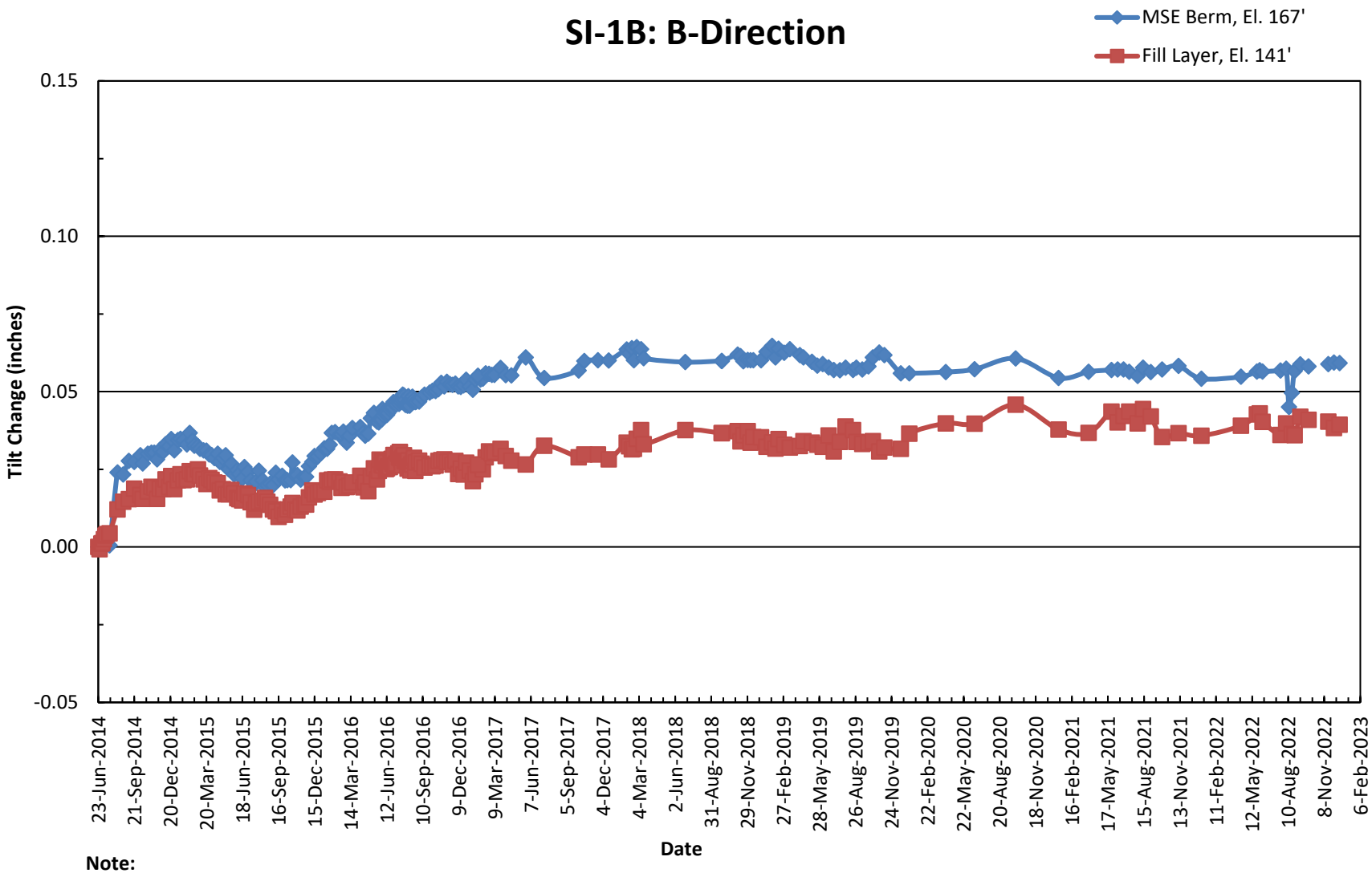
**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

