Gmail

Linda Loomis <naiadconsulting@gmail.com>

LMRWD Stability Study

Joel W. Toso <jtoso@wenck.com> Tue, Apr 29, 2014 at 3:14 PM
To: "Holman, Bill" <holmanbill@stanleygroup.com>
Cc: "lbraun@braunintertec.com" <lbraun@braunintertec.com>, "lkremer@barr.com" <lkremer@barr.com>, "Naiadconsulting@gmail.com" <Naiadconsulting@gmail.com>

Bill,

Linda Loomis, the administrator for Lower Minn, called and asked that another reading and analysis of the inclinometers by done at the site adjacent to Minnesota River in Eden Prairie. Would you coordinate with Braun (Braun Intertec Project SP-09-04727) to see when this could be accomplished? I attached the most recent readings I have for your reference.

Send the bill directly to the District c/o Linda Loomis, Naiadconsulting@gmail.com, 763-545-4659.

Thanks,

Joel

Joel Toso, PE

Wenck Associates Inc., 1800 Pioneer Creek Ctr., P.O. Box 249, Maple Plain, MN 55359-9000
www.wenck.com | jtoso@wenck.com | D 763.479.4231 | F 763.479.4242 | C 612.296-7732 |

From: Holman, Bill [mailto:holmanbill@stanleygroup.com]
Sent: Tuesday, May 22, 2012 10:33 AM
To: Joel W. Toso
Subject: FW: LMRWD Stability Study

Good news. No movement since last fall.

From: Braun, Loren [mailto:LBraun@braunintertec.com]
Sent: Tuesday, May 22, 2012 8:42 AM
To: Holman, Bill
Subject: LMRWD Stability Study

Latest readings

BRAUN INTERTEC

Employee Ownership
working for you

Loren W. Braun, PE

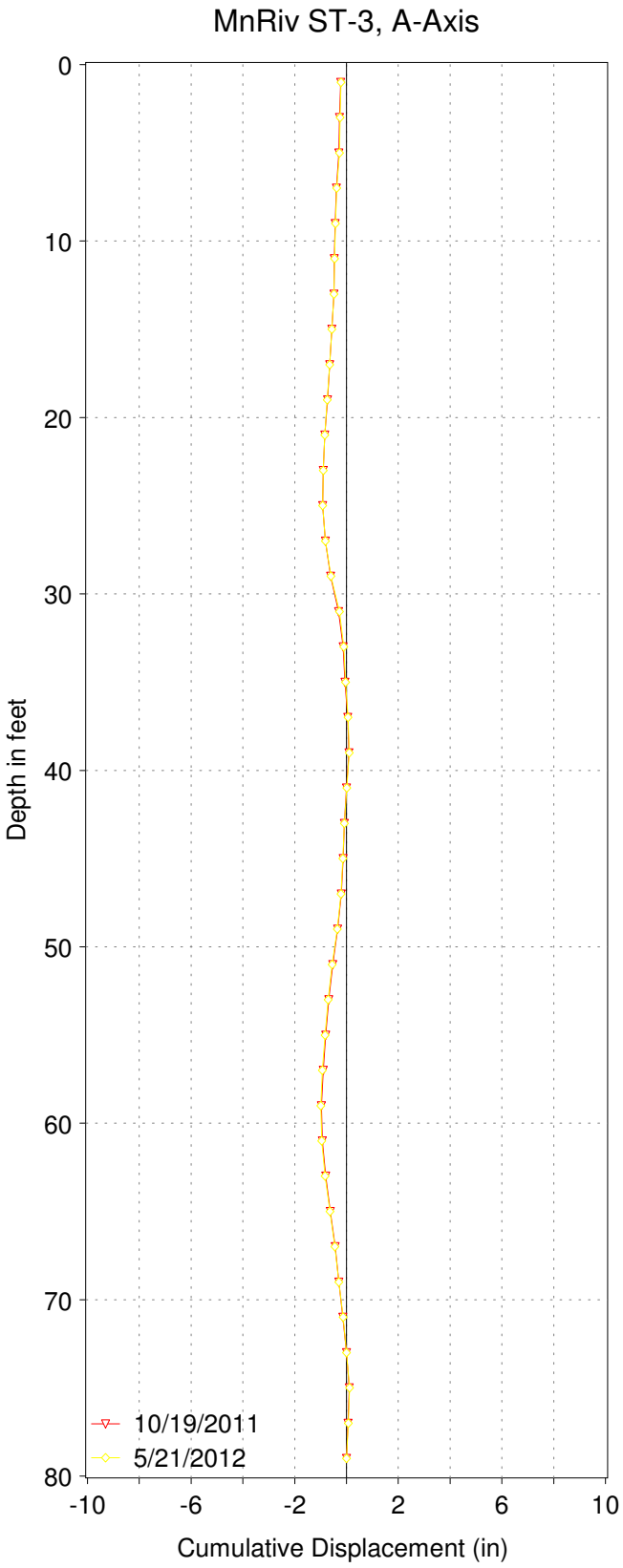
Senior Engineer
1826 Buerkle Road | Saint Paul, MN 55110
651.487.7011 direct | 612.369.8046 mobile | 651.487.1812 fax
LBraun@braunintertec.com

