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August 30, 2013

Mr. Jason Wise, P.E.
ODOT District 12 Geotechnical Engineer
Ohio Department of Transportation
5500 Transportation Boulevard
Garfield Heights, Ohio 44125-5396

Re: July 2013 Quarterly Report
CUY-90-15.24 Slope Monitoring
PID 76117
EDP Project No. 062943.00

Dear Mr. Wise:

Quarterly instrument readings for the CUY-90-15.24 Slope Monitoring project are presented in the attached report. Both "hard" and electronic copies are being sent. An additional hard copy is being sent to Chris Merklin in ODOT's Central Office.

If you have any questions or comments regarding this report, please call.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Alan J. Esser, P.E., D.GE
Principal Consultant

Attachments

Copy to: Chris Merklin, P.E., ODOT Central Office

JULY 2013 QUARTERLY REPORT

CUY-90-15.24 SLOPE MONITORING
PID 76117
CLEVELAND, OHIO
SME PROJECT NO. 062943.00

AUGUST 30, 2013

Soil and Materials Engineers, Inc.
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INTRODUCTION

Instrument readings and interpretations for July 2013 are presented in this report. Readings and data for this report were obtained between July 16 and 25, 2013. Plots of the quarterly readings are included in the appendices. Since earthwork and foundation construction activities have slowed there has been less change in the instrument readings. Therefore, this quarter, we changed the organization of the report putting the piezometer plots in Appendix A and the inclinometer plots, with the exception of the stabilization structure, in Appendix B. Reports for the stabilization structure instrumentation remain in Appendix C. The plots are arranged in the order that they are discussed in the report.

Data Logger Storage Problem Resolved
We reported last quarter that the data logger in Enclosure 2 was scanning but not storing data. This issue began three days after the January quarterly data download and was not discovered and resolved until May 14, 2013. That issue was resolved in May with the help of Geokon and the datalogger has remained operational and successfully recorded data this quarter.

Loss of Data for Enclosure 1
When we returned for the July data download, we found that the datalogger in Enclosure 1 had stopped recording on June 4th due to the loss of battery power. This resulted in a loss of data for the load cells, anchors, and driven piles after June 4. A fully charged battery was installed in July. We have checked and verified that the datalogger has remained operational and is recording data.

PIEZOMETERS, APPENDIX A

We saw little or no change in total head for most piezometers this past quarter. The few exceptions are discussed in the following paragraphs.

P-001. Total head in the shallow piezometer decreased about one-half foot this quarter. Total head in the deep piezometer remained constant.

P-003. We include two plots for this installation in the appendix. In the first, we plot total head vs. time since installation; in the second we plot total head vs. time since April 2007 to show changes on a time scale that is compatible with the other instrumentation. Total head in the piezometer at elevation 600 feet increased by about one-half foot. This continues the slight upward trend in pore pressures at this depth. Change in the remaining piezometers was negligible.

P-004. Protective covers have not been replaced for these instruments and the data loggers have not been reinstalled. Manual readings since May 2012 have shown that total heads in both piezometers are increasing. Although the total heads are increasing, the rate of increase is gradually decreasing.

B-05-02
The original piezometers at this location were replaced in January 2012. Two plots are included in the appendix; one includes data for both the original and the replacement piezometers; the other includes data only for the replacement piezometers.

Total head in shallow piezometer increased this quarter after remaining nearly constant the prior quarter. Total head in the deep piezometer has continued to increase at about the same rate since April 2012.

B-05-11. Because of the ongoing construction activity, no protective covers are installed at this location and we have not reinstalled the miniloggers. Manual readings have been taken instead. Total head increased in both piezometers this quarter. This followed a quarter with no change in total head in the shallow piezometer. In both the shallow and deep piezometers, the rate of pore pressure increase is slowing.

B-05-13. We have not been able to read piezometers at B-05-13 since July 2012 when soil was placed over the installation for work on Pier 5. Conditions at this location are shown in Figure 2 later in the report.

B-101. Pressure head in the shallow piezometer was zero again this quarter so the total head is equivalent to the elevation head. This indicates that the groundwater elevation is at or below the elevation of the piezometer. Total head in the deep piezometer decreased about 0.4 feet.

B-105. Total head increased 0.4 feet in the shallow piezometer, and decreased 0.2 feet in the deep piezometer this quarter. Total head (pore pressure) appears to be trending downward in both piezometers.

B-303. Total head decreased 0.7 feet at this location this quarter. Readings since July 2009 indicate a very slight downward trend in the pore pressure (1.57×10^{-3} feet /day).

INCLINOMETERS, APPENDIX B

Inclinometer surveys for I-001, I-004, I-010, B-05-03, B-05-11, B-105A and B-203 show no change or negligible change in displacement this quarter. Some of the zone plots for these instruments indicate significant variation from reading to reading. These variations are caused by slight differences in the readings due to instrument accuracy and changes to the bias corrections. The remaining inclinometer surveys are discussed below.

I-002. Changes in the A-axis displacements were negligible this quarter. The plot shows some apparent B-axis displacement of the upper 40 feet of the tube. This is likely due to an errant reading.

I-003. Approximately 4 feet of soil was excavated from around the instruments at this location on July 23, 2013. This is shown in Figure 1. The excavation caused the displacement seen in the top 4 feet of the inclinometer plot. Changes were negligible below 4 feet.

Figure 1. Approximately 4 feet of soil was excavated from around the instruments at P/I-003 on July 23, 2013. The protective covers at this location were not concreted in place because additional construction was expected. Sometime after this photo was taken, a large quantity of fill and rubble was placed over this installation.

I-008. Inclinometer readings this quarter indicate negligible change in the A-axis displacements since last quarter except for the top 4 feet of the slope tube which indicates some slight positive displacement. The B-axis plot shows an apparent reversal of the displacement that appeared in the April readings. These displacements are likely due to errant data points, although it is possible that the protective cover may have been bumped resulting in the A-axis displacement.

B-05-02. We continue to see an increase in A-axis displacement at a depth of about 38 feet at this location. The resultant zone plot for this depth indicates a decrease in displacement. This is due to the B-axis displacement which is probably due to an inability to adequately correct the bias for the B-axis displacement. We expect that this will correct itself with the next scheduled scan of this inclinometer tube.

B-05-04. Changes in displacement this quarter were negligible. However, the zone plot for the resultant displacement at 115 feet indicates a significant change in movement. This plot is exaggerated because of the small magnitude of the displacements and a slight difference in the bias correction.

B-05-07. The inclinometer scans indicate rotation of the inclinometer tube above about 140 feet which is not removed by the bias corrections. We have seen some of this in the past on the B-

axis but not so much on the A-axis. It is likely that this is due to errant readings in the 120 to 140 foot depth range and should correct itself with the next readings.

B-05-13. We are still unable to obtain readings at B-05-13 because the instruments are covered. Figure 2 shows the area.

B-101. The plot for this inclinometer continues to show A-axis lateral displacement which we believe may be due to displacement at the tip of the tube due to insufficient embedment to provide fixity. This was discussed in detail in last quarter's report.

B-102. This quarter's readings indicate the possibility of some A-axis displacement (down slope) of the upper 20 feet of the slope east of the bridge.

Figure 2. Fill was placed over the instruments at B-05-13 to create a pad for equipment.

TILTMETERS, APPENDIX C

Changes in Tiltmeters 3, 4, 5, and 6 were negligible this quarter. This quarter's reading at Tilt 1 shows a large negative change. This may be an errant reading but should be watched since Tilt 7 is also changing. The reading at Tilt 2 decreased returning almost to the trend that has continued since the tiltmeters were installed. This completes an annual "bump" away from the general trend that has been repeating since 2006-07. Tilt 7 has been trending positive for the past year where previously these readings were slightly negative. Tilt 8 shows a positive change this quarter that is slightly larger than the changes recorded in the past. Readings at this location

have trended along the zero line with the exception of 2010-11 when the readings increased in the negative direction before correcting in July 2011. Figure 3 shows the location and direction of positive rotation for each of the tiltmeters.

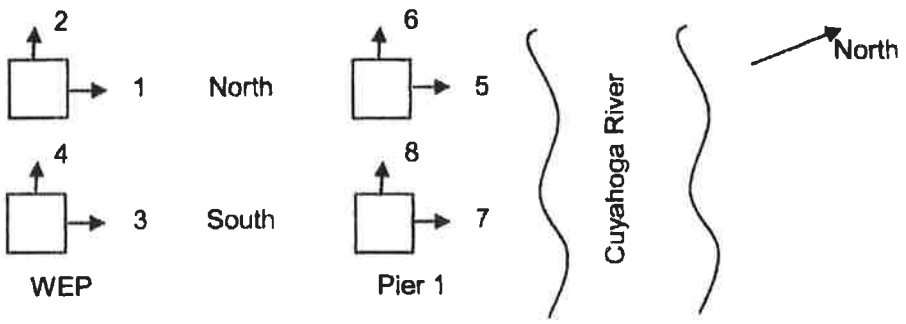


Figure 3. Tiltmeter locations with arrows showing the direction of positive tilt.

STABILIZATION STRUCTURE, APPENDIX C

The general arrangement of the stabilization structure and its instrumentation is shown in Figures 4 and 5.

As indicated in the introduction, the datalogger in Enclosure 1 stopped recording after June 4. Comments for the load cells, anchors, and driven piles in this section of the report are based on data through June 4, 2013.

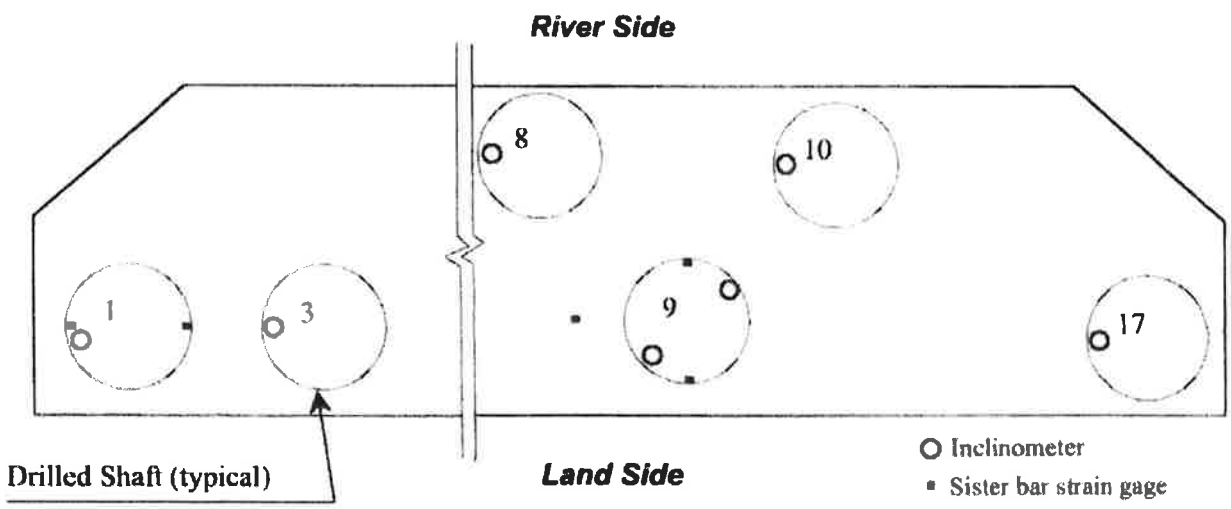


Figure 4. Pier cap with the location of inclinometers and strain gauges.

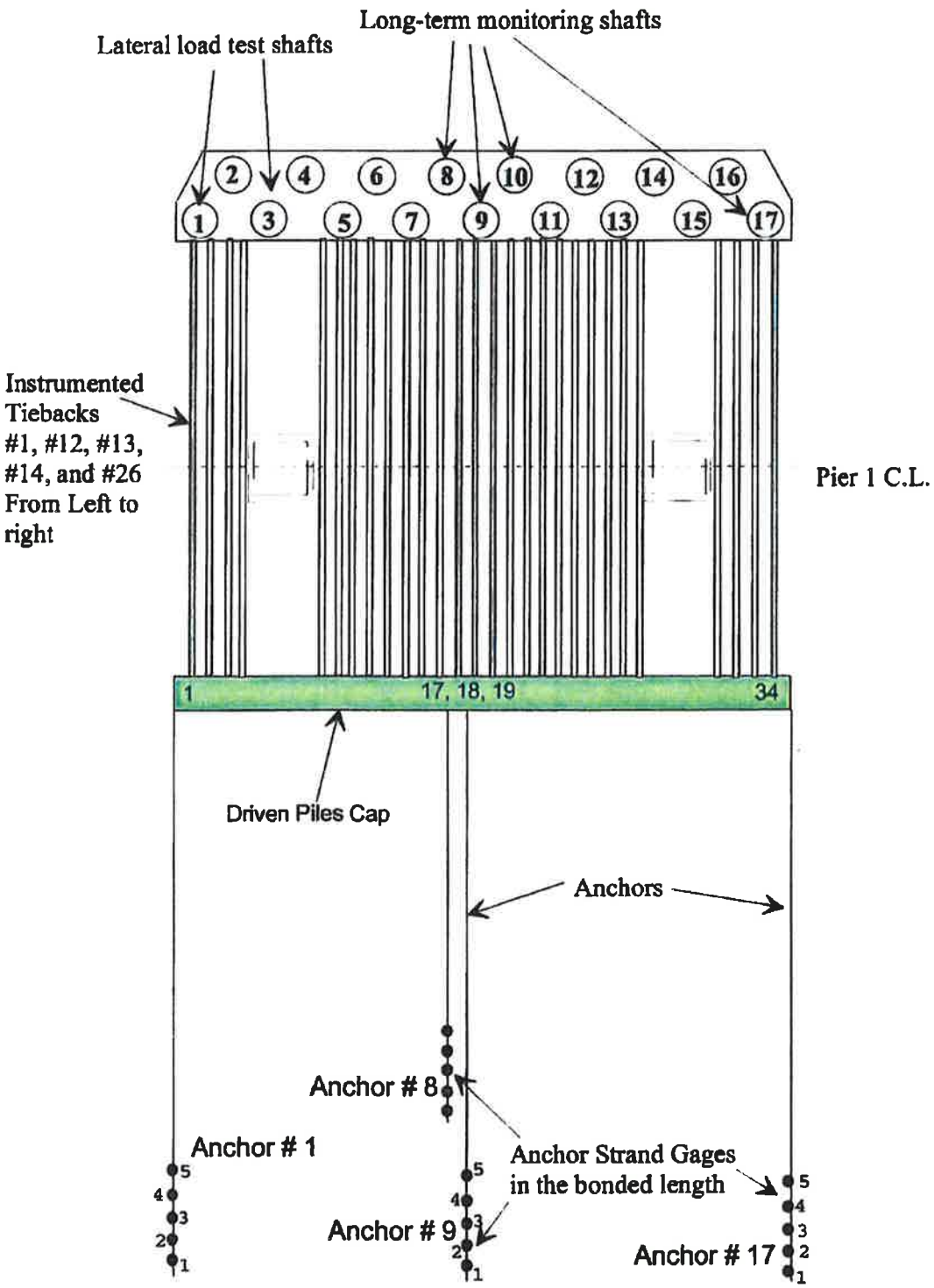


Figure 5. Plan of the stabilization system showing the locations of the instrumented foundation elements.

Load Cells

There was no appreciable change in the load cell readings for Load Cells 1, 9, and 17 through June 4, except for erroneous data points for Load Cell 1 on May 21 and June 2, 2013. These were caused by single erroneous data points for Gauge 1 on May 21 and Gauge 4 on June 2. When the datalogger in Enclosure 1 was restored on May 14, 2013, Gauges 2 and 3 on Load Cell 8 had stopped recording. This caused the jump in the plot of the loads recorded for this load cell. Table 1 shows which gauges were active in each of the load cells this quarter.

Table 1. Active gauges (indicated by check mark) in load cells on the four instrumented anchors.

Load Cell	Gauge					
	1	2	3	4	5	6
1	✓			✓	✓	✓
8	✓				✓	✓
9	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	✓	✓	✓

Anchors

With the exception of an occasional errant data point, loads recorded for all strandmeters on all anchors remained nearly constant this quarter. Loads for the strandmeters that are still functioning are listed in Table 2. Strandmeter gauges that have failed are indicated by an "×" in the table. The average load for the load cell corresponding to each anchor is also listed. If the strandmeters were functioning properly, we would expect to see loads increasing from Strandmeter 1 to Strandmeter 5 in each of the anchors and none of the strandmeter loads would exceed the load in the corresponding load cell. We should not see large negative (compression) loads such as for Strandmeter 3 on Anchor 8.

Table 2. Strandmeter loads for the four instrumented anchors, tension is positive.

Anchor	Load Cell (kips)	Strandmeter (kips)				
		1	2	3	4	5
1	462	-10.2	×	+/- 0	×	1919
8	370	27.9	65.2	-175.8	×	×
9	468	-18.7	8.2	2.8	194.3	770
17	358	-37	×	-24.9	×	232.5

Driven piles

Some erroneous data was reported for the driven piles last quarter. This only affected the average plots. Plots for the individual piles were not affected. The average plots have been corrected in this quarter's report.

The axial loads have changed very little since the change in axial load that occurred on March 16, 2013. That change affected all piles except Pile 34. The loads in Piles 1 and 34 continue to trend slightly down (Pile 1) or up (Pile 34).

Both strong axis and weak axis bending moments remained virtually constant this quarter. The single exception is strong axis bending in Pile 1 which has been trending toward zero since mid-March of this year.

Tiebeams

Data for the tiebeams has become erratic and meaningless since about August 2012. Data from January 12 through May 1, 2013 was lost due to the shutdown of the datalogger in Enclosure 2. This was discussed in last quarter's report. The long straight-line parts of the tiebeam graphs in this report are for the period when data was lost. Data was recorded for all gauges this quarter but it is apparent from the plots that the data is meaningless despite the fact that we "cleaned" the data keeping only the most credible data points.

Four gauges are mounted at each tiebeam section. All four gauges are needed to calculate the axial loads and bending moments. Data for some gauges on the anchor side is still good but the loss of other gauges makes it impossible to calculate meaningful loads and moments. Virtually all gauges on the drilled pier side are giving erratic readings.

Gauges began failing in early September 2012. This corresponds to the time when contractors excavated to create a level pad and began staging equipment and materials under the bridge between the pier cap and the pile cap. It seems apparent that this activity damaged the gauges, and it's obvious that the gauges are not going to recover. We therefore will continue to look at the data, but will stop reporting results for the tiebeams, unless, in the unlikely event, that we again see any meaningful results.

Should there be any failures, we should see that in the data for the driven piles, anchors, and drilled piers which do not appear to have been affected. Consideration might be given to restricting access to this area under the bridge during the next stage of construction.

Drilled Piers

The attached plots compare the current quarter average readings to the one-year average for Drilled Piers 1 and 9. Plots of axial load and bending moment vs. time are also included for selected depths. For Pier 1, the plots for gauges at 16 and 58 feet are included; for Pier 9, the plots are for 17 and 50 feet. These plots show the season variation in axial load and bending moment. Plots for other depths show a similar pattern. The straight line section of the plots is due to the shutdown of the datalogger in Enclose 2 as discussed in last quarter's report.

The axial load and bending moment in Pier 1 changed the most at the top of the shaft where the difference was less than 5%. Changes below 16 feet were negligible for axial load except at 114 feet where the change was about 5%. Changes below 30 feet were negligible for bending moment.

For Pier 9, the largest changes occur in the upper approximately 25 feet of the shaft. The largest axial load change was 5.2% and the largest bending moment change was 9.7%. Changes below 25 feet were less than about 2%.

Drilled Pier Inclinometer Surveys

Changes in the drilled pier inclinometer surveys were negligible this quarter.

EXPANSION JOINTS AND TRUSS OPENINGS

Location of Measurements

The general location of the bridge deck and truss expansion joint measurements is shown in Figures 6 and 7. Measurements and temperatures at the time of the measurements are plotted in Figures 8 and 9. Truss and deck measurements were taken on April 18, 2013.

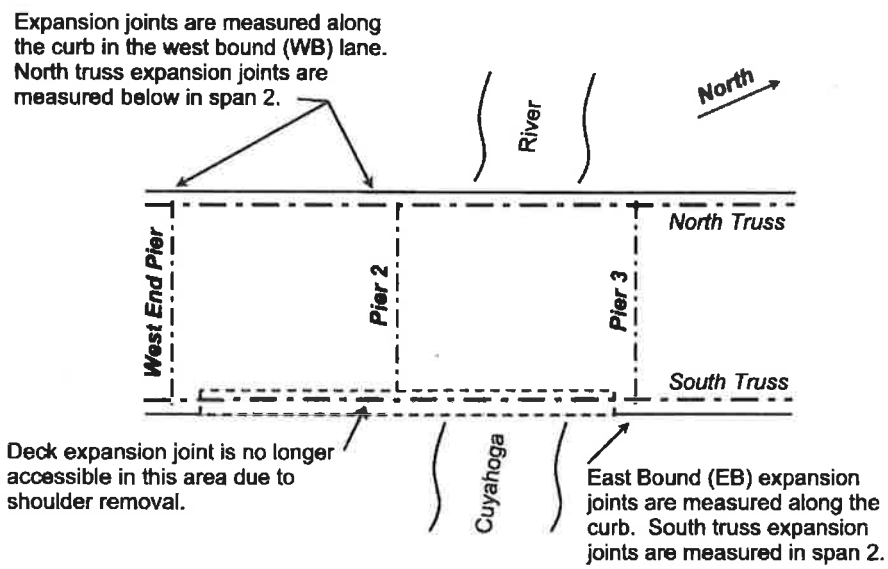


Figure 6. General location of the expansion joint measurements.

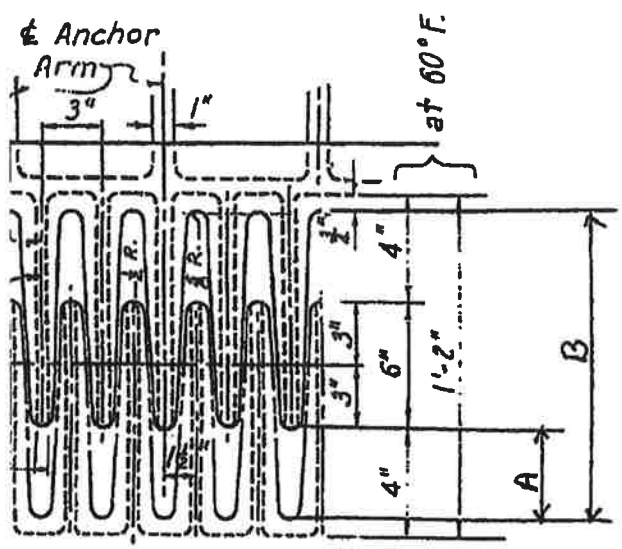


Figure 7. Locations of measurements for the bridge deck expansion joints.

Bridge Deck Expansion Joints

Expansion joint measurements on the bridge deck are taken near the west end pier and Piers 2 and 4. The plots in Figure 8 are labeled 1WB for the expansion joint at the west end pier in the westbound traffic lane, 2WB for the expansion joint near Pier 2 in the westbound traffic lane, and so forth. Measurements of the expansion joints in the eastbound traffic lanes are similarly labeled with EB substituted for WB in the label.

Temperature at the time of this quarter's expansion joint measurements was 3 degrees higher than last quarter. Changes in the gap measurements were similar in magnitude to the changes that have occurred in the past for similar temperature differences. Compare, for example, the difference this quarter to the differences observed from December 2011 to January 2012. With few exceptions, in the past, when the temperature increased the gap in the expansion joints decreased and vice versa. Changes this quarter are consistent with the past trend except at 1EB and 1WB where the trend is reversed; that is, the gap increased with the temperature increase. This reversal of the "normal" trend also occurred at these same two locations in the October 2010 to February 2011 quarterly readings.

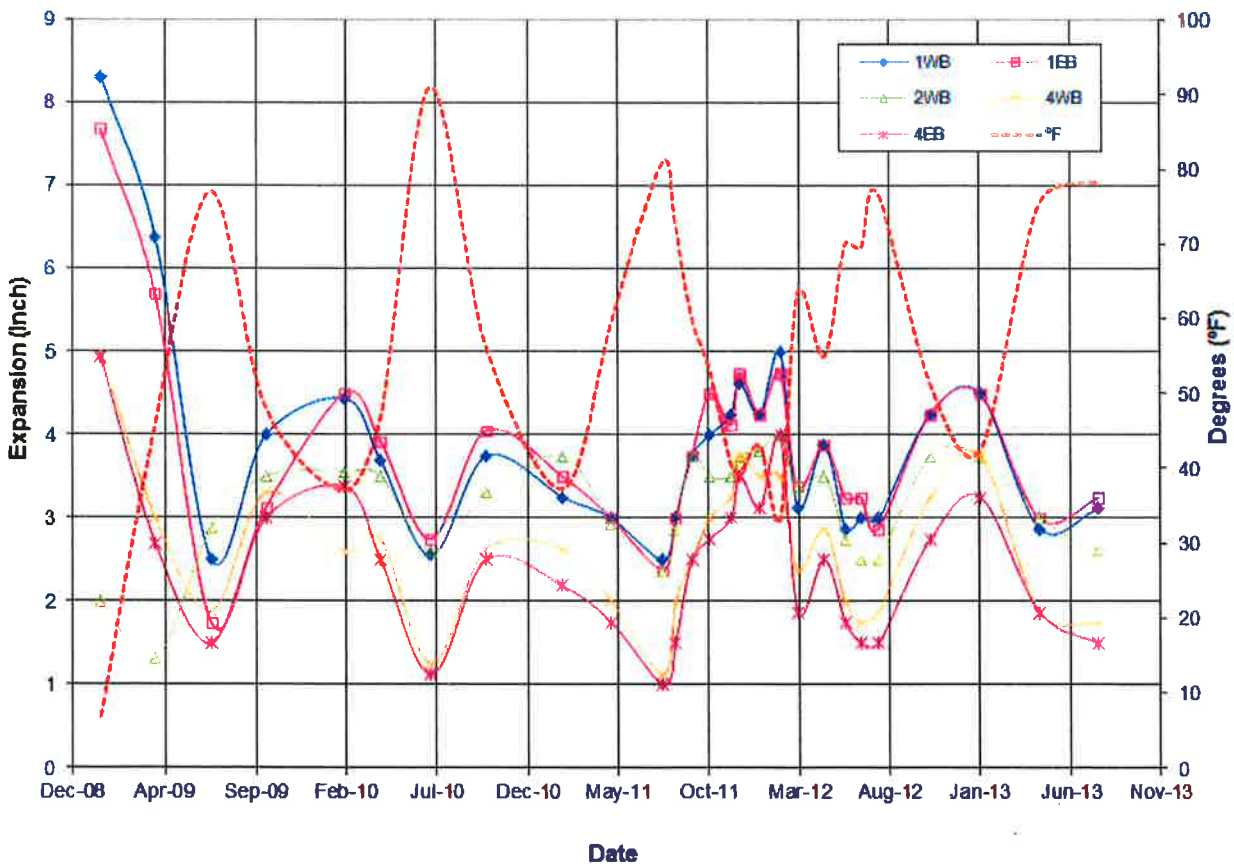


Figure 8. Bridge deck expansion joint and temperature measurements July 25, 2013.

Bridge Truss Openings

Four locations, A, B, C, and D, are measured on the north and south trusses at span 2, floor beam 12. The plots in Figure 9 are labeled NA, NB, etc., for the north truss and SA, SB, etc., for the south truss.

We see the same general trend in the truss measurements with gaps increasing as temperatures decreased and vice versa. We saw some short term deviations from the trend during the time that monthly measurements were taken. This quarter all measurements decreased with the slightly higher temperature with the exception of measurement NA. At NA the measurement increased slightly.

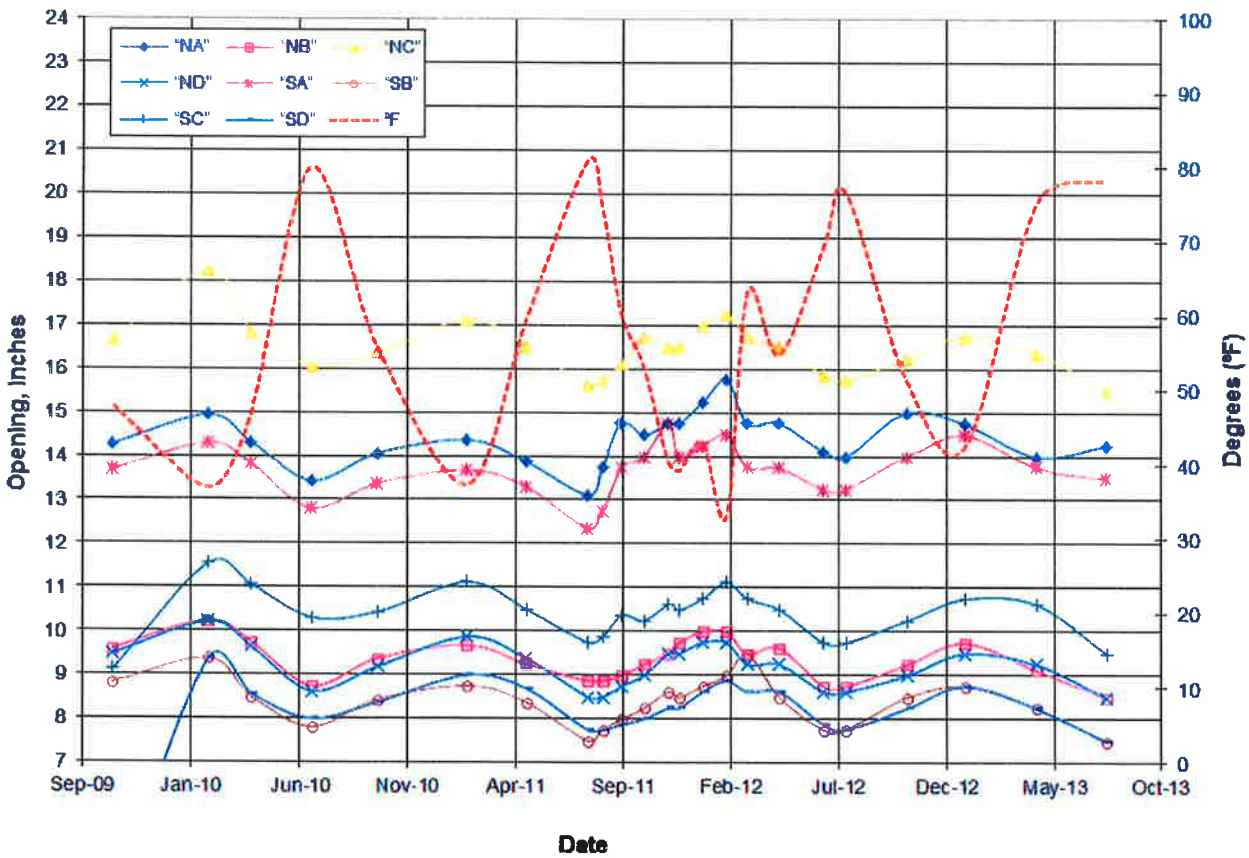


Figure 9. Bridge truss joint spacing and temperature measurements July 25, 2013.

AGGREGATE STOCKPILES

We observed and photographed the aggregate stockpiles on July 16, 2013. At that time, we estimated that the two larger piles near the east fence were approximately 25 to 30 feet high covering about 50% of the property. The closest pile was about 5 to 10 feet from the east fence line. The amount of material stockpiled increased since last quarter, but the distance from the fence line is about the same.

Figure 10. Aggregate stockpile east of the ODOT right-of-way (July 16, 2013).

Figure 11. Aggregate stockpile near ODOT's east right-of-way fence (July 16, 2013).

This completes the July 2013 report for the CUY-90-15.24 Slope Monitoring Project, ODOT PID 76117.

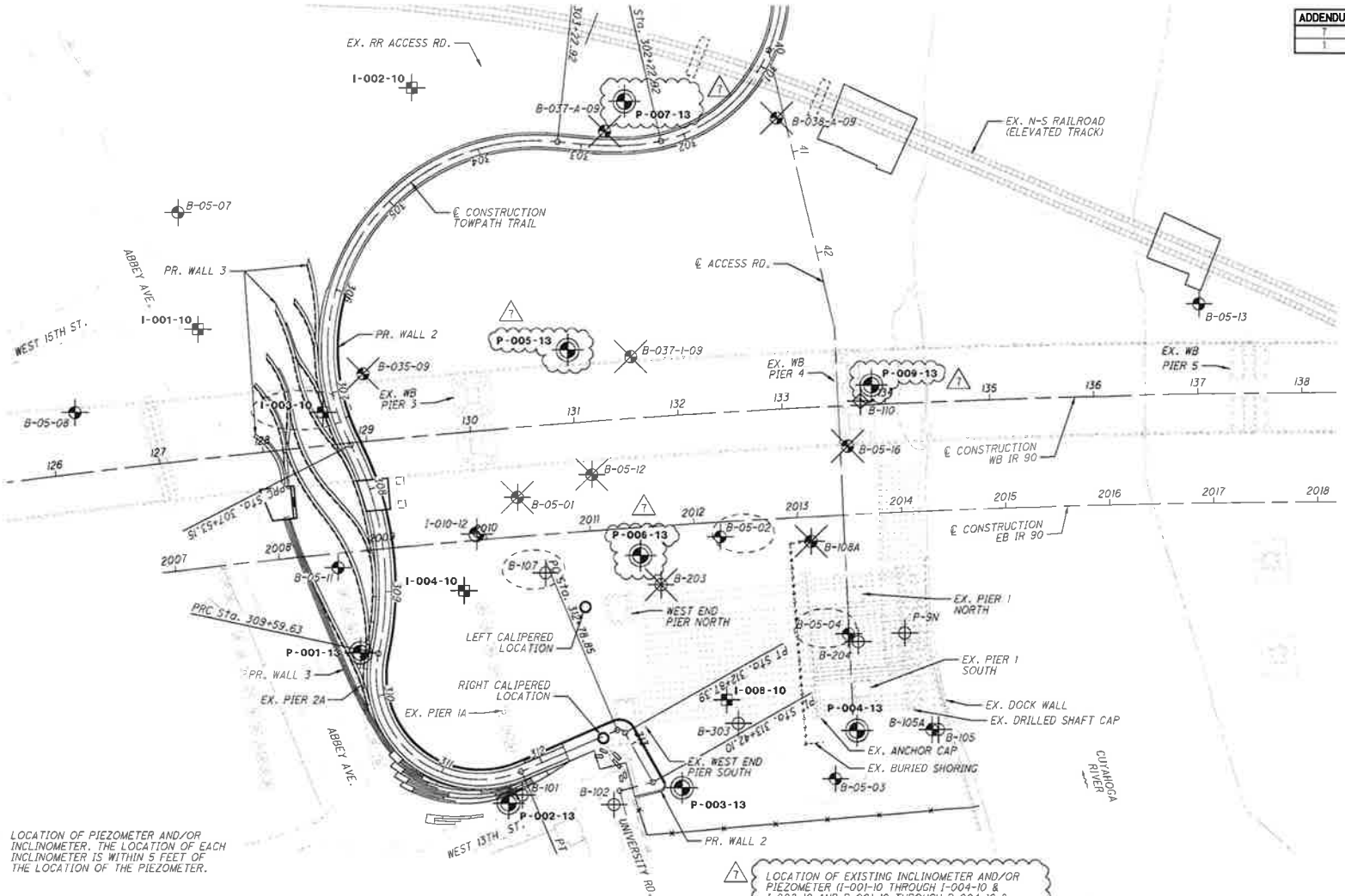
Report prepared by:

Alan J. Esser, P.E., D.GE
Principal Consultant

Report reviewed by:

Seth Molenaar
Material Specialist

ADDENDUM	DATE
7	8/2/13
1	4/16/13



LEGEND

P-001-13 — LOCATION OF PIEZOMETER AND/OR INCLINOMETER. THE LOCATION OF EACH INCLINOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE PIEZOMETER.

B-05-01 — LOCATION OF INCLINOMETER/PIEZOMETER INSTALLED BY BBCM IN 2006 (B-05-01 THROUGH B-05-04, B-05-07, B-05-08, B-05-11 THROUGH B-05-13, AND B-05-16). THESE INSTRUMENTS ARE NOT AFFECTED BY THE GRADING AND REMAIN IN SERVICE.

B-105A — LOCATION OF REPLACEMENT INCLINOMETER INSTALLED BY BBCM IN 2006 (B-105A AND B-108A).

B-101 — LOCATION OF INCLINOMETER AND/OR PIEZOMETER INSTALLED BY BBCM BETWEEN 1994 AND 1999 (B-101, B-102, B-105, B-107, B-203, B-204, B-303, AND P-9N).

B-110 — LOCATION OF INCLINOMETER AT B-110, WHICH WAS DESTROYED BY EXCAVATION ACTIVITIES IN MARCH, 2006

I-010-12 — LOCATION OF INCLINOMETER INSTALLED DURING PIER 3 CONSTRUCTION, 2012

7 — LOCATION OF EXISTING INCLINOMETER AND/OR PIEZOMETER (I-001-10 THROUGH I-004-10 & I-008-10 AND P-001-10 THROUGH P-004-10 & P-008-10 INSTALLED AS PART OF THE CCGI CONTRACT). THE LOCATION OF EACH PIEZOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE INCLINOMETER. DEVELOPER IS RESPONSIBLE FOR THE REPLACEMENT INSTRUMENTATION, IF DAMAGED. (NOT USED: I-005-10 THROUGH I-007-10 & I-009-10 AND P-005-10 THROUGH P-007-10 & P-009-10).

I-001-10 — LOCATION OF ABANDONED INCLINOMETER AND/OR PIEZOMETER (B-05-01, B-05-12, B-05-16, B-035-0-09, B-037-I-09, AND B-037-A-09, B-038-A-09, B-107, B-108A, B-203)

INCLINOMETER AND/OR PIEZOMETER TO BE REPLACED. THE FUTURE INSTALLATION WILL HAVE THE SAME DESIGNATION PRECEDED BY LETTER 'A' (B-05-02, B-05-04, B-107, I-003-10)

NOTE:
THE DEVELOPER NEEDS TO PROTECT ALL THE INSTRUMENTS AND REPLACE ANY IF DAMAGED, PER SCOPE REQUIREMENTS.