Riverbend Landfill
Inclinometer Measurements



# Riverbend Landfill
# Inclinometer Measurements
# SI-1B: B-Direction

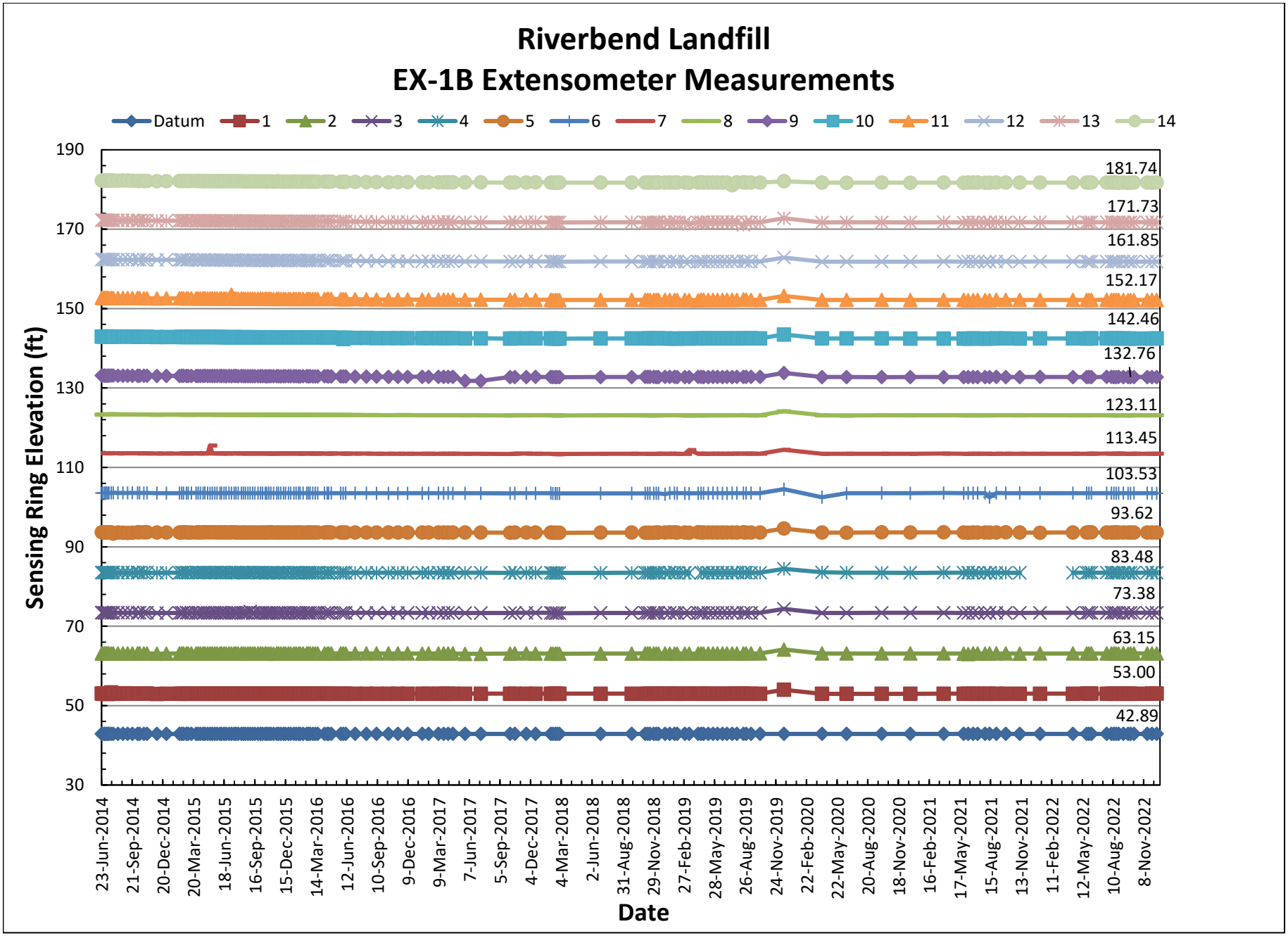



**Note:**

**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

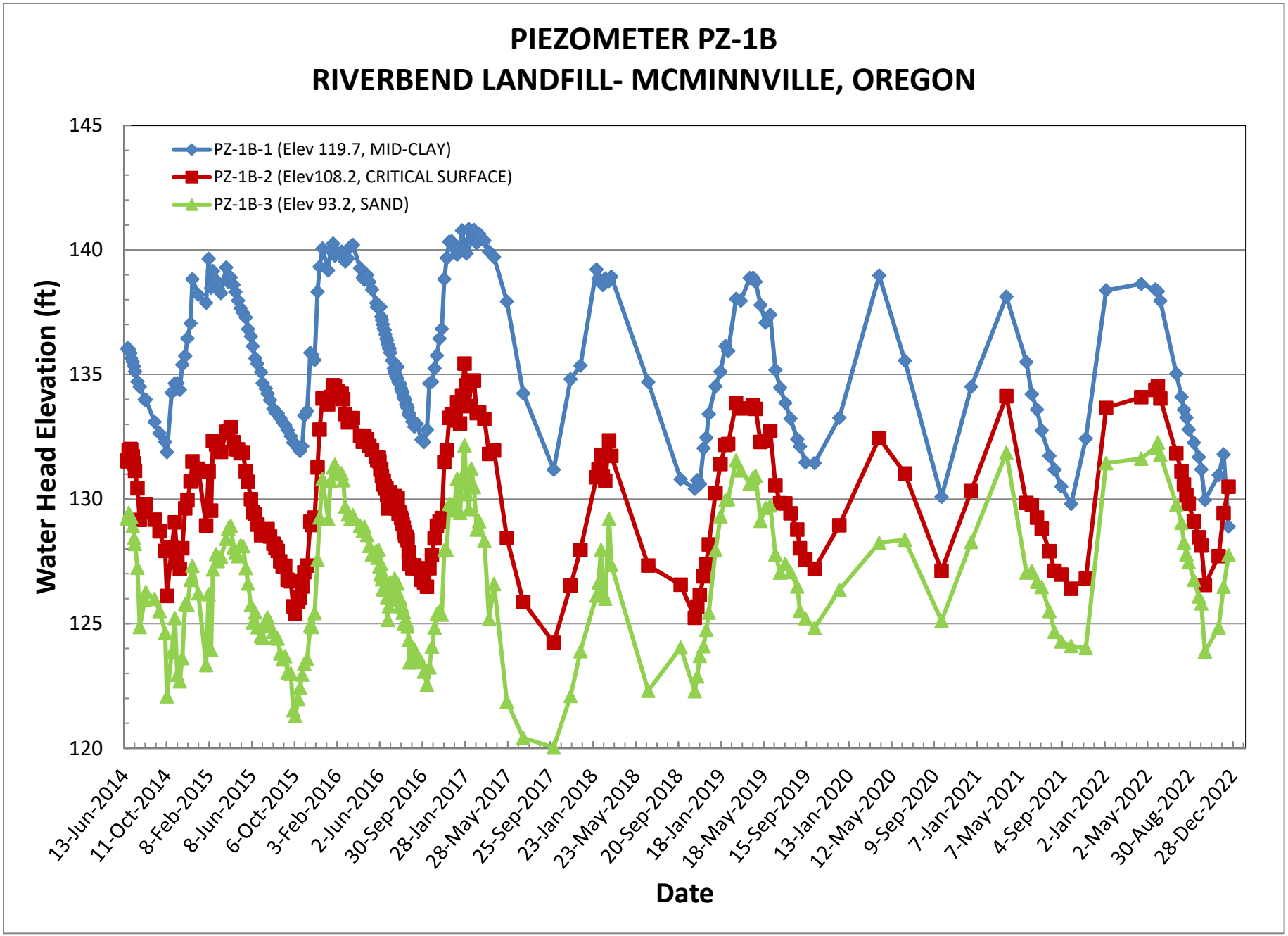
# RIVERBEND LANDFILL

# EXTENSOMETER EX-1B


Riverbend Landfill
EX-1B Extensometer Measurements
Datum
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Sensing Ring Elevation (ft)
190
170
150
130
110
90
70
50
30
181.74
171.73
161.85
152.17
142.46
132.76
123.11
113.45
103.53
93.62
83.48
73.38
63.15
53.00
42.89
23-Jun-2014
21-Sep-2014
20-Dec-2014
20-Mar-2015
18-Jun-2015
16-Sep-2015
15-Dec-2015
14-Mar-2016
12-Jun-2016
10-Sep-2016
9-Dec-2016
9-Mar-2017
7-Jun-2017
5-Sep-2017
4-Dec-2017
4-Mar-2018
2-Jun-2018
31-Aug-2018
29-Nov-2018
27-Feb-2019
28-May-2019
26-Aug-2019
24-Nov-2019
22-Feb-2020
22-May-2020
20-Aug-2020
18-Nov-2020
16-Feb-2021
17-May-2021
15-Aug-2021
13-Nov-2021
11-Feb-2022
12-May-2022
10-Aug-2022
8-Nov-2022
Date