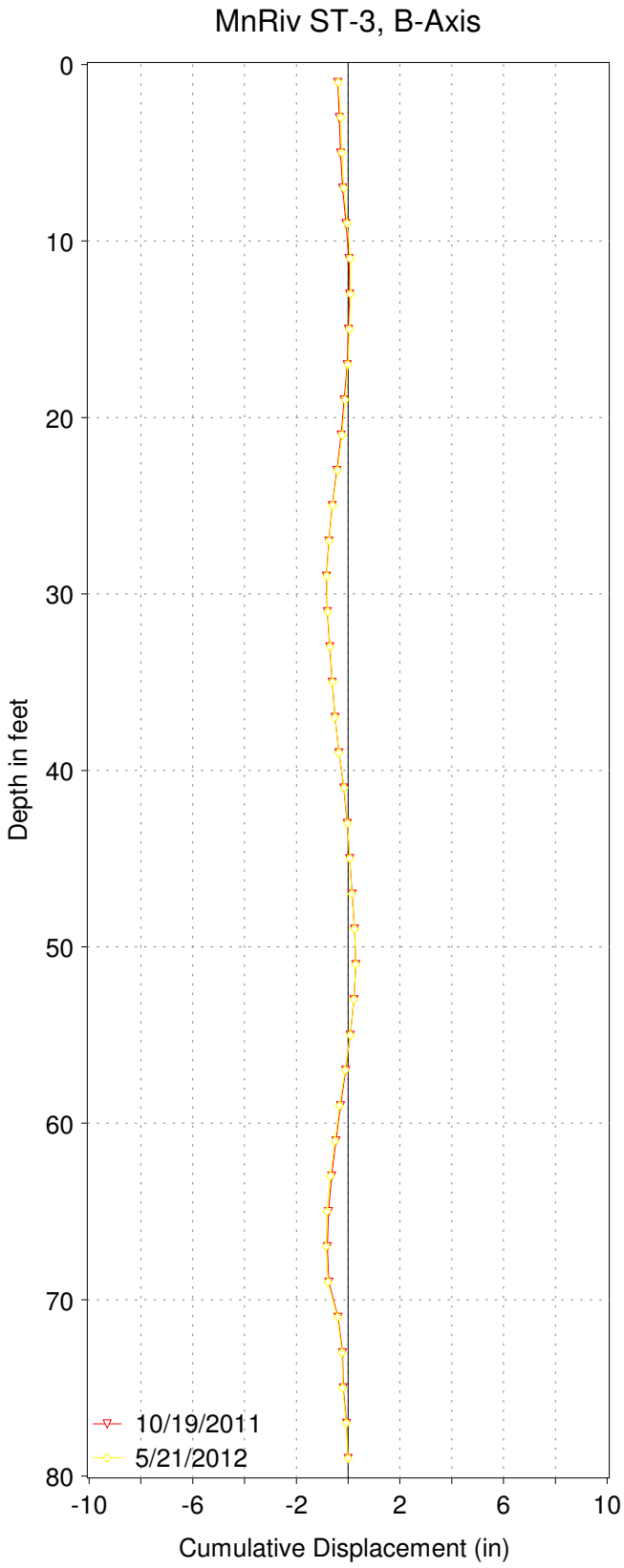
braunintertec.com |Twitter: Braun Intertec | LinkedIn: Braun Intertec