HORIZONTAL SCALE IN FEET 0 50 100

DRAWN CDS
CHECKED JN

INSTRUMENTATION PLAN
CUYAHOGA RIVER WEST BANK

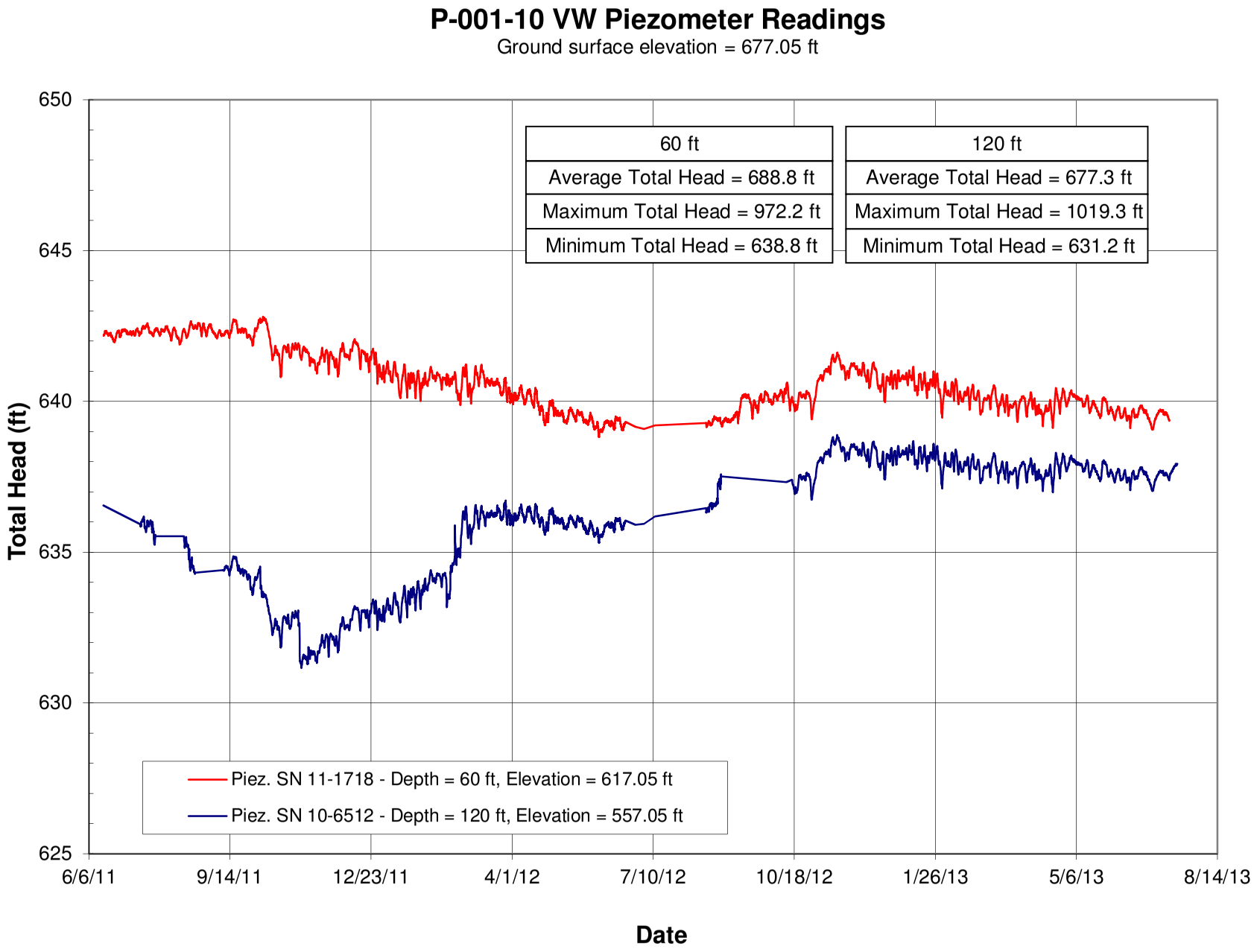
CUY-90-14.90

1 / 4

61 / 93

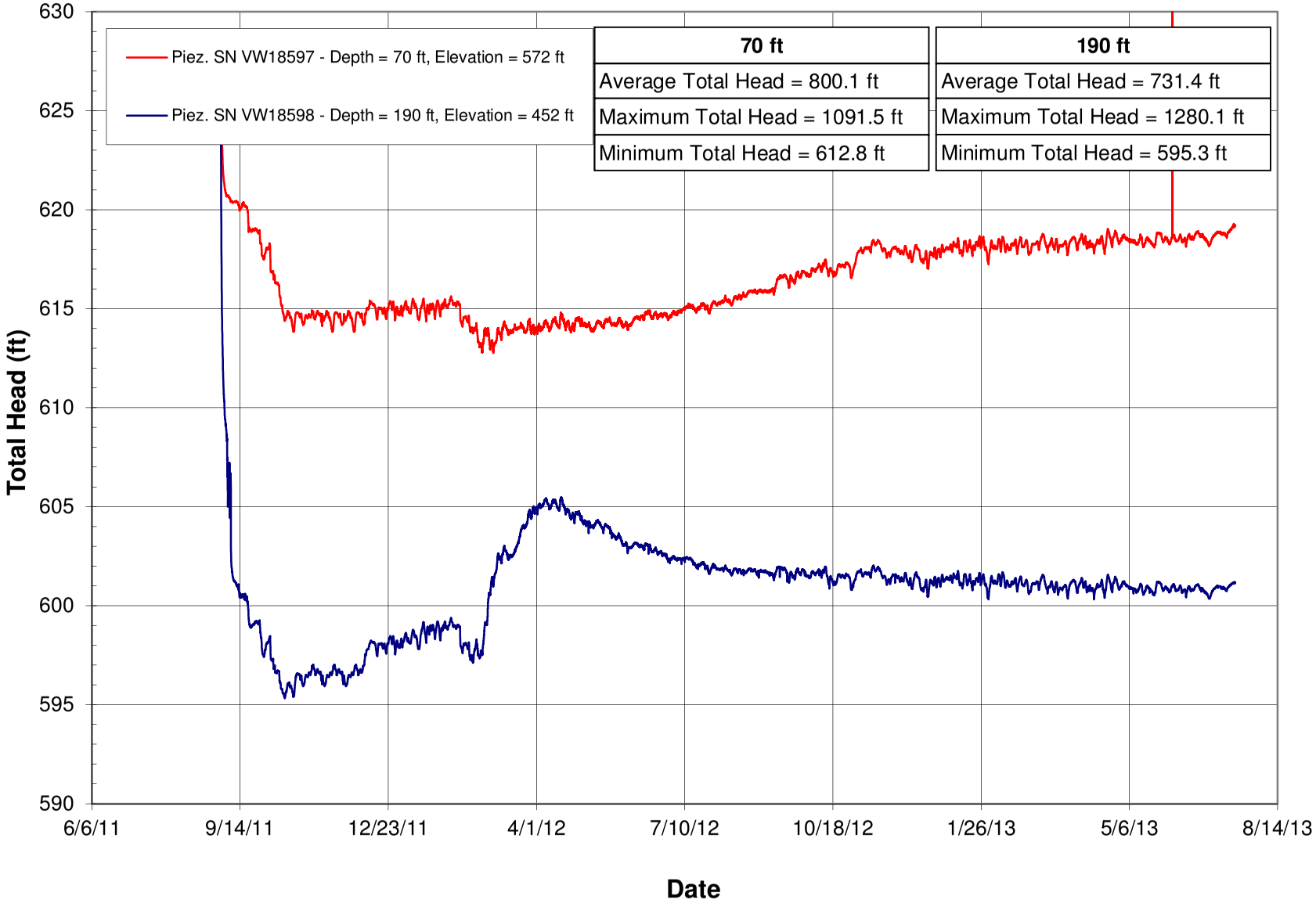
P:\82119\geotechnical\sheets\82119ZP410 Addendum 7.dgn 8/2/2013 10:14:37 AM cstack

APPENDIX A
PIEZOMETERS

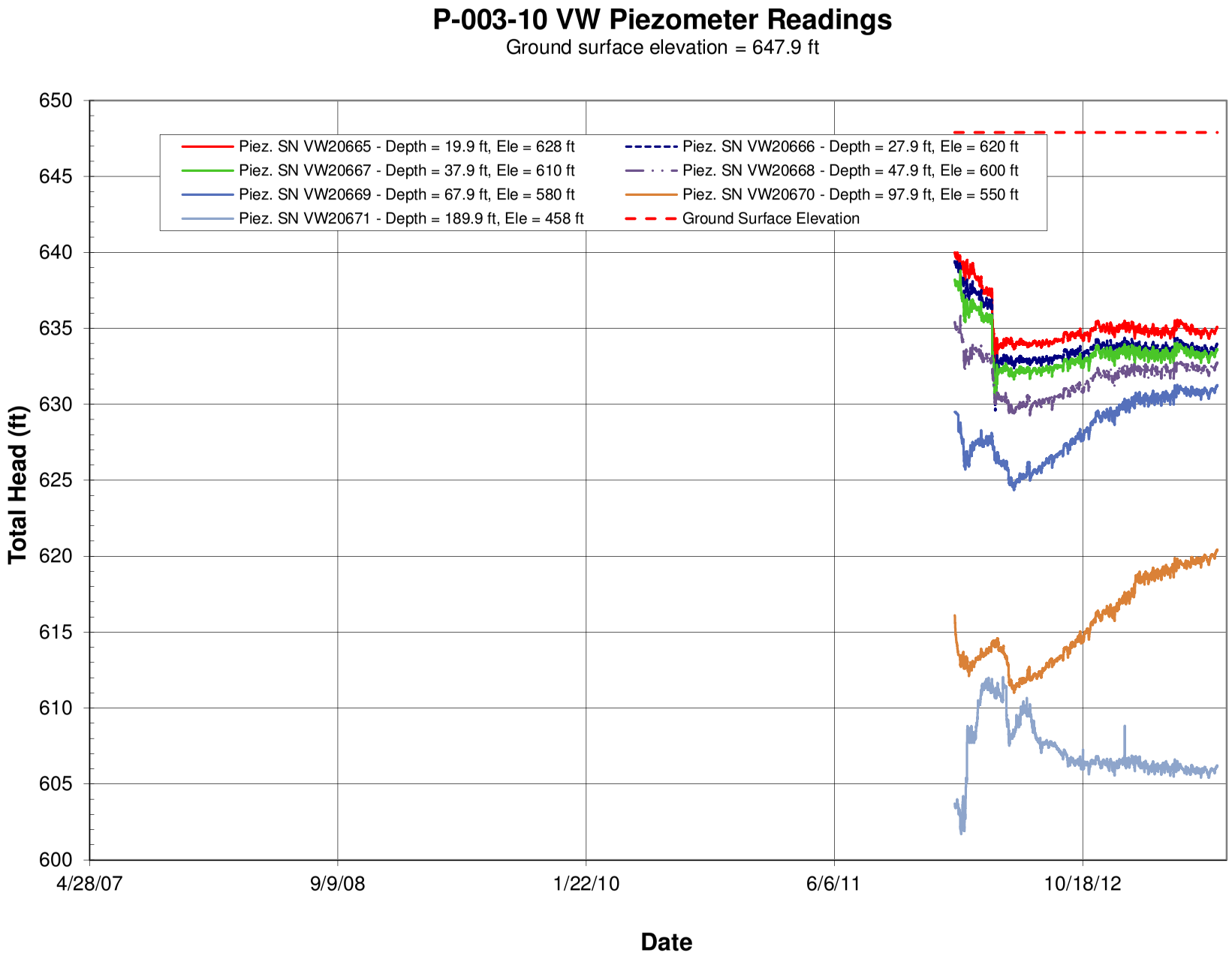

P-001-10 VW Piezometer Readings
Ground surface elevation = 677.05 ft
60 ft
Average Total Head = 688.8 ft
Maximum Total Head = 972.2 ft
Minimum Total Head = 638.8 ft
120 ft
Average Total Head = 677.3 ft
Maximum Total Head = 1019.3 ft
Minimum Total Head = 631.2 ft
Piez. SN 11-1718 - Depth = 60 ft, Elevation = 617.05 ft
Piez. SN 10-6512 - Depth = 120 ft, Elevation = 557.05 ft
Total Head (ft)
650
645
640
635
630
625
6/6/11
9/14/11
12/23/11
4/1/12
7/10/12
10/18/12
1/26/13
5/6/13
8/14/13
Date

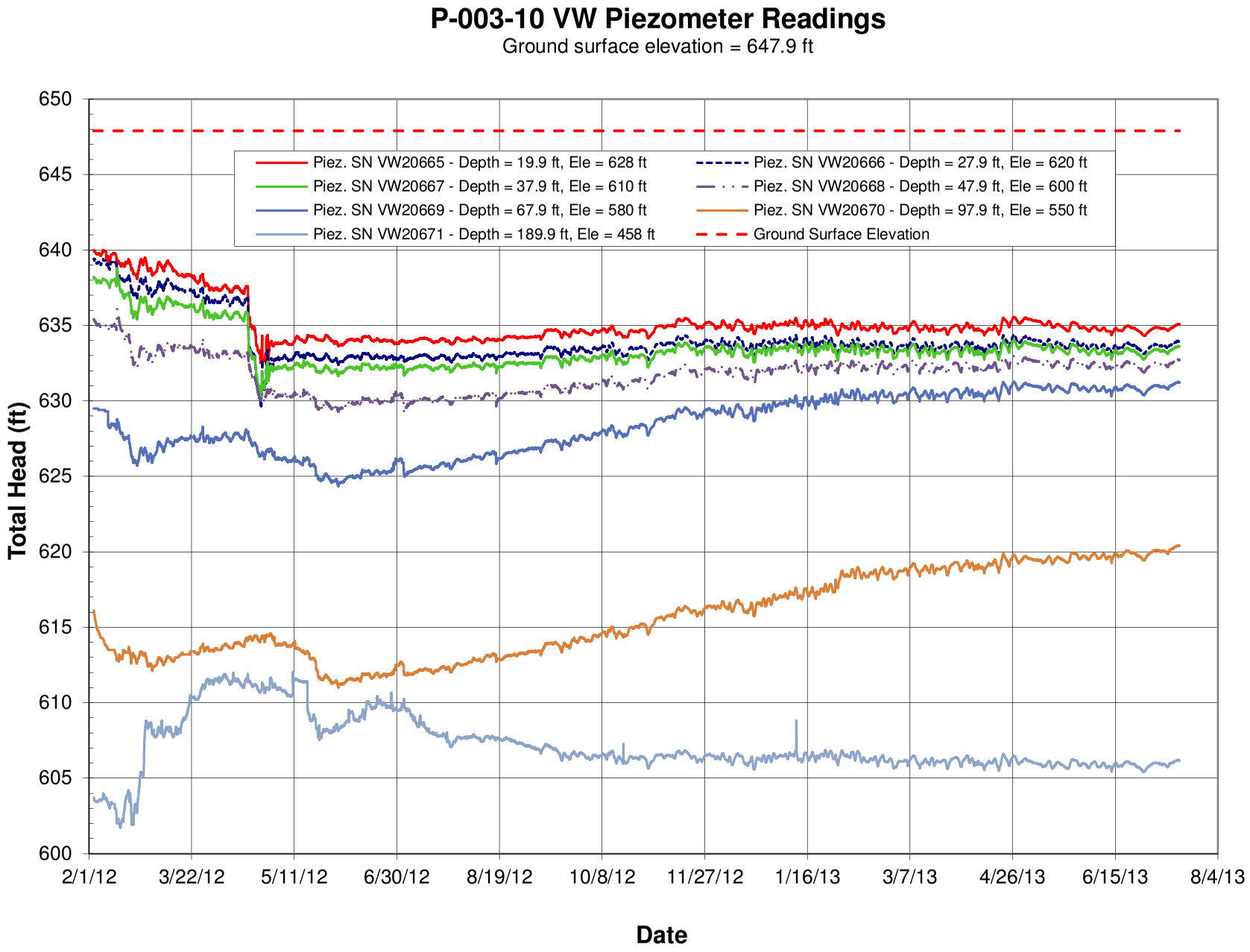
P-002-10 VW Piezometer Readings

Ground surface elevation = 644 ft



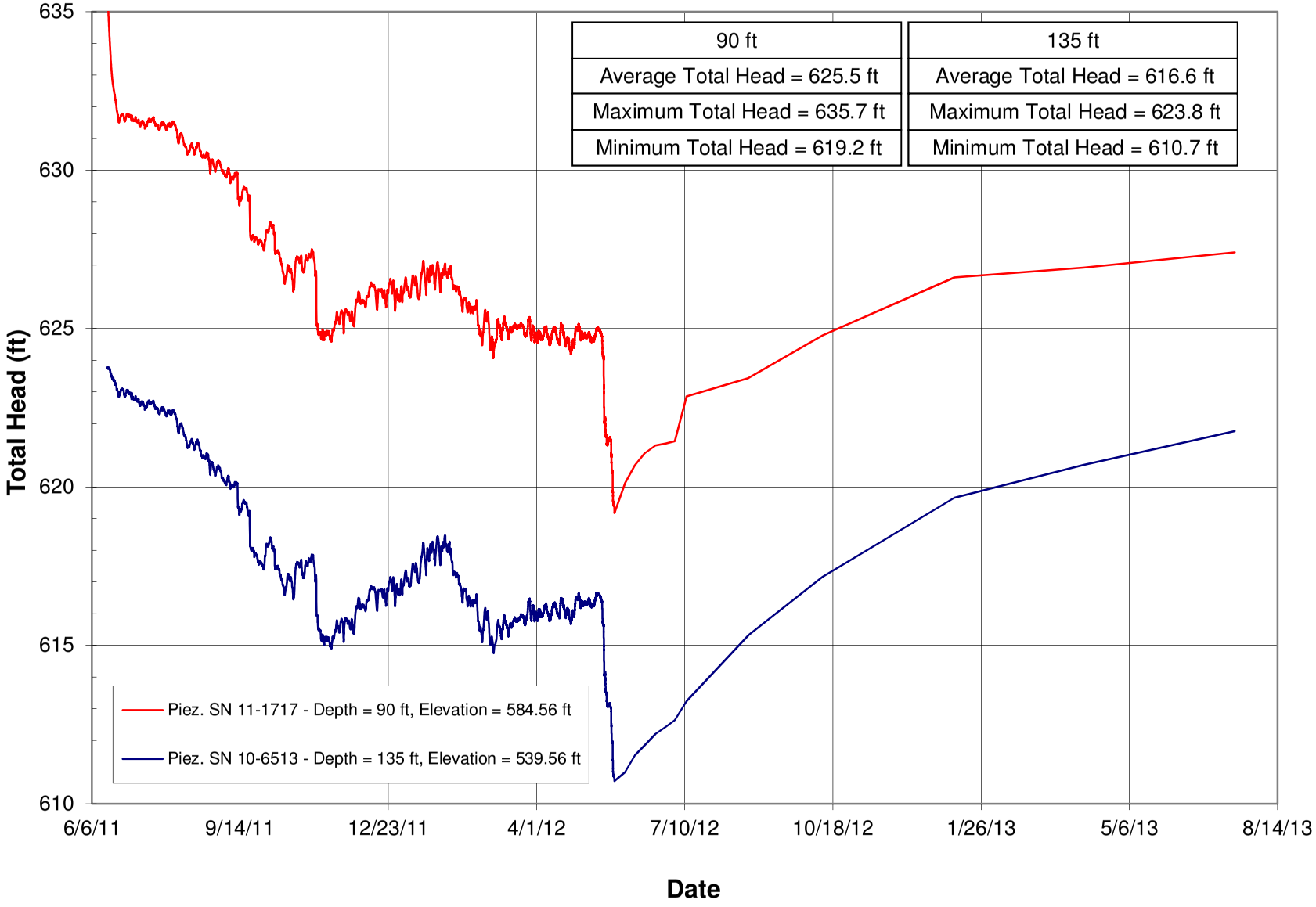
70 ft	190 ft
Average Total Head = 800.1 ft	Average Total Head = 731.4 ft
Maximum Total Head = 1091.5 ft	Maximum Total Head = 1280.1 ft
Minimum Total Head = 612.8 ft	Minimum Total Head = 595.3 ft


P-003-10 VW Piezometer Readings
Ground surface elevation = 647.9 ft
Piez. SN VW20665 - Depth = 19.9 ft, Ele = 628 ft
Piez. SN VW20666 - Depth = 27.9 ft, Ele = 620 ft
Piez. SN VW20667 - Depth = 37.9 ft, Ele = 610 ft
Piez. SN VW20668 - Depth = 47.9 ft, Ele = 600 ft
Piez. SN VW20669 - Depth = 67.9 ft, Ele = 580 ft
Piez. SN VW20670 - Depth = 97.9 ft, Ele = 550 ft
Piez. SN VW20671 - Depth = 189.9 ft, Ele = 458 ft
Ground Surface Elevation
Total Head (ft)
650
645
640
635
630
625
620
615
610
605
600
4/28/07
9/9/08
1/22/10
6/6/11
10/18/12
Date


P-003-10 VW Piezometer Readings
Ground surface elevation = 647.9 ft
Piez. SN VW20665 - Depth = 19.9 ft, Ele = 628 ft
Piez. SN VW20666 - Depth = 27.9 ft, Ele = 620 ft
Piez. SN VW20667 - Depth = 37.9 ft, Ele = 610 ft
Piez. SN VW20668 - Depth = 47.9 ft, Ele = 600 ft
Piez. SN VW20669 - Depth = 67.9 ft, Ele = 580 ft
Piez. SN VW20670 - Depth = 97.9 ft, Ele = 550 ft
Piez. SN VW20671 - Depth = 189.9 ft, Ele = 458 ft
Ground Surface Elevation
Total Head (ft)
650
645
640
635
630
625
620
615
610
605
600
2/1/12
3/22/12
5/11/12
6/30/12
8/19/12
10/8/12
11/27/12
1/16/13
3/7/13
4/26/13
6/15/13
8/4/13
Date

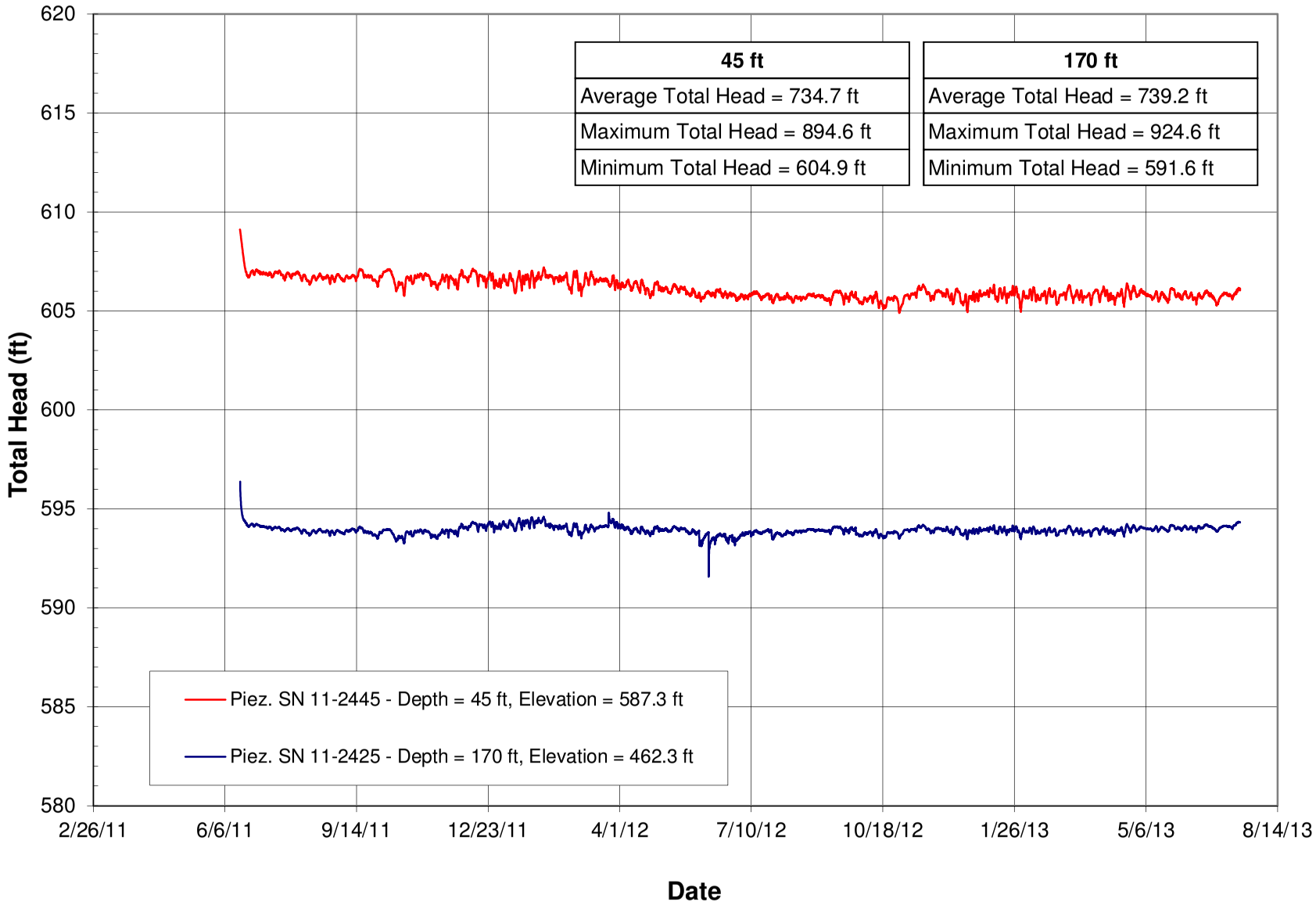
P-004-10 VW Piezometer Readings

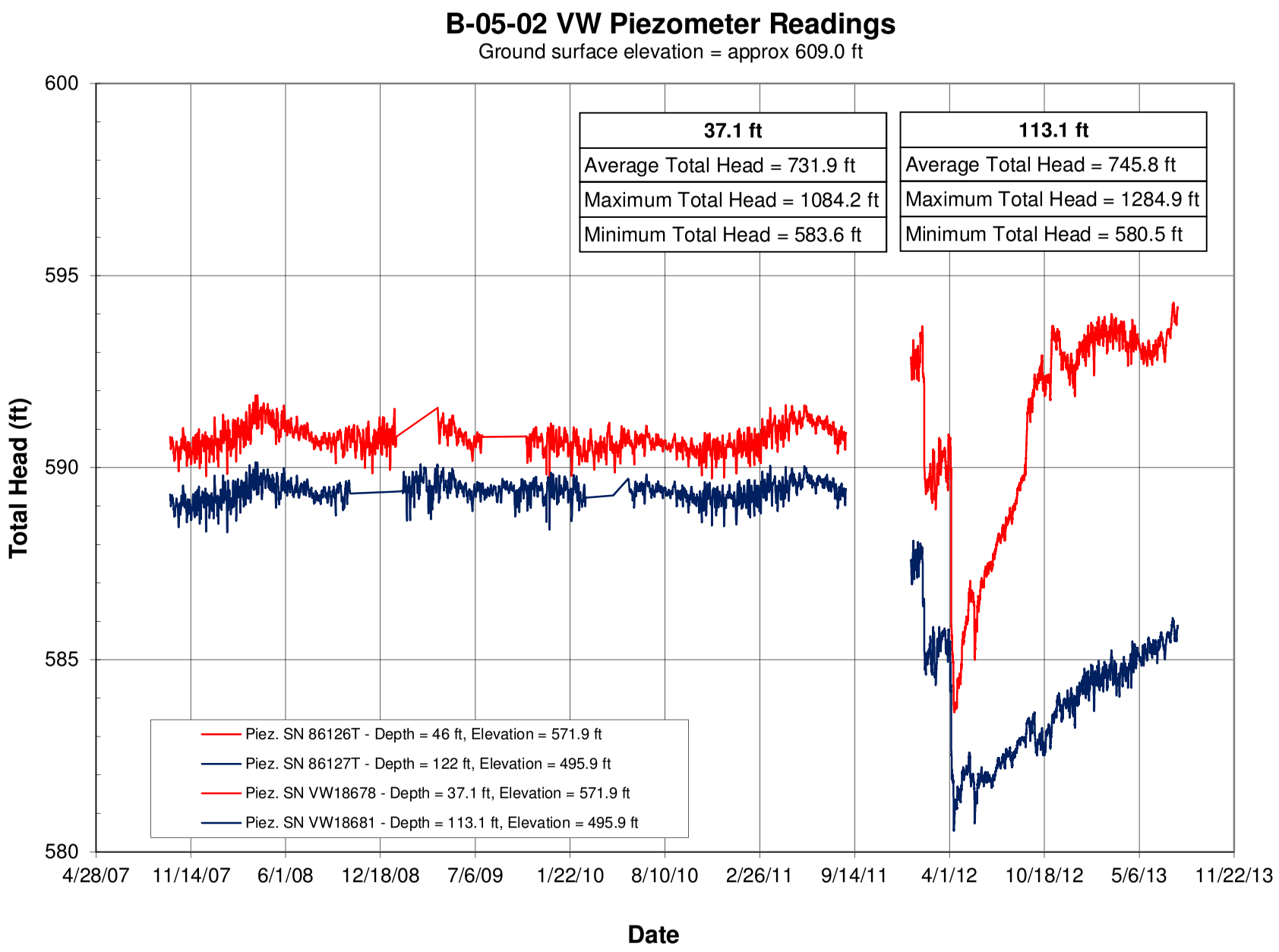
Ground surface elevation = 674.6 ft



P-008-10 VW Piezometer Readings

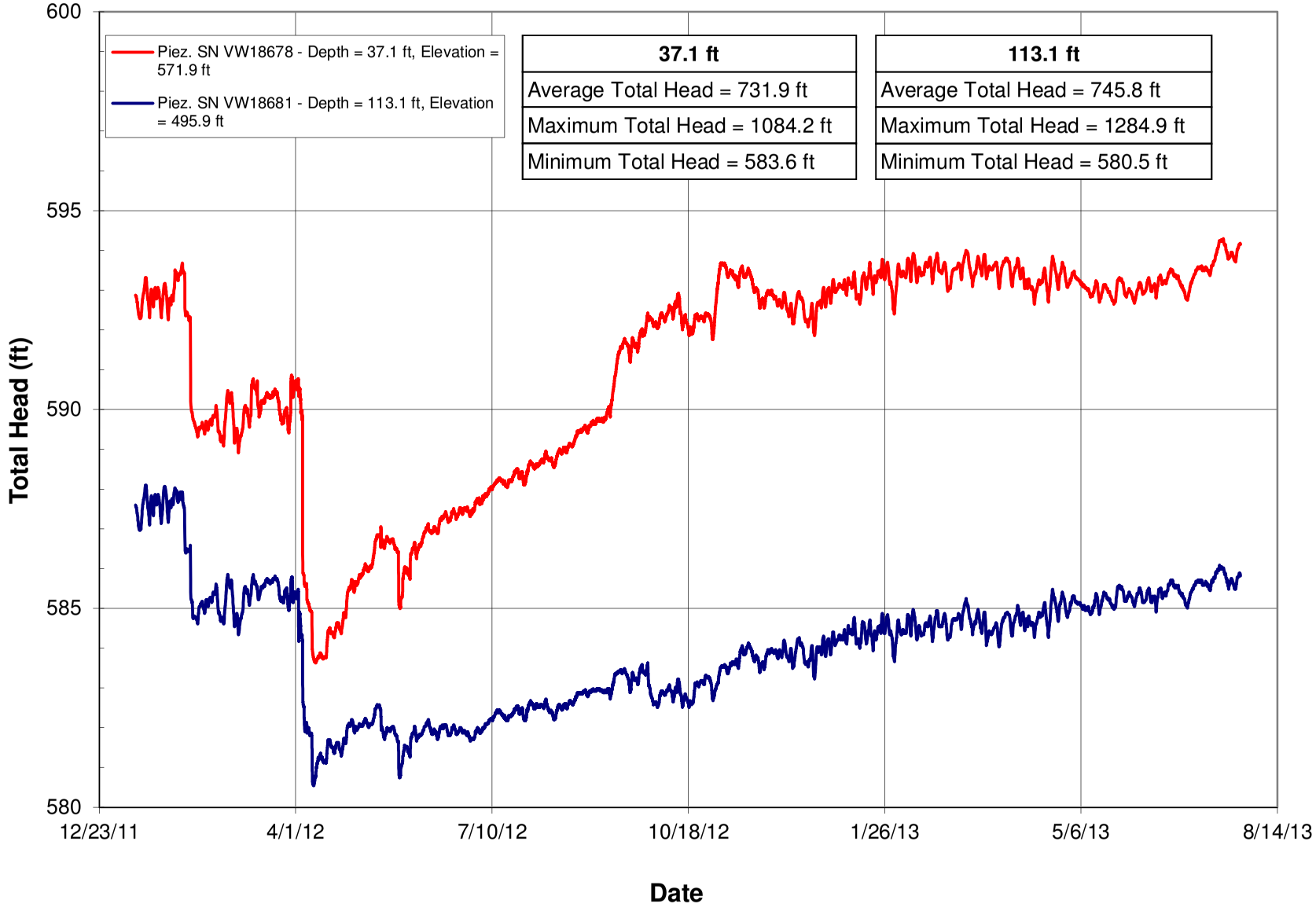
Ground surface elevation = 632.3 ft




B-05-02 VW Piezometer Readings
Ground surface elevation = approx 609.0 ft
37.1 ft
Average Total Head = 731.9 ft
Maximum Total Head = 1084.2 ft
Minimum Total Head = 583.6 ft
113.1 ft
Average Total Head = 745.8 ft
Maximum Total Head = 1284.9 ft
Minimum Total Head = 580.5 ft
Piez. SN 86126T - Depth = 46 ft, Elevation = 571.9 ft
Piez. SN 86127T - Depth = 122 ft, Elevation = 495.9 ft
Piez. SN VW18678 - Depth = 37.1 ft, Elevation = 571.9 ft
Piez. SN VW18681 - Depth = 113.1 ft, Elevation = 495.9 ft
Total Head (ft)
600
595
590
585
580
4/28/07
11/14/07
6/1/08
12/18/08
7/6/09
1/22/10
8/10/10
2/26/11
9/14/11
4/1/12
10/18/12
5/6/13
11/22/13
Date

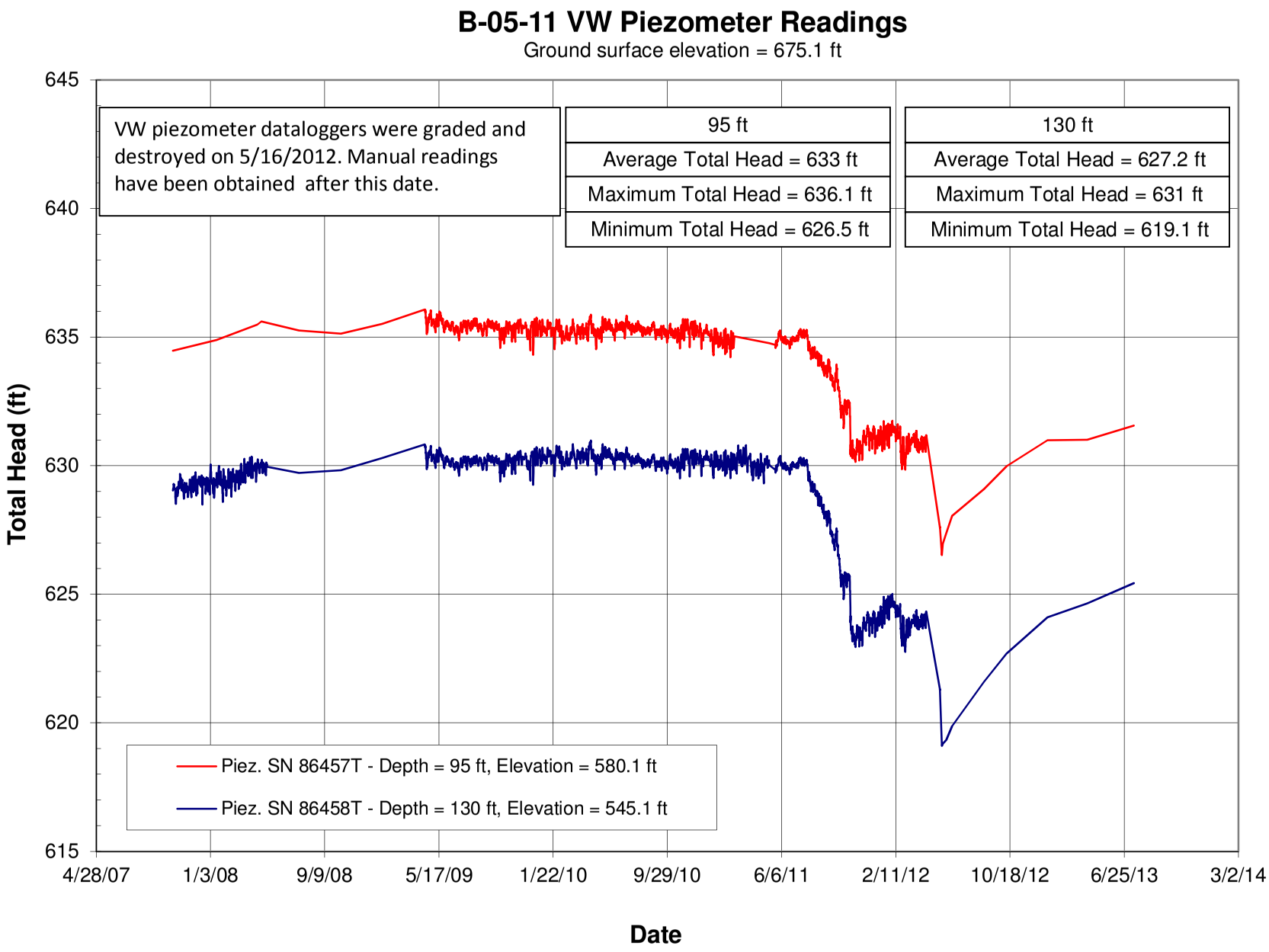
B-05-02 VW Piezometer Readings

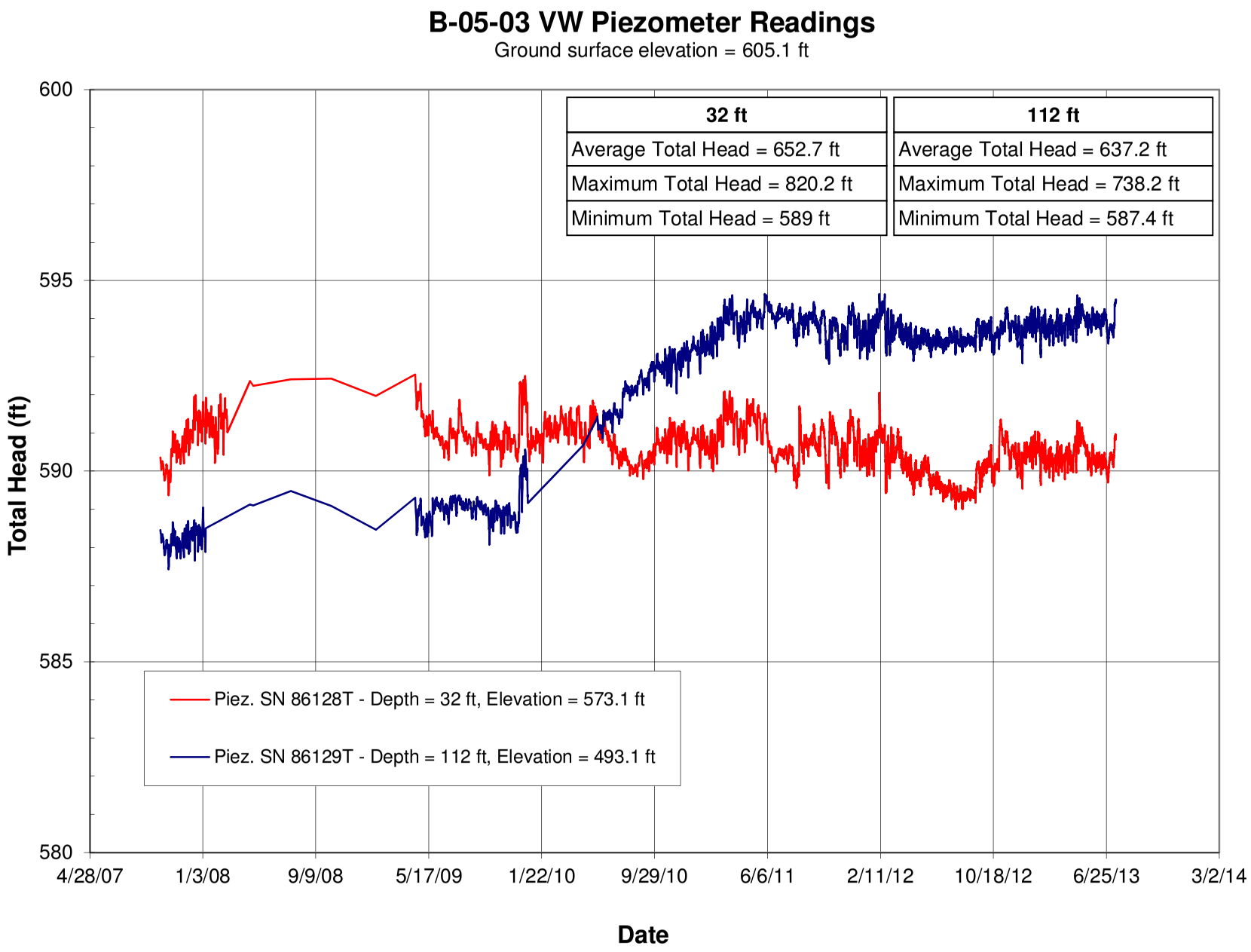
Ground surface elevation = approx 609.0 ft

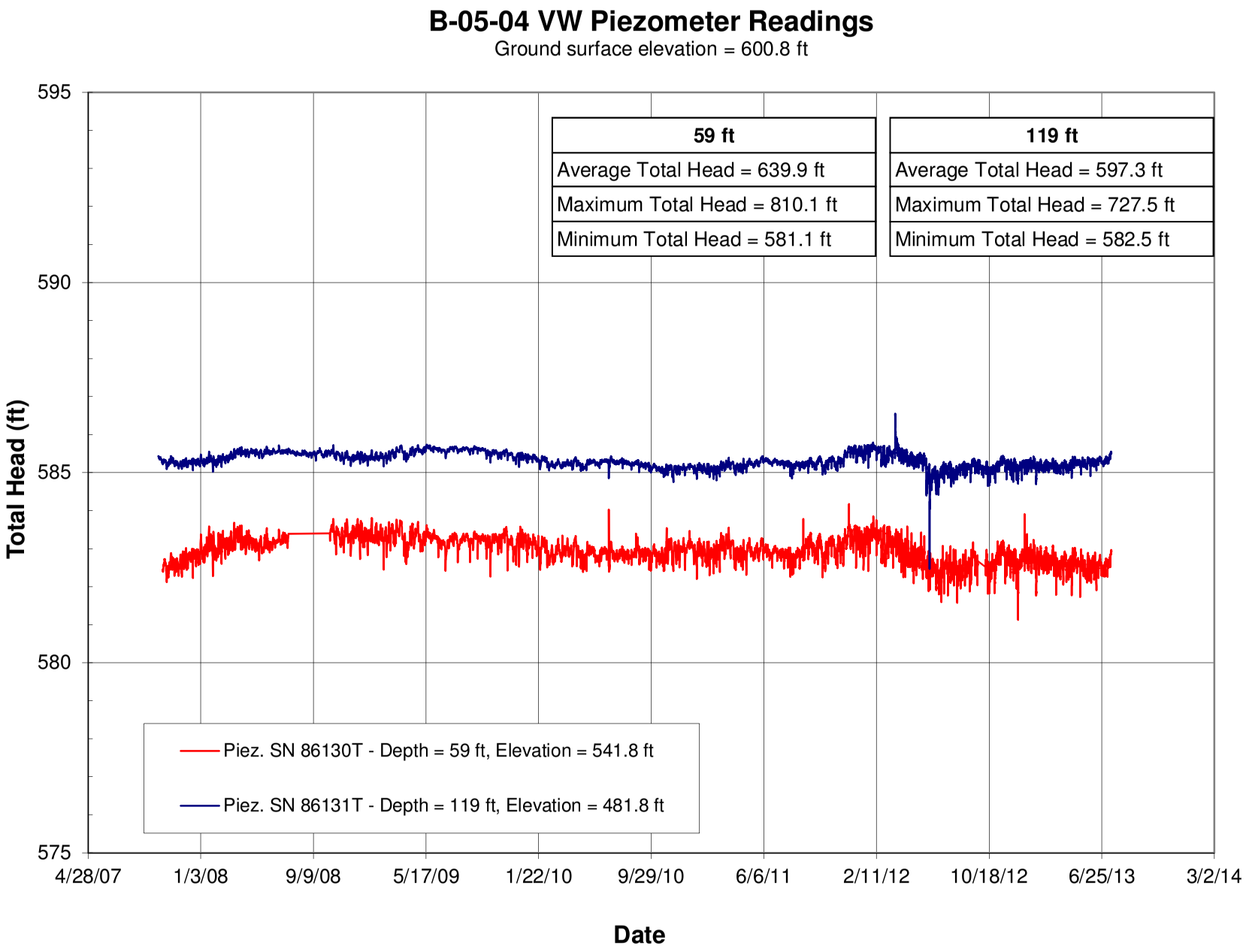


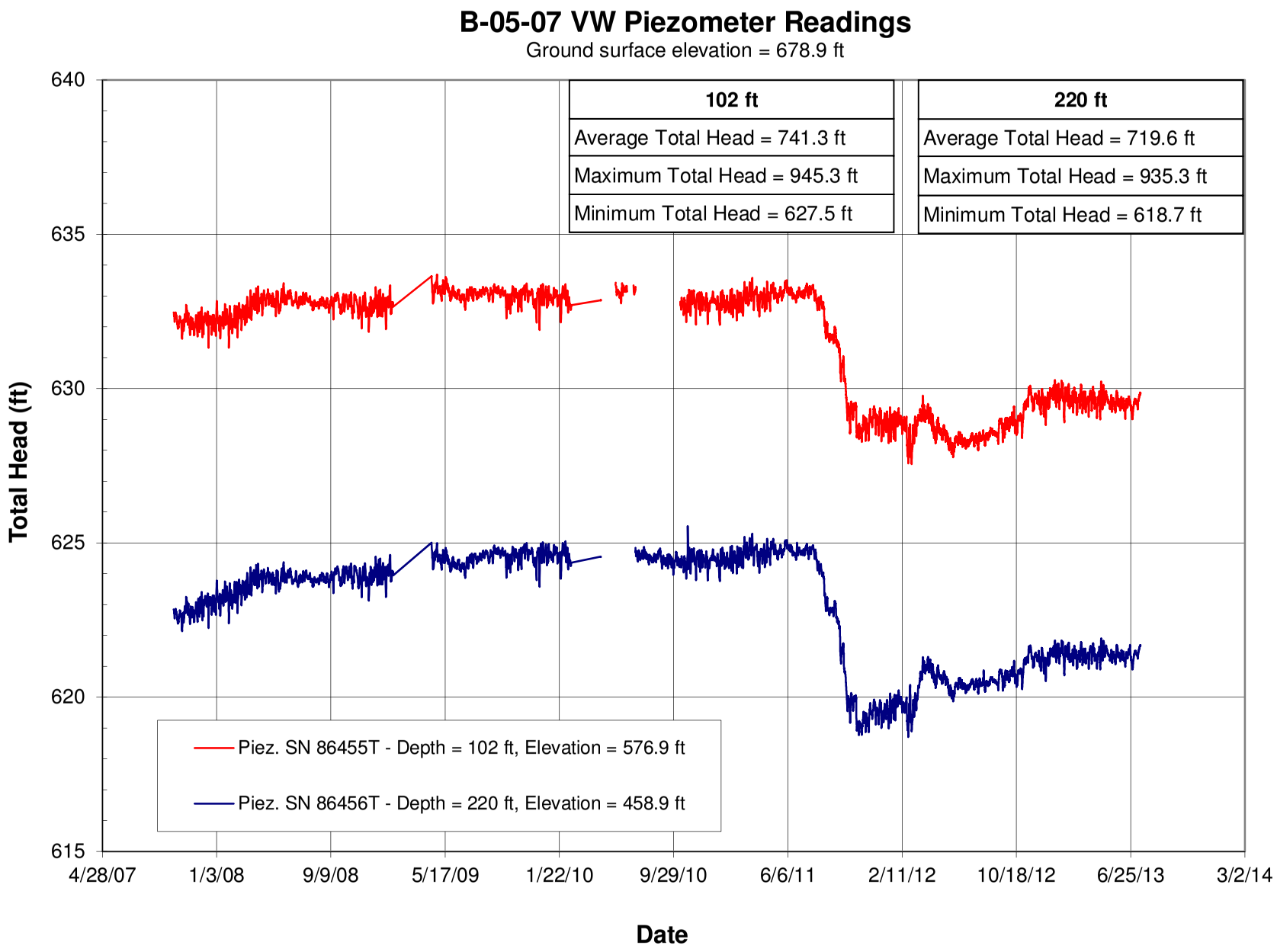
37.1 ft
Average Total Head = 731.9 ft
Maximum Total Head = 1084.2 ft
Minimum Total Head = 583.6 ft