# RIVERBEND LANDFILL

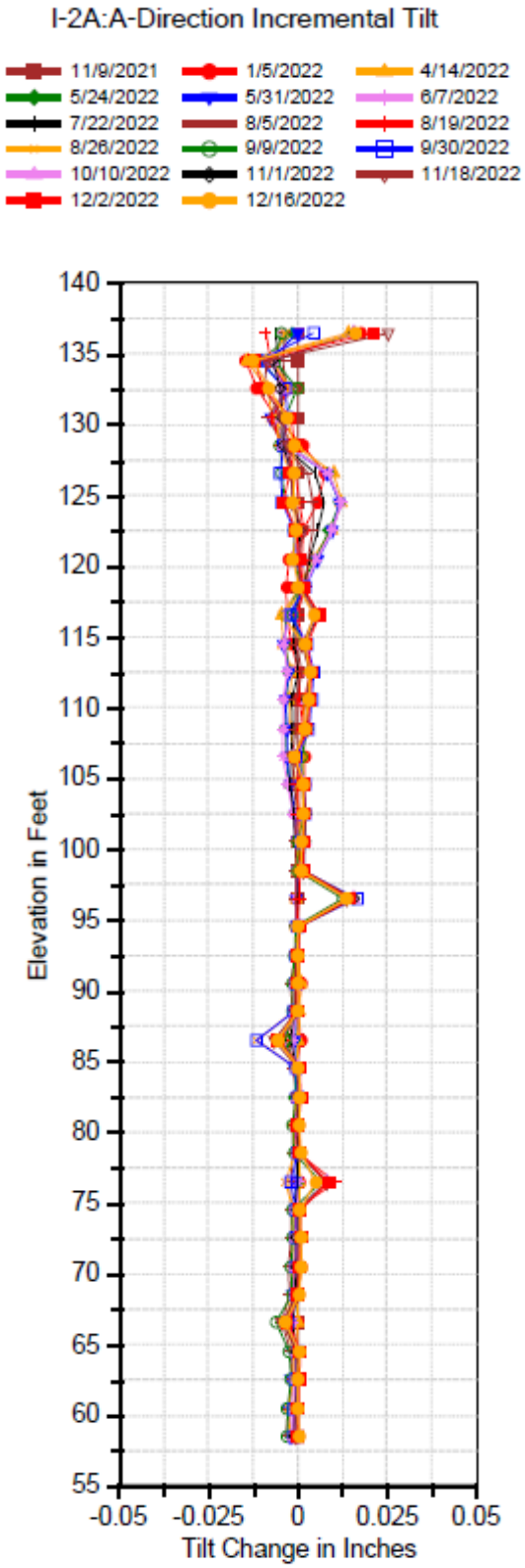
# PIEZOMETER PZ-1B

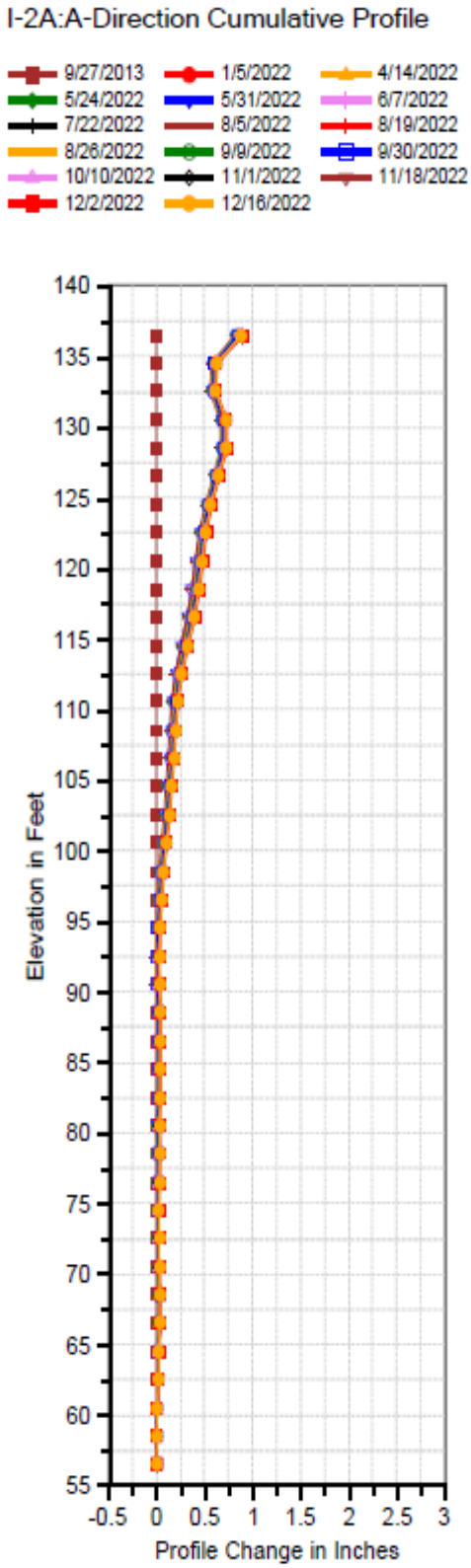

PIEZOMETER PZ-1B
RIVERBEND LANDFILL- MCMINNVILLE, OREGON
PZ-1B-1 (Elev 119.7, MID-CLAY)
PZ-1B-2 (Elev108.2, CRITICAL SURFACE)
PZ-1B-3 (Elev 93.2, SAND)
Water Head Elevation (ft)
145
140
135
130
125
120
13-Jun-2014
11-Oct-2014
8-Feb-2015
8-Jun-2015
6-Oct-2015
3-Feb-2016
2-Jun-2016
30-Sep-2016
28-Jan-2017
28-May-2017
25-Sep-2017
23-Jan-2018
23-May-2018
20-Sep-2018
18-Jan-2019
18-May-2019
15-Sep-2019
13-Jan-2020
12-May-2020
9-Sep-2020
7-Jan-2021
7-May-2021
4-Sep-2021
2-Jan-2022
2-May-2022
30-Aug-2022
28-Dec-2022
Date

# RIVERBEND LANDFILL

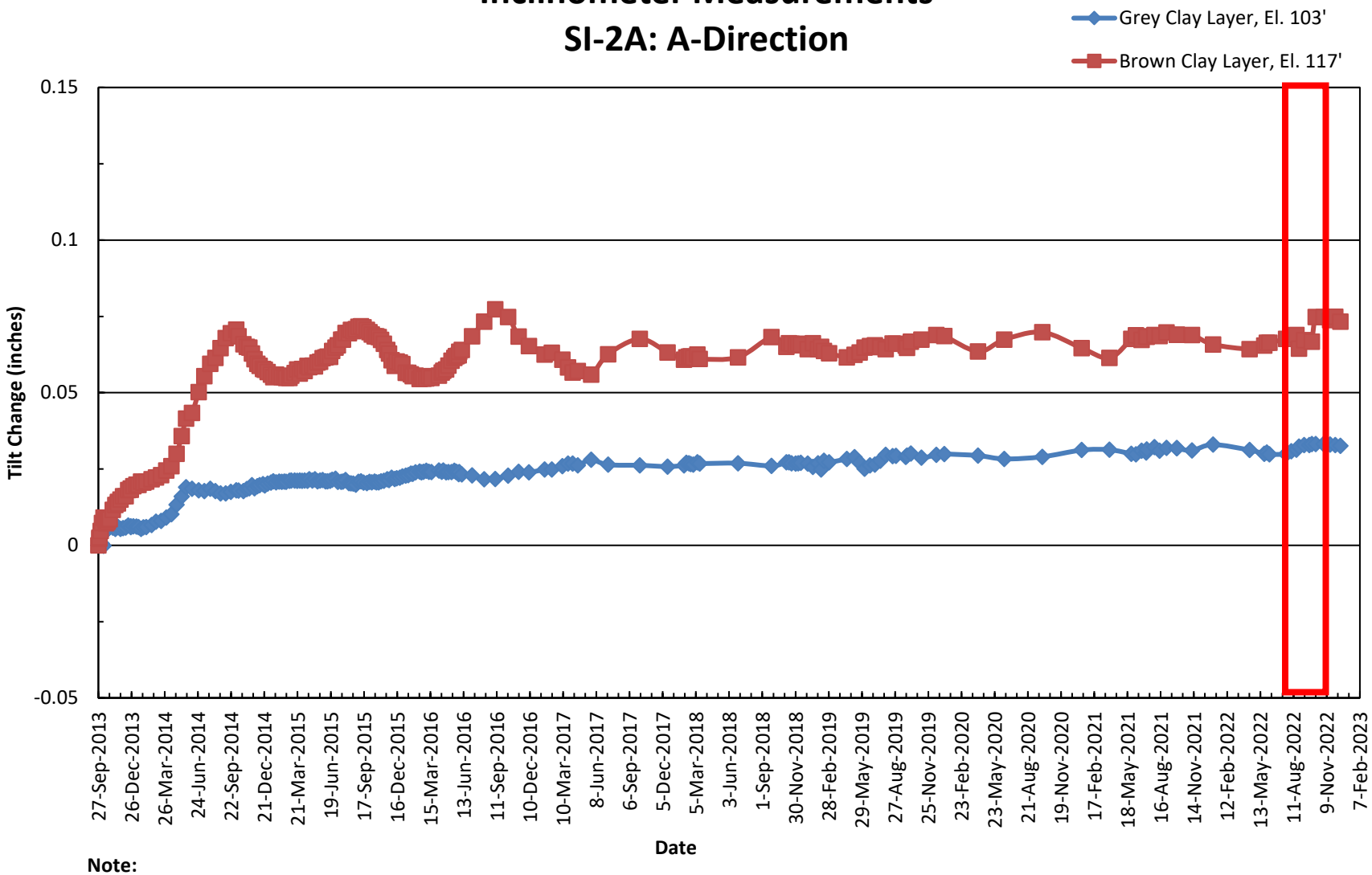
# INCLINOMETER SI-2A

Riverbend Landfill
Inclinometer Measurements



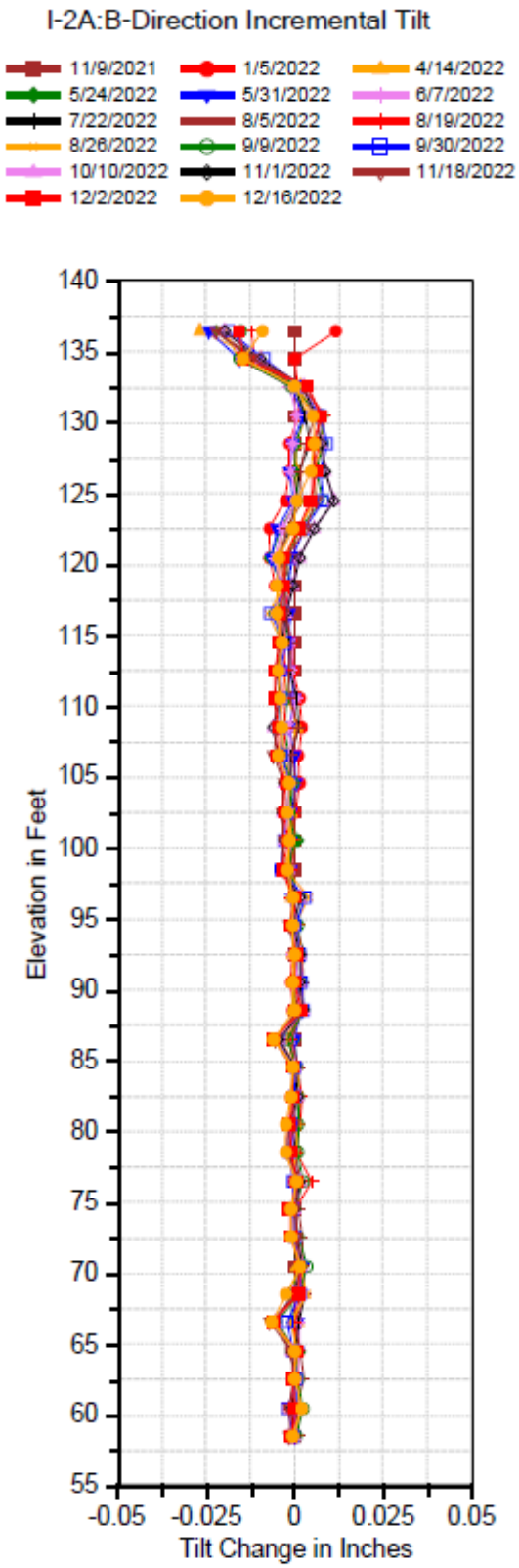
# Riverbend Landfill
# Inclinometer Measurements
# SI-2A: A-Direction