2 attachments

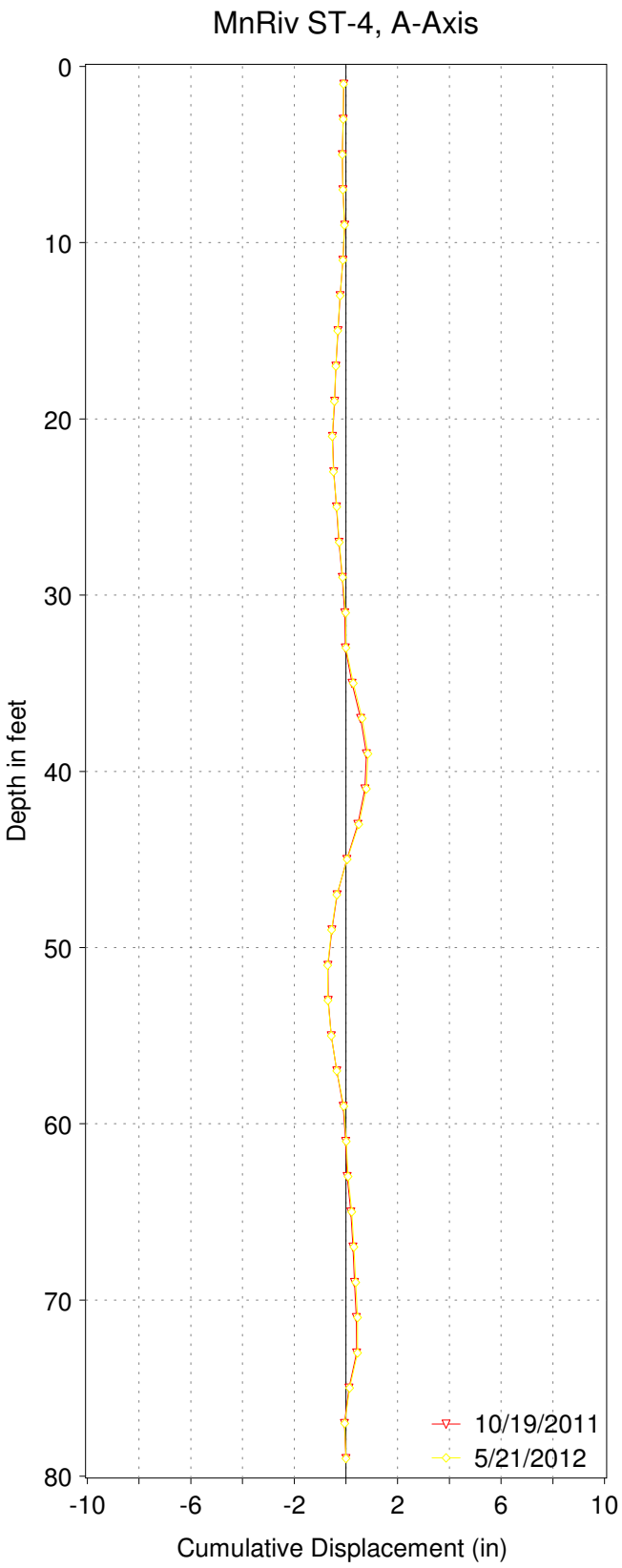
MnRiv ST-4.pdf
32K

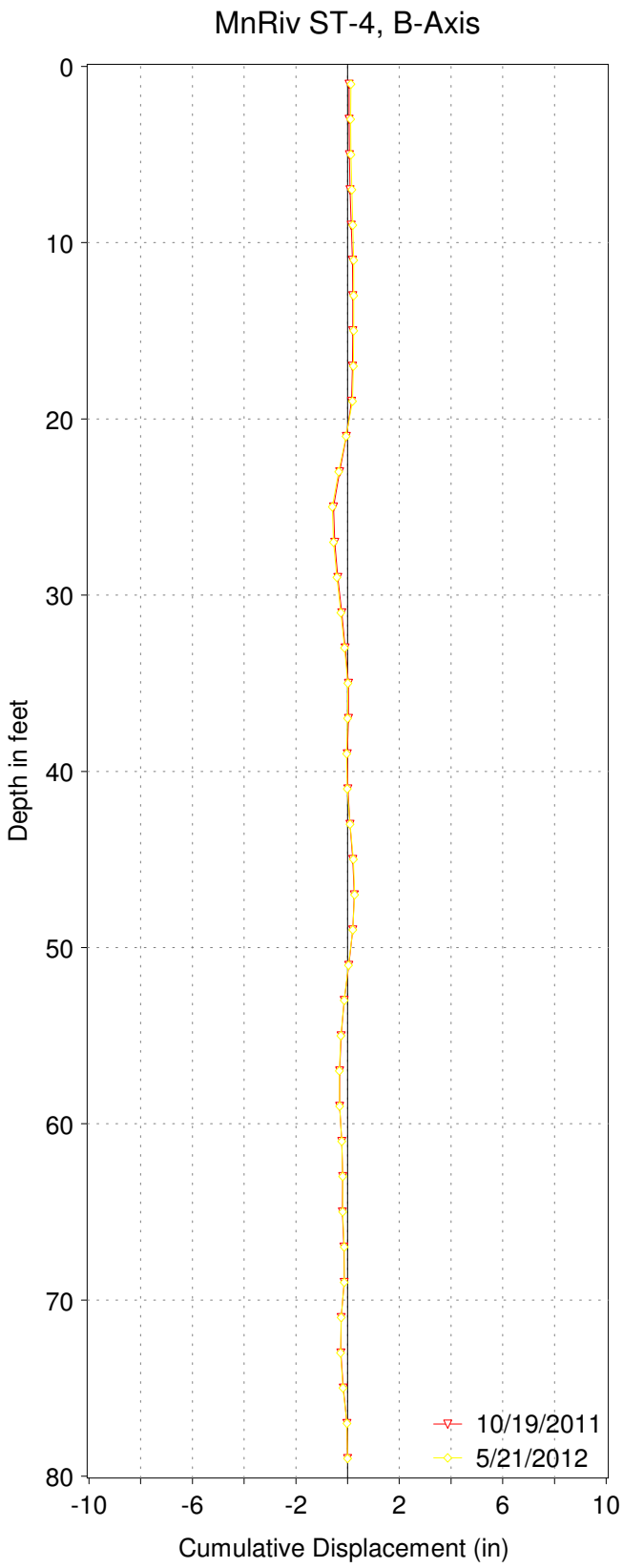
MnRiv ST-3.pdf
32K





Braun Intertec Project SP-09-04727
Slope Inclinometers
LMRWD Stability Analysis
Eden Prairie, MN





Braun Intertec Project SP-09-04727
Slope Inclinometers
LMRWD Slope Analysis
Eden Prairie, MN

LMRWD Inclinometers

Holman, Bill <holmanbill@stanleygroup.com> Fri, Oct 3, 2014 at 2:09 PM
To: Linda Loomis <naiadconsulting@gmail.com>
Cc: "Joel W. Toso" <jtoso@wenck.com>

Hi Linda,

We did get Braun out to the site again to read those inclinometers on September 16th. The attached show the comparison with the July 14th readings earlier this summer. The displacement graphs show some variation in the casing profiles post July 2014, but that variation is minor, and per Braun, within the limits of instrument and operator variability. In addition, Braun indicated that the direction of the differentials was opposite those which would suggest failure-related movement. So their conclusion was that the area being monitored is currently stable. Braun also indicated that no evidence of movement was observed on the ground surface during the reading events.