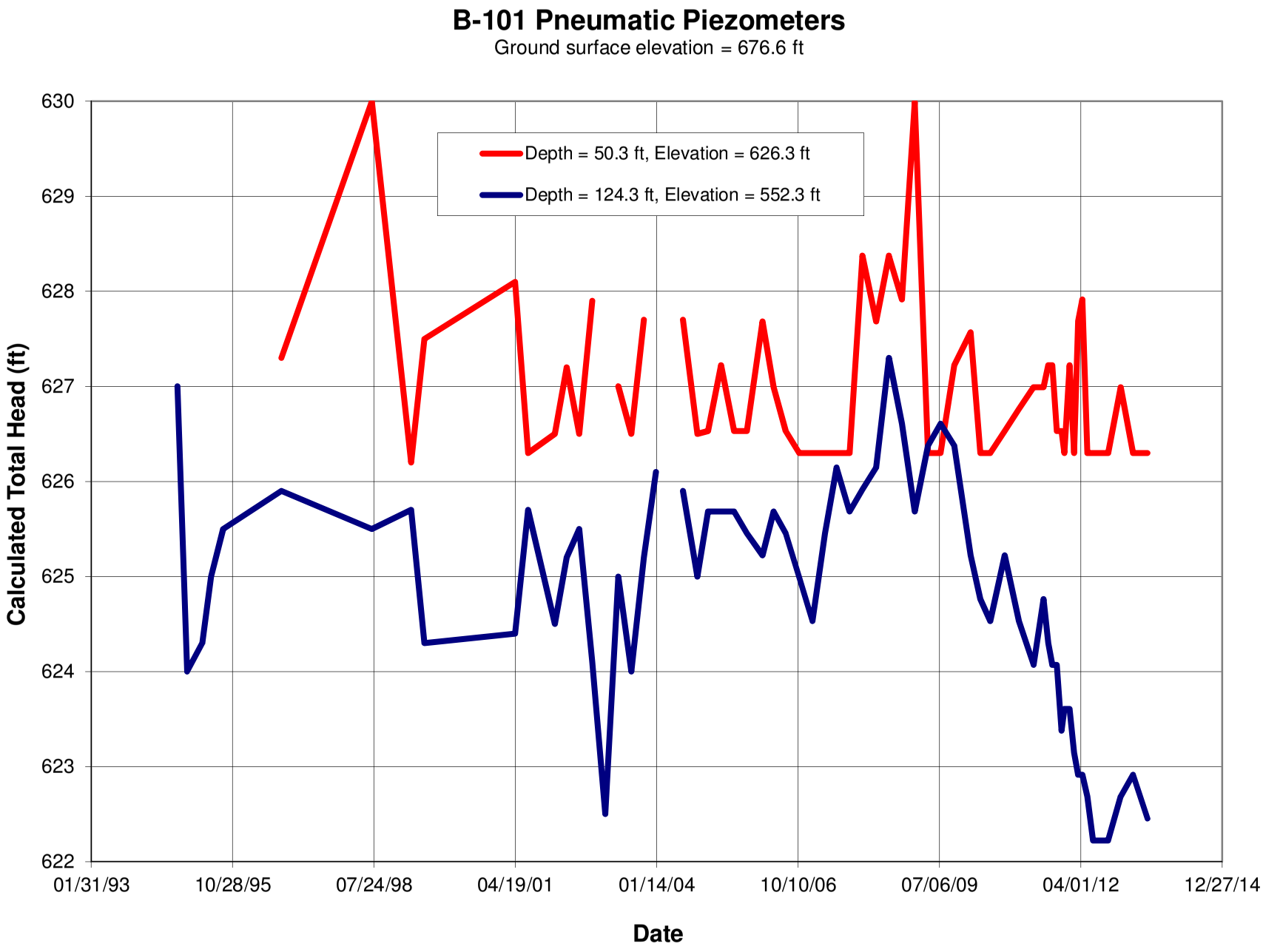
113.1 ft
Average Total Head = 745.8 ft
Maximum Total Head = 1284.9 ft
Minimum Total Head = 580.5 ft

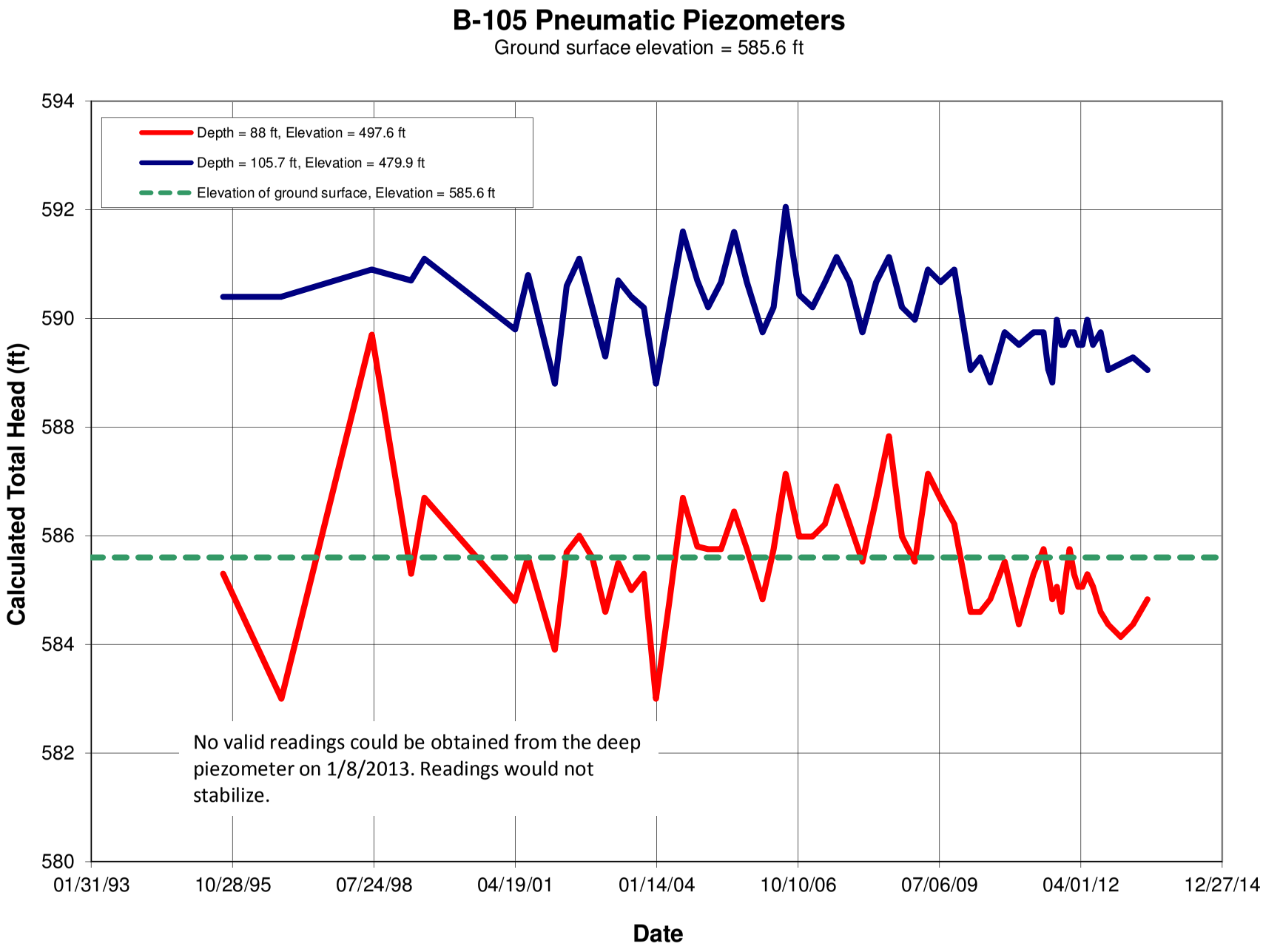

B-05-11 VW Piezometer Readings
Ground surface elevation = 675.1 ft
VW piezometer dataloggers were graded and destroyed on 5/16/2012. Manual readings have been obtained after this date.
95 ft
Average Total Head = 633 ft
Maximum Total Head = 636.1 ft
Minimum Total Head = 626.5 ft
130 ft
Average Total Head = 627.2 ft
Maximum Total Head = 631 ft
Minimum Total Head = 619.1 ft
Piez. SN 86457T - Depth = 95 ft, Elevation = 580.1 ft
Piez. SN 86458T - Depth = 130 ft, Elevation = 545.1 ft
Total Head (ft)
645
640
635
630
625
620
615
4/28/07
1/3/08
9/9/08
5/17/09
1/22/10
9/29/10
6/6/11
2/11/12
10/18/12
6/25/13
3/2/14
Date

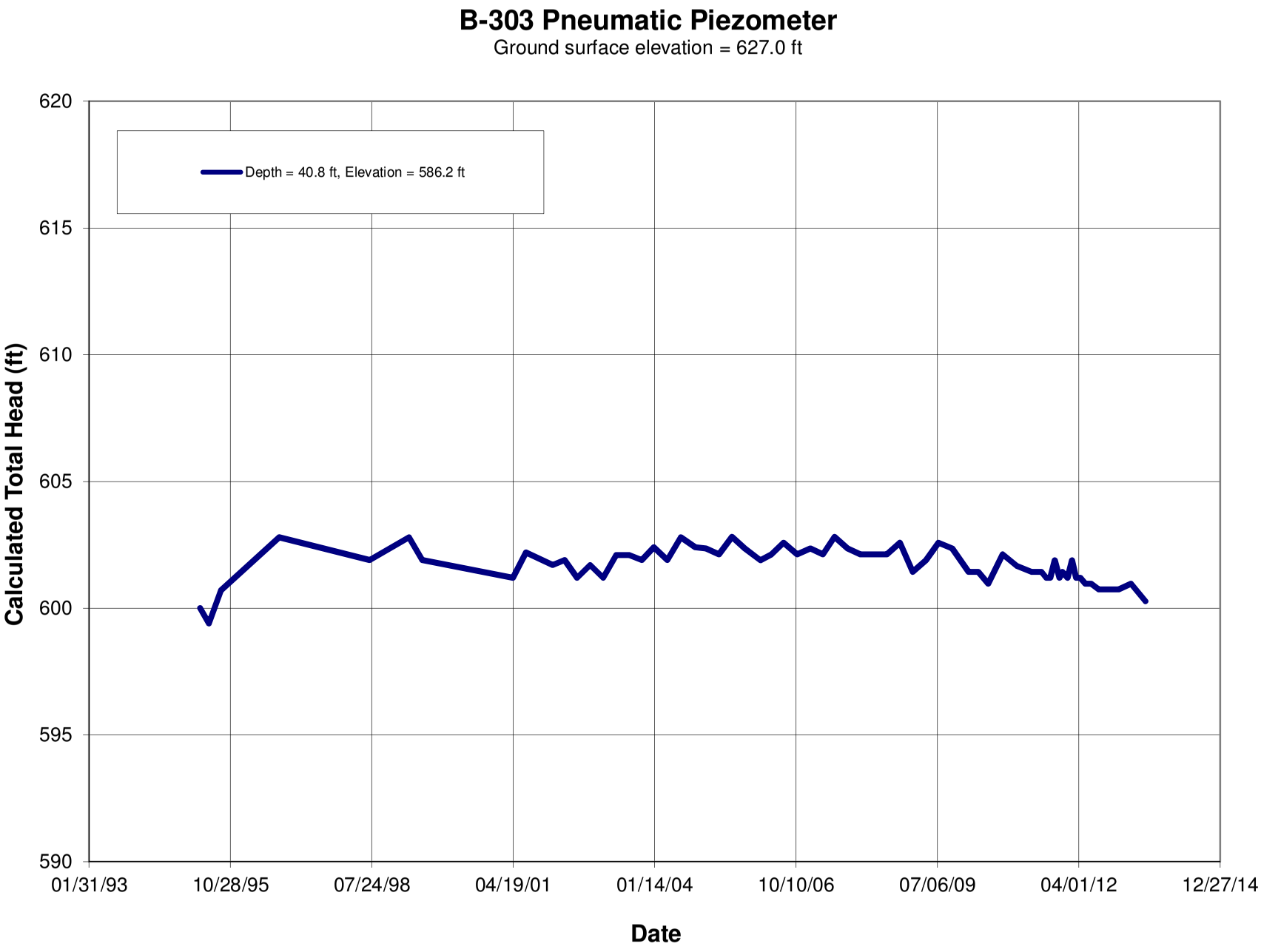

B-05-03 VW Piezometer Readings
Ground surface elevation = 605.1 ft
32 ft
Average Total Head = 652.7 ft
Maximum Total Head = 820.2 ft
Minimum Total Head = 589 ft
112 ft
Average Total Head = 637.2 ft
Maximum Total Head = 738.2 ft
Minimum Total Head = 587.4 ft
Piez. SN 86128T - Depth = 32 ft, Elevation = 573.1 ft
Piez. SN 86129T - Depth = 112 ft, Elevation = 493.1 ft
Total Head (ft)
600
595
590
585
580
4/28/07
1/3/08
9/9/08
5/17/09
1/22/10
9/29/10
6/6/11
2/11/12
10/18/12
6/25/13
3/2/14
Date


B-05-04 VW Piezometer Readings
Ground surface elevation = 600.8 ft
59 ft
Average Total Head = 639.9 ft
Maximum Total Head = 810.1 ft
Minimum Total Head = 581.1 ft
119 ft
Average Total Head = 597.3 ft
Maximum Total Head = 727.5 ft
Minimum Total Head = 582.5 ft
Piez. SN 86130T - Depth = 59 ft, Elevation = 541.8 ft
Piez. SN 86131T - Depth = 119 ft, Elevation = 481.8 ft
Total Head (ft)
595
590
585
580
575
4/28/07
1/3/08
9/9/08
5/17/09
1/22/10
9/29/10
6/6/11
2/11/12
10/18/12
6/25/13
3/2/14
Date

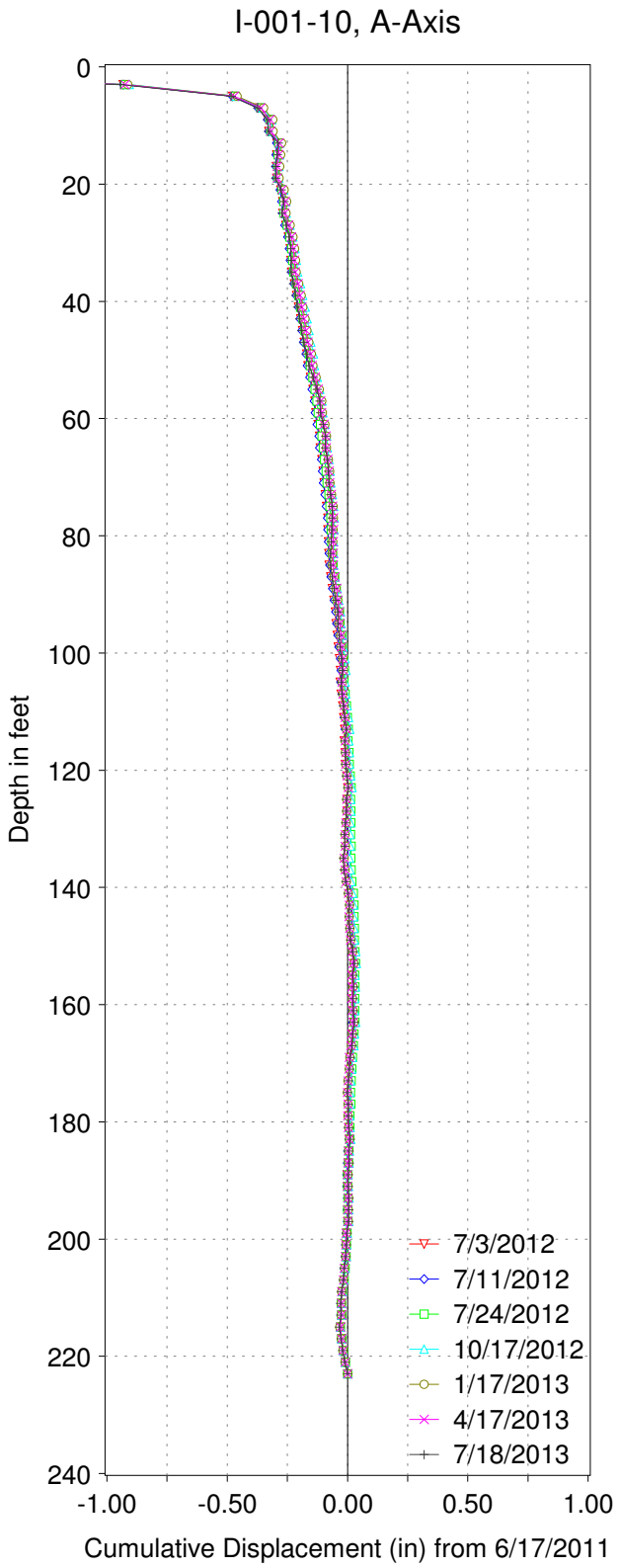

B-05-07 VW Piezometer Readings
Ground surface elevation = 678.9 ft
102 ft
Average Total Head = 741.3 ft
Maximum Total Head = 945.3 ft
Minimum Total Head = 627.5 ft
220 ft
Average Total Head = 719.6 ft
Maximum Total Head = 935.3 ft
Minimum Total Head = 618.7 ft
Piez. SN 86455T - Depth = 102 ft, Elevation = 576.9 ft
Piez. SN 86456T - Depth = 220 ft, Elevation = 458.9 ft
Total Head (ft)
640
635
630
625
620
615
4/28/07
1/3/08
9/9/08
5/17/09
1/22/10
9/29/10
6/6/11
2/11/12
10/18/12
6/25/13
3/2/14
Date

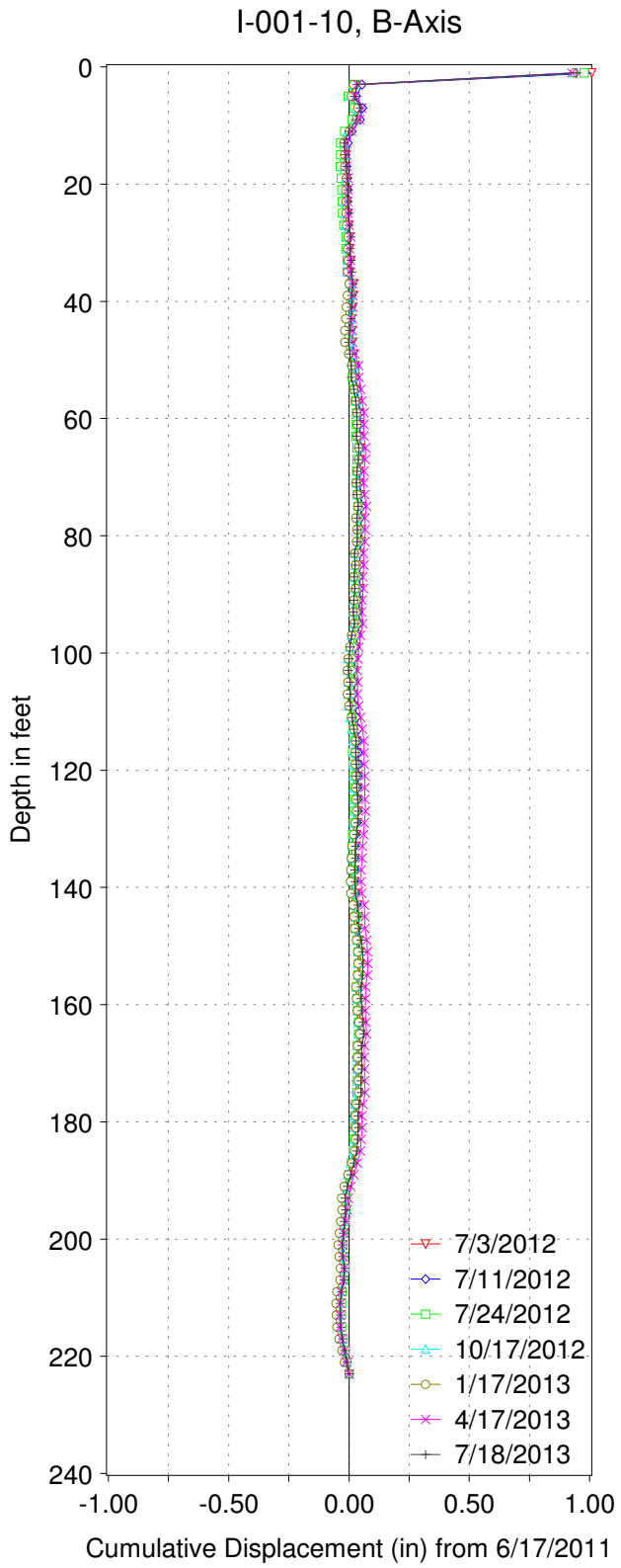

B-101 Pneumatic Piezometers
Ground surface elevation = 676.6 ft
Depth = 50.3 ft, Elevation = 626.3 ft
Depth = 124.3 ft, Elevation = 552.3 ft
Calculated Total Head (ft)
630
629
628
627
626
625
624
623
622
01/31/93
10/28/95
07/24/98
04/19/01
01/14/04
10/10/06
07/06/09
04/01/12
12/27/14
Date


B-105 Pneumatic Piezometers
Ground surface elevation = 585.6 ft
Depth = 88 ft, Elevation = 497.6 ft
Depth = 105.7 ft, Elevation = 479.9 ft
Elevation of ground surface, Elevation = 585.6 ft
No valid readings could be obtained from the deep piezometer on 1/8/2013. Readings would not stabilize.
Calculated Total Head (ft)
594
592
590
588
586
584
582
580
01/31/93
10/28/95
07/24/98
04/19/01
01/14/04
10/10/06
07/06/09
04/01/12
12/27/14
Date


B-303 Pneumatic Piezometer
Ground surface elevation = 627.0 ft
Depth = 40.8 ft, Elevation = 586.2 ft
Calculated Total Head (ft)
620
615
610
605
600
595
590
01/31/93
10/28/95
07/24/98
04/19/01
01/14/04
10/10/06
07/06/09
04/01/12
12/27/14
Date

APPENDIX B
INCLINOMETERS





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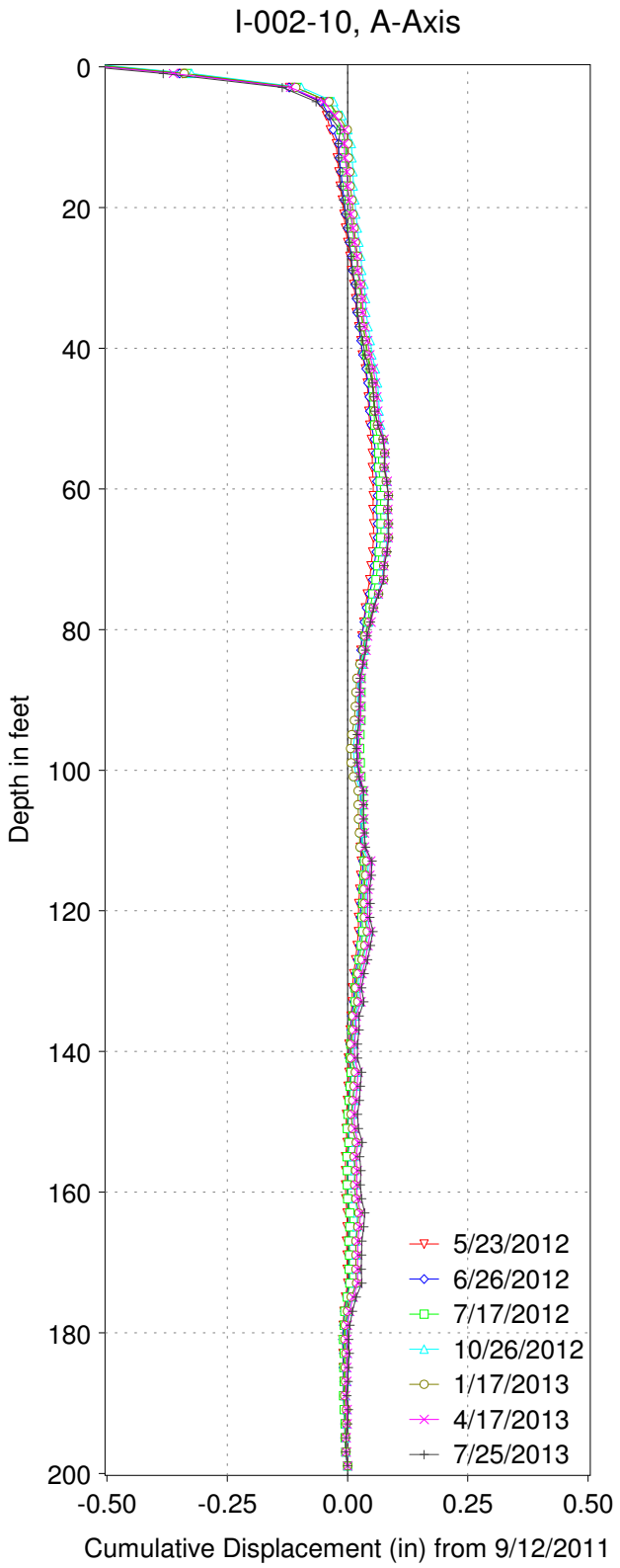
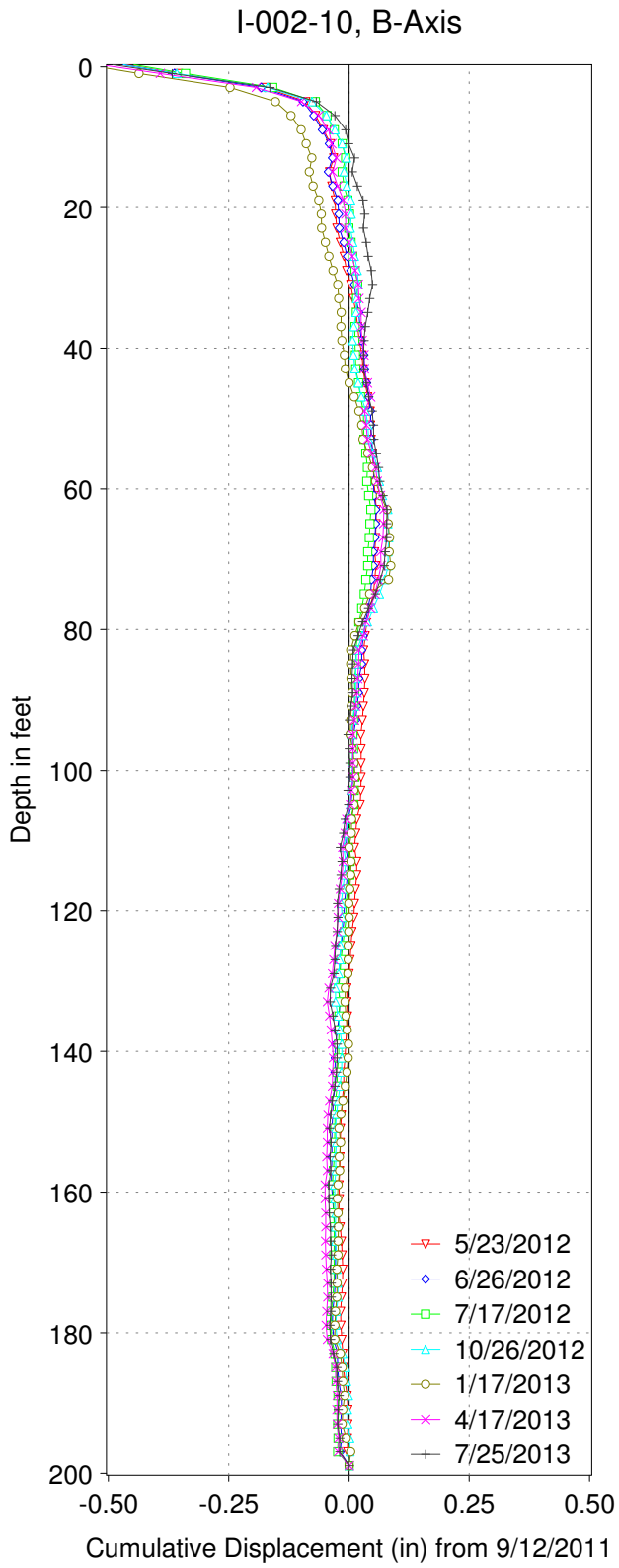
SME Project# 062943.00
Reading Date: 7/18/2013

Soil and Materials Engineers, Inc.





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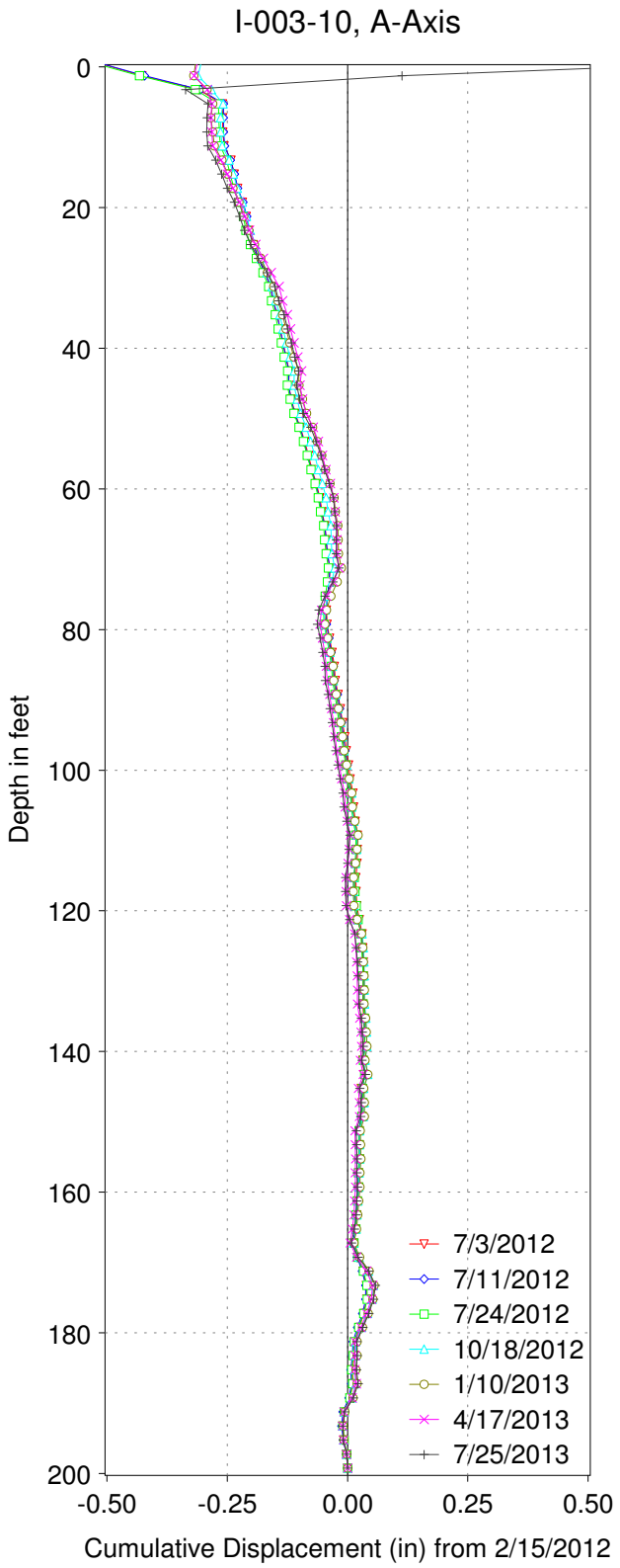

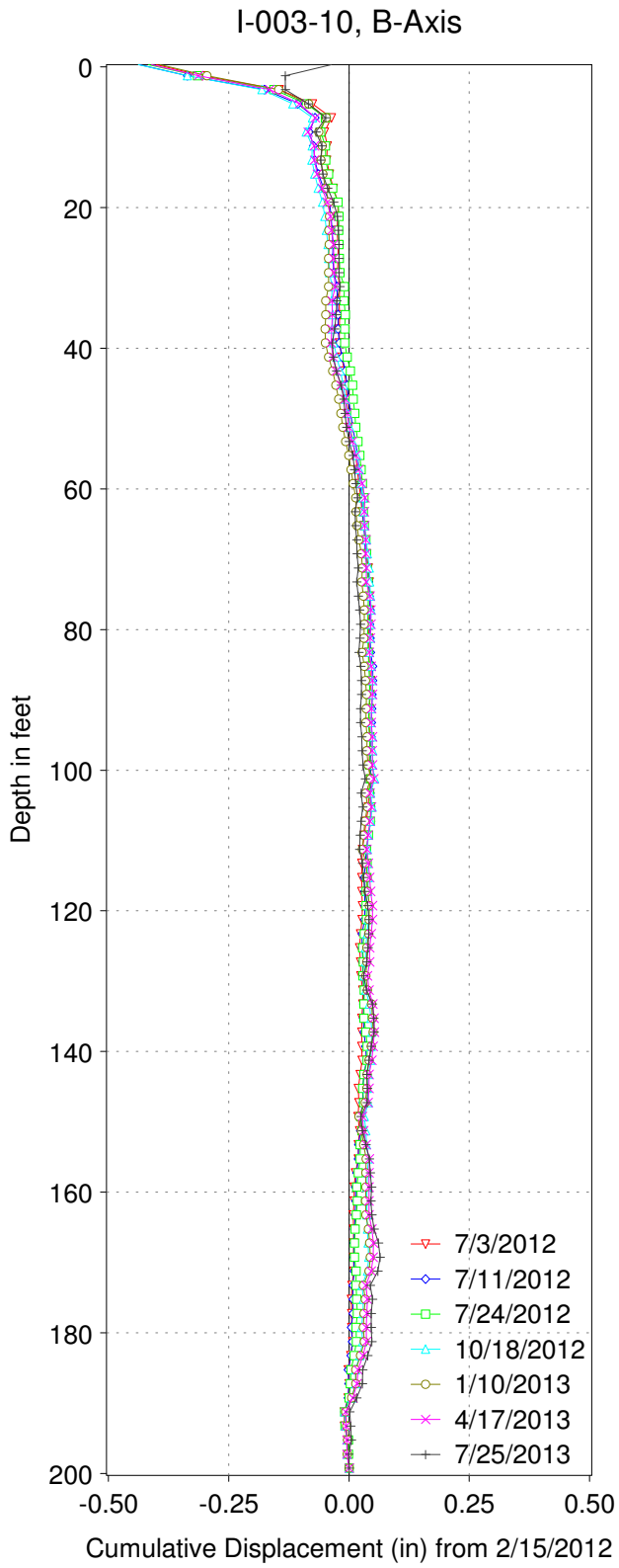

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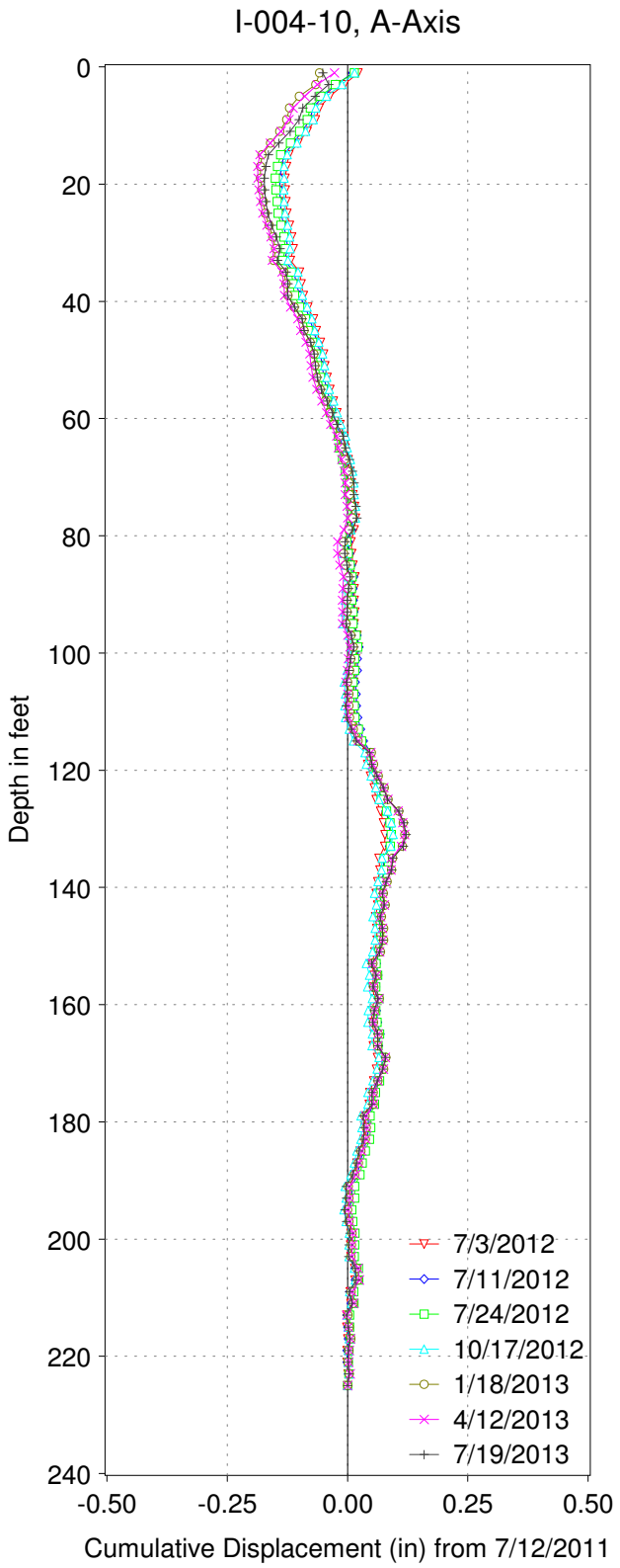