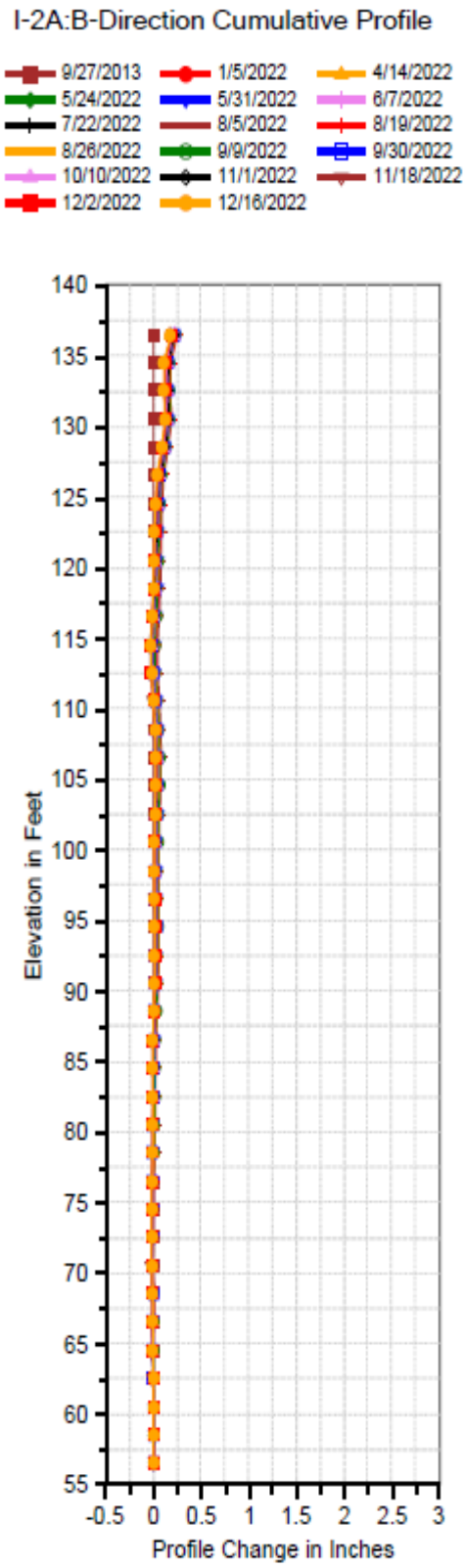



**Note:**

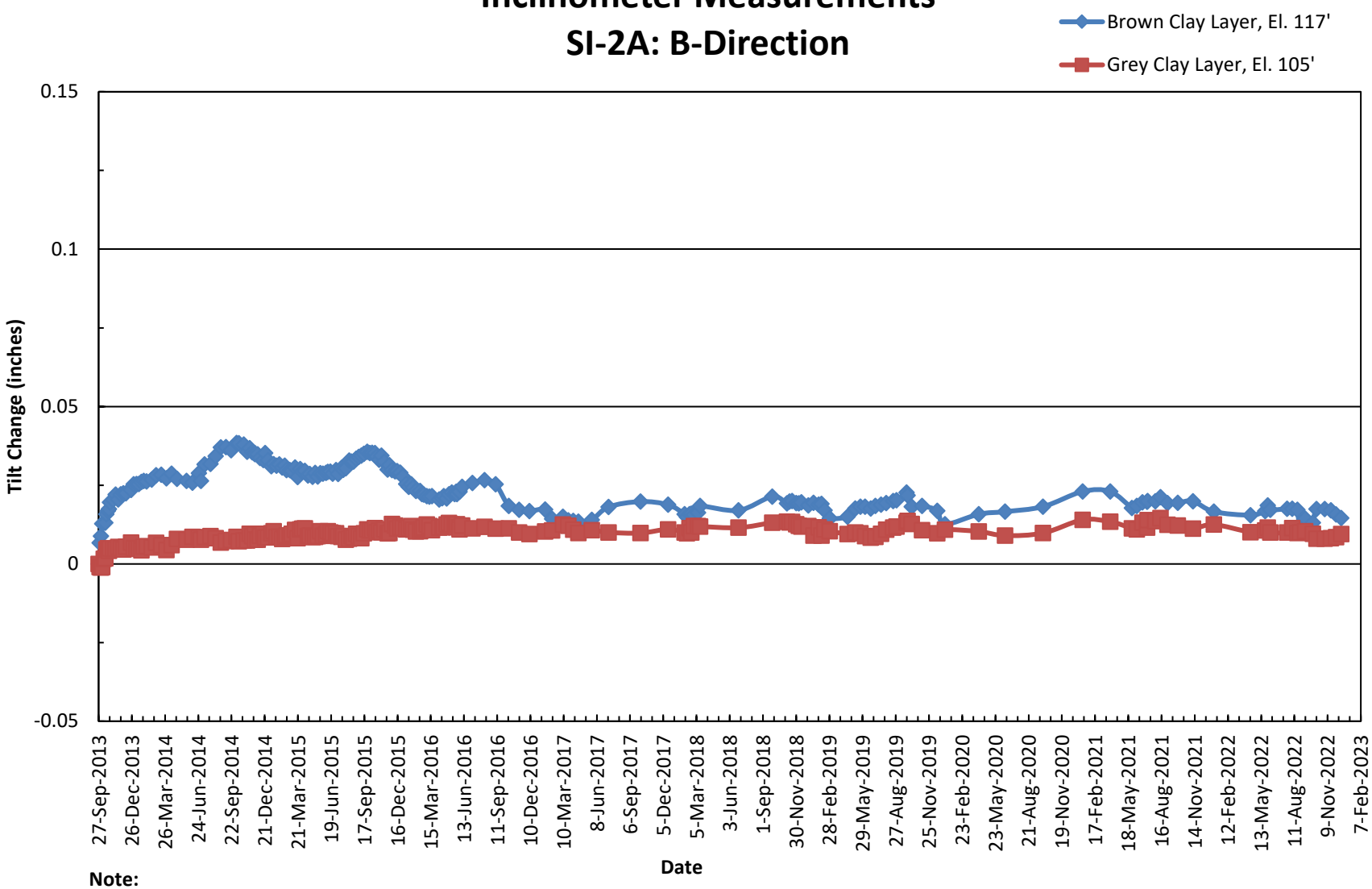
**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