I also requested a discussion of the disparity that had been recorded between the original inclinometer measurements and the measurements taken this summer and fall. The Braun instrumentation specialist's response follows:

> "The disparity between the old and new data is really about the equipment. We've had some old installations that have required monitoring over a period of years but haven't often gotten into situations where equipment repairs and calibrations have impacted data quality, and it was that work – a more comprehensive than typical splicing and repair of a damaged section of cable, a couple of new connection fittings, recalibration of the tilt sensors in the probe and even a new computer board in our data collector that likely influenced the continuity we might otherwise have seen between the old and new data.
>
> I did not foresee that and apologize since you only get one shot at these things from beginning to end, and when it comes to interpreting data that is impacted by many artificial agents like probe setting (getting the depth just right every time), cable length and extension, casing temperature and humidity, etc, such gaps – and the fact that you might have a failure you don't have a complete grasp on – don't help.
>
> I was not involved in the earlier readings so can't speak to much to those on their own – I think it would suffice to say that we ultimately had no significant concerns regarding ground movements well upslope from the failure scarps then or now, and while our equipment repairs did cause an irretrievable gap in data continuity pre-2014, we have data now that maintains our opinion regarding upslope stability. Certainly, however, you can convey that our opinion – and yours – will change as time passes, and the scarp continues to calve and migrate upslope toward the instruments and structures beyond. "

In summary, neither Braun nor Stanley see any indication of the slope moving in the vicinity of the inclinometers and homes. It is unfortunate that we lost the ability to utilize the earlier (pre 2014) readings due to equipment problems, but we now have a good baseline as we move forward. We still need to be aware that while movement has not occurred in the vicinity of the homes or inclinometers, the base of the bluff continues to erode and slough, and unless measures are taken to stabilize, may eventually encroach upon our instrumentation.

Thanks,

Bill Holman

Principal Geotechnical Engineer

Stanley Consultants, Inc.

952-738-4331

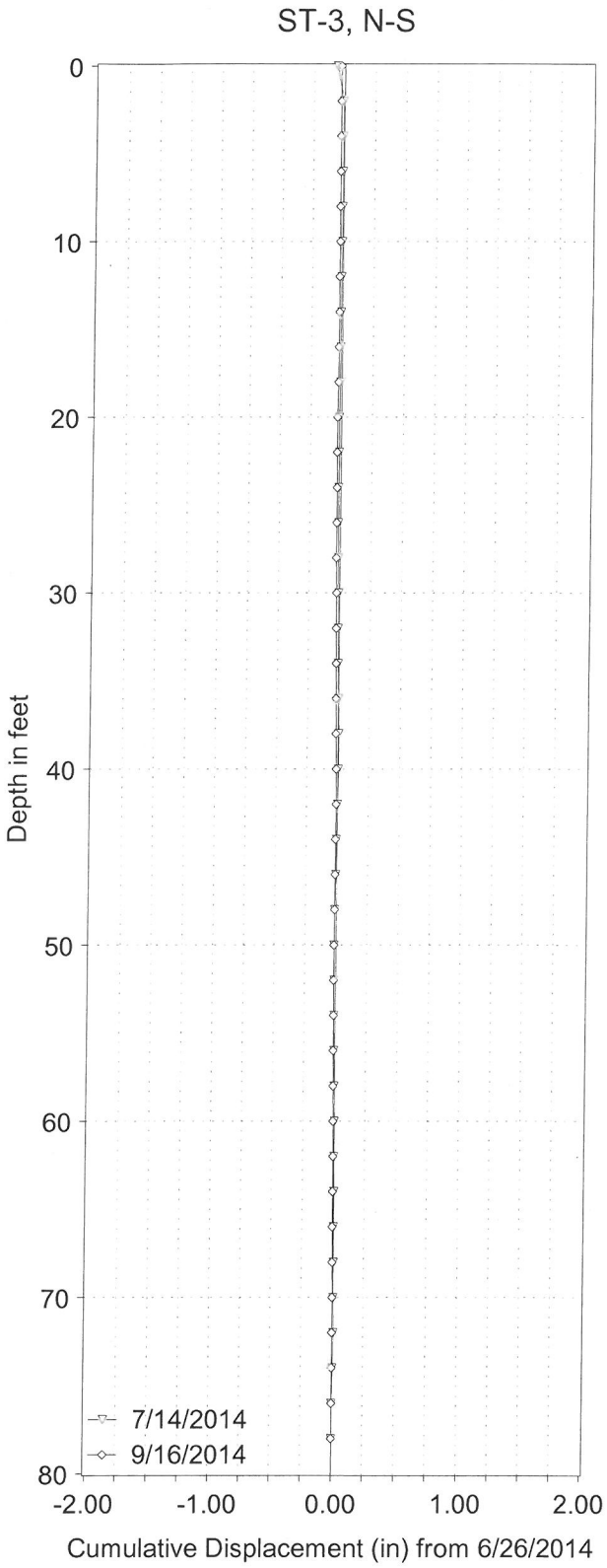
651-276-4102 (cell)