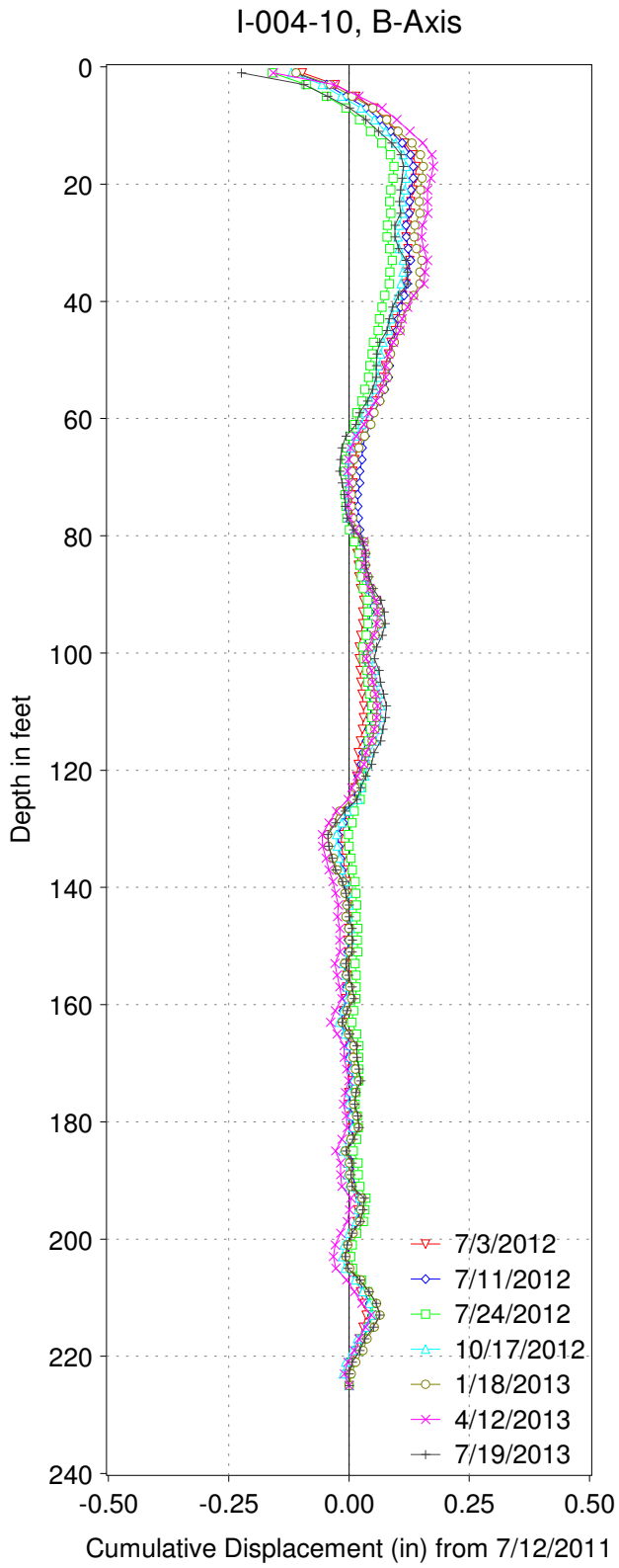

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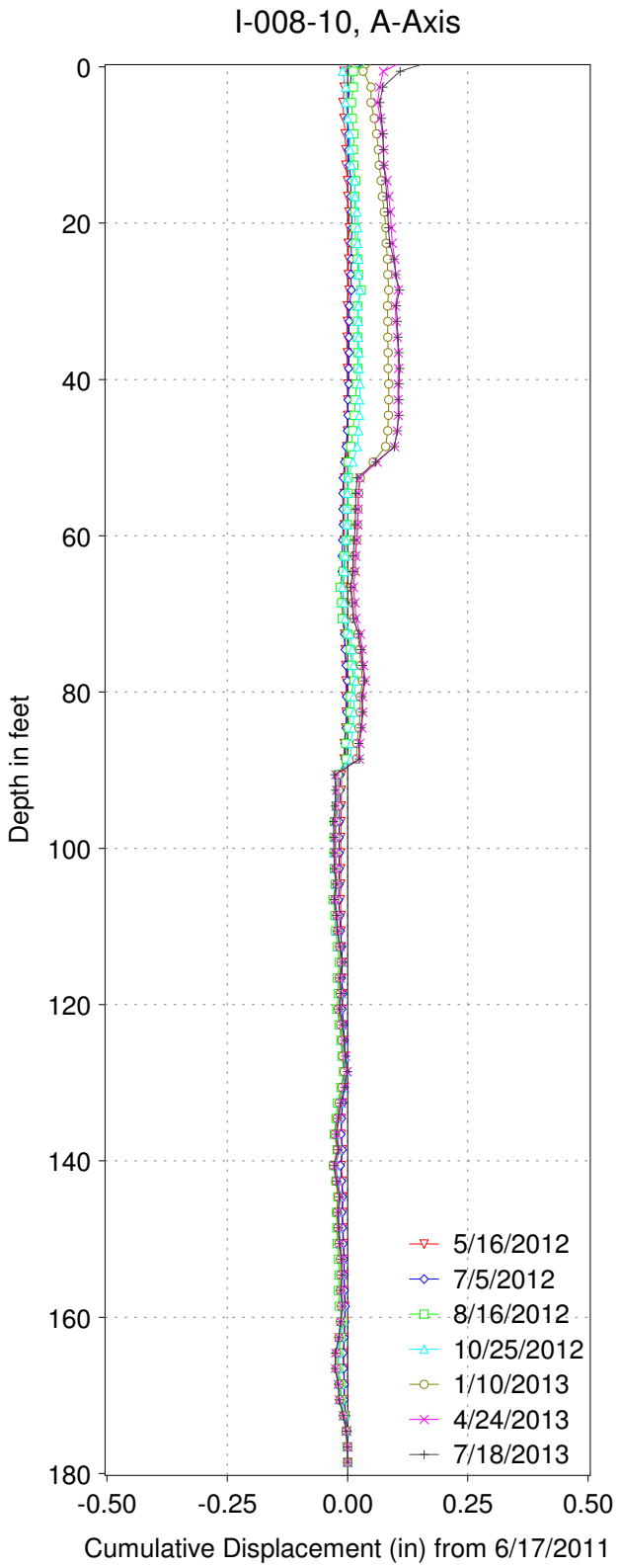

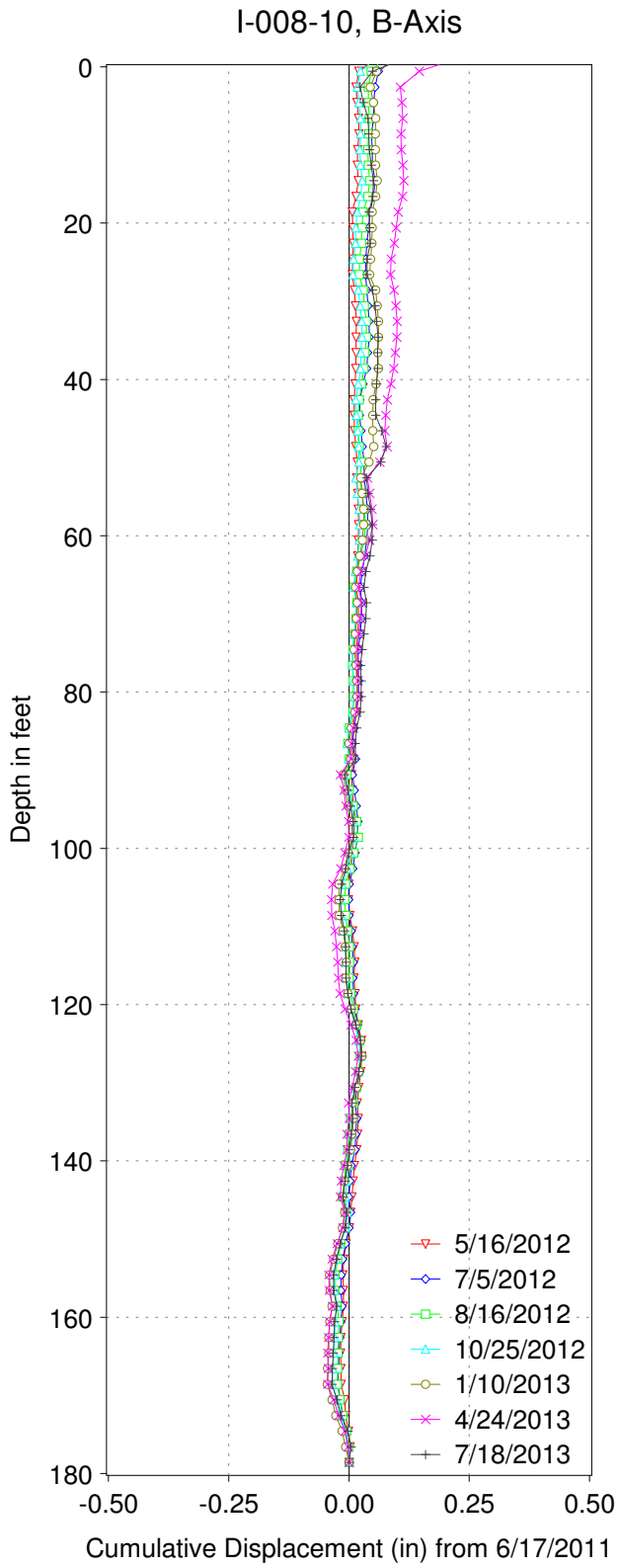

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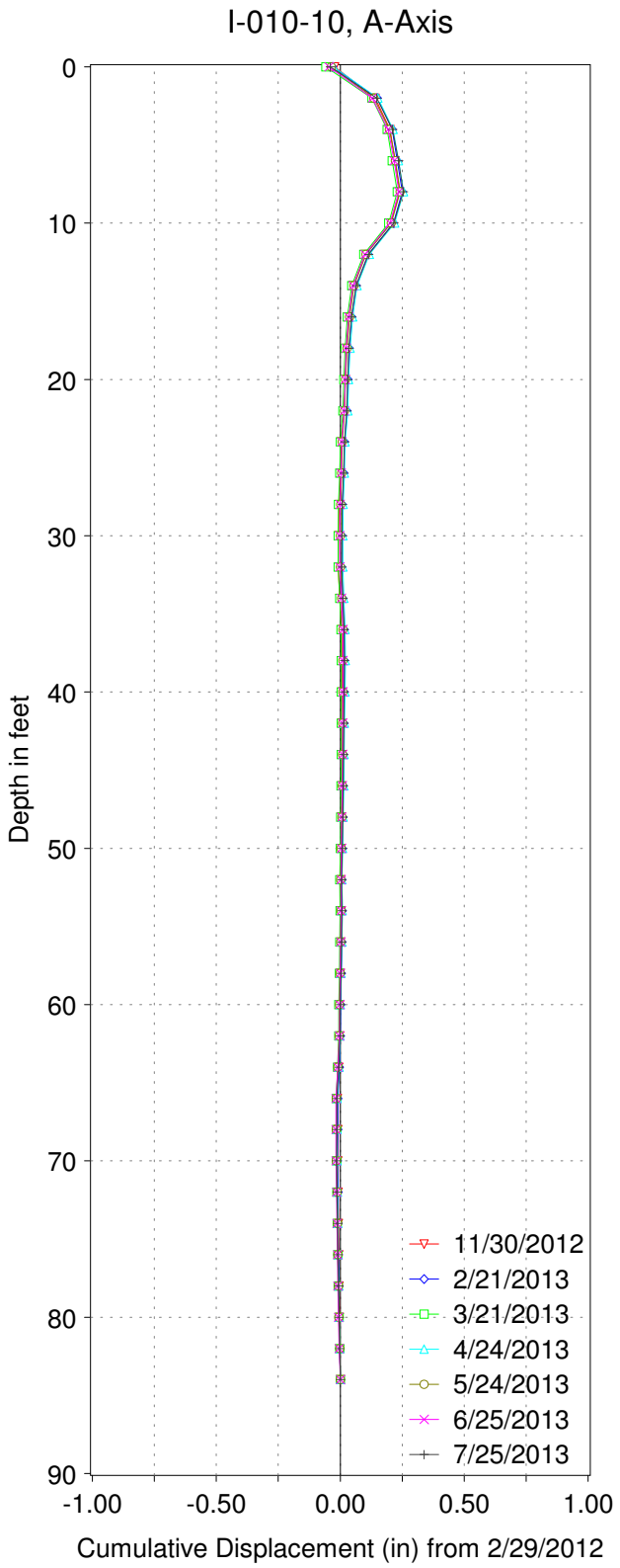

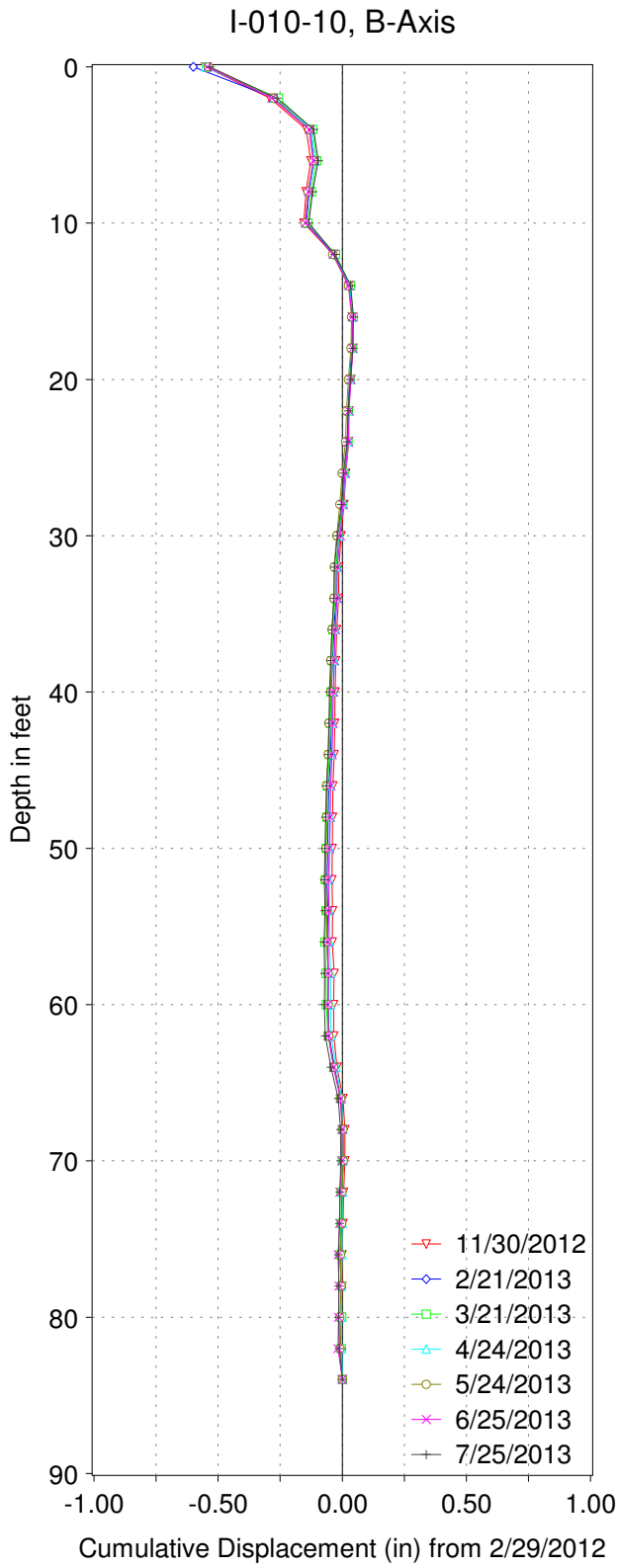

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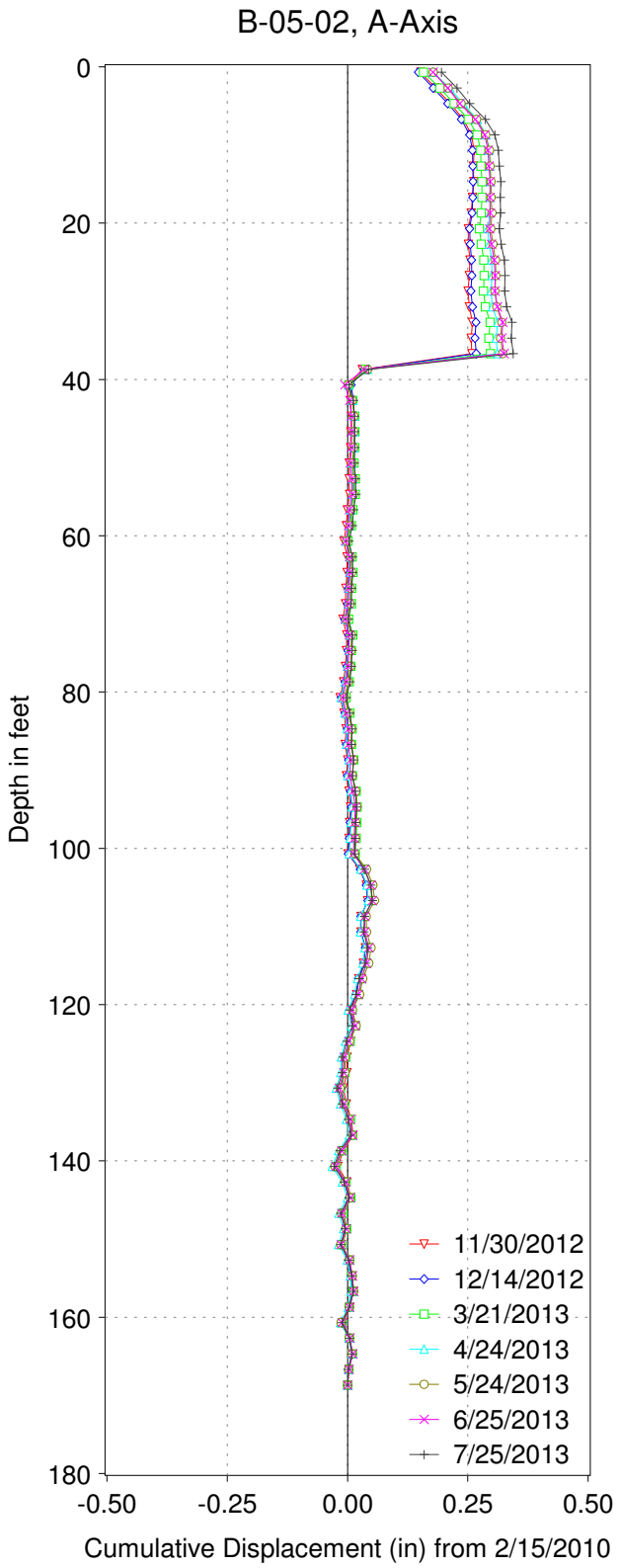

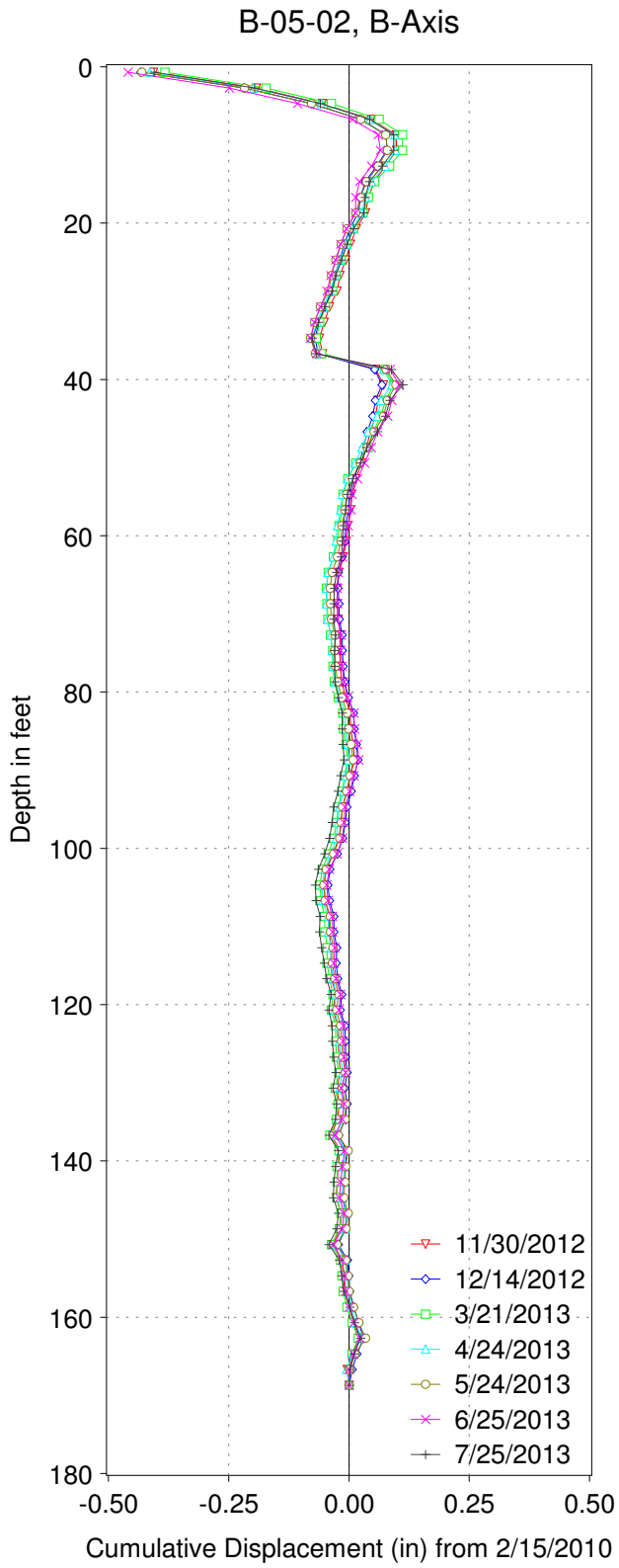

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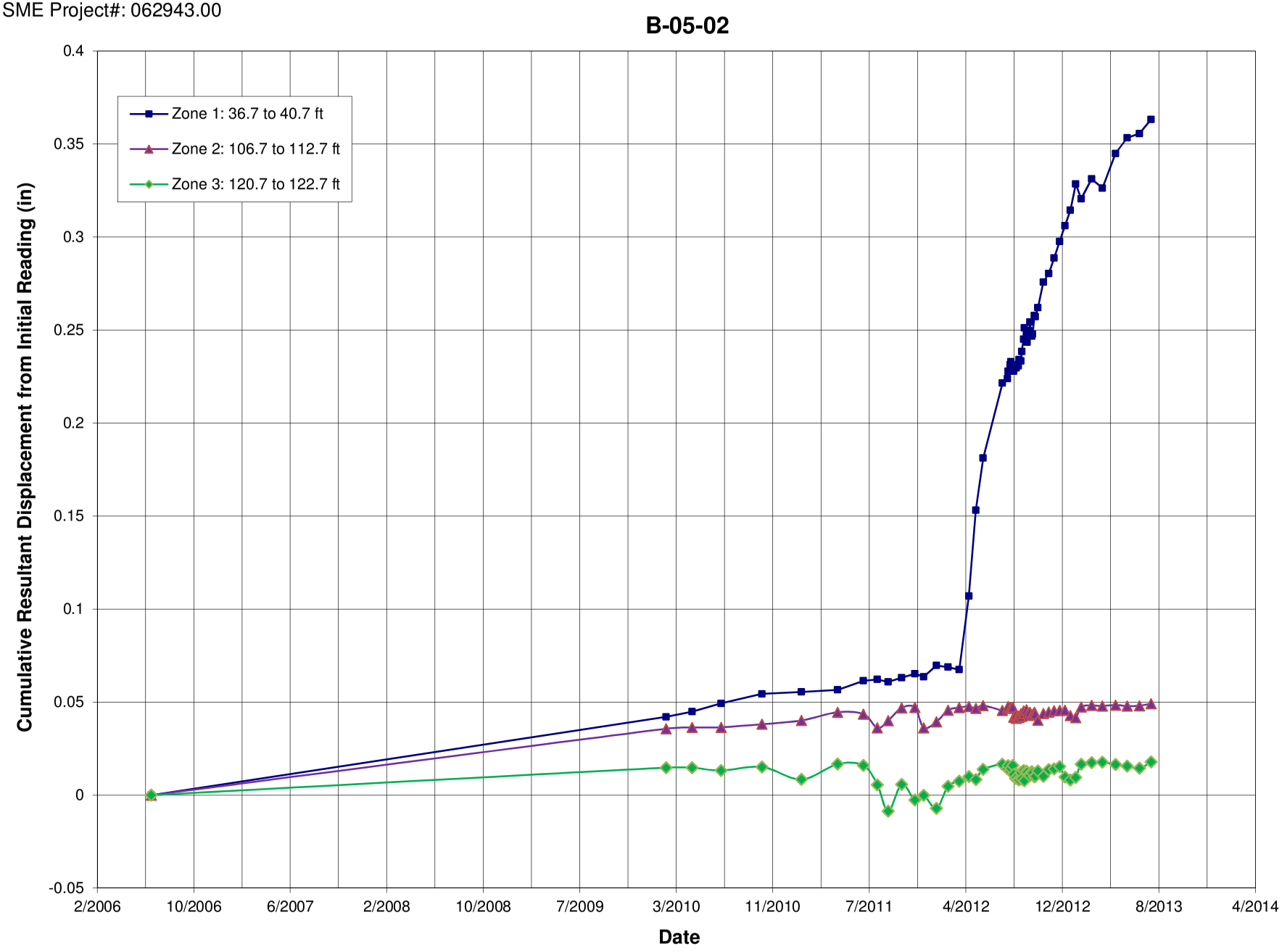

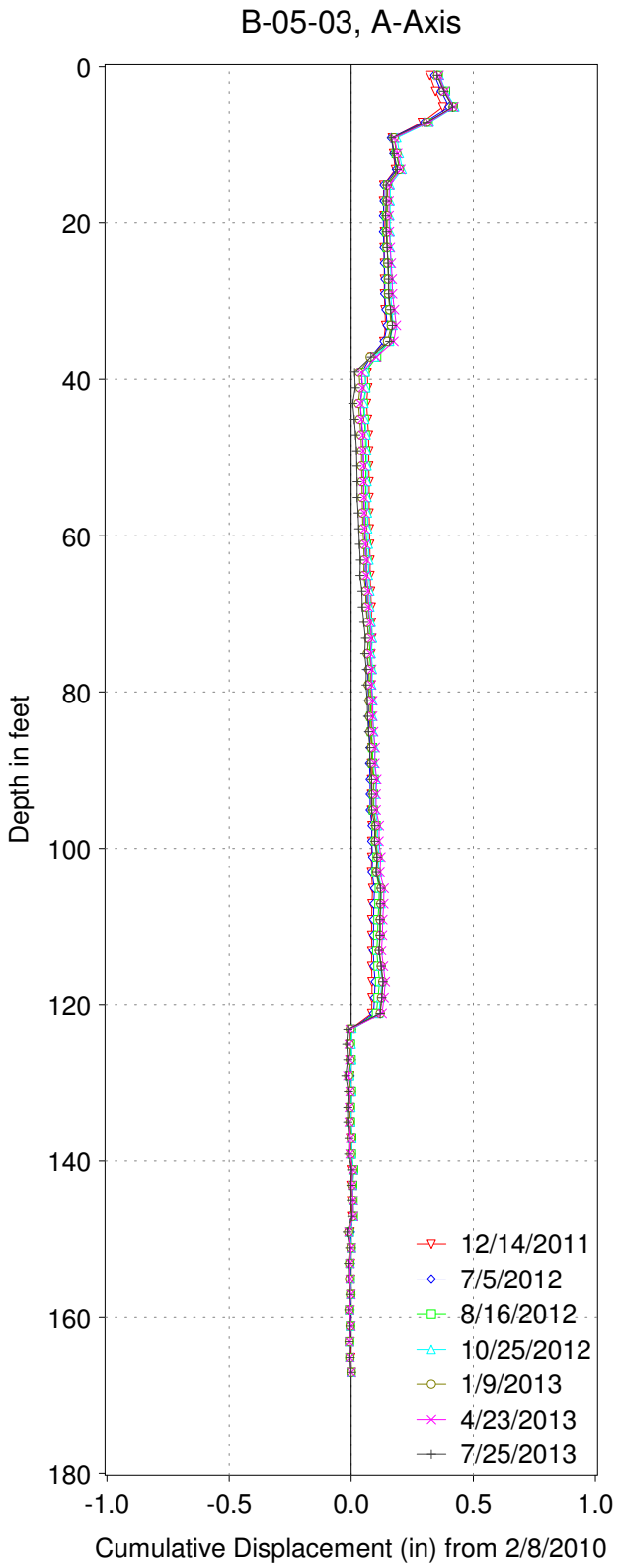

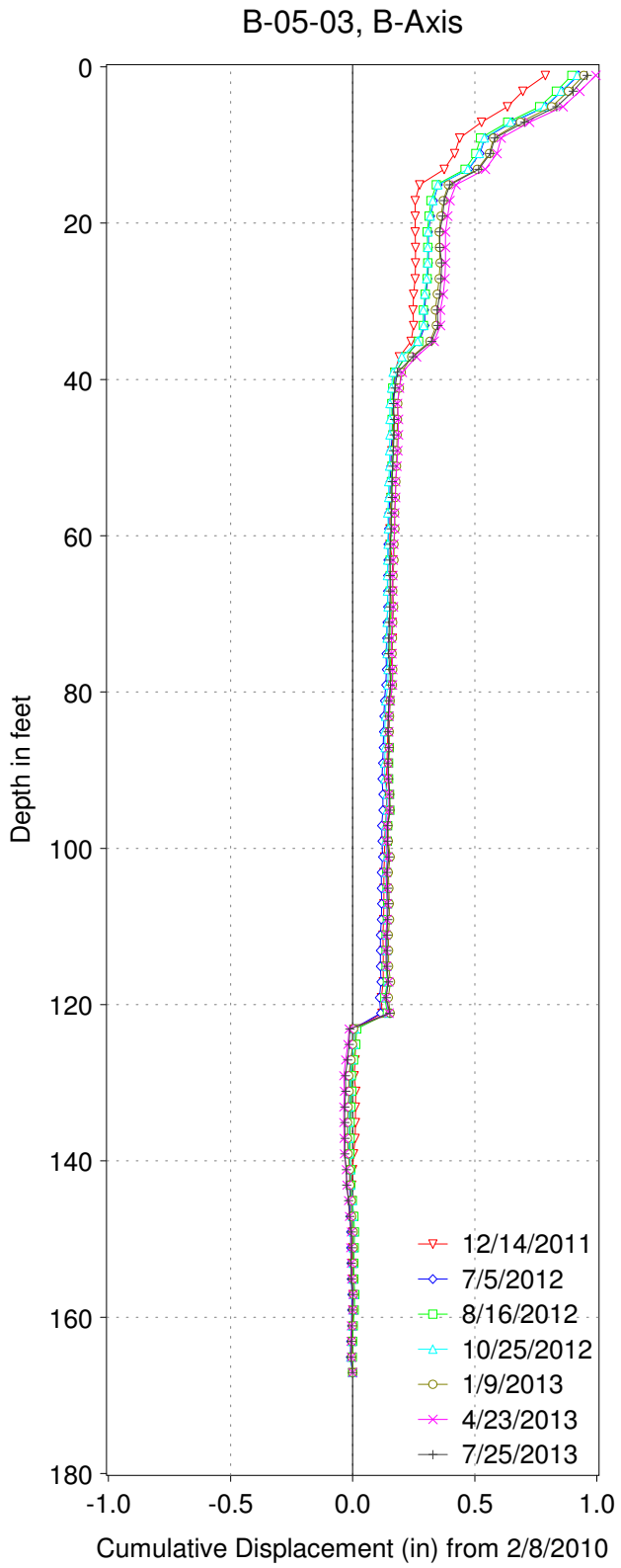

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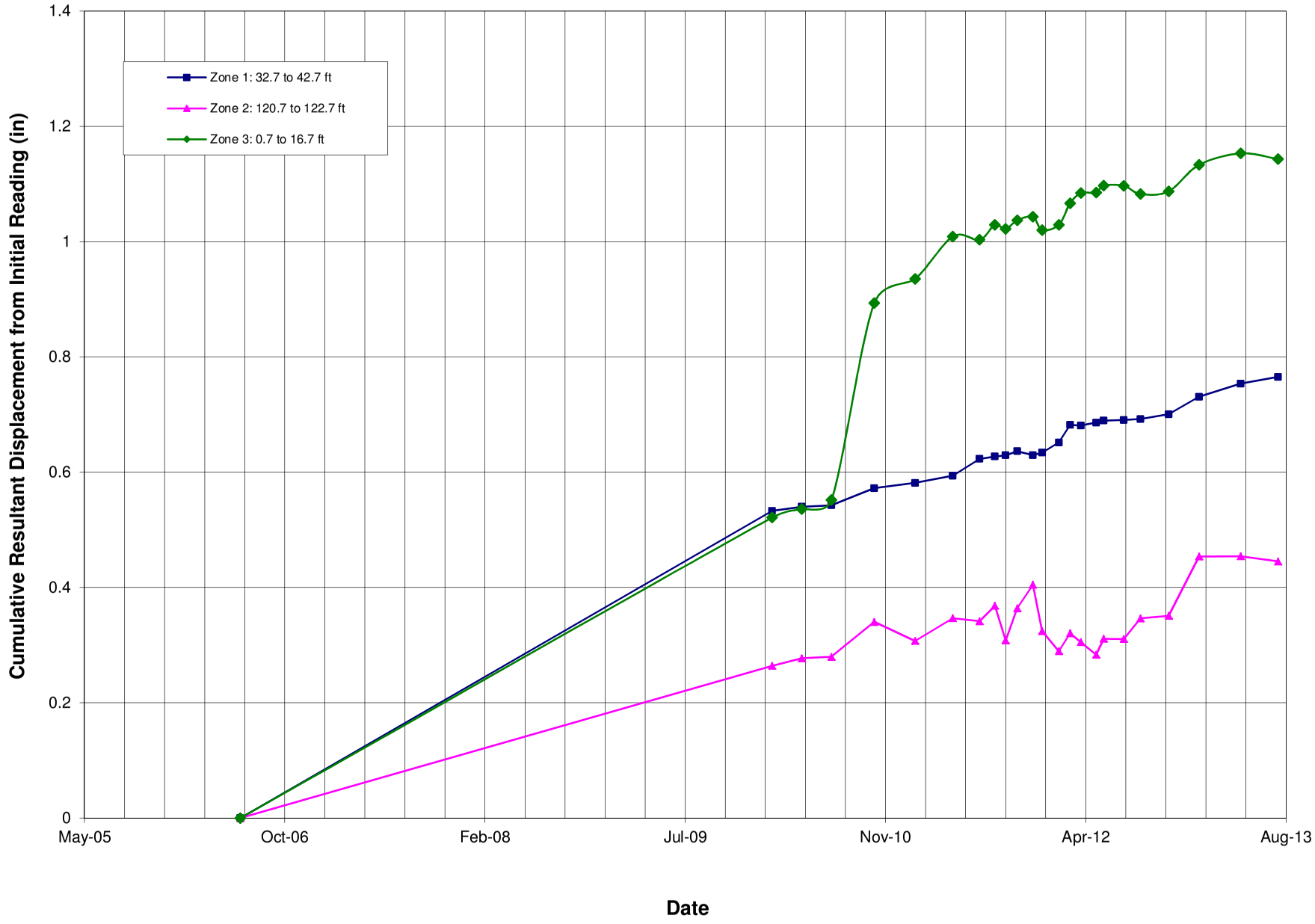
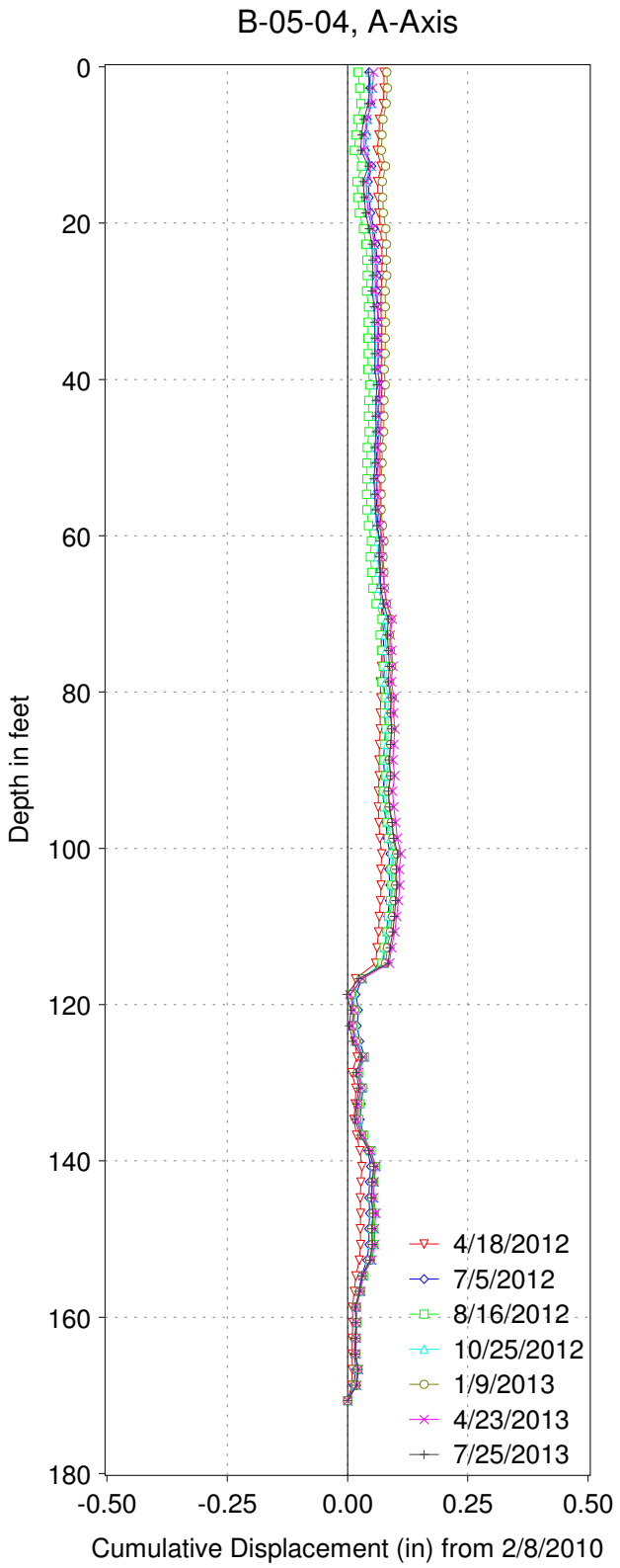
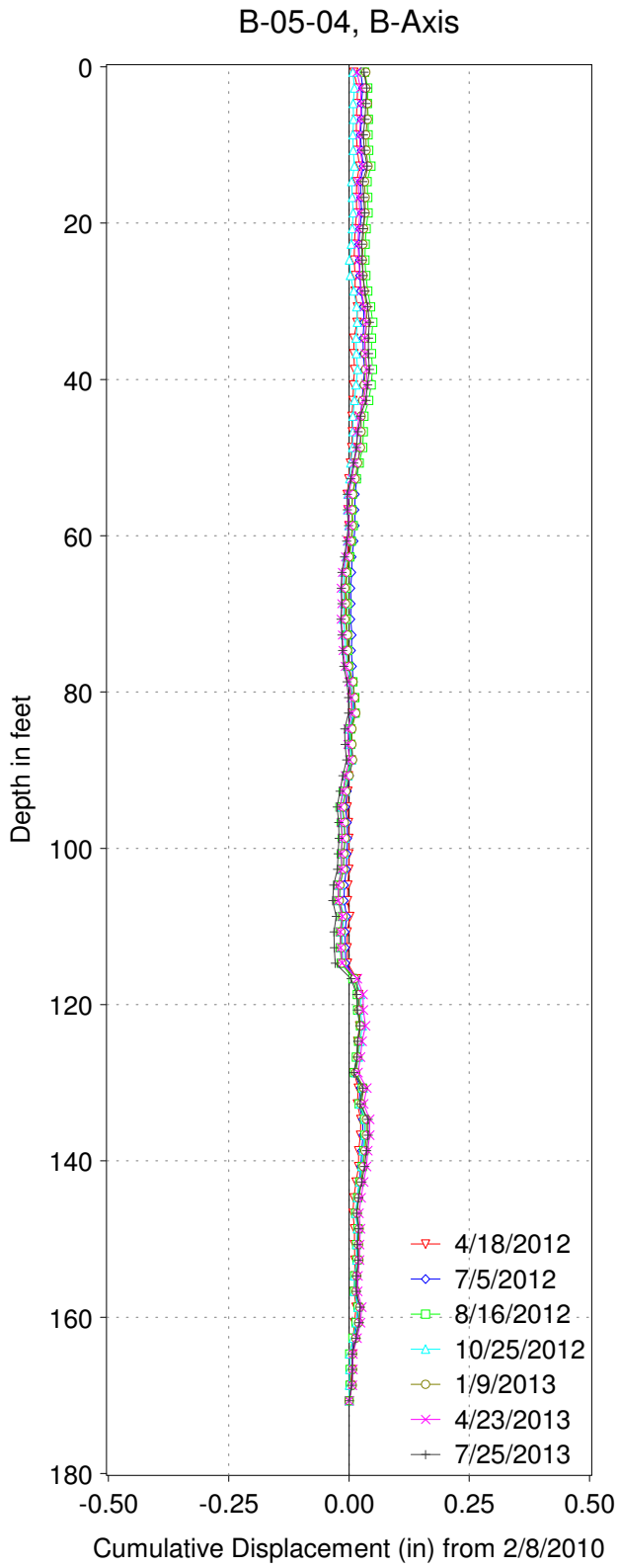
B-05-03







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PID 76117
SME Project#: 062943.00
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Soil and Materials Engineers, Inc.