Riverbend Landfill
Inclinometer Measurements



# Riverbend Landfill
# Inclinometer Measurements
# SI-2A: B-Direction

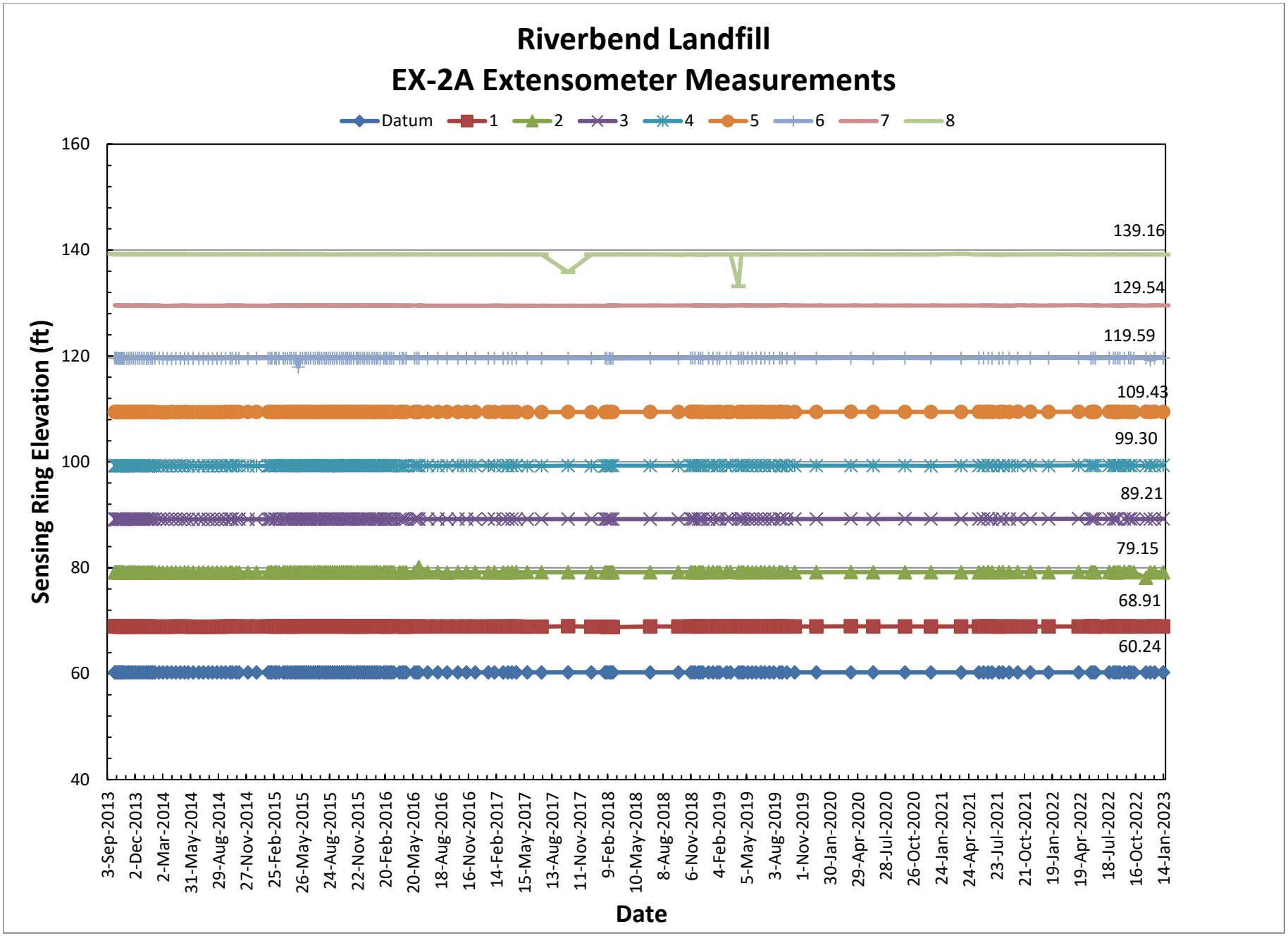



**Note:**

**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

# RIVERBEND LANDFILL

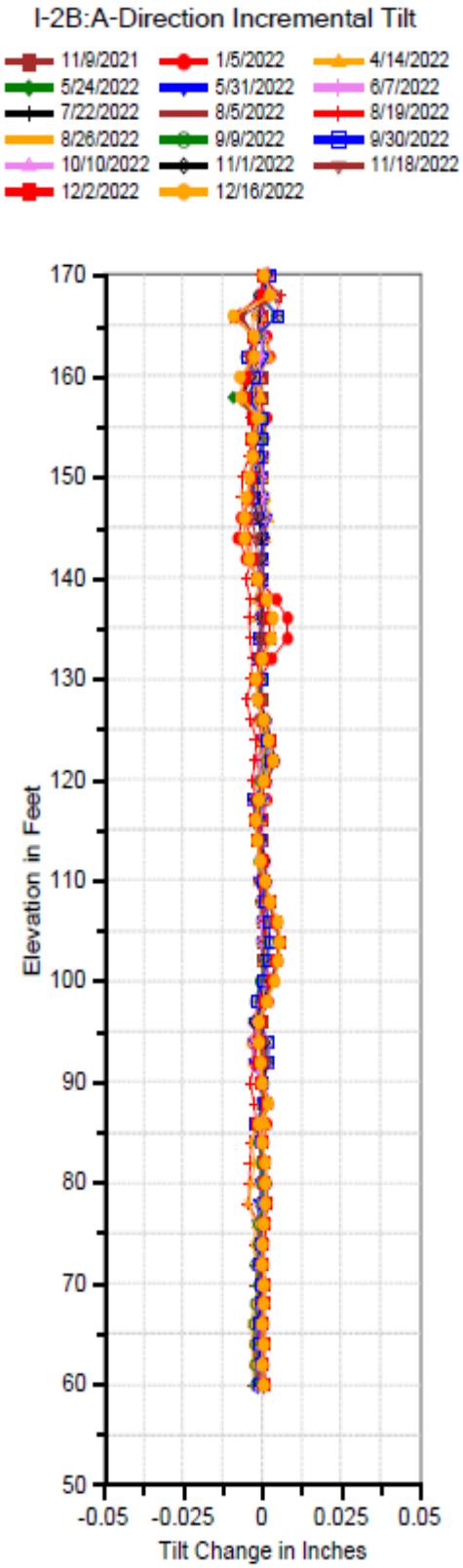
# EXTENSOMETER EX-2A

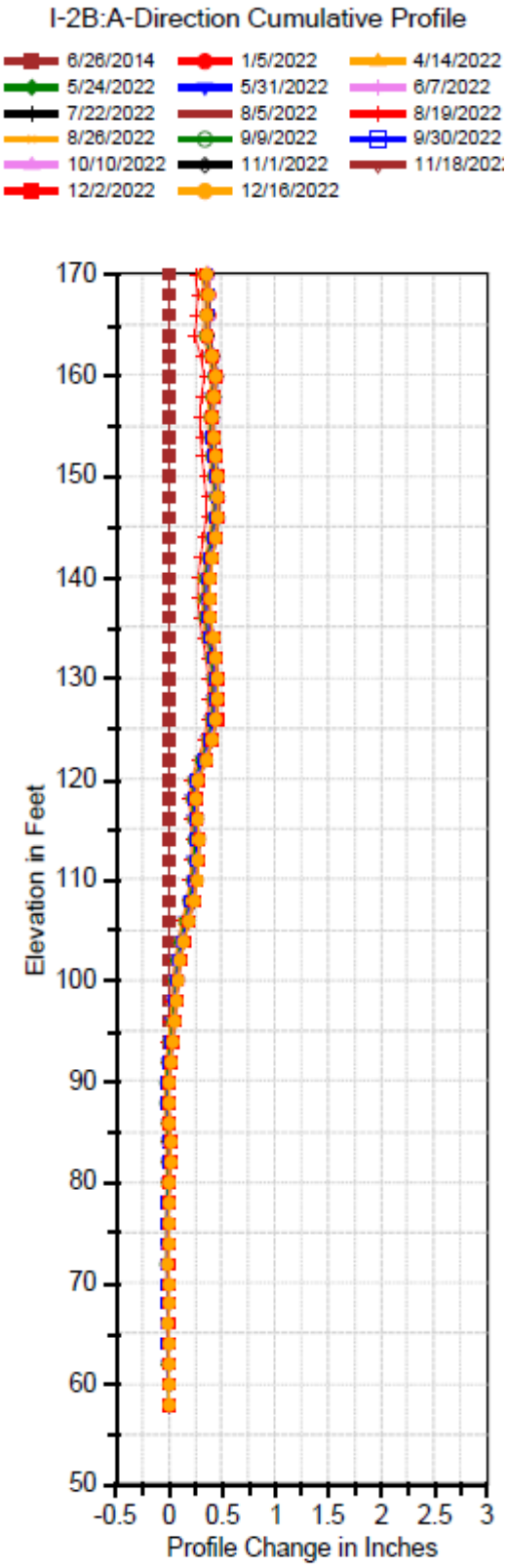

Riverbend Landfill
EX-2A Extensometer Measurements
Datum
1
2
3
4
5
6
7
8
Sensing Ring Elevation (ft)
160
140
120
100
80
60
40
139.16
129.54
119.59
109.43
99.30
89.21
79.15
68.91
60.24
3-Sep-2013
2-Dec-2013
2-Mar-2014
31-May-2014
29-Aug-2014
27-Nov-2014
25-Feb-2015
26-May-2015
24-Aug-2015
22-Nov-2015
20-Feb-2016
20-May-2016
18-Aug-2016
16-Nov-2016
14-Feb-2017
15-May-2017
13-Aug-2017
11-Nov-2017
9-Feb-2018
10-May-2018
8-Aug-2018
6-Nov-2018
4-Feb-2019
5-May-2019
3-Aug-2019
1-Nov-2019
30-Jan-2020
29-Apr-2020
28-Jul-2020
26-Oct-2020
24-Jan-2021
24-Apr-2021
23-Jul-2021
21-Oct-2021
19-Jan-2022
19-Apr-2022
18-Jul-2022
16-Oct-2022
14-Jan-2023
Date

# RIVERBEND LANDFILL

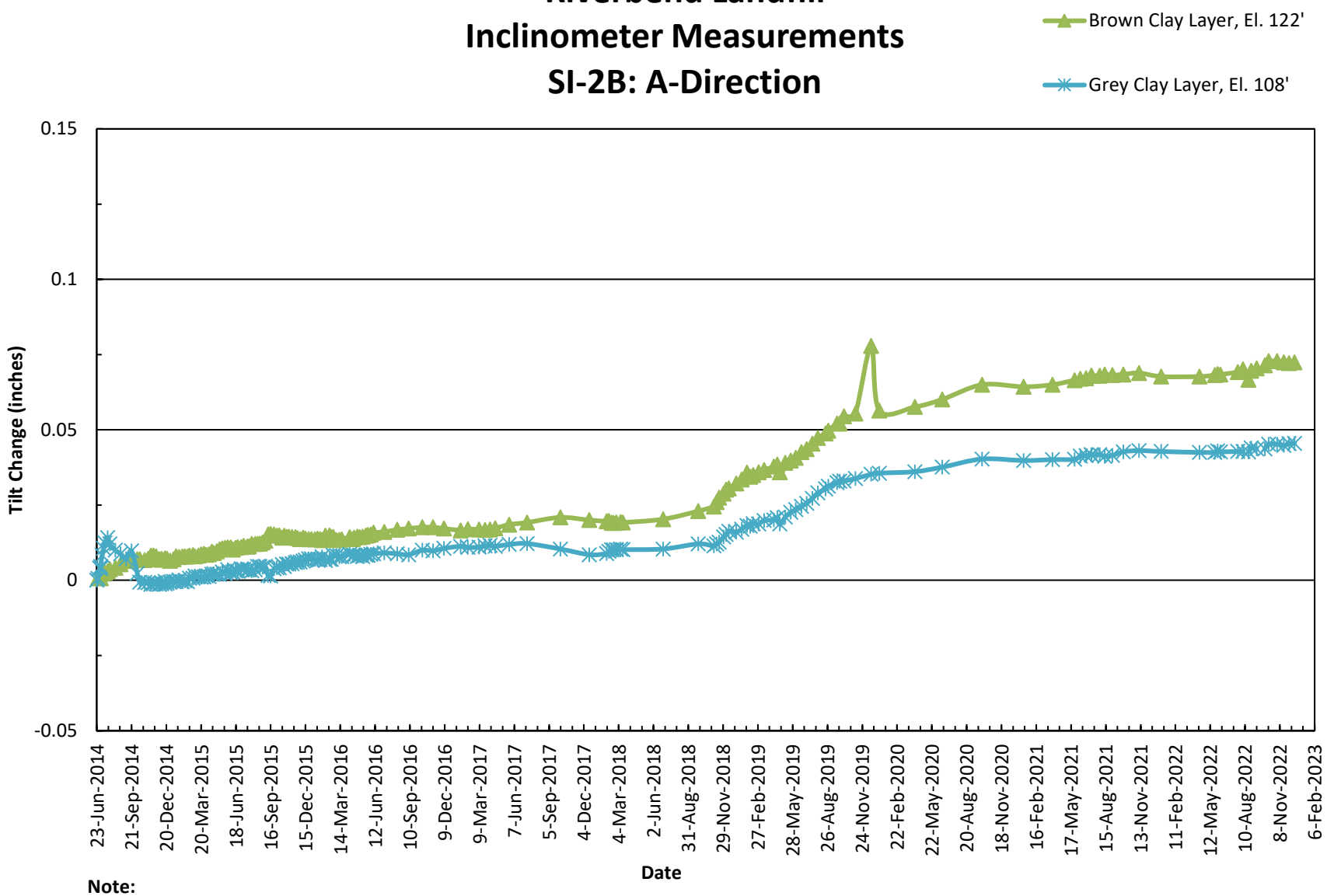
# INCLINOMETER SI-2B

Riverbend Landfill
Inclinometer Measurements



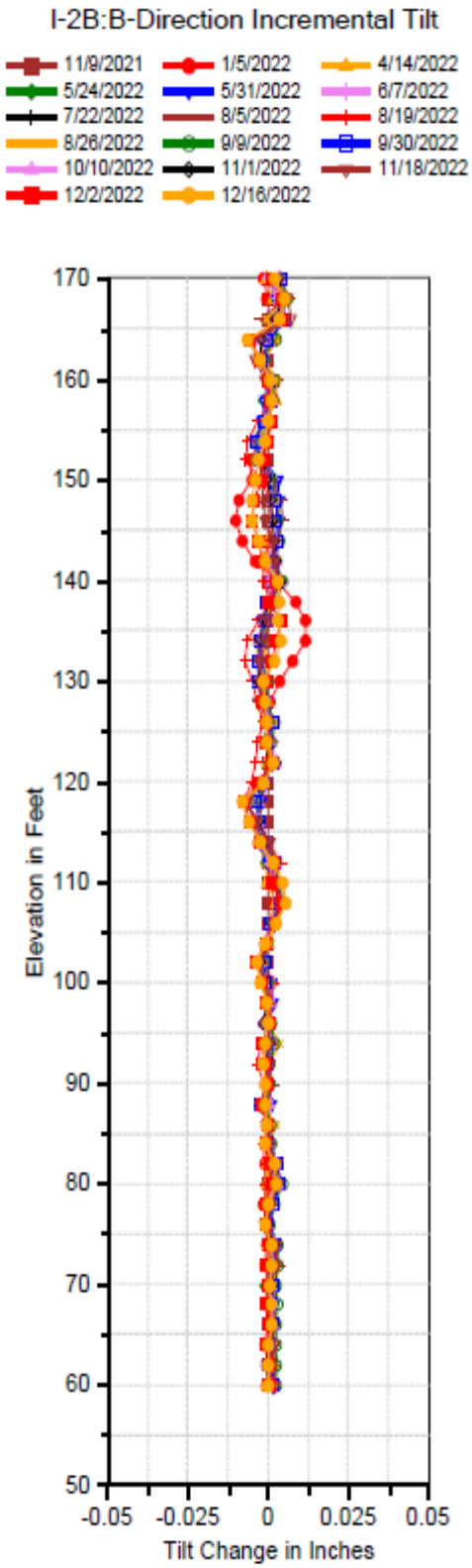
# Riverbend Landfill
# Inclinometer Measurements
# SI-2B: A-Direction