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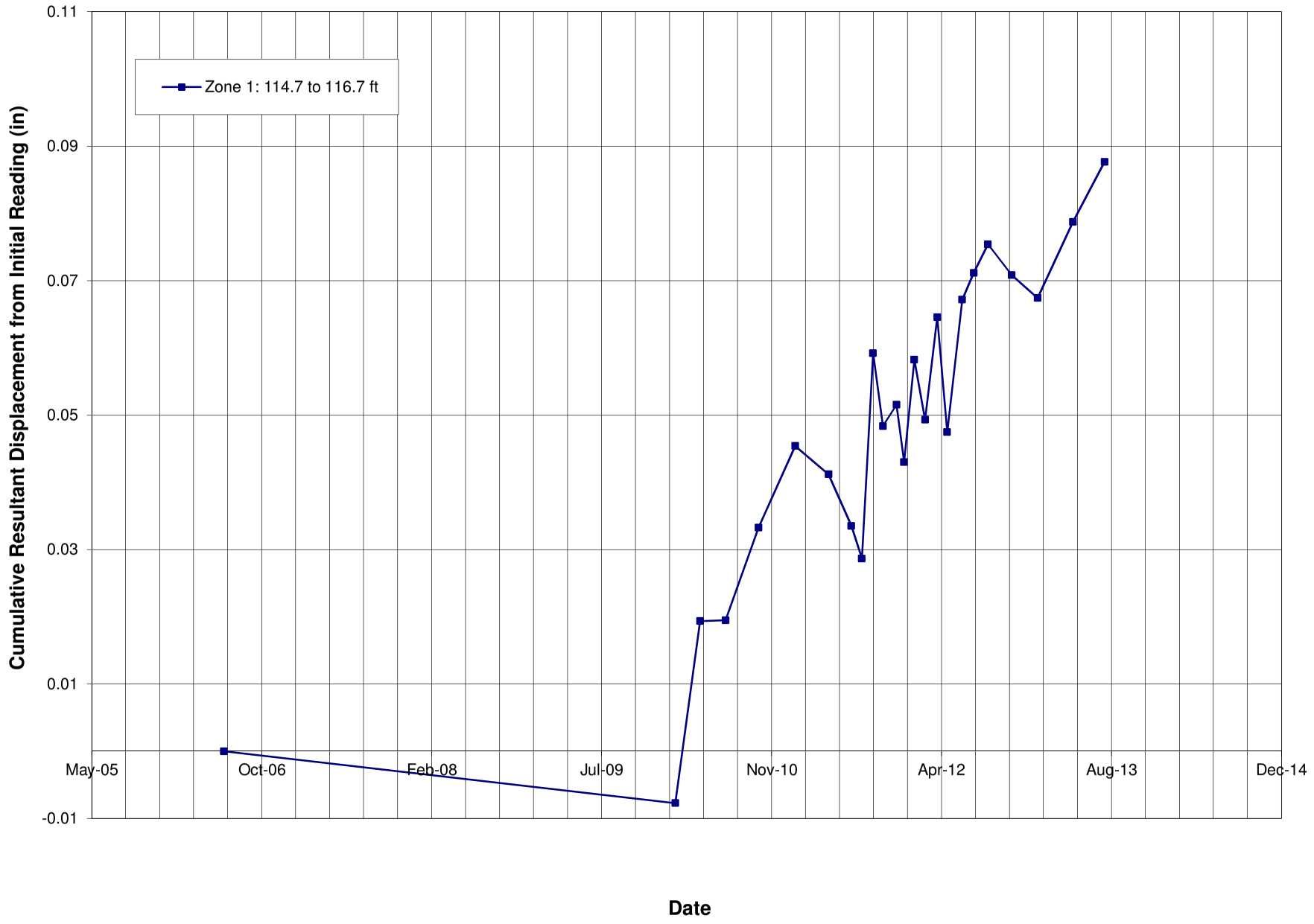
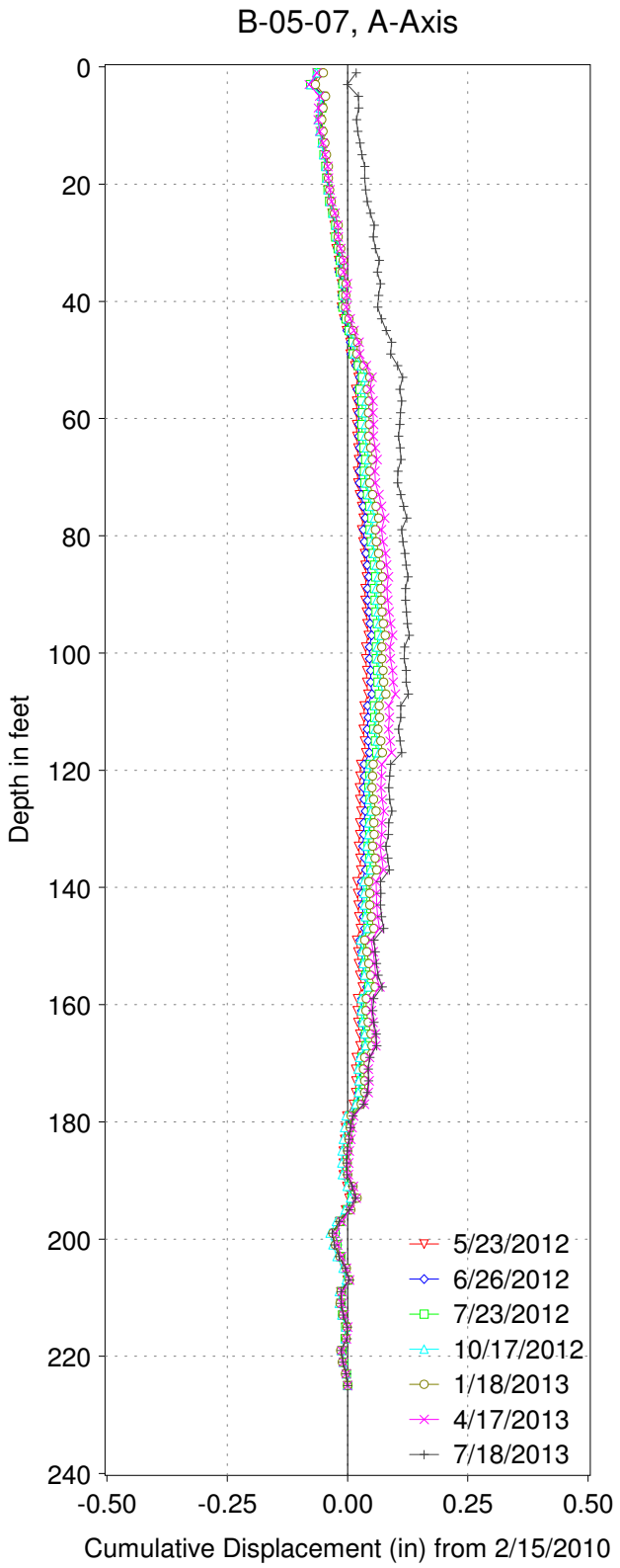
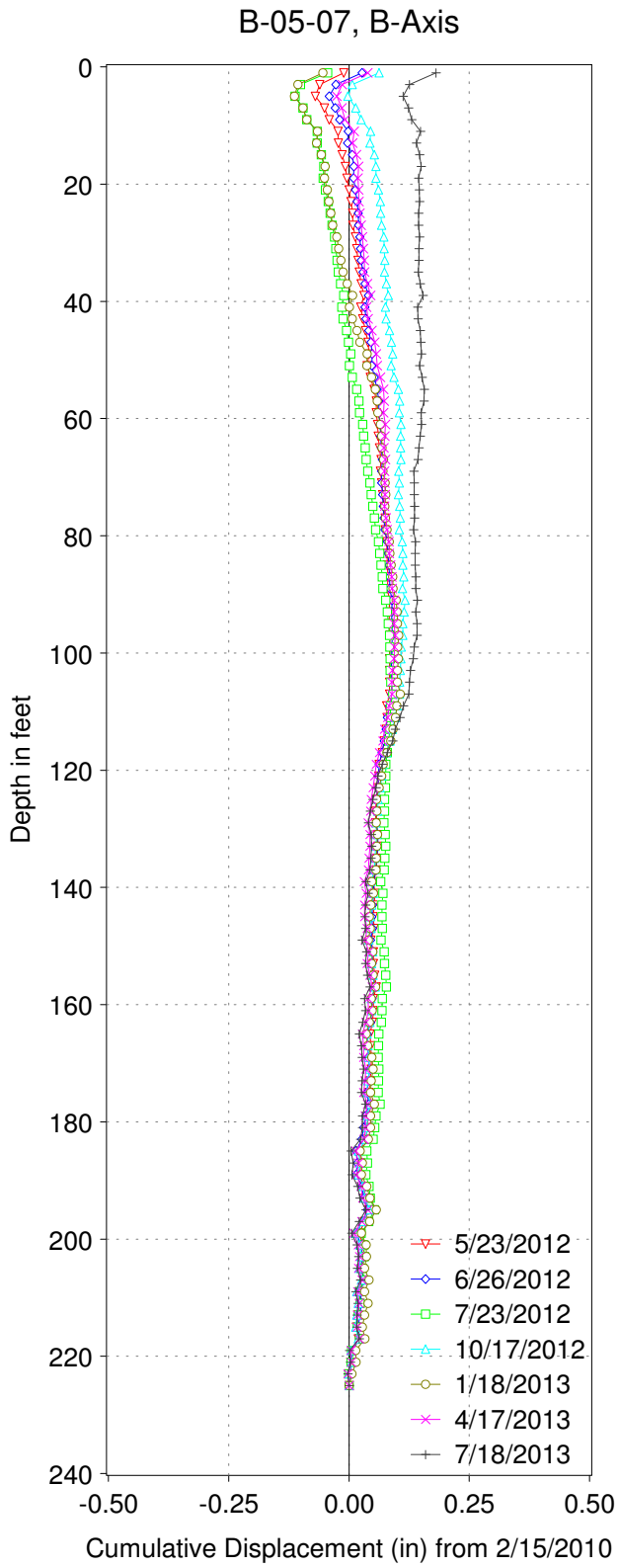
SME Project#: 062943.00

B-05-04

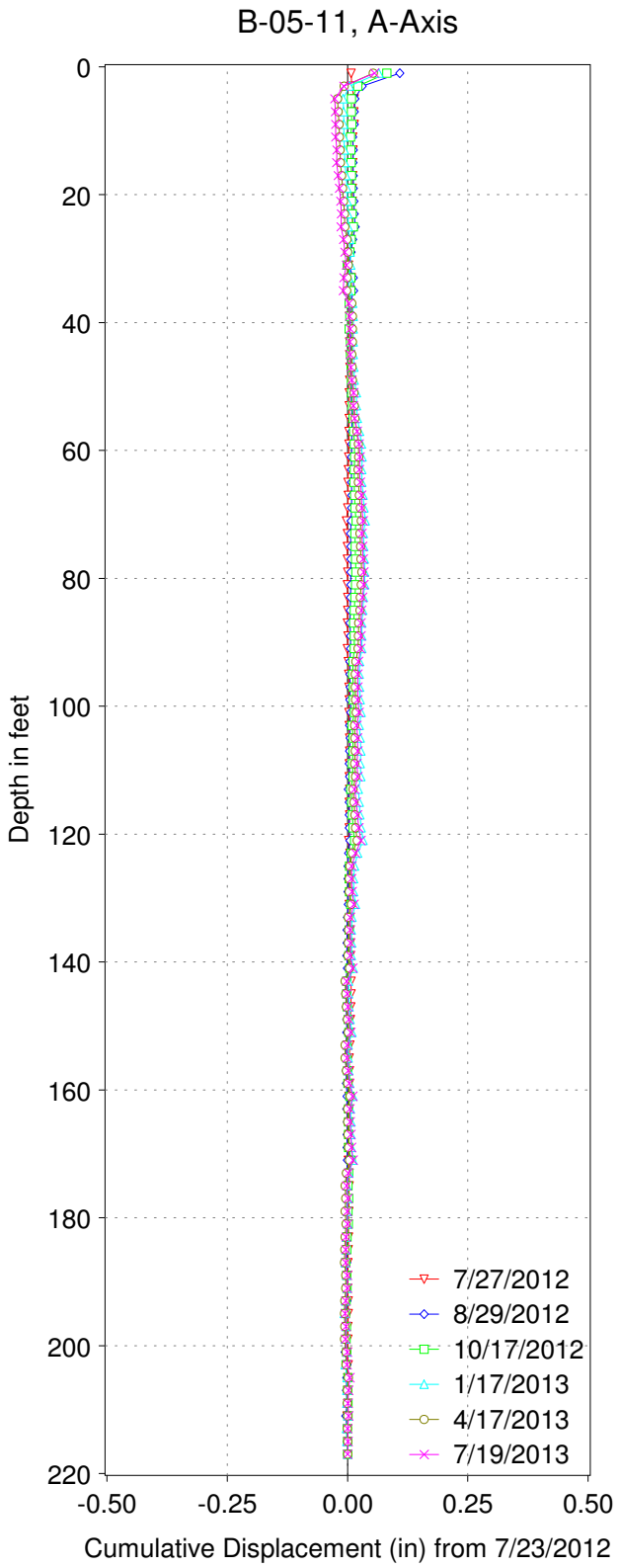


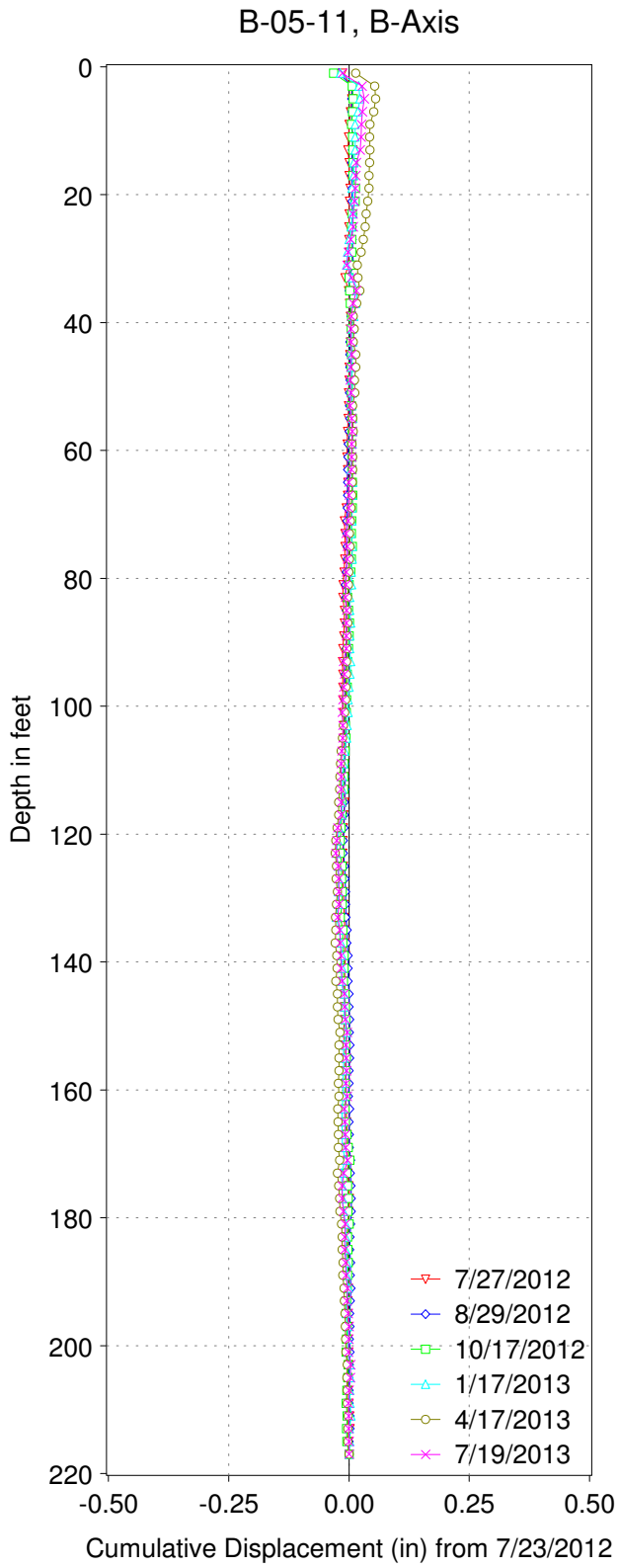




CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 7/18/2013

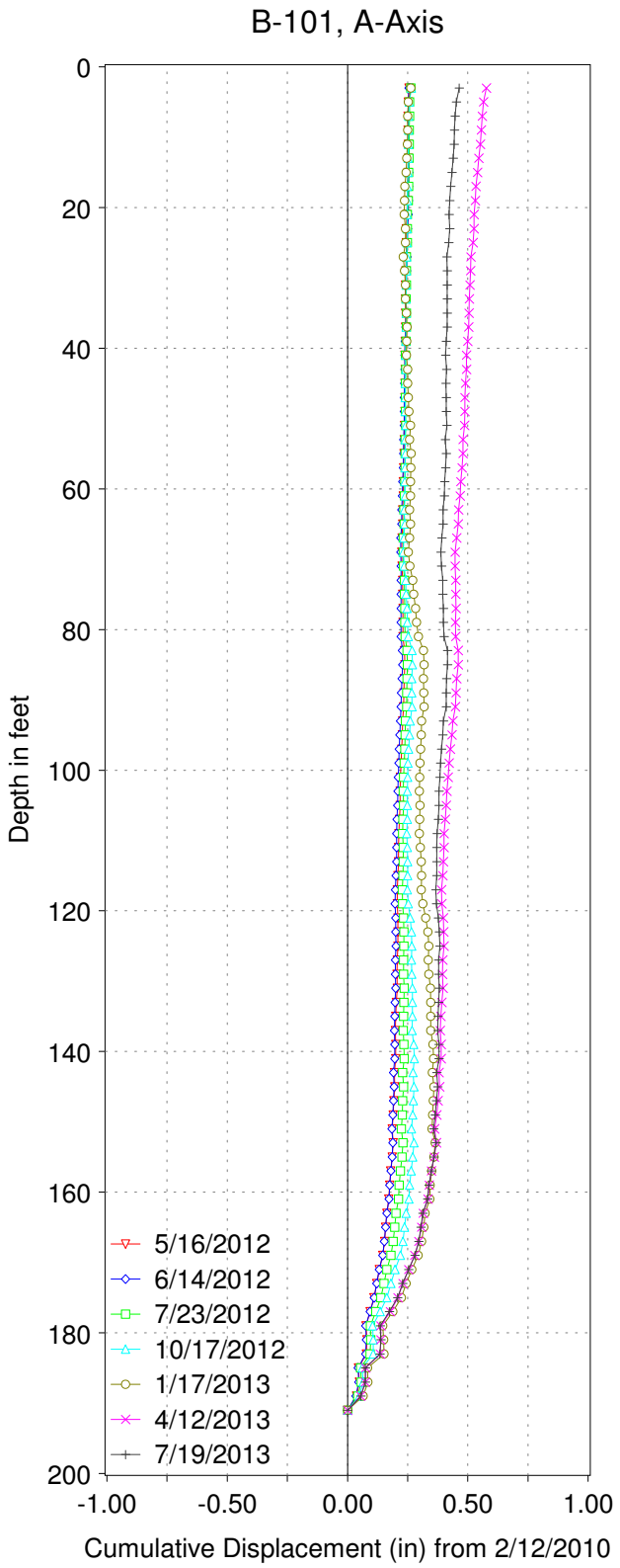
Soil and Materials Engineers, Inc.

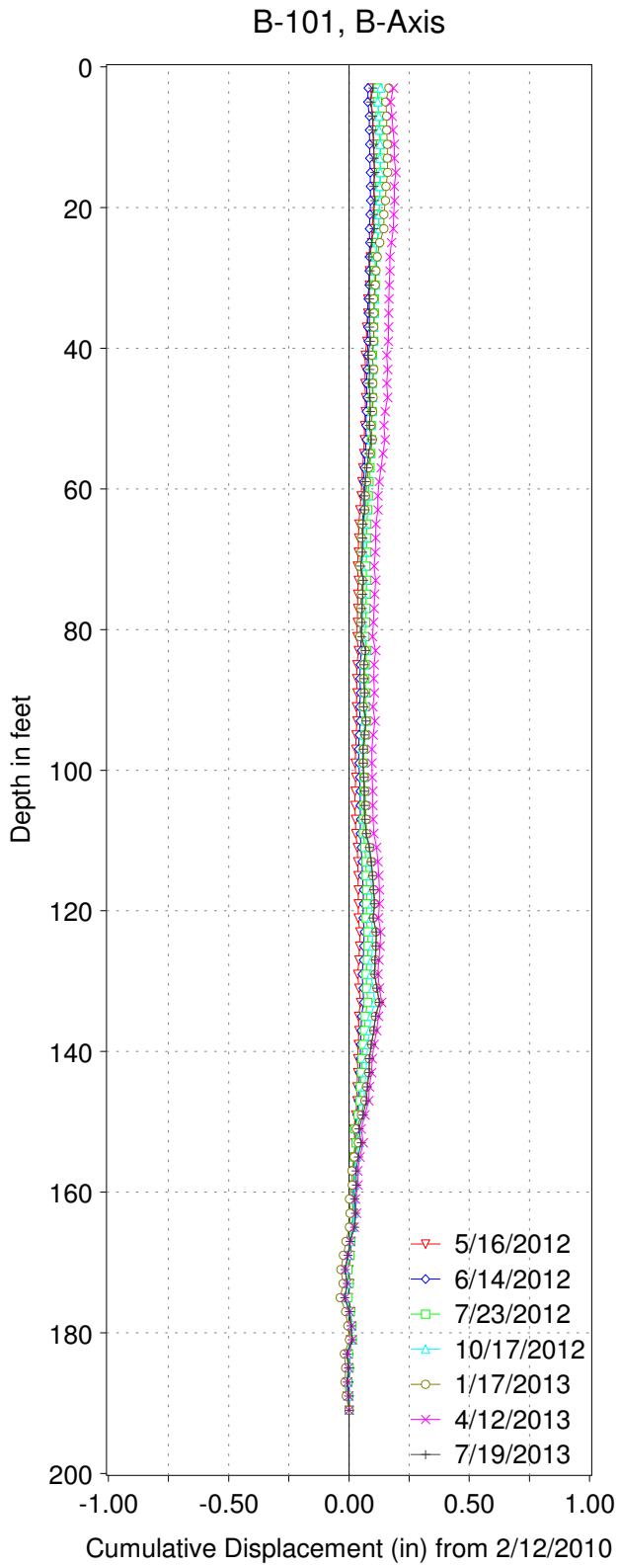




CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 7/19/2013

Soil and Materials Engineers, Inc.





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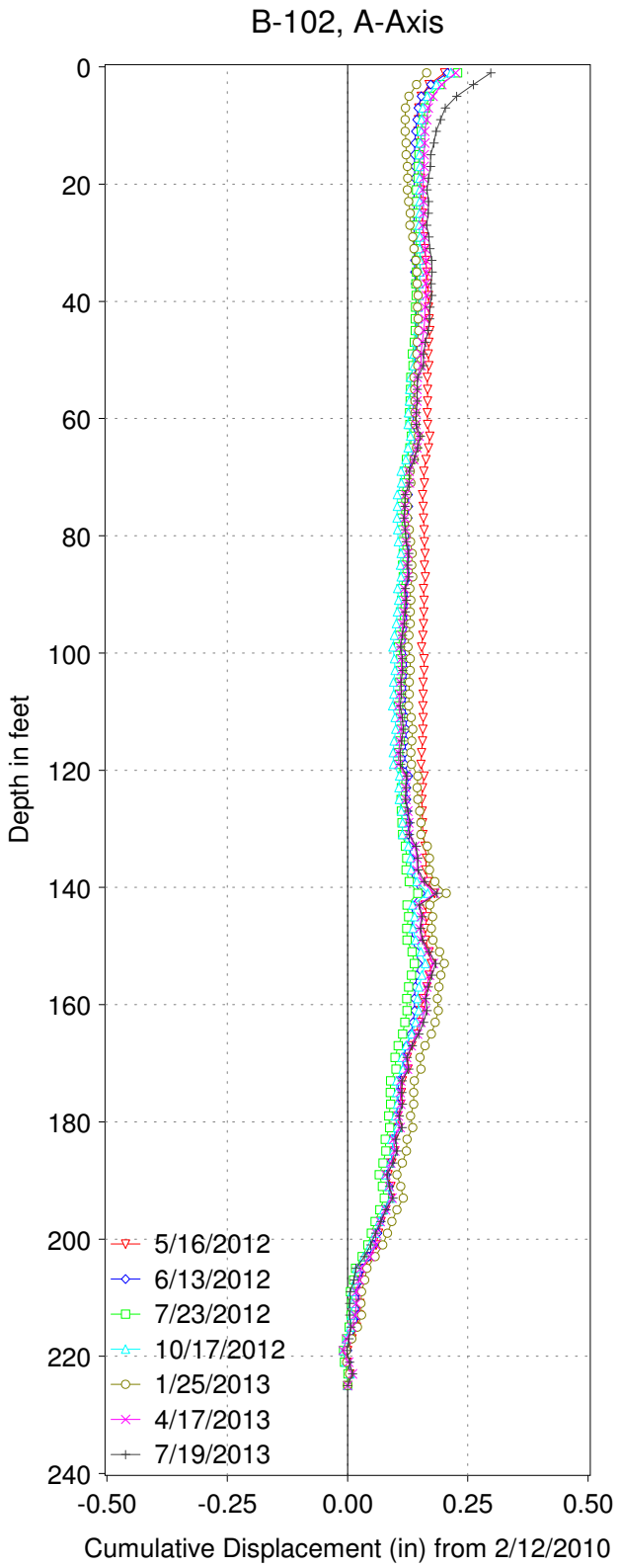
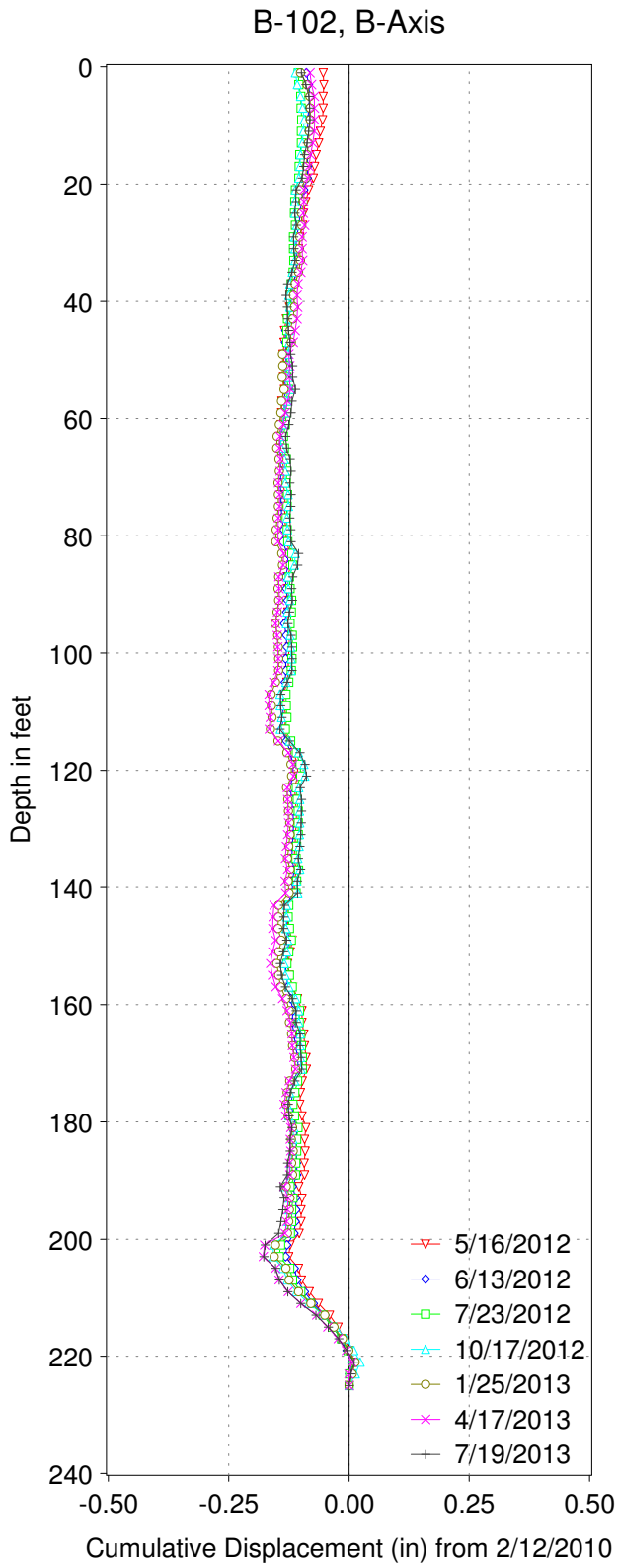
PID 76117
SME Project#: 062943.00
Reading Date: 7/19/2013

Soil and Materials Engineers, Inc.





CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 7/19/2013

Soil and Materials Engineers, Inc.

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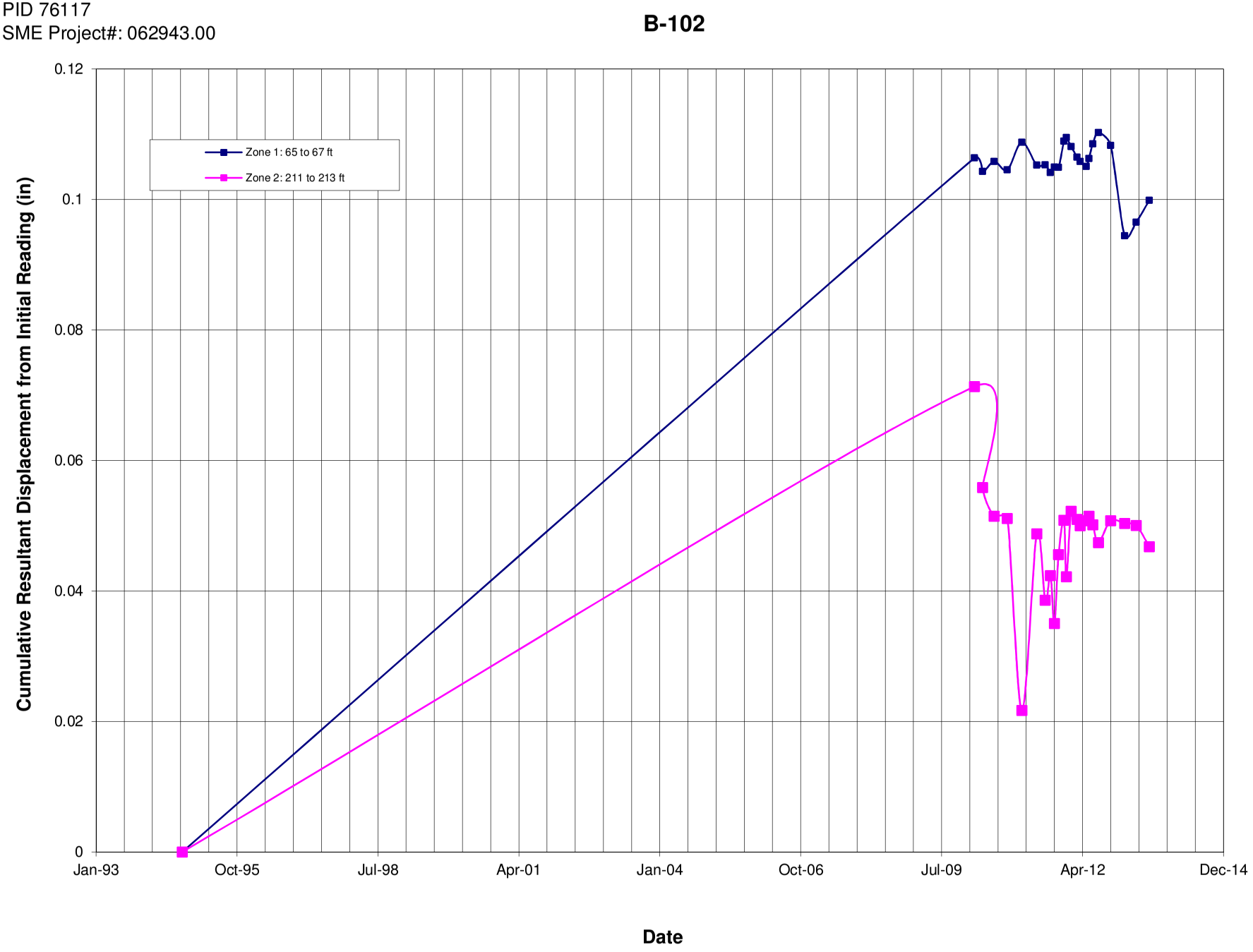
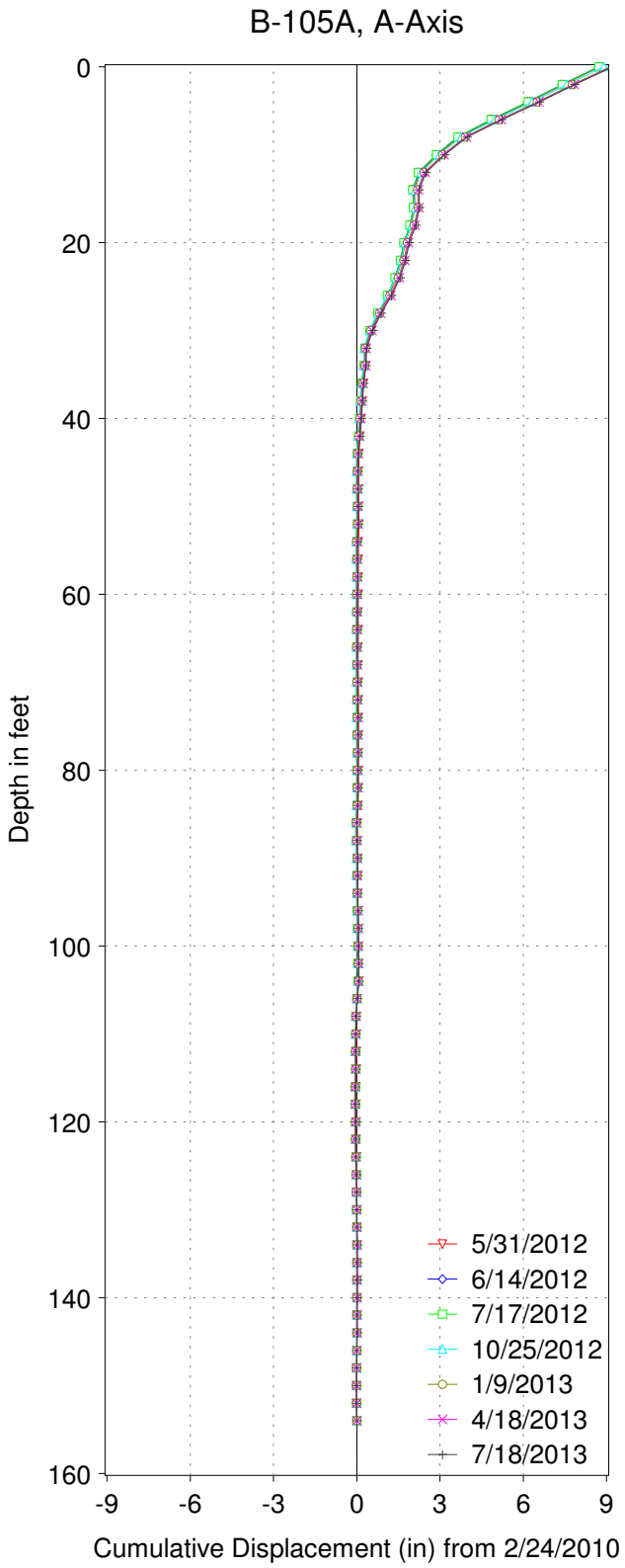
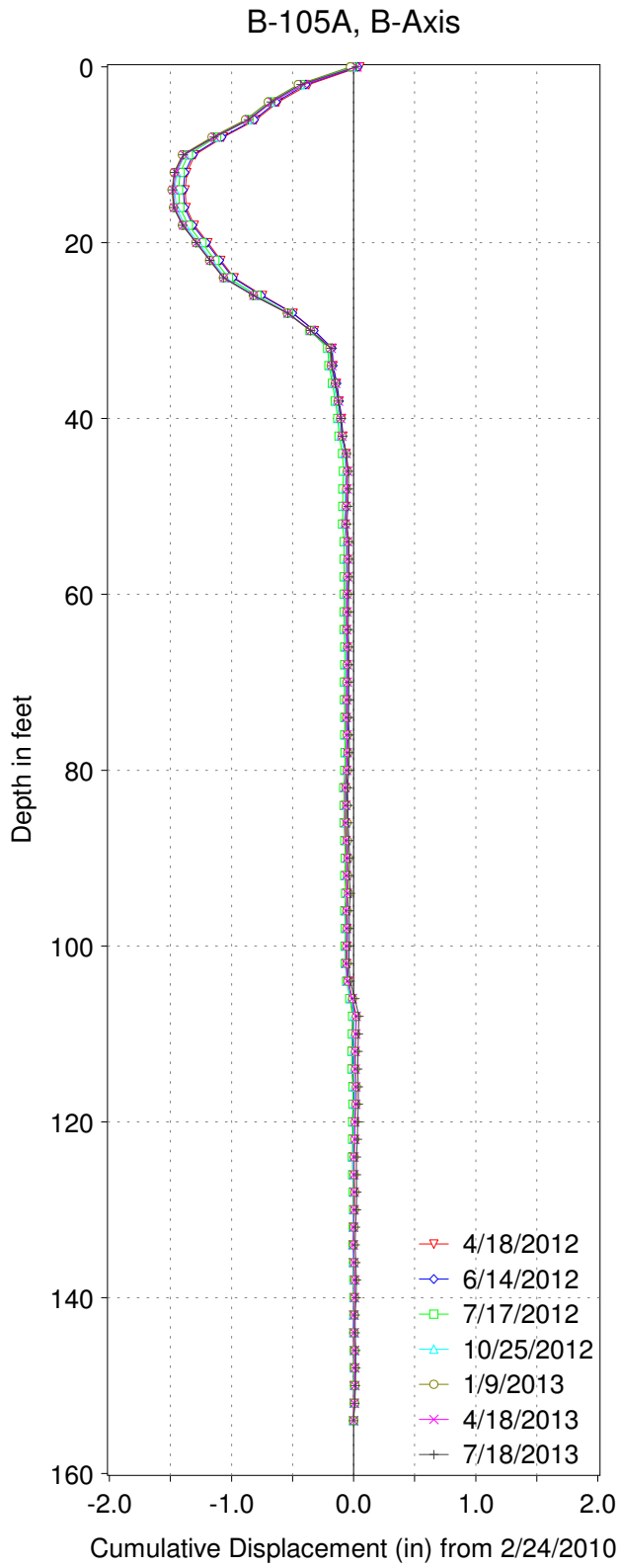
PID 76117
SME Project#: 062943.00





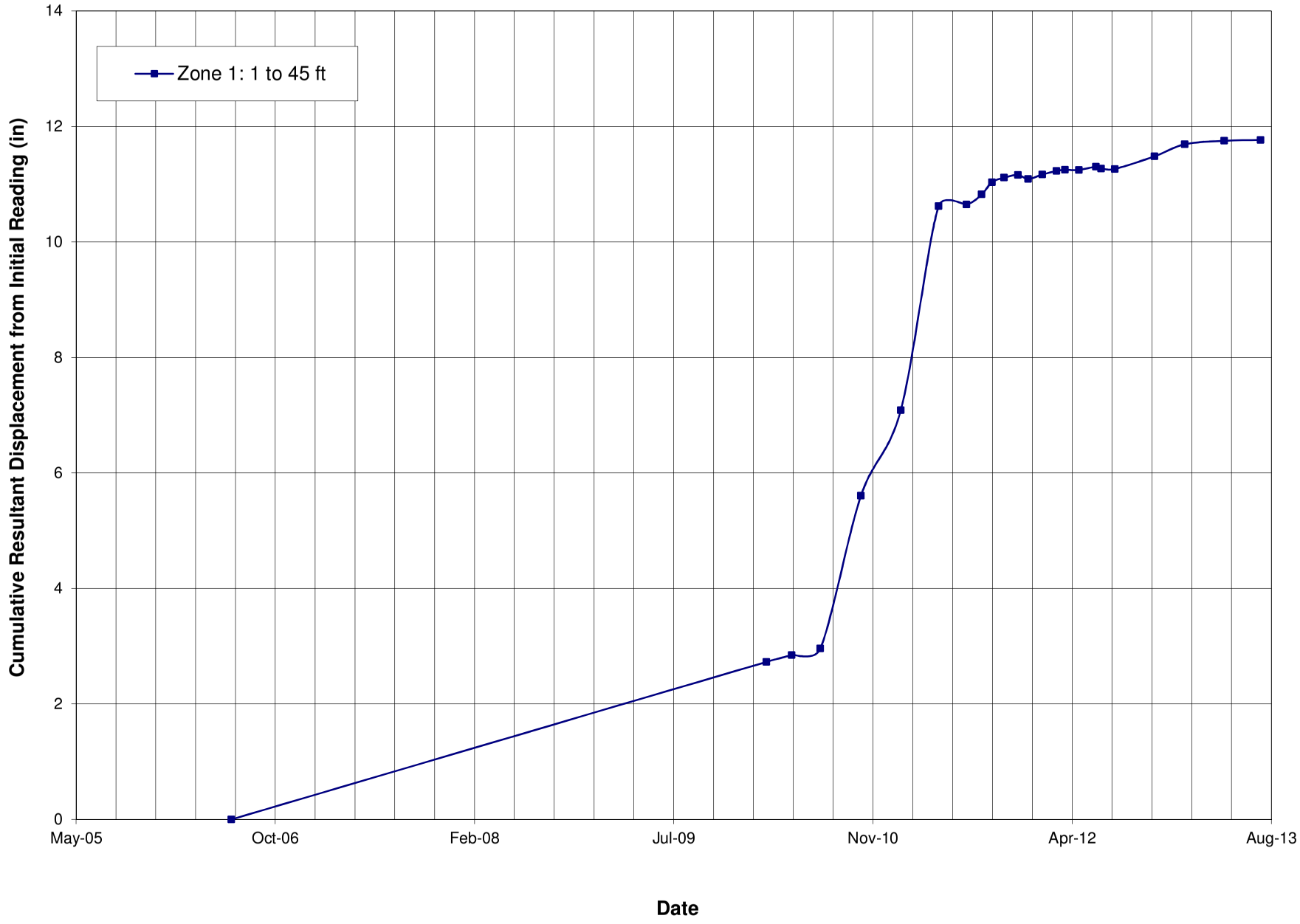


CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 7/18/2013

Soil and Materials Engineers, Inc.