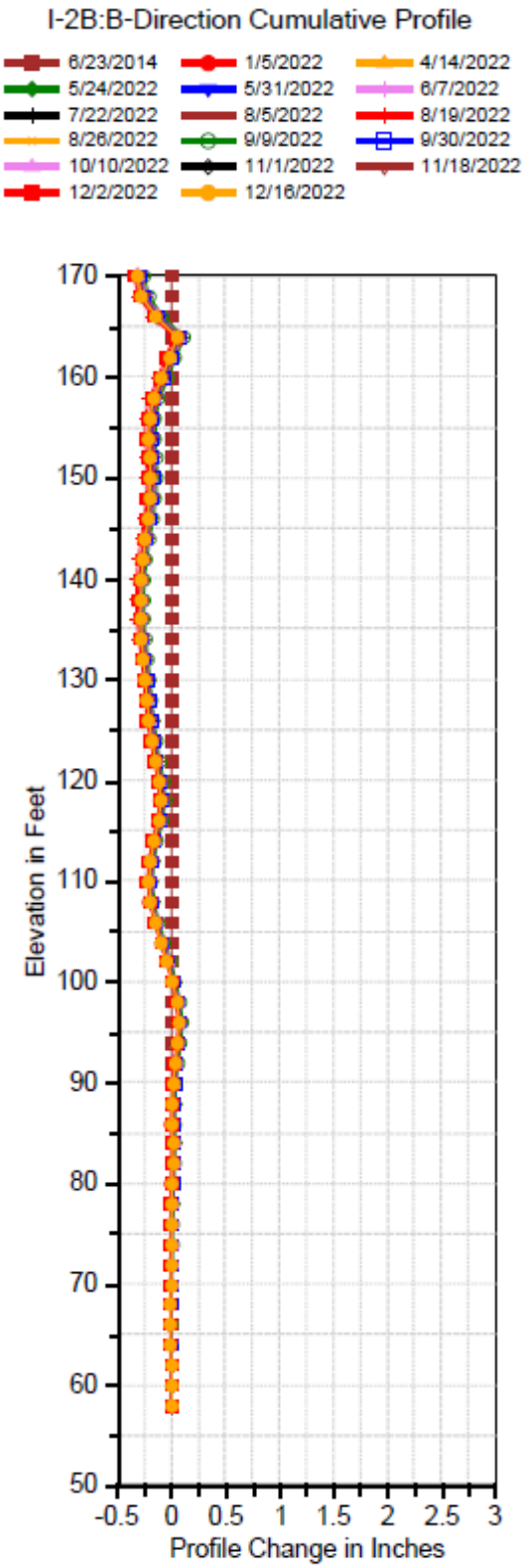



**Note:**

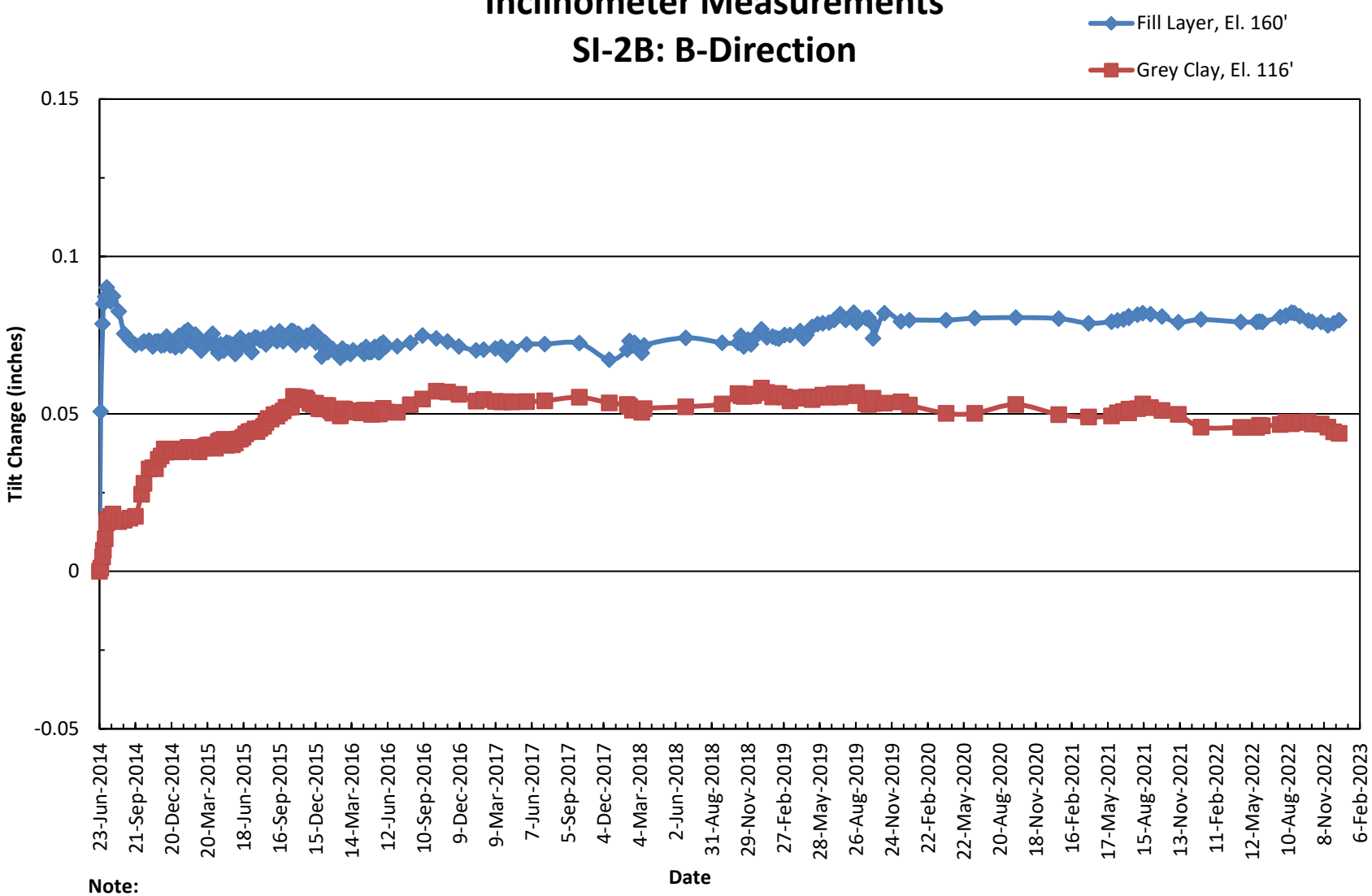
**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