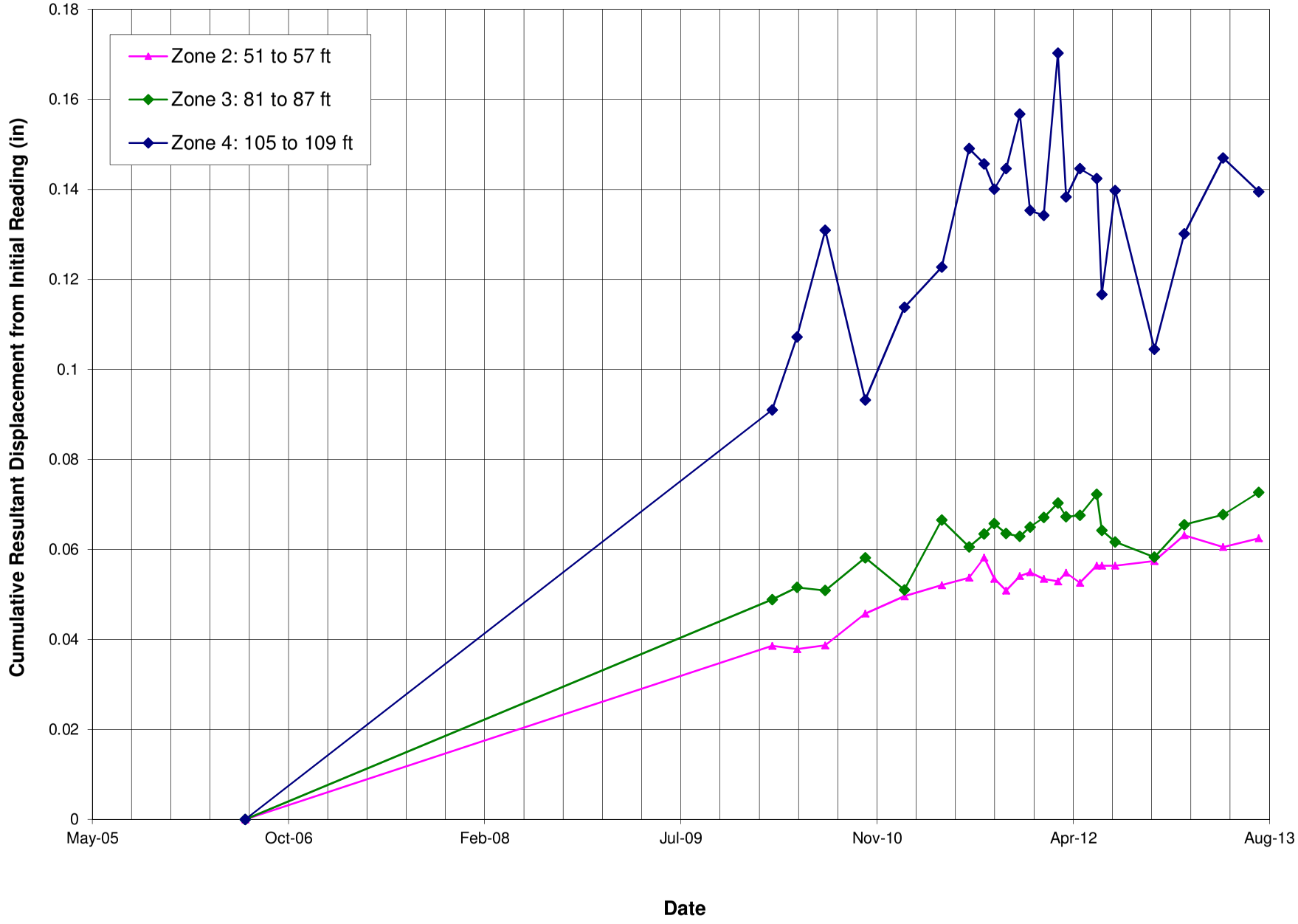
CUY-90-15.24
PID 76117
SME Project#: 062943.00

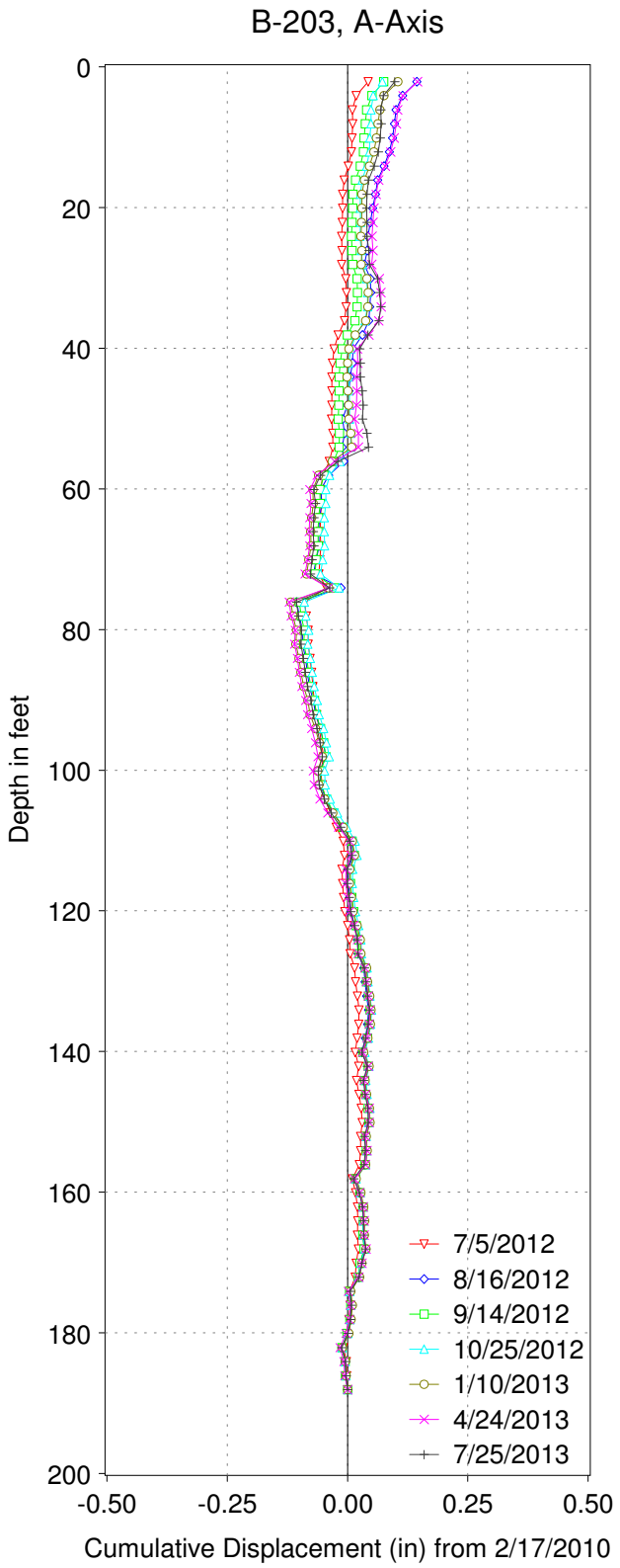
B-105A

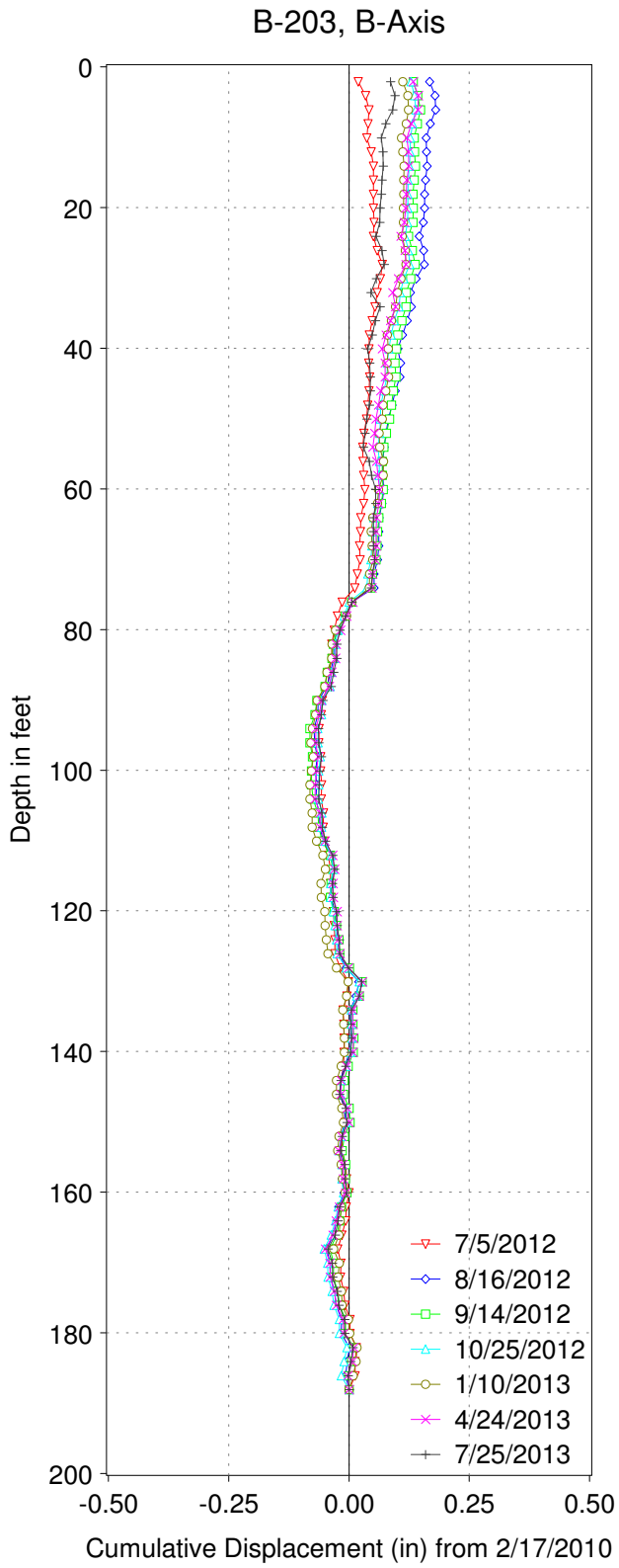


CUY-90-15.24
PID 76117
SME Project#: 062943.00

B-105A





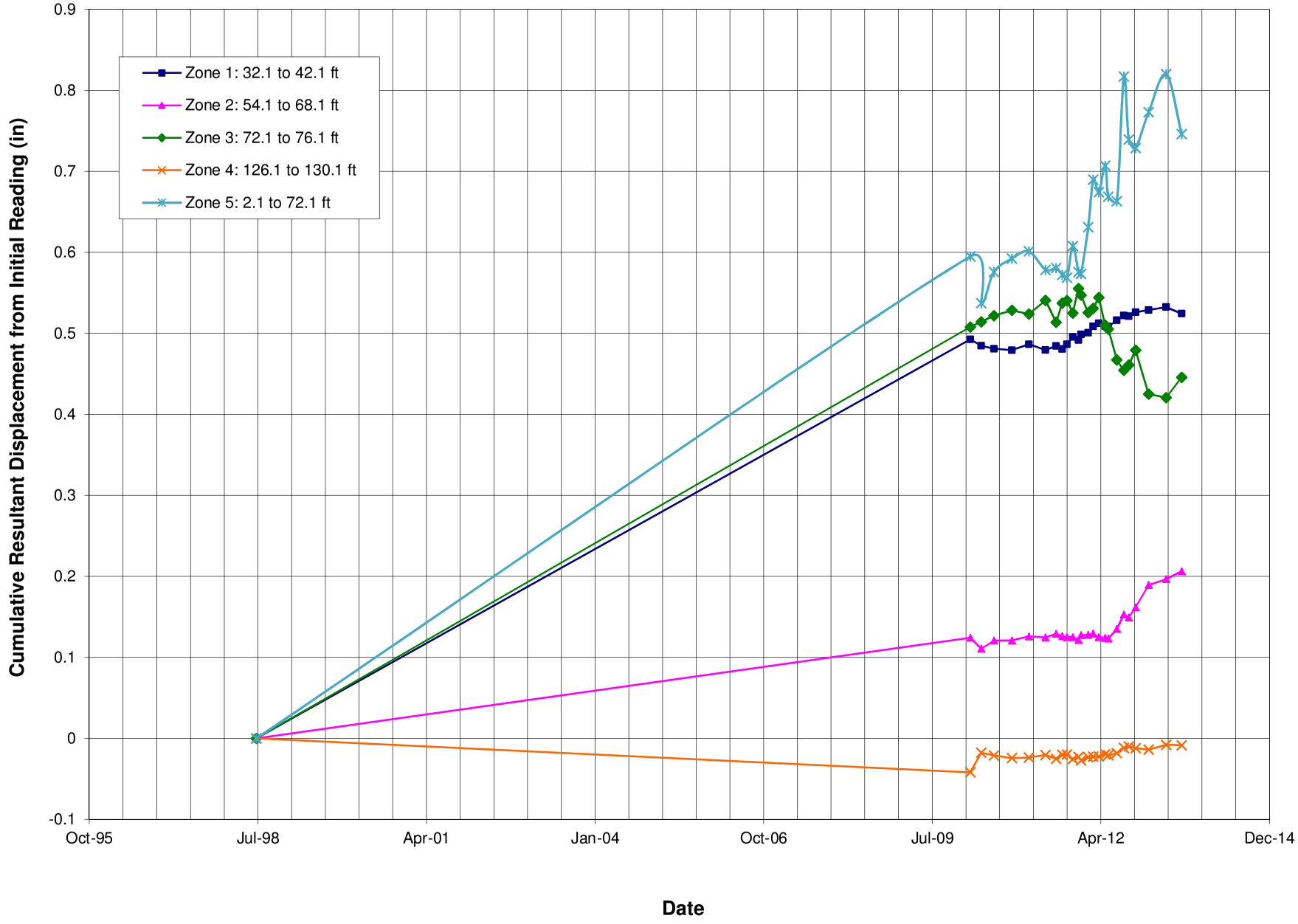


CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 7/25/2013

Soil and Materials Engineers, Inc.

CUY-90-15.24
PID 76117
SME Project#: 062943.00

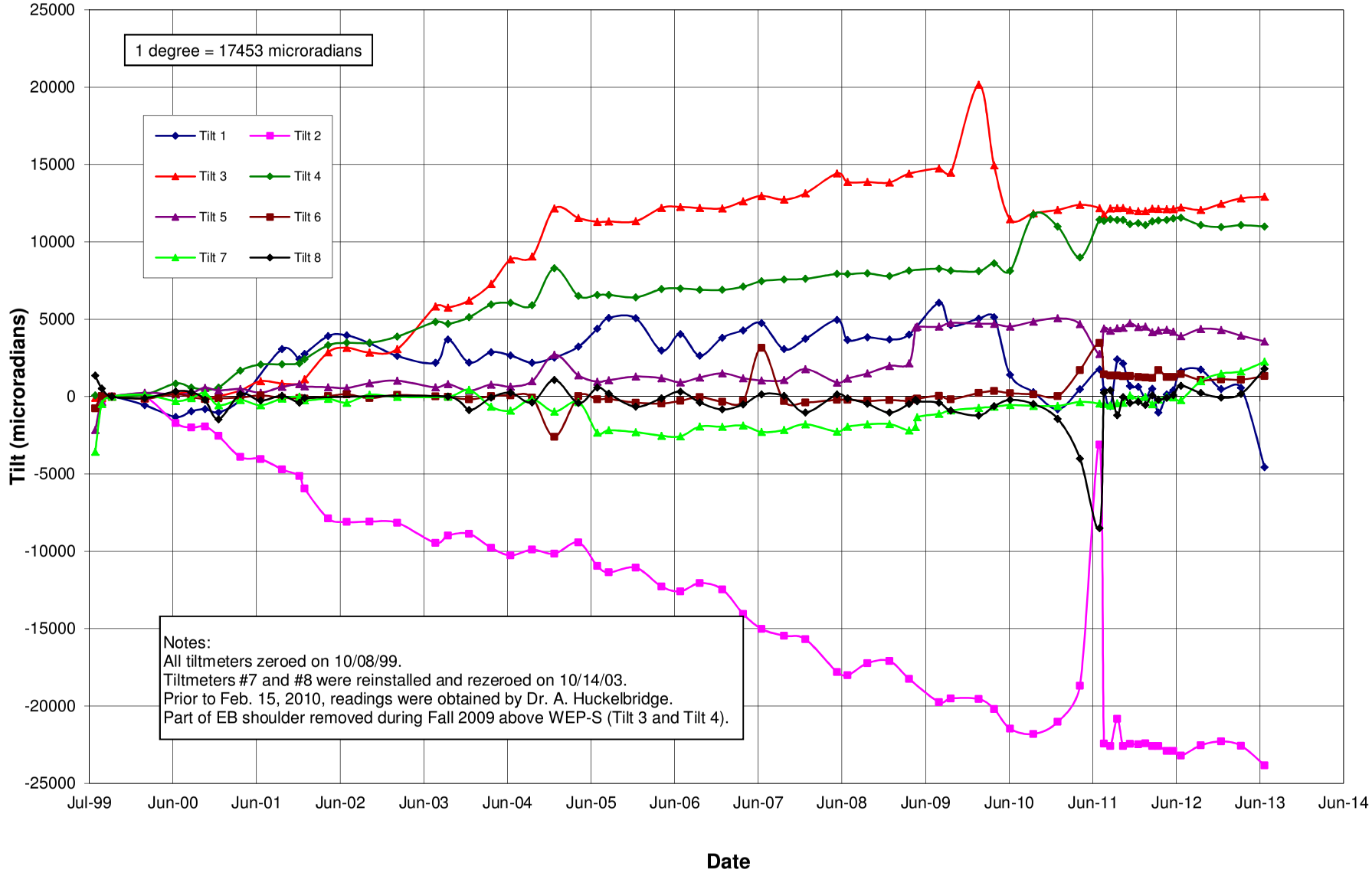
B-203



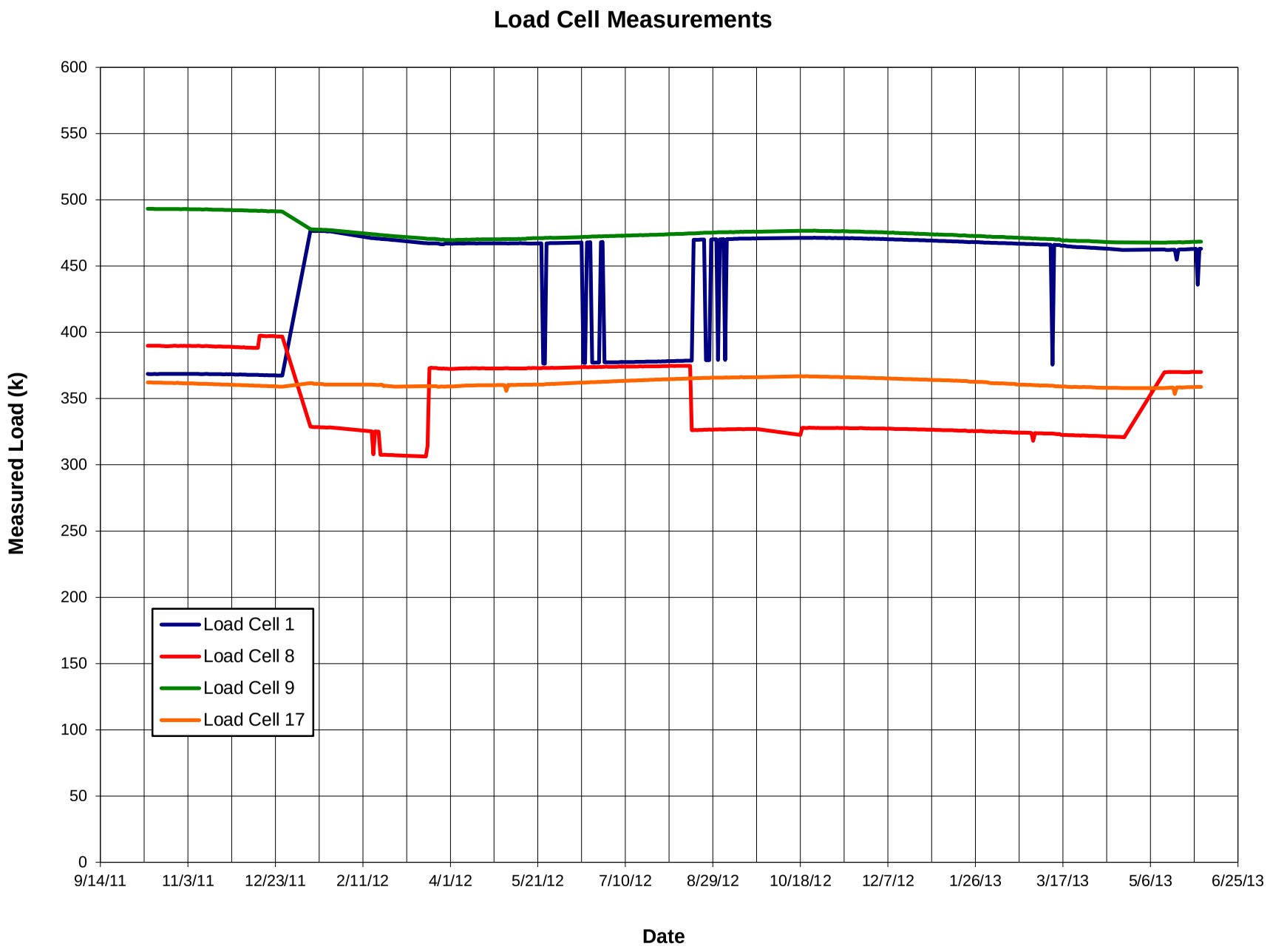
APPENDIX C
TILTMETERS AND STABILIZATION STRUCTURE

CUY-90-15.24 Slope Monitoring
PID 76117
Cleveland, Ohio
SME Project#: 062943.00

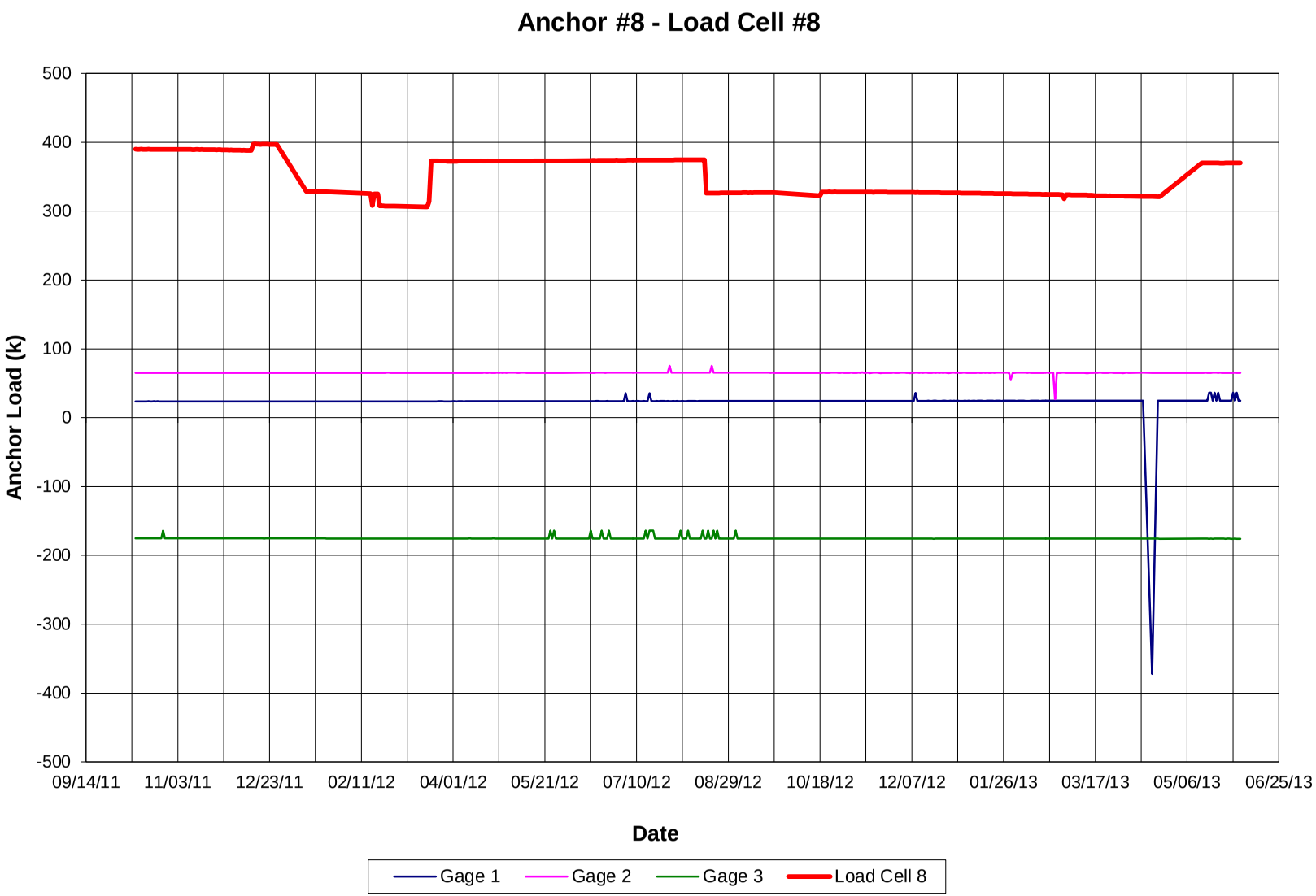
Tiltmeter Readings



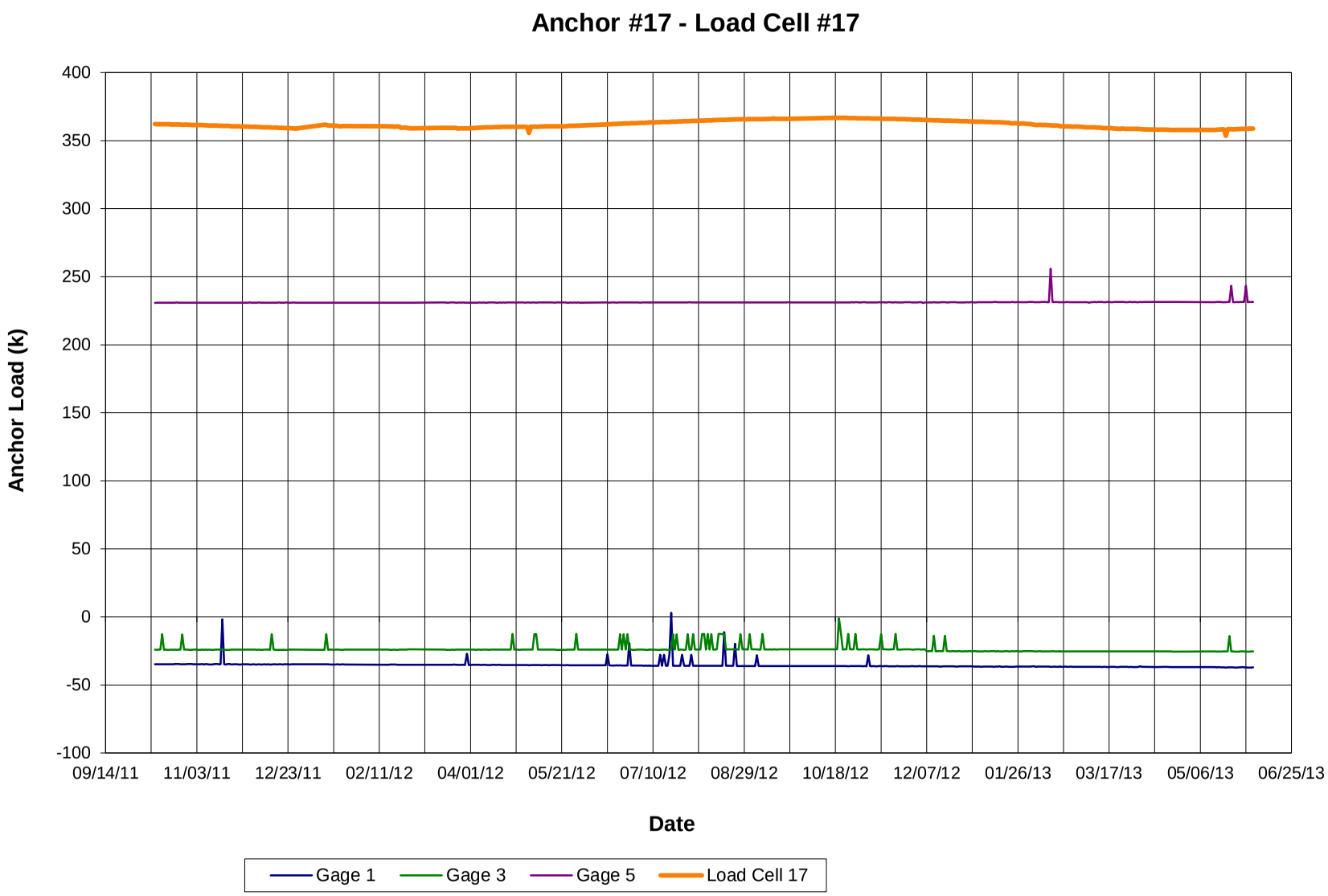
CUY-90-15.24 Slope Monitoring
PID #76177
EDP #09305G



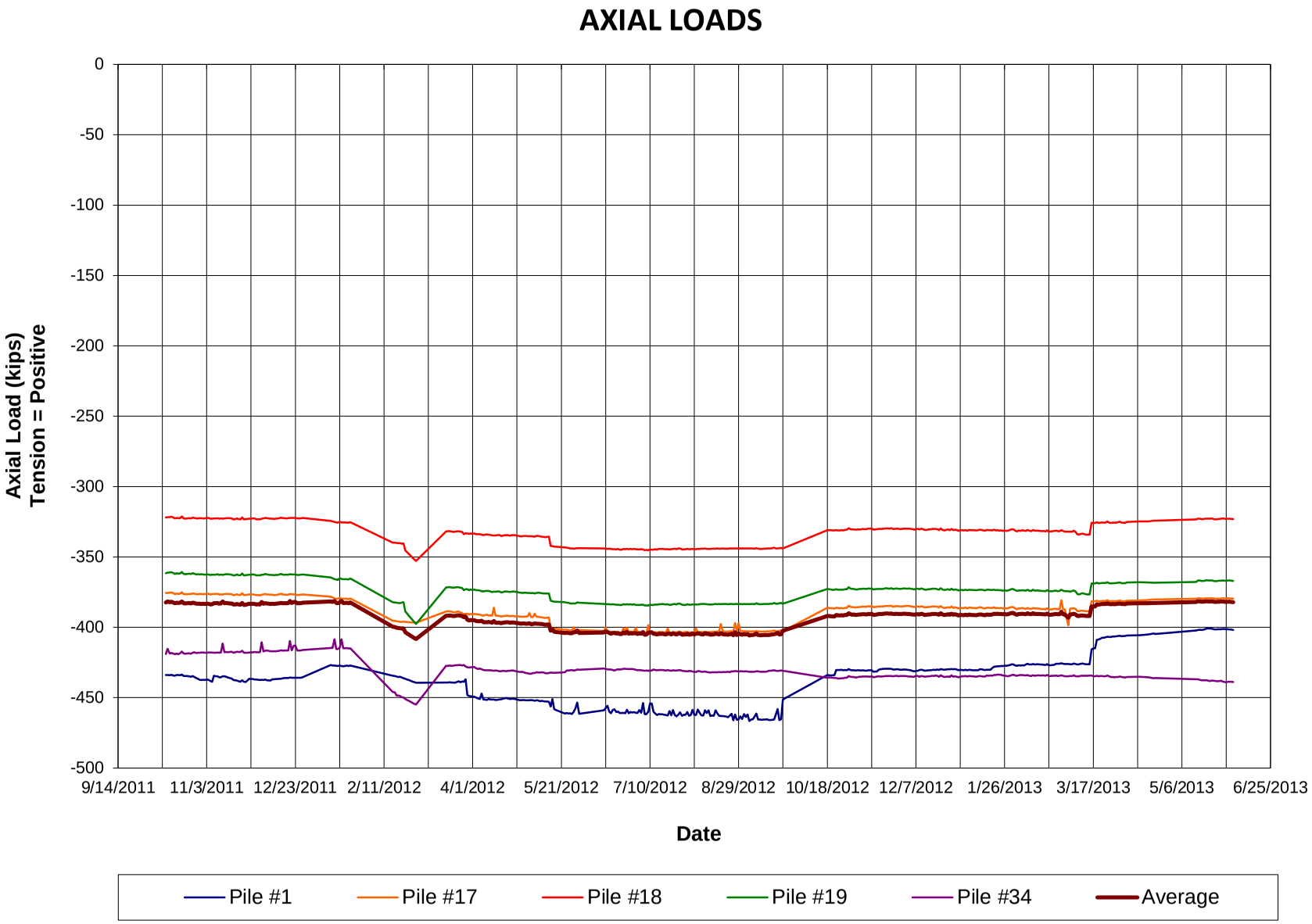
Anchor #1 - Load Cell #1
Anchor Load (k)
2500
2000
1500
1000
500
0
-500
09/14/11
11/03/11
12/23/11
02/11/12
04/01/12
05/21/12
07/10/12
08/29/12
10/18/12
12/07/12
01/26/13
03/17/13
05/06/13
06/25/13
Date
Gage 1
Gage 3
Gage 5
Load Cell 1


Anchor #8 - Load Cell #8
Anchor Load (k)
500
400
300
200
100
0
-100
-200
-300
-400
-500
09/14/11
11/03/11
12/23/11
02/11/12
04/01/12
05/21/12
07/10/12
08/29/12
10/18/12
12/07/12
01/26/13
03/17/13
05/06/13
06/25/13
Date
Gage 1
Gage 2
Gage 3
Load Cell 8

Anchor #9 - Load Cell #9
Anchor Load (k)
1000
900
800
700
600
500
400
300
200
100
0
09/14/11
11/03/11
12/23/11
02/11/12
04/01/12
05/21/12
07/10/12
08/29/12
10/18/12
12/07/12
01/26/13
03/17/13
05/06/13
06/25/13
Date
Gage 1
Gage 2
Gage 3
Gage 4
Gage 5
Load Cell 9

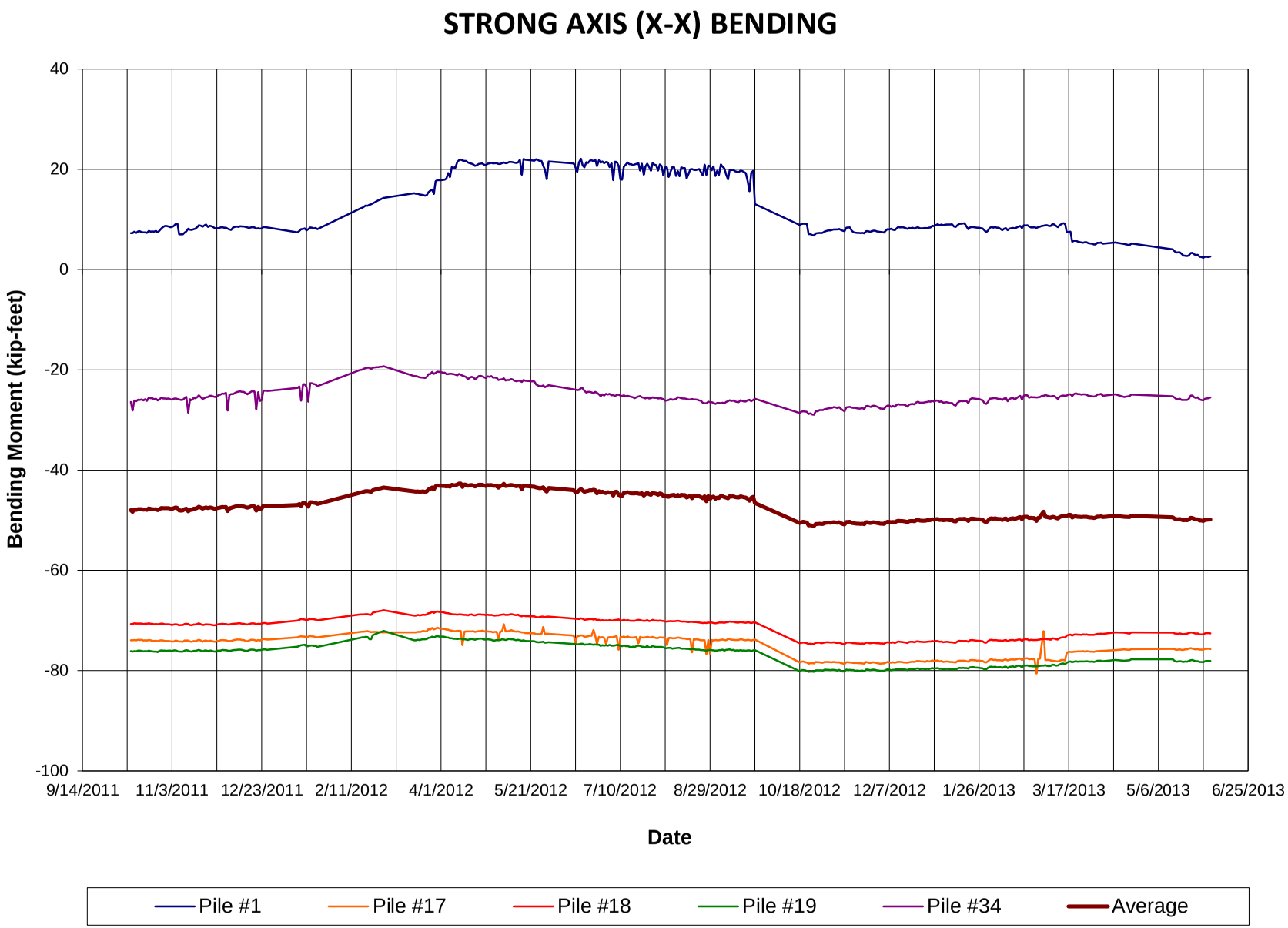

Anchor #17 - Load Cell #17
Anchor Load (k)
400
350
300
250
200
150
100
50
0
-50
-100
09/14/11
11/03/11
12/23/11
02/11/12
04/01/12
05/21/12
07/10/12
08/29/12
10/18/12
12/07/12
01/26/13
03/17/13
05/06/13
06/25/13
Date
Gage 1
Gage 3
Gage 5
Load Cell 17

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



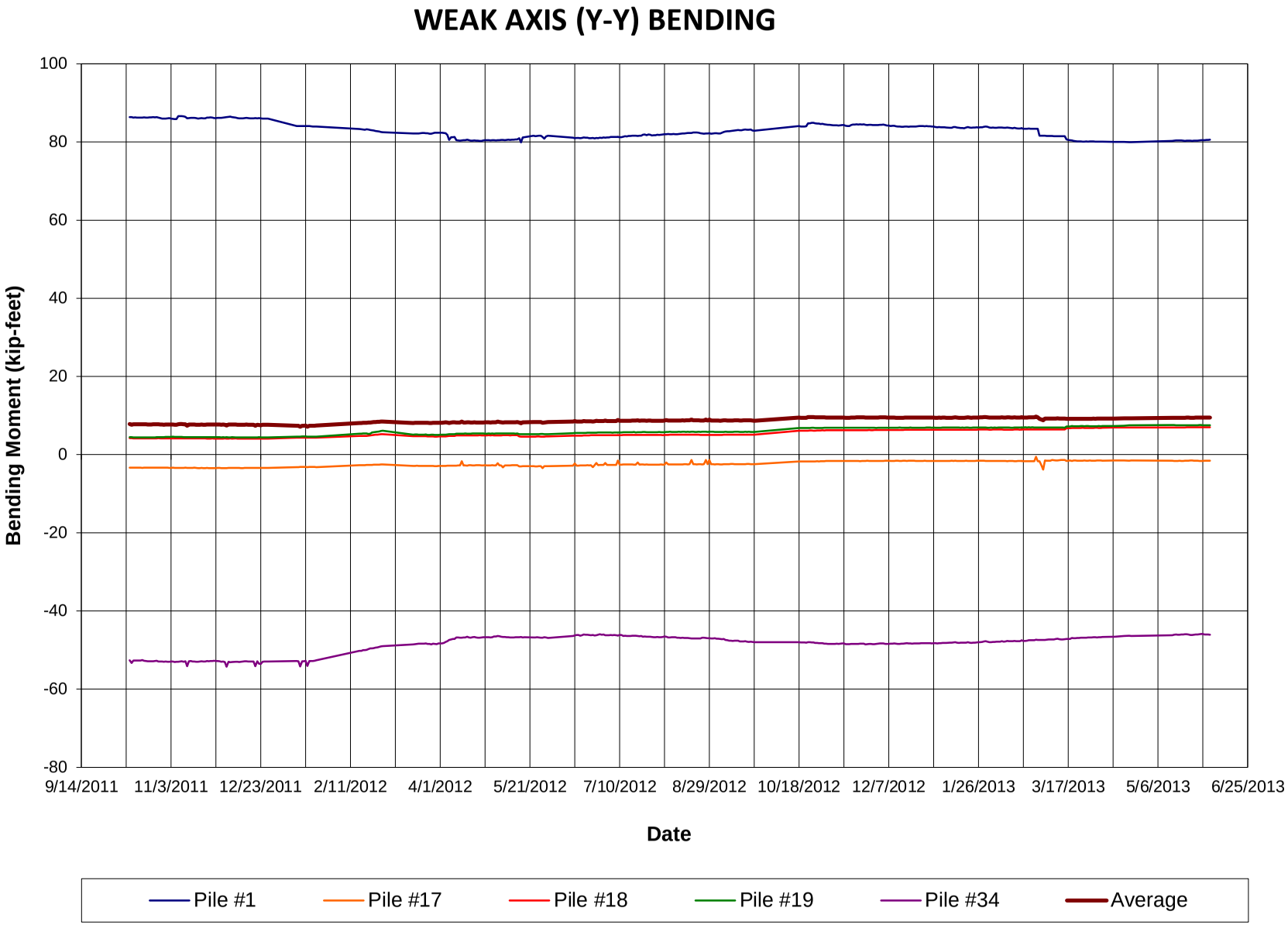
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



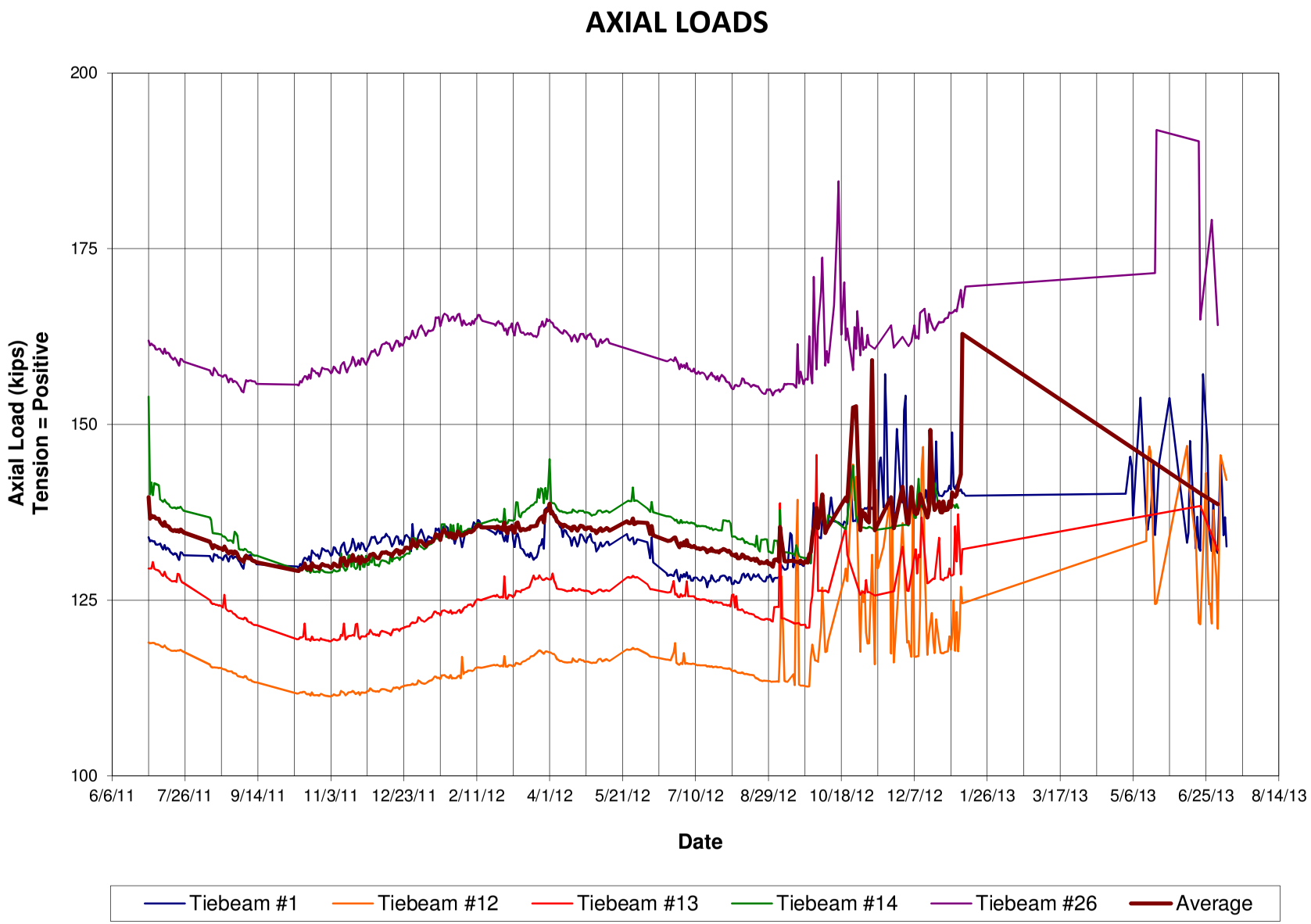
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



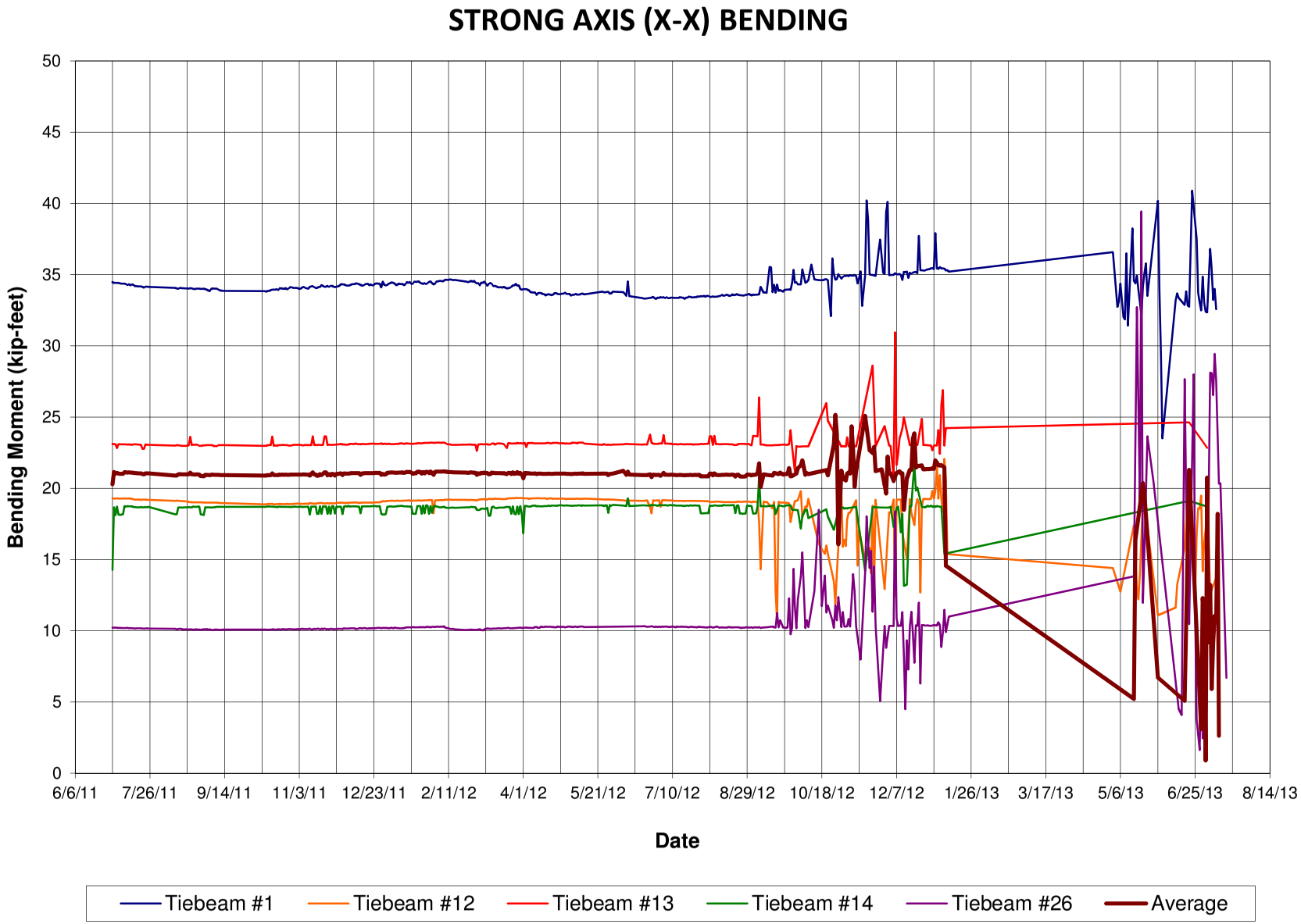
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



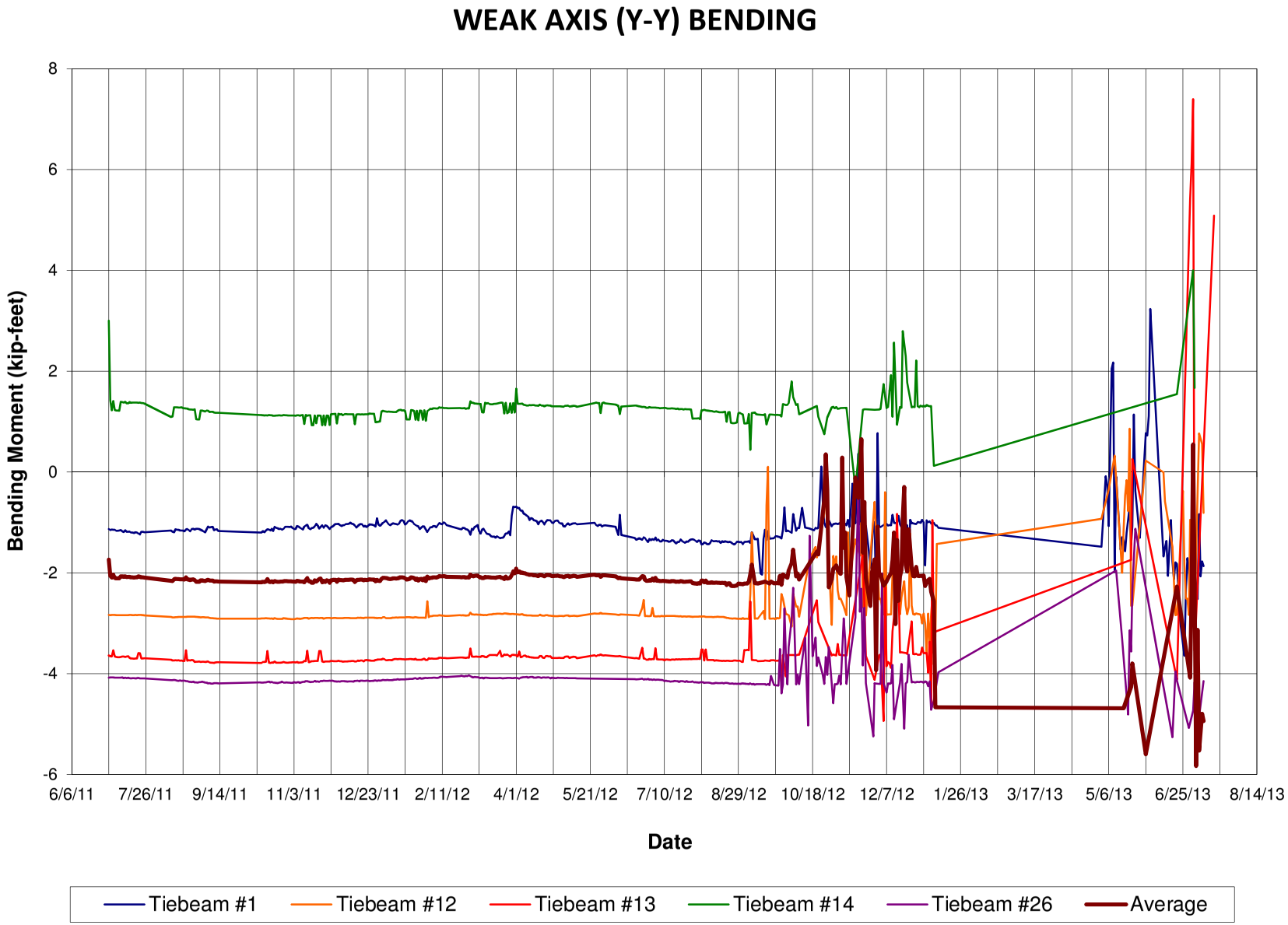
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



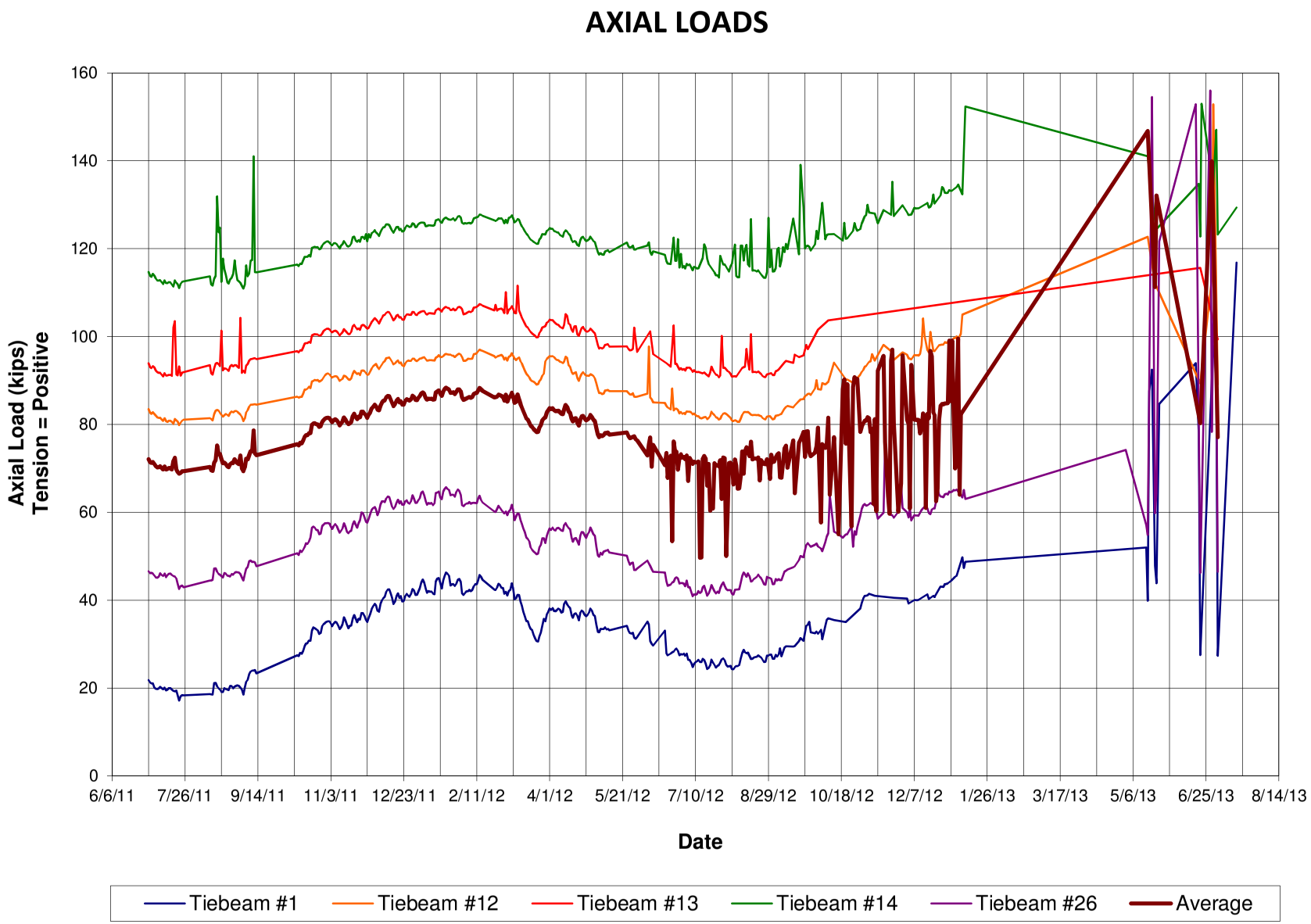
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



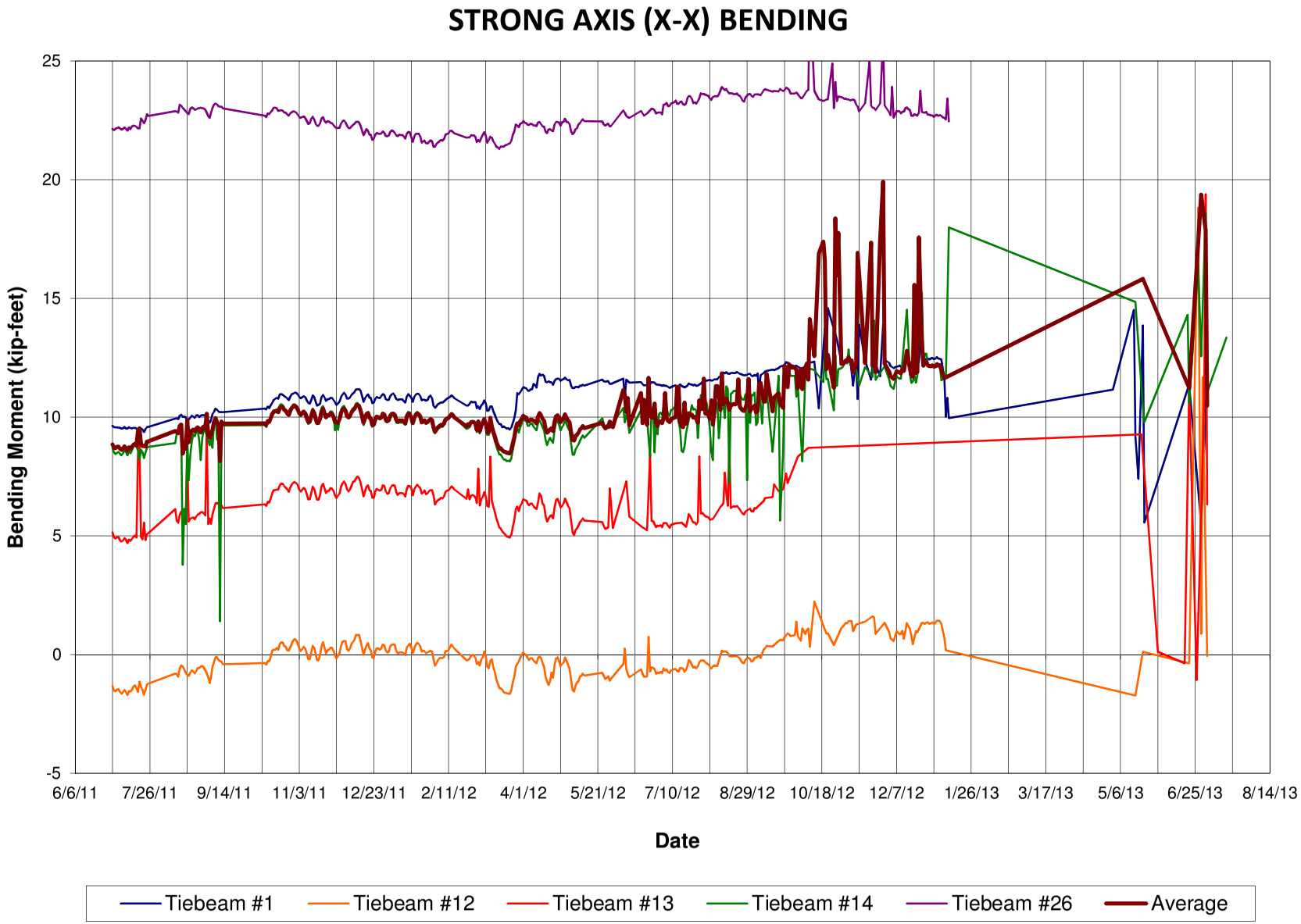
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



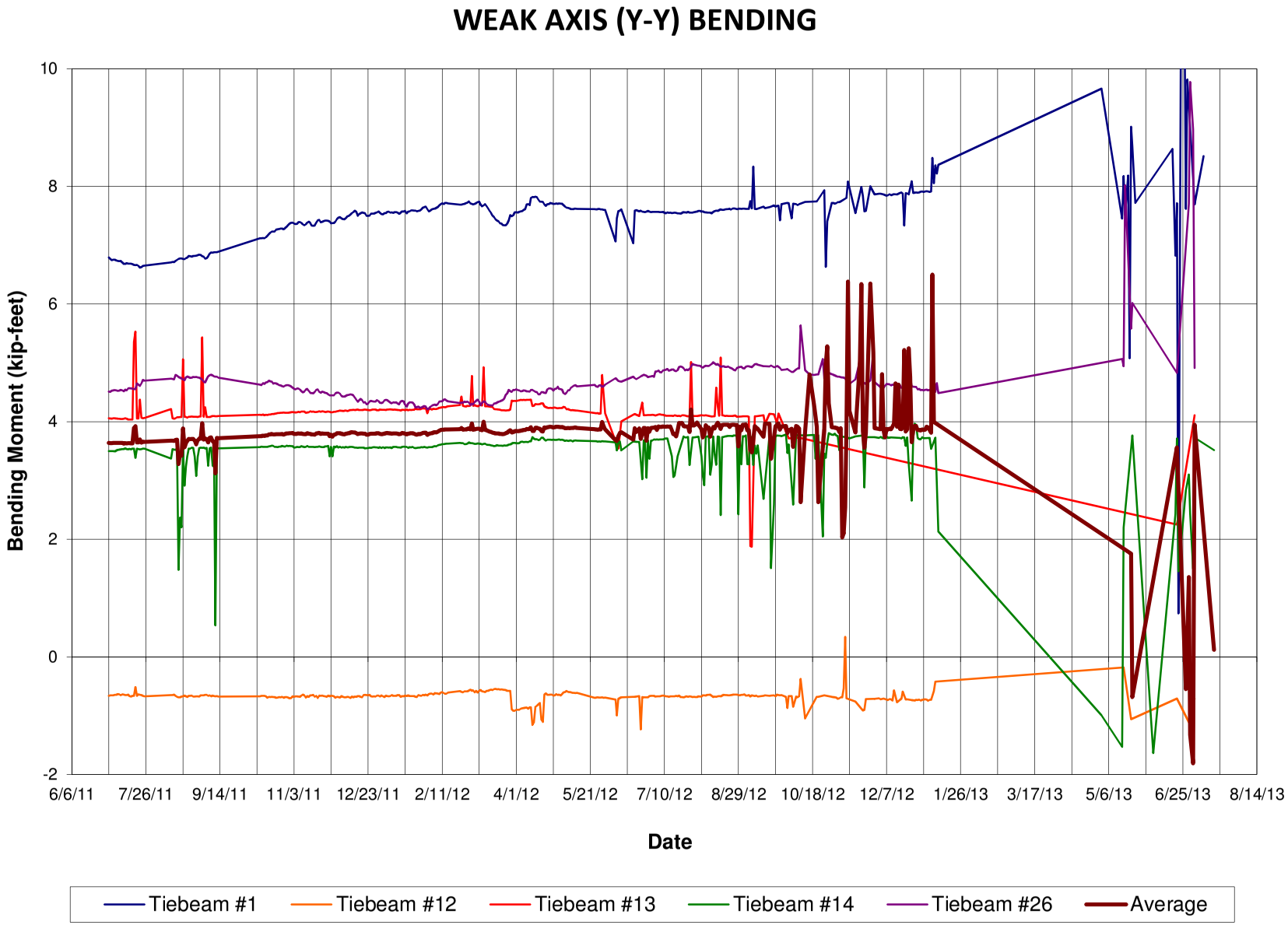
Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G



Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 76117
EDP #09305G

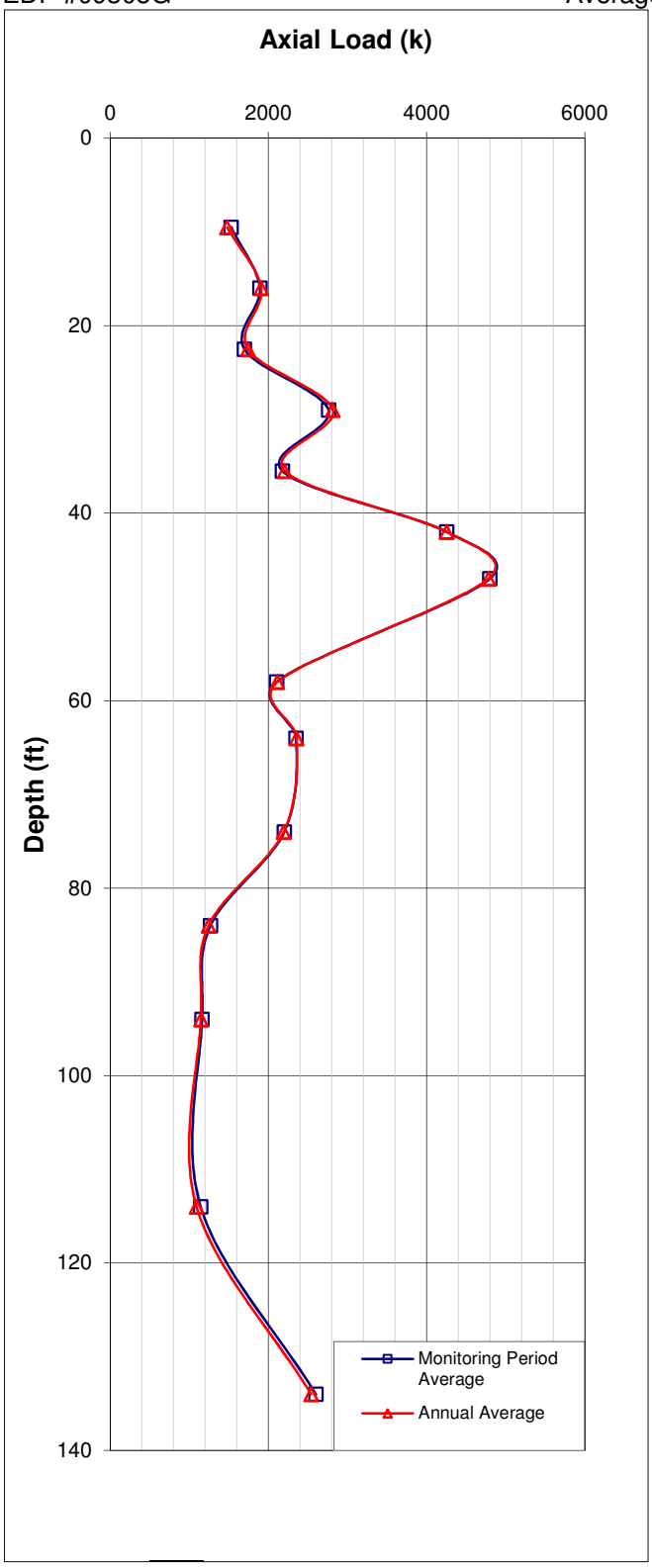


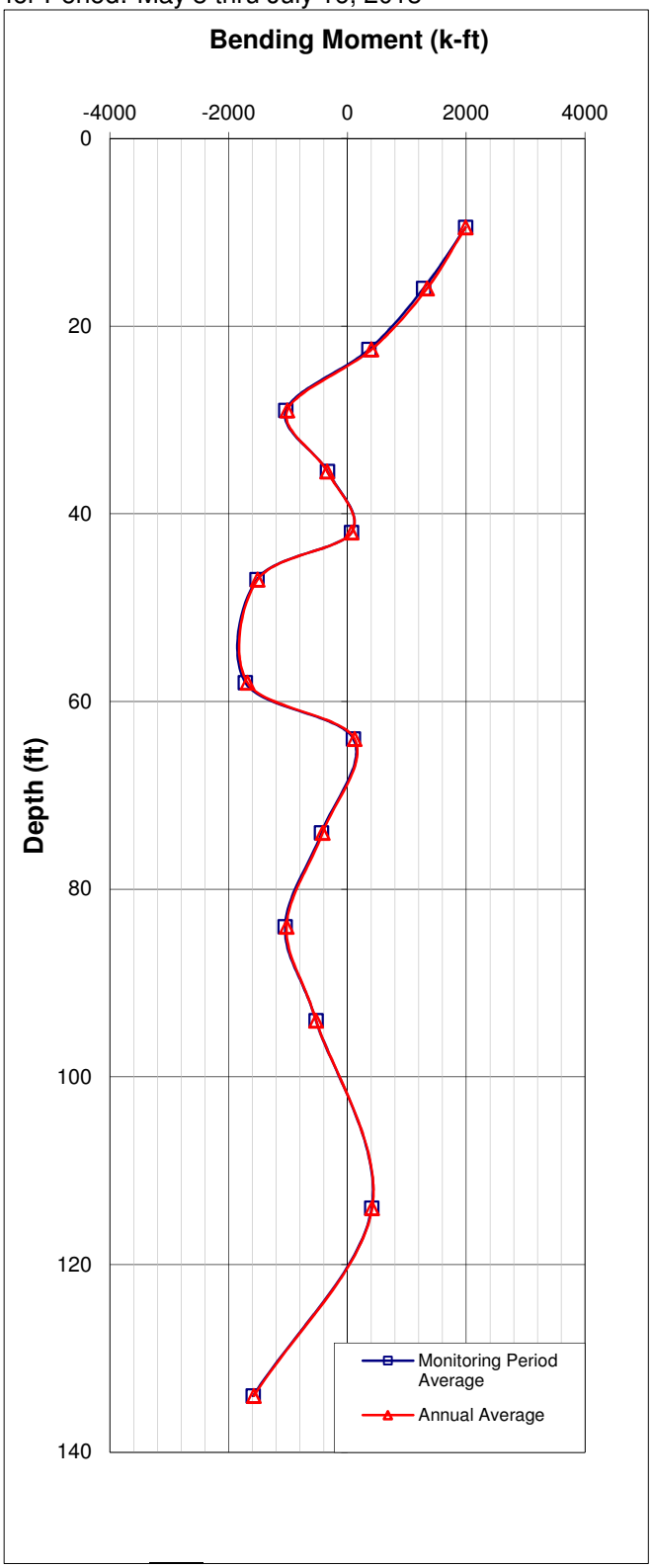
Tiebeams - Drilled Pier Side

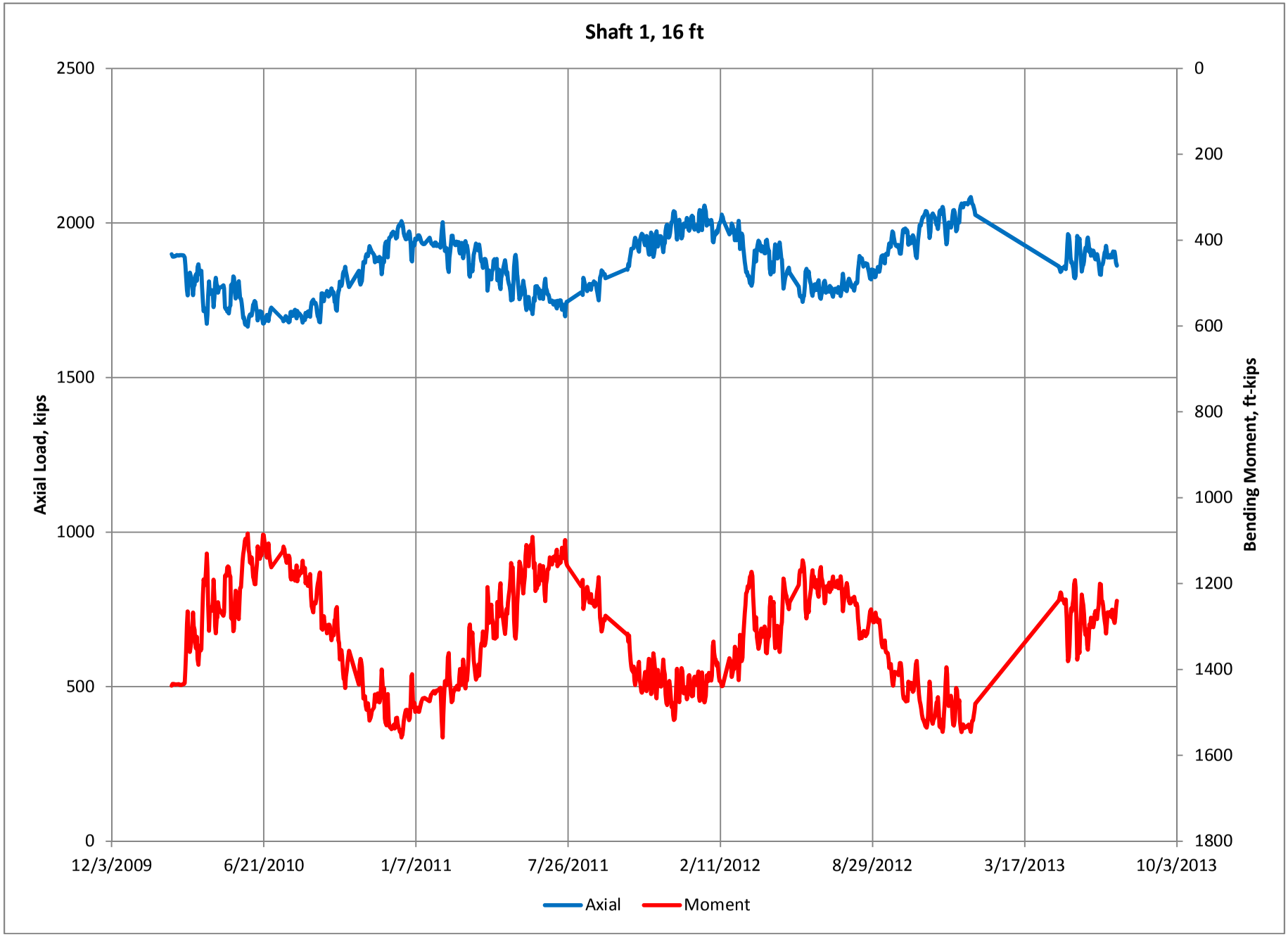
CUY-90-15.24 Slope Monitoring

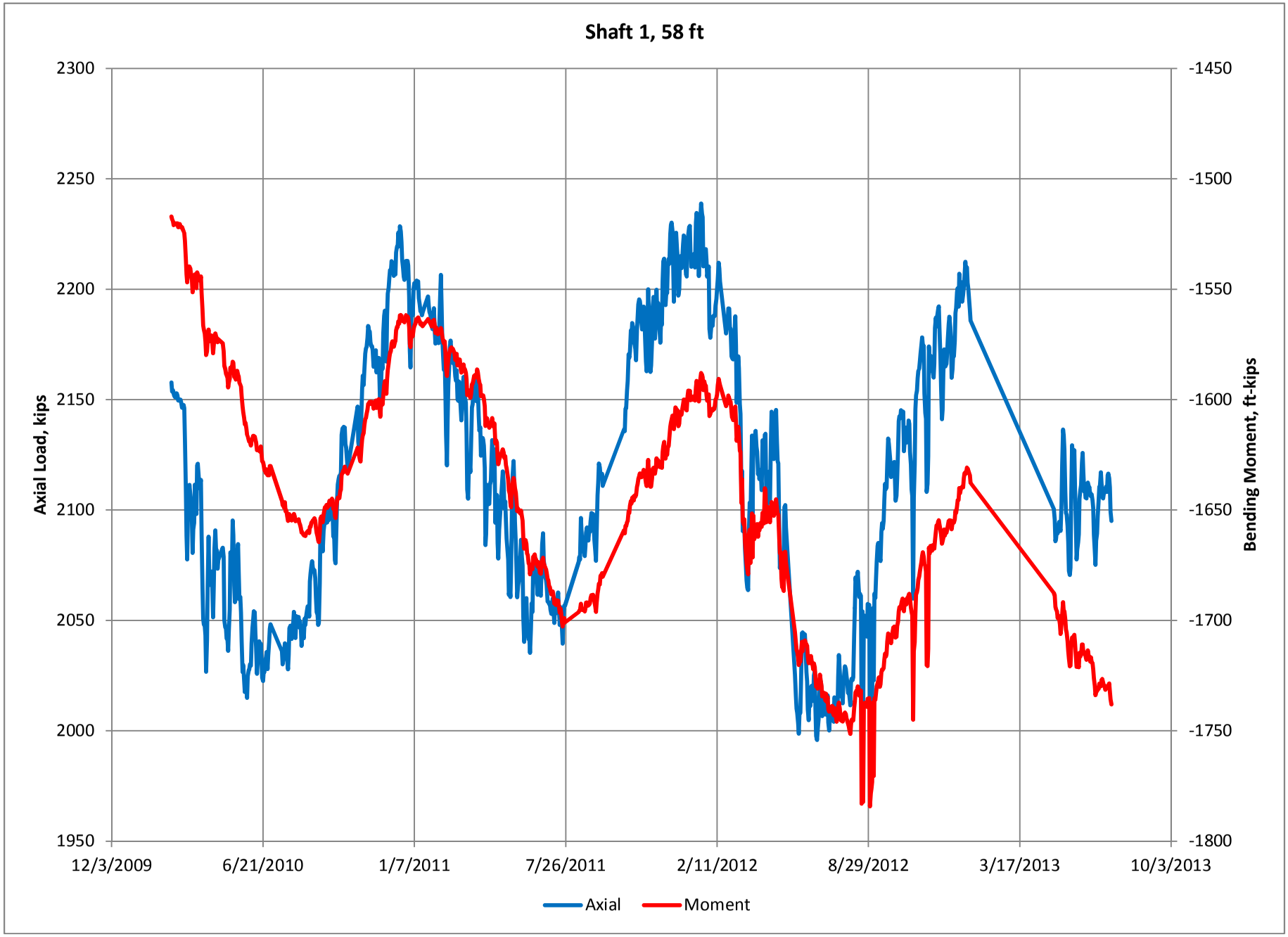
PID 76117
Cleveland, Ohio
EDP #09305G

Drilled Shaft #1
(Weak Axis Bending)
Average for Period: May 8 thru July 16, 2013





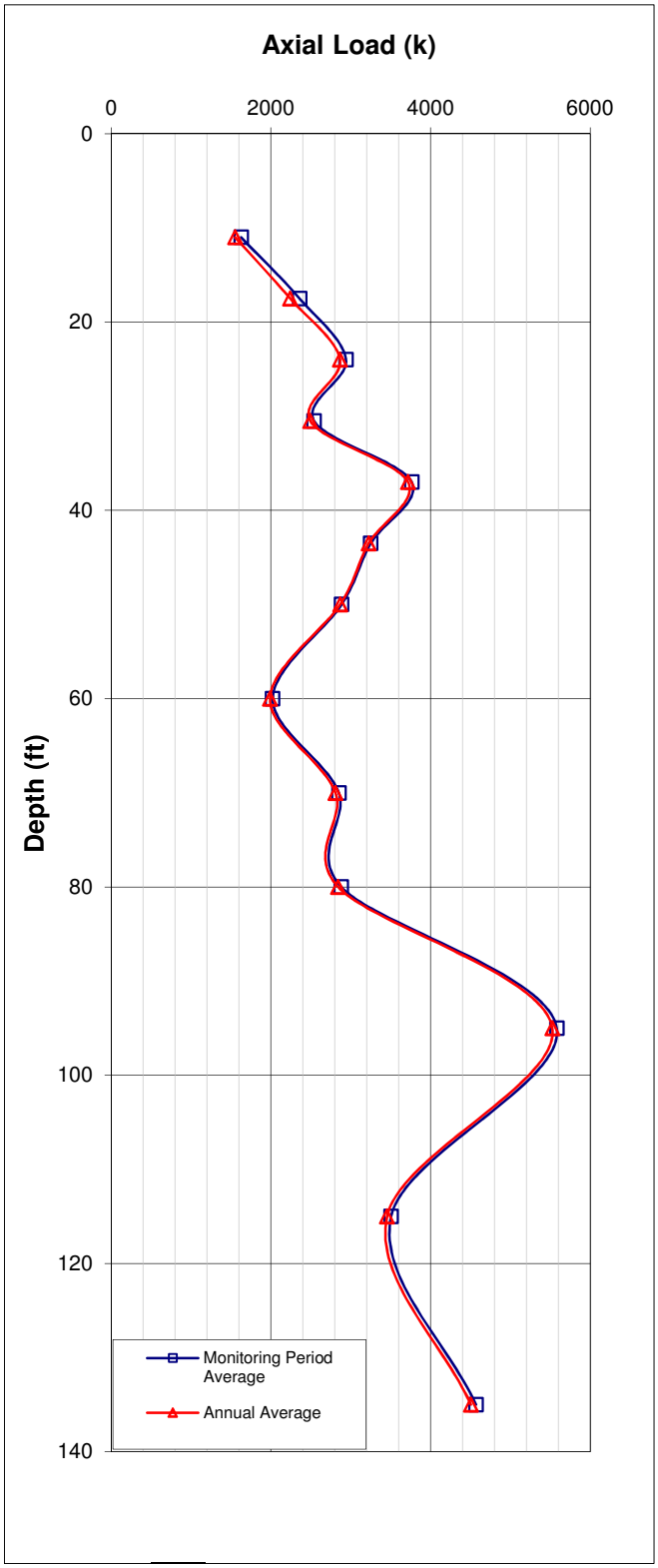

Shaft 1, 16 ft
Axial Load, kips
Bending Moment, ft-kips
2500
2000
1500
1000
500
0
0
200
400
600
800
1000
1200
1400
1600
1800
12/3/2009
6/21/2010
1/7/2011
7/26/2011
2/11/2012
8/29/2012
3/17/2013
10/3/2013
Axial
Moment

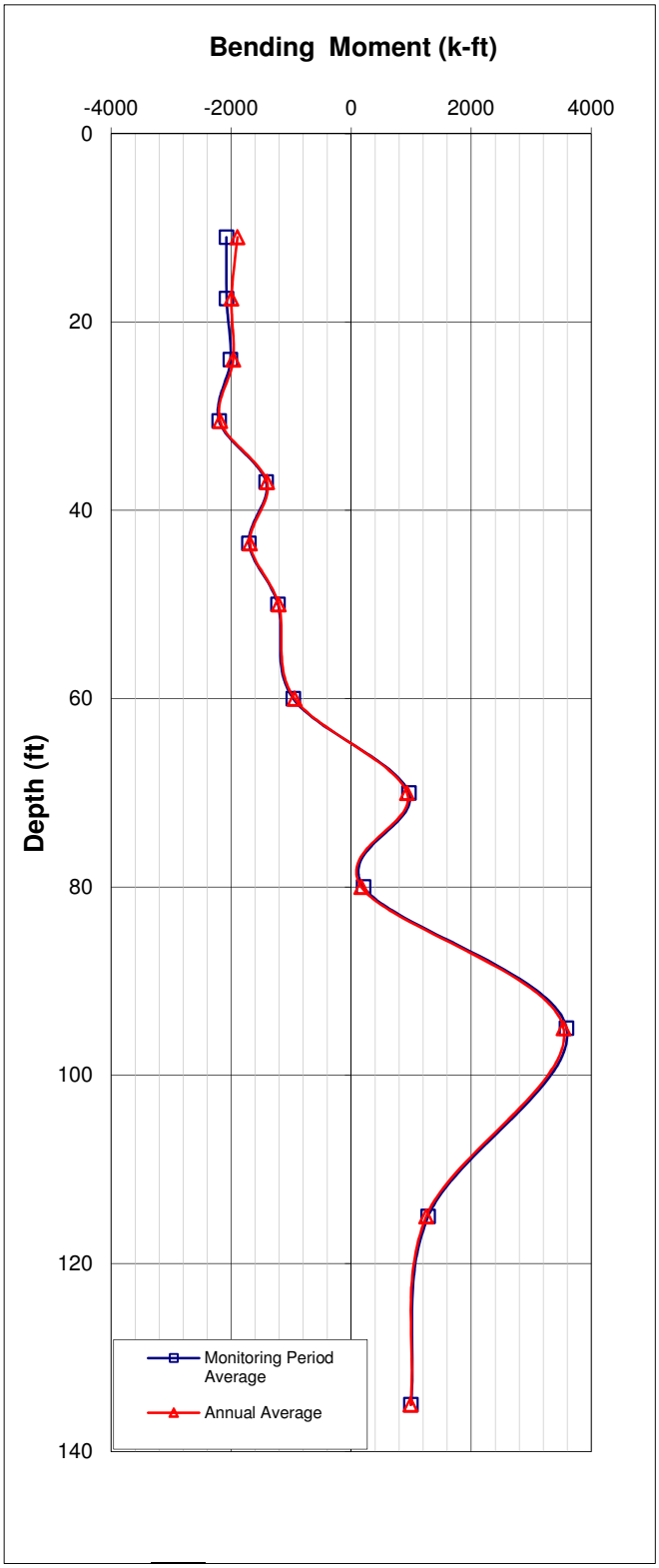

Shaft 1, 58 ft
Axial Load, kips
Bending Moment, ft-kips
2300
2250
2200
2150
2100
2050
2000
1950
-1450
-1500
-1550
-1600
-1650
-1700
-1750
-1800
12/3/2009
6/21/2010
1/7/2011
7/26/2011
2/11/2012
8/29/2012
3/17/2013
10/3/2013
Axial
Moment