Riverbend Landfill
Inclinometer Measurements



# Riverbend Landfill
# Inclinometer Measurements
# SI-2B: B-Direction

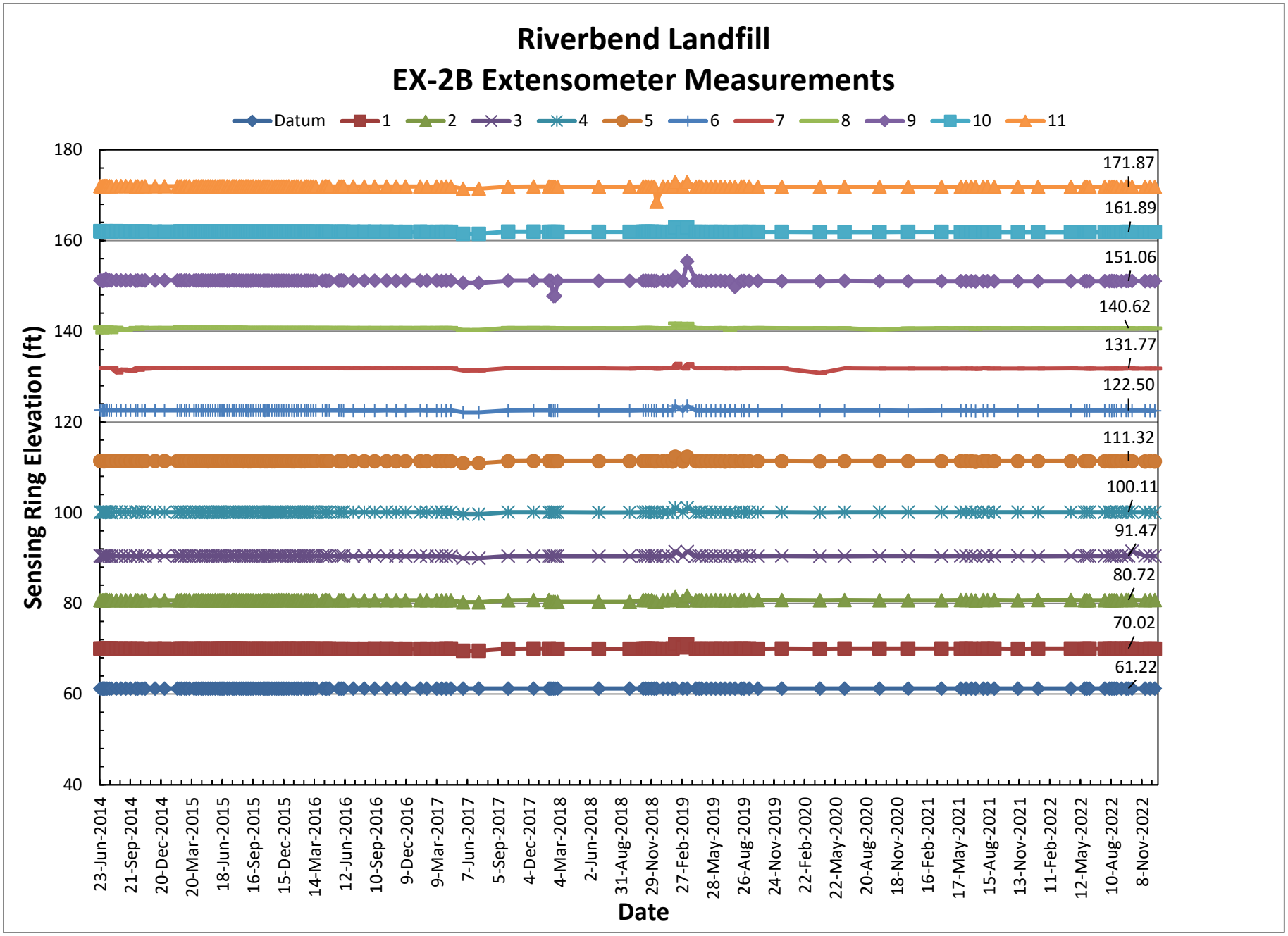



**Note:**

**1. Selected elevations of tilt change represent locations at which maximum tilt change was measured since installation of the inclinometer.**

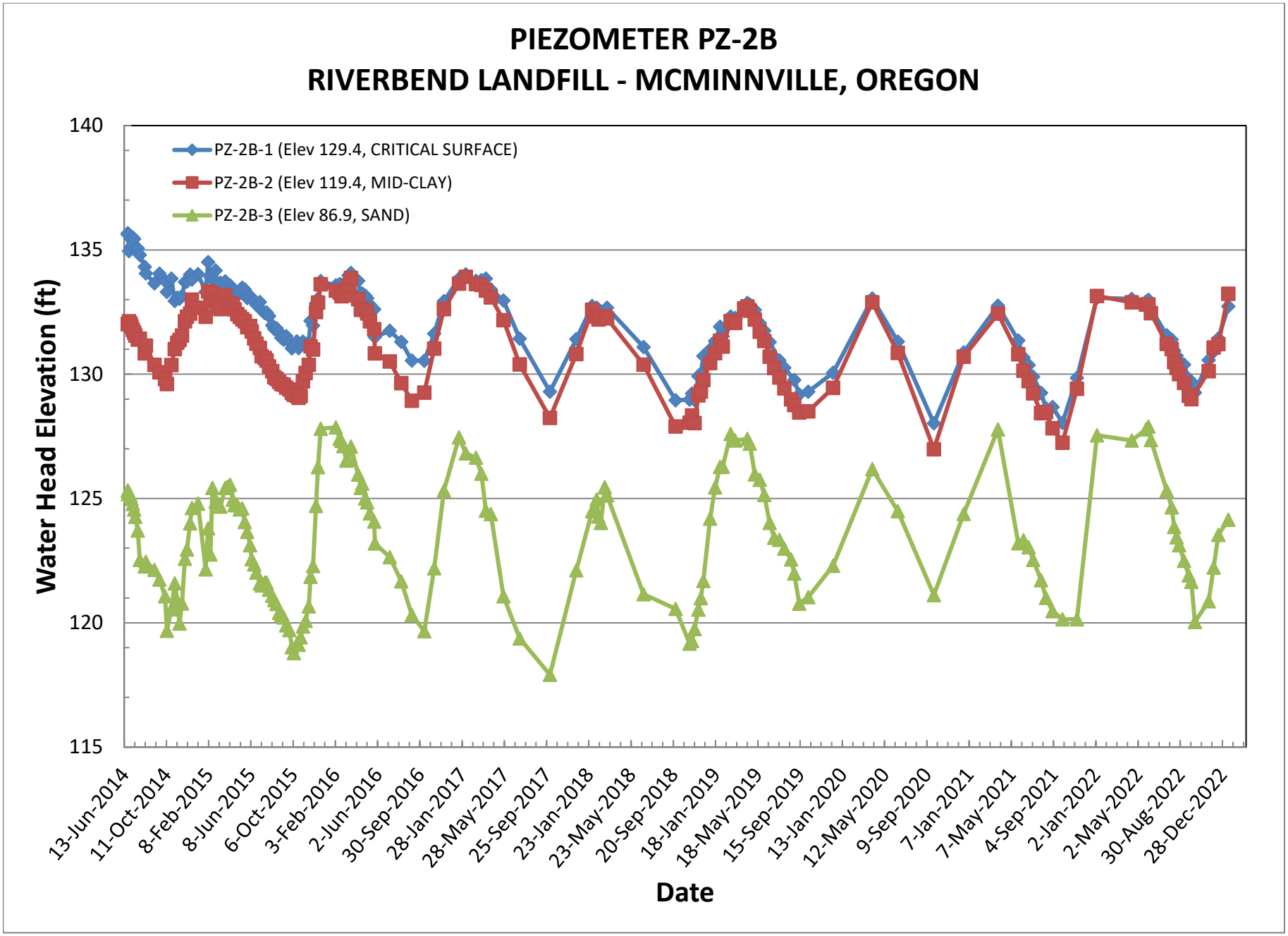
# RIVERBEND LANDFILL

# EXTENSOMETER EX-2B


Riverbend Landfill
EX-2B Extensometer Measurements
Datum
1
2
3
4
5
6
7
8
9
10
11
Sensing Ring Elevation (ft)
180
160
140
120
100
80
60
40
171.87
161.89
151.06
140.62
131.77
122.50
111.32
100.11
91.47
80.72
70.02
61.22
23-Jun-2014
21-Sep-2014
20-Dec-2014
20-Mar-2015
18-Jun-2015
16-Sep-2015
15-Dec-2015
14-Mar-2016
12-Jun-2016
10-Sep-2016
9-Dec-2016
9-Mar-2017
7-Jun-2017
5-Sep-2017
4-Dec-2017
4-Mar-2018
2-Jun-2018
31-Aug-2018
29-Nov-2018
27-Feb-2019
28-May-2019
26-Aug-2019
24-Nov-2019
22-Feb-2020
22-May-2020
20-Aug-2020
18-Nov-2020
16-Feb-2021
17-May-2021
15-Aug-2021
13-Nov-2021
11-Feb-2022
12-May-2022
10-Aug-2022
8-Nov-2022
Date

# RIVERBEND LANDFILL

# PIEZOMETER PZ-2B


PIEZOMETER PZ-2B
RIVERBEND LANDFILL - MCMINNVILLE, OREGON
PZ-2B-1 (Elev 129.4, CRITICAL SURFACE)
PZ-2B-2 (Elev 119.4, MID-CLAY)
PZ-2B-3 (Elev 86.9, SAND)
Water Head Elevation (ft)
140
135
130
125
120
115
13-Jun-2014
11-Oct-2014
8-Feb-2015
8-Jun-2015
6-Oct-2015
3-Feb-2016
2-Jun-2016
30-Sep-2016
28-Jan-2017
28-May-2017
25-Sep-2017
23-Jan-2018
23-May-2018
20-Sep-2018
18-Jan-2019
18-May-2019
15-Sep-2019
13-Jan-2020
12-May-2020
9-Sep-2020
7-Jan-2021
7-May-2021
4-Sep-2021
2-Jan-2022
2-May-2022
30-Aug-2022
28-Dec-2022
Date