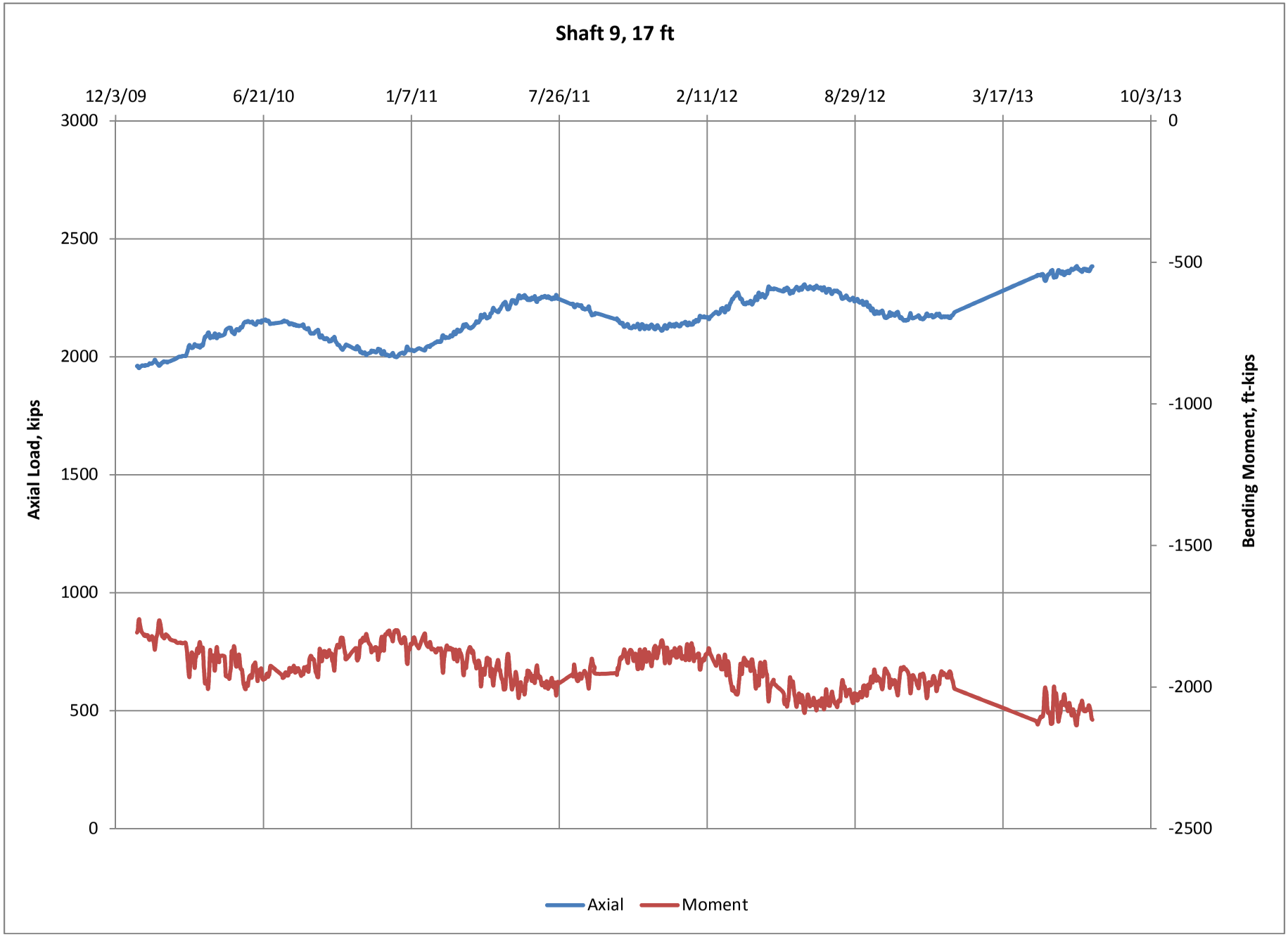
CUY-90-15.24 Slope Monitoring

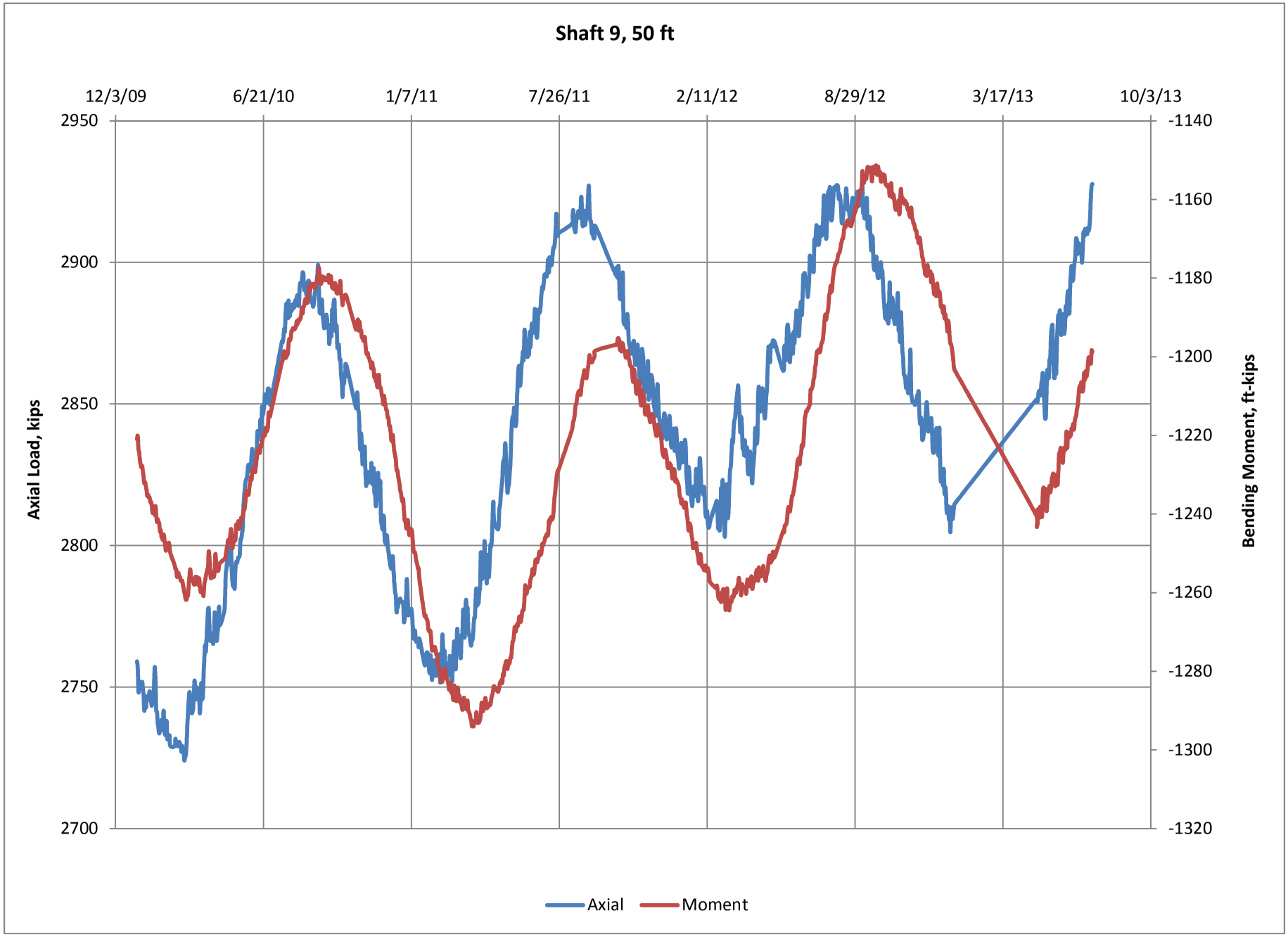
PID 76117
Cleveland, Ohio
EDP #09305G

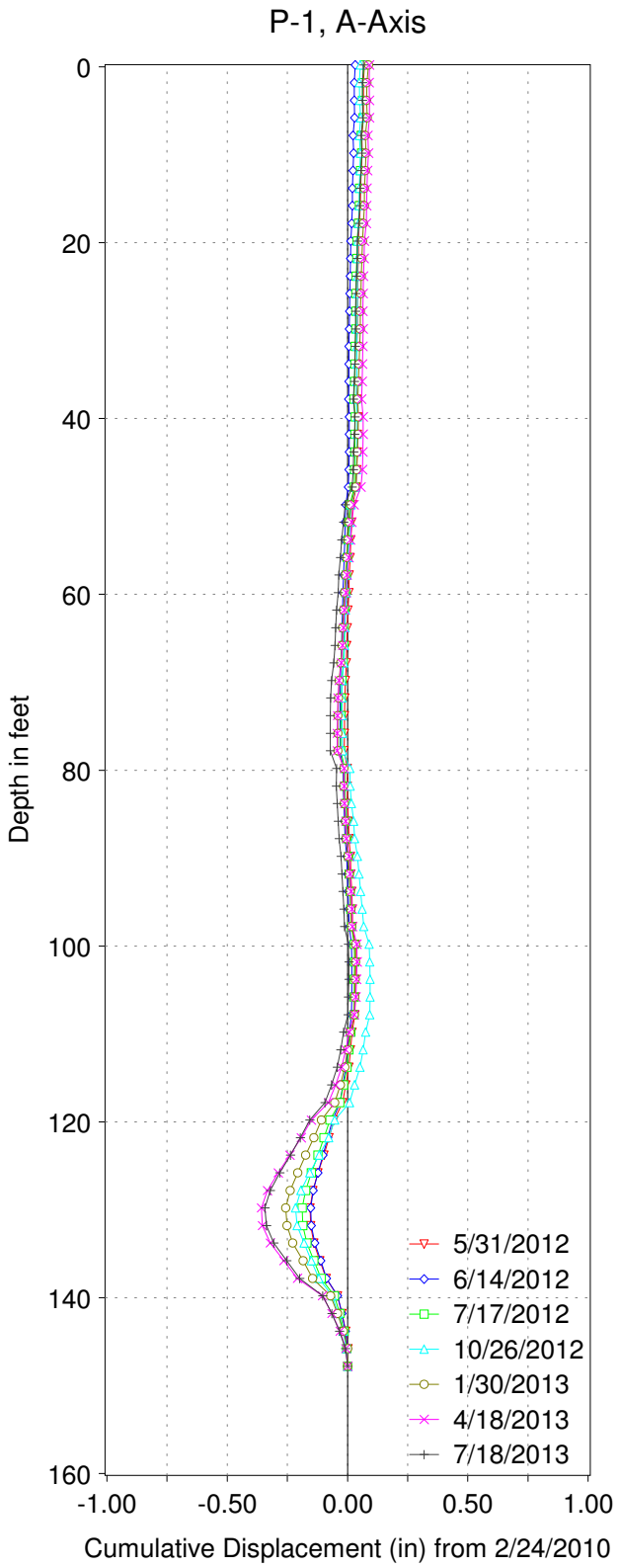
Drilled Shaft #9
Strong Axis Bending
Average for Period: May 8 thru July 16, 2013

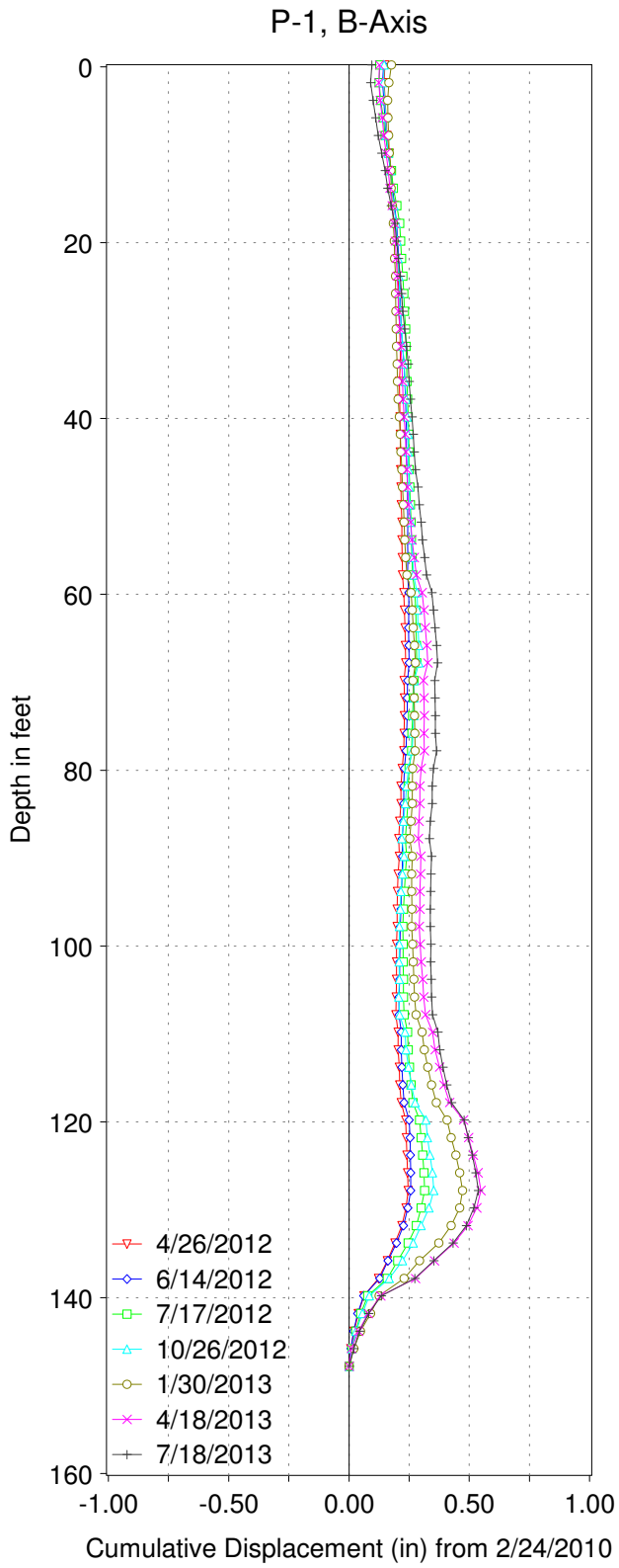





Shaft 9, 17 ft
12/3/09
6/21/10
1/7/11
7/26/11
2/11/12
8/29/12
3/17/13
10/3/13
3000
2500
2000
1500
1000
500
0
0
-500
-1000
-1500
-2000
-2500
Axial Load, kips
Bending Moment, ft-kips
Axial
Moment


Shaft 9, 50 ft
12/3/09
6/21/10
1/7/11
7/26/11
2/11/12
8/29/12
3/17/13
10/3/13
2950
2900
2850
2800
2750
2700
Axial Load, kips
-1140
-1160
-1180
-1200
-1220
-1240
-1260
-1280
-1300
-1320
Bending Moment, ft-kips
Axial
Moment





CUY-90-15.24
PID 76117
SME Project#: 062943.00
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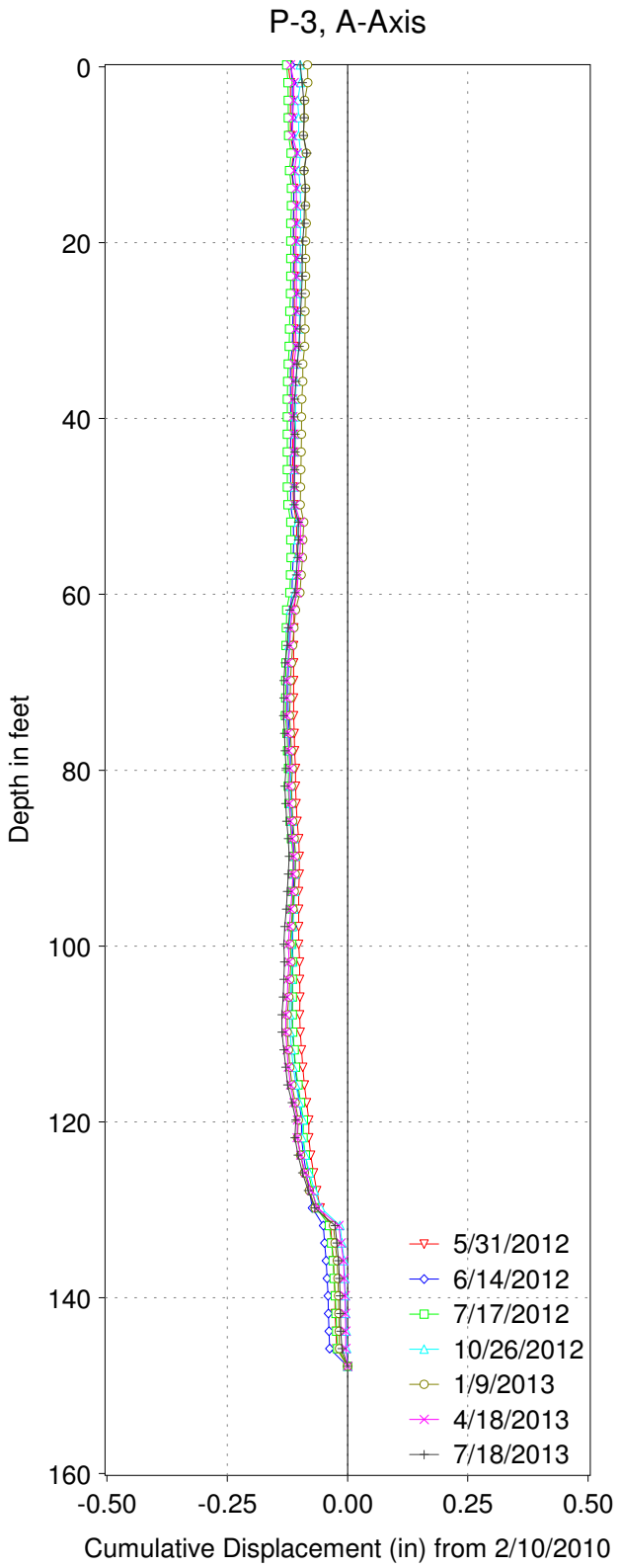

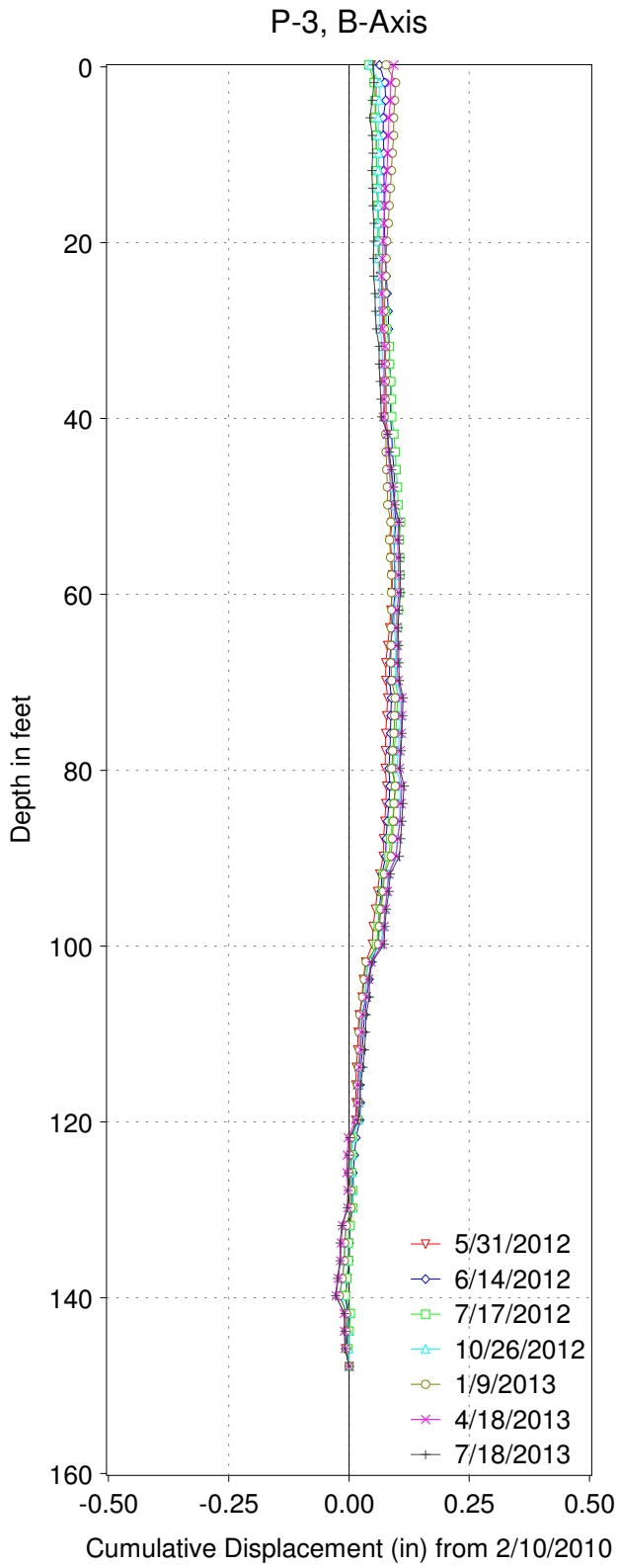

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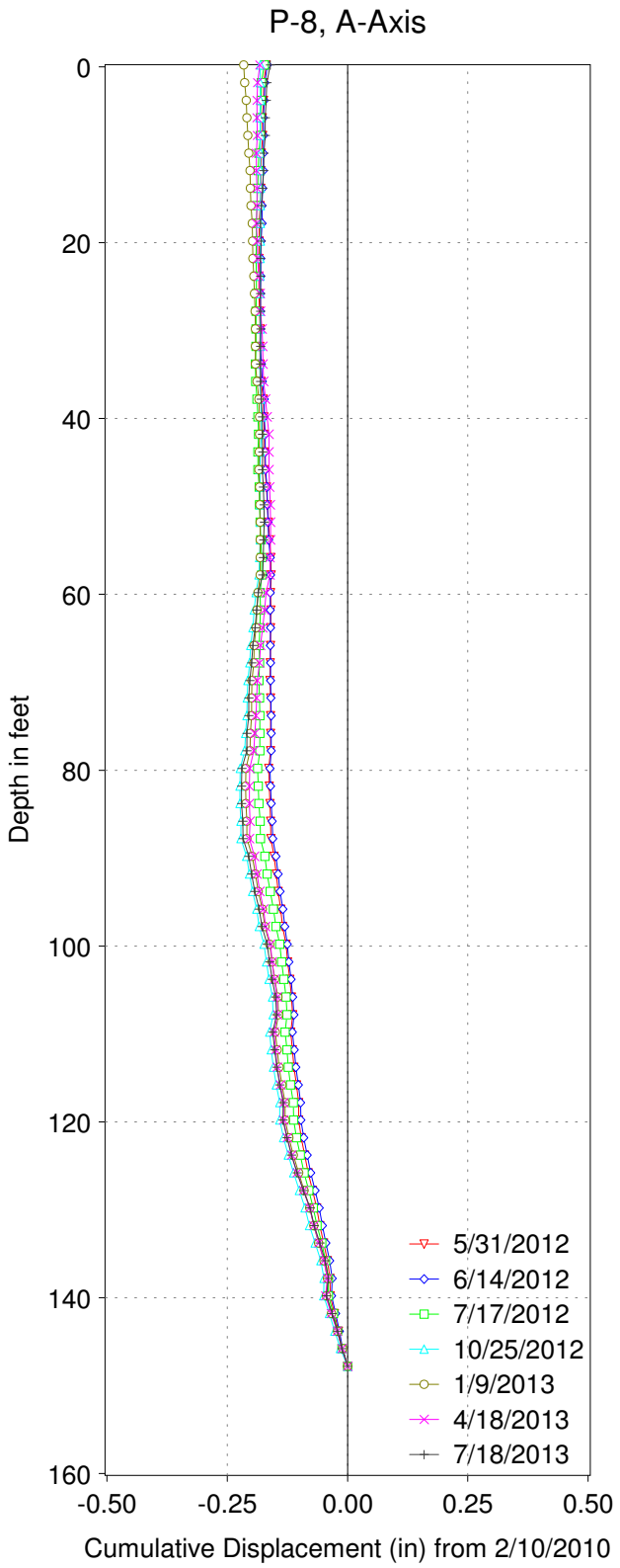

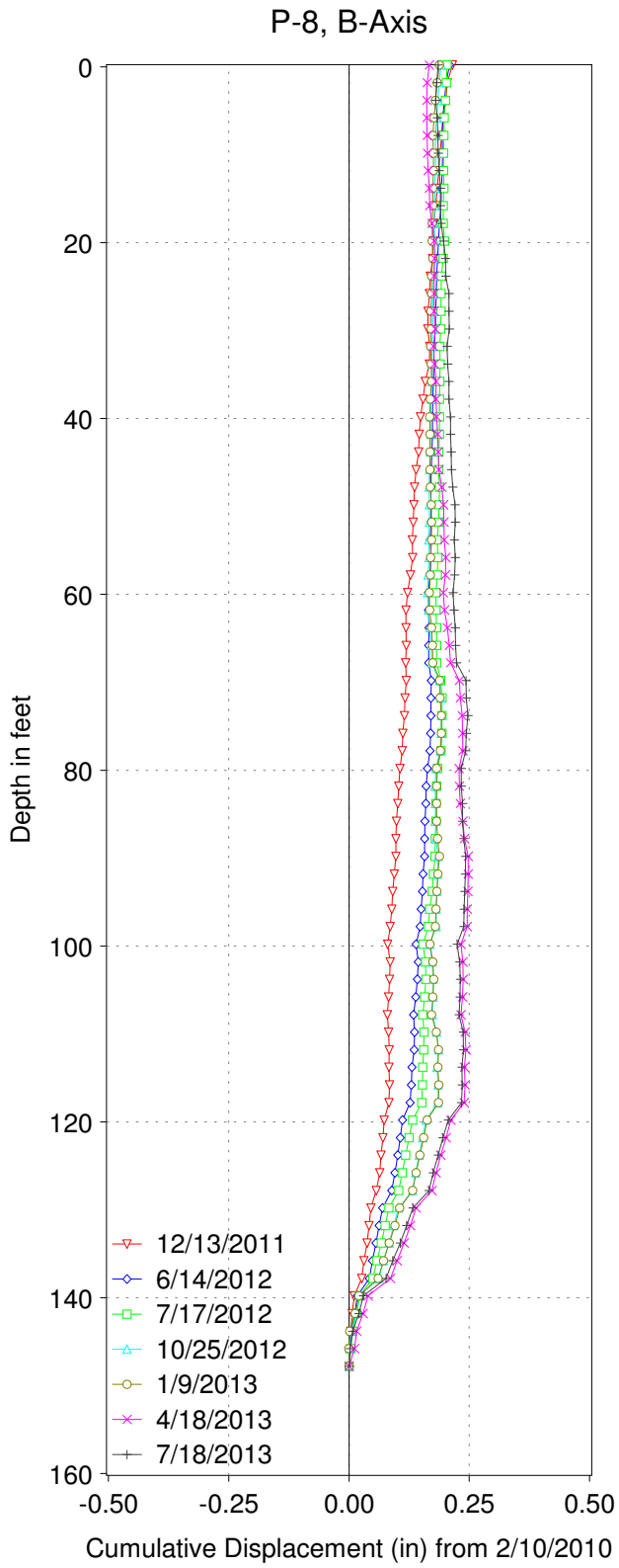

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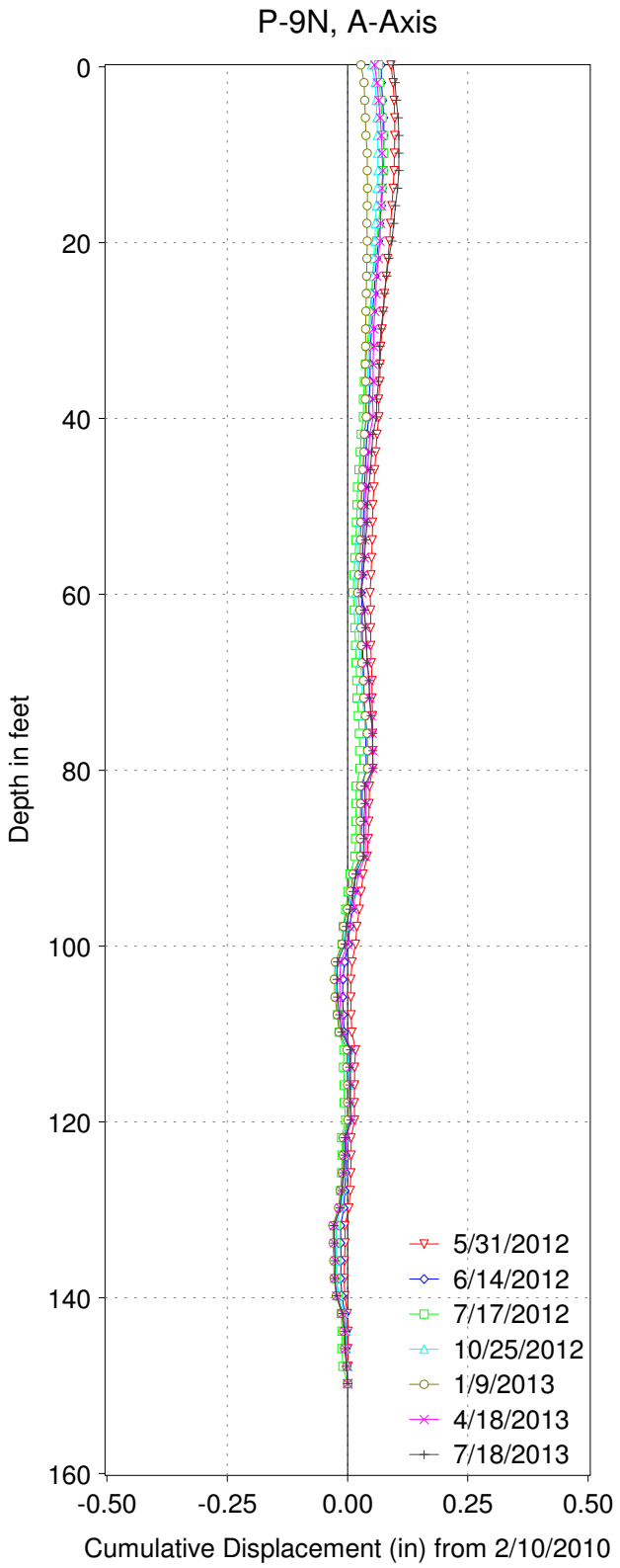

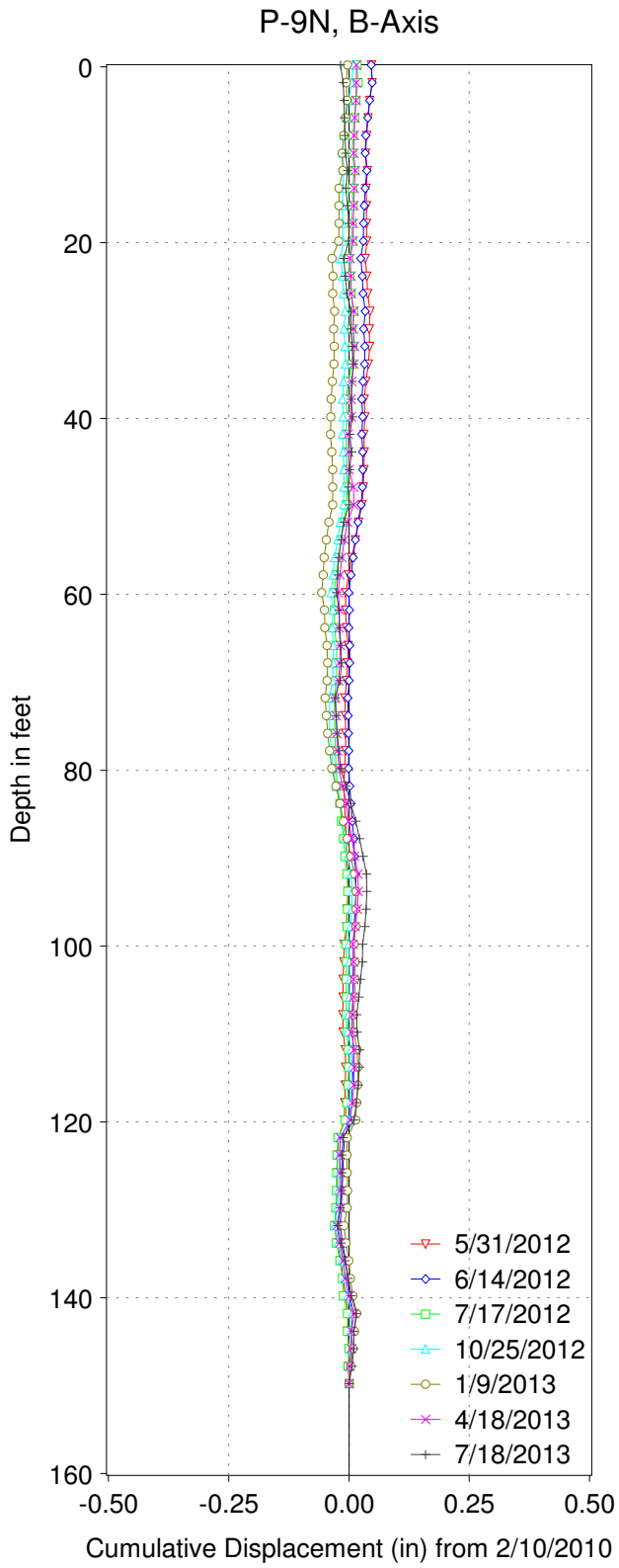

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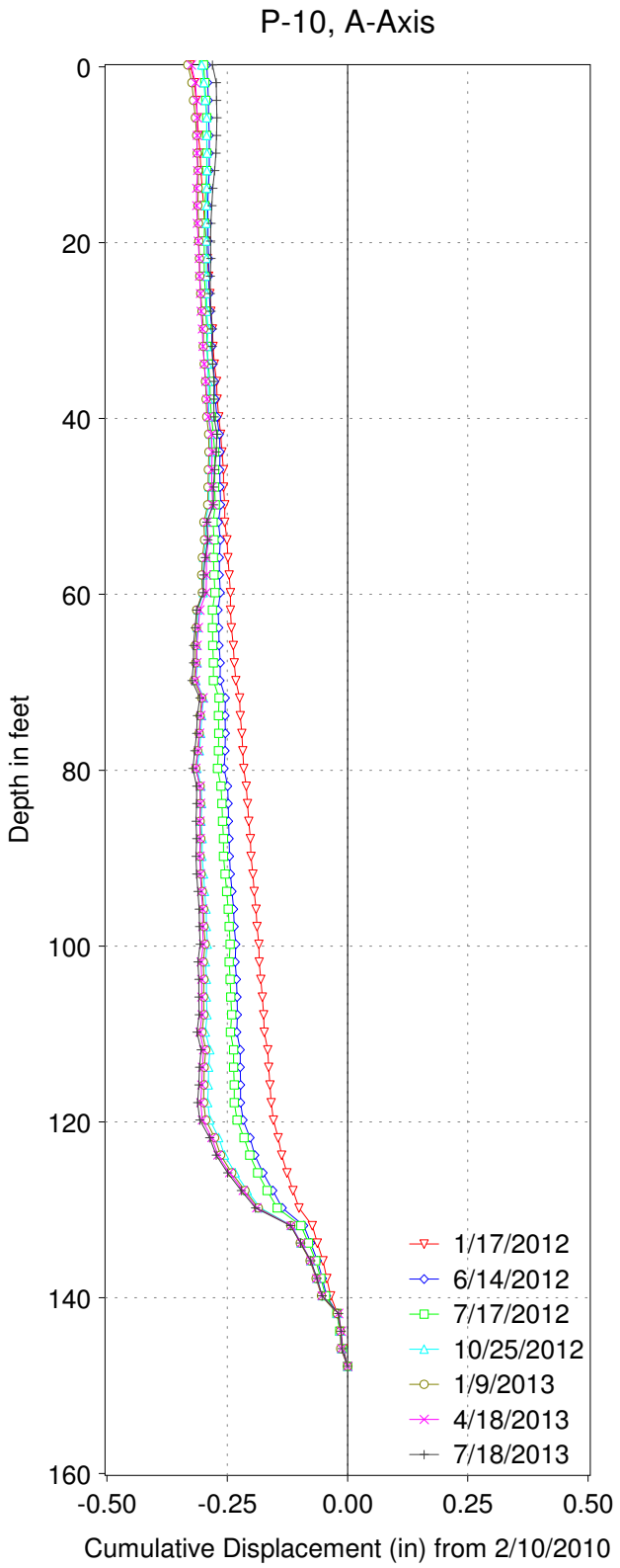

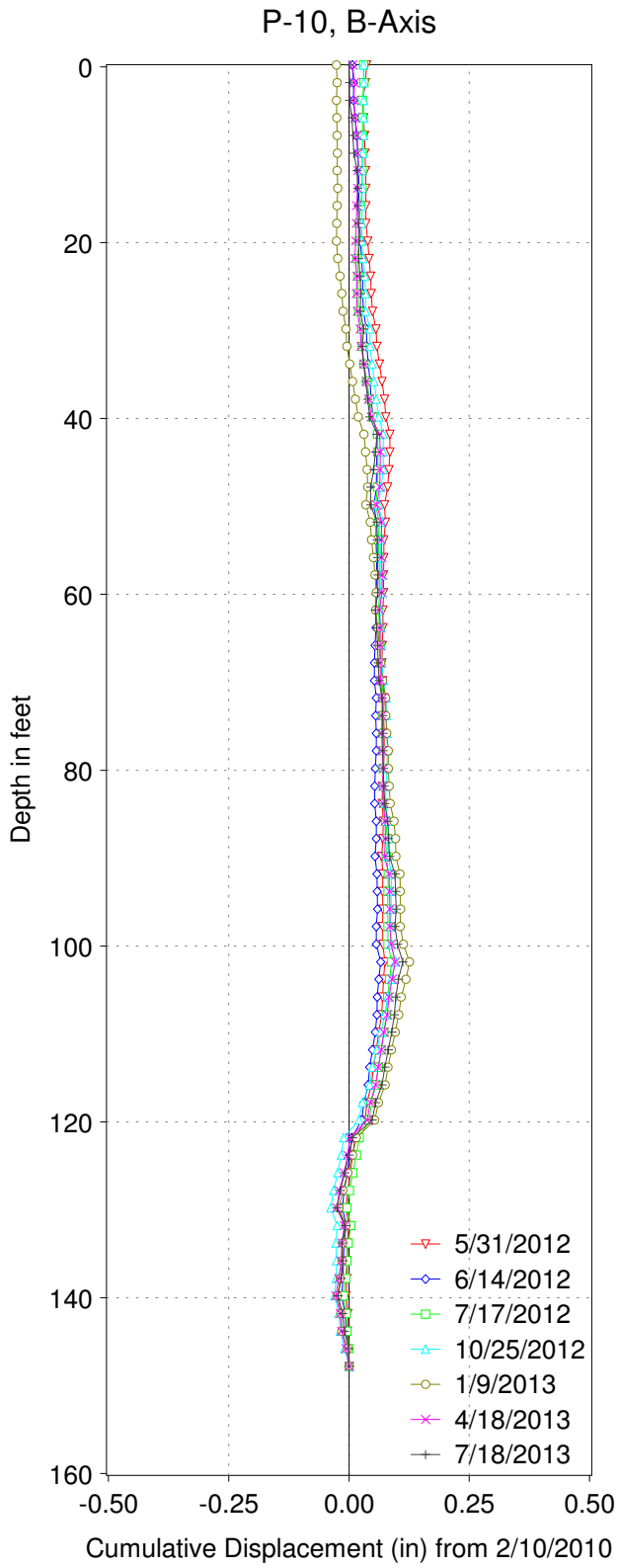

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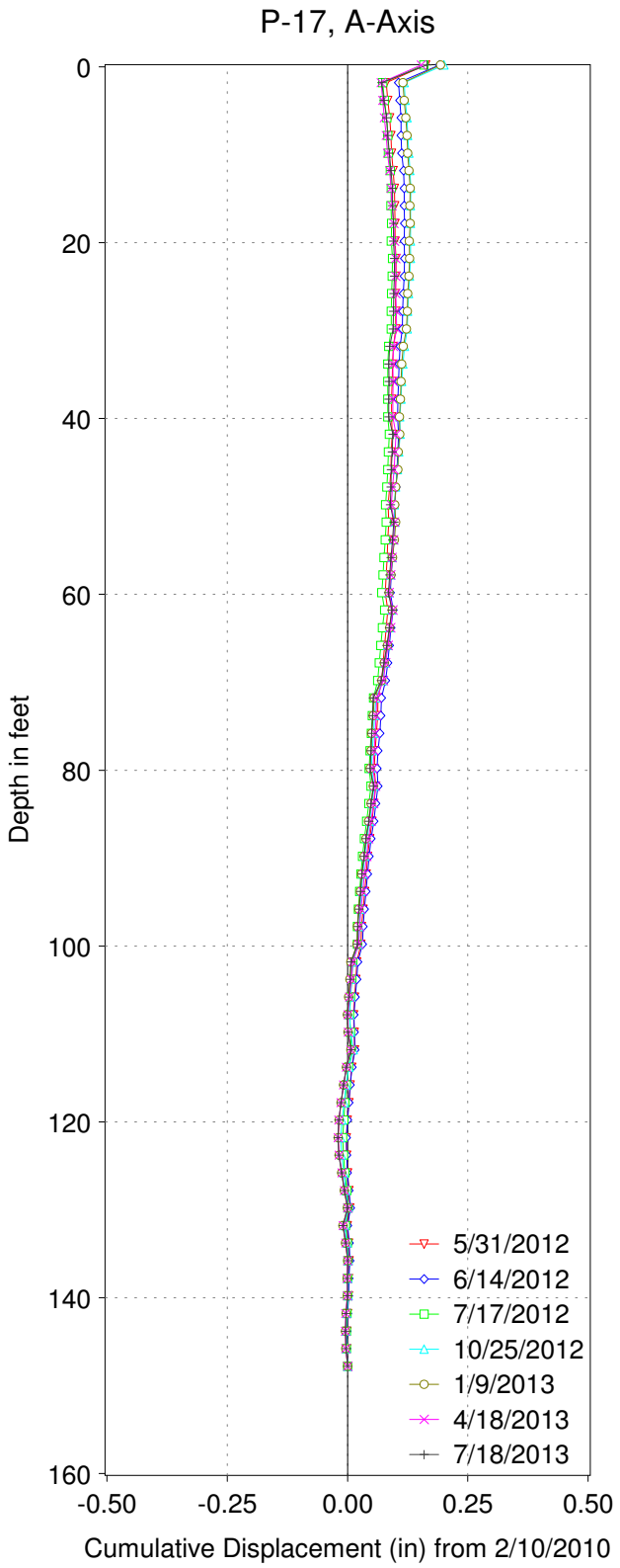

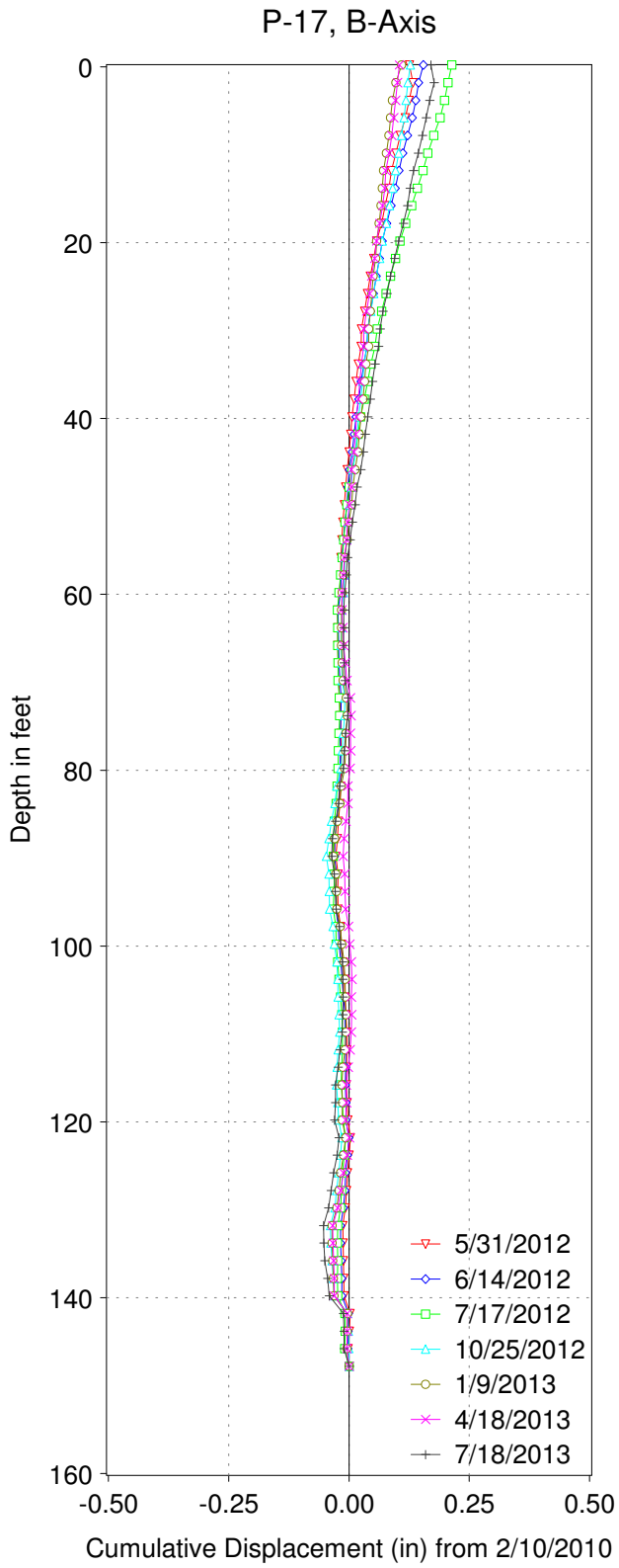

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