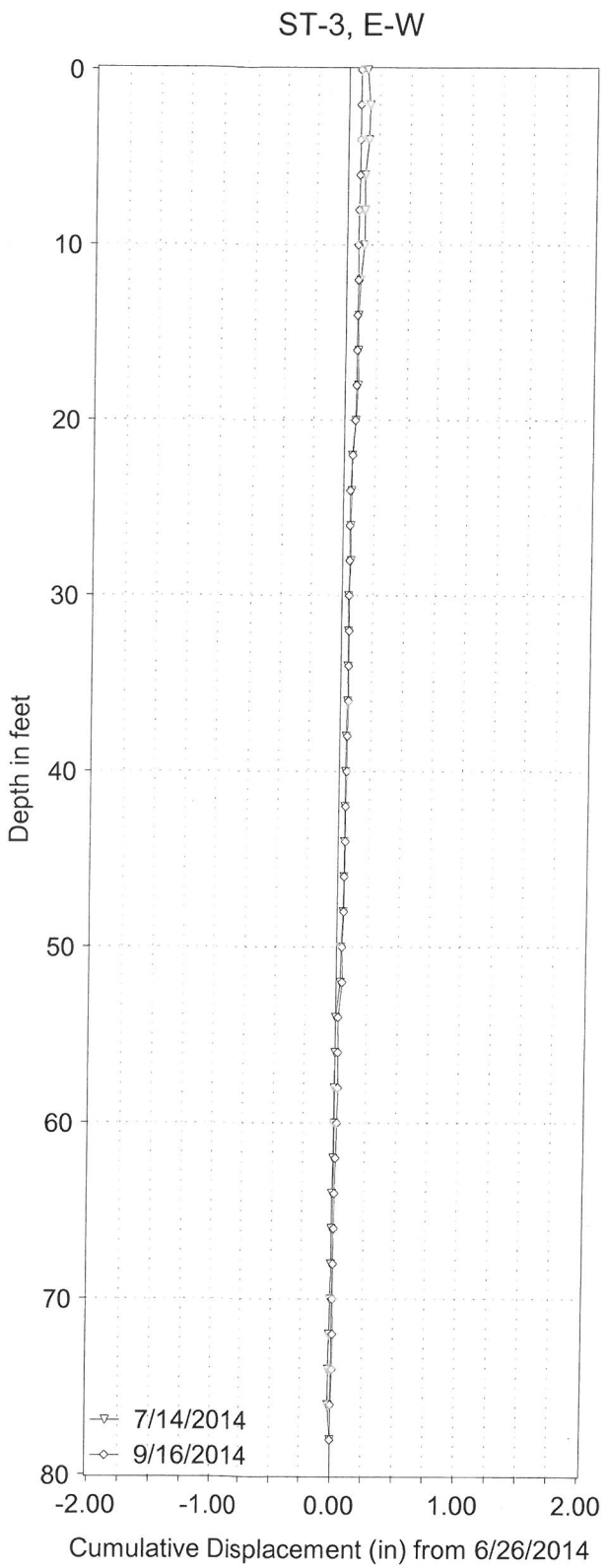
From: Linda Loomis [mailto:naiadconsulting@gmail.com]
Sent: Thursday, September 04, 2014 2:07 PM
To: Holman, Bill
Subject: LMRWD Inclinometers

Bill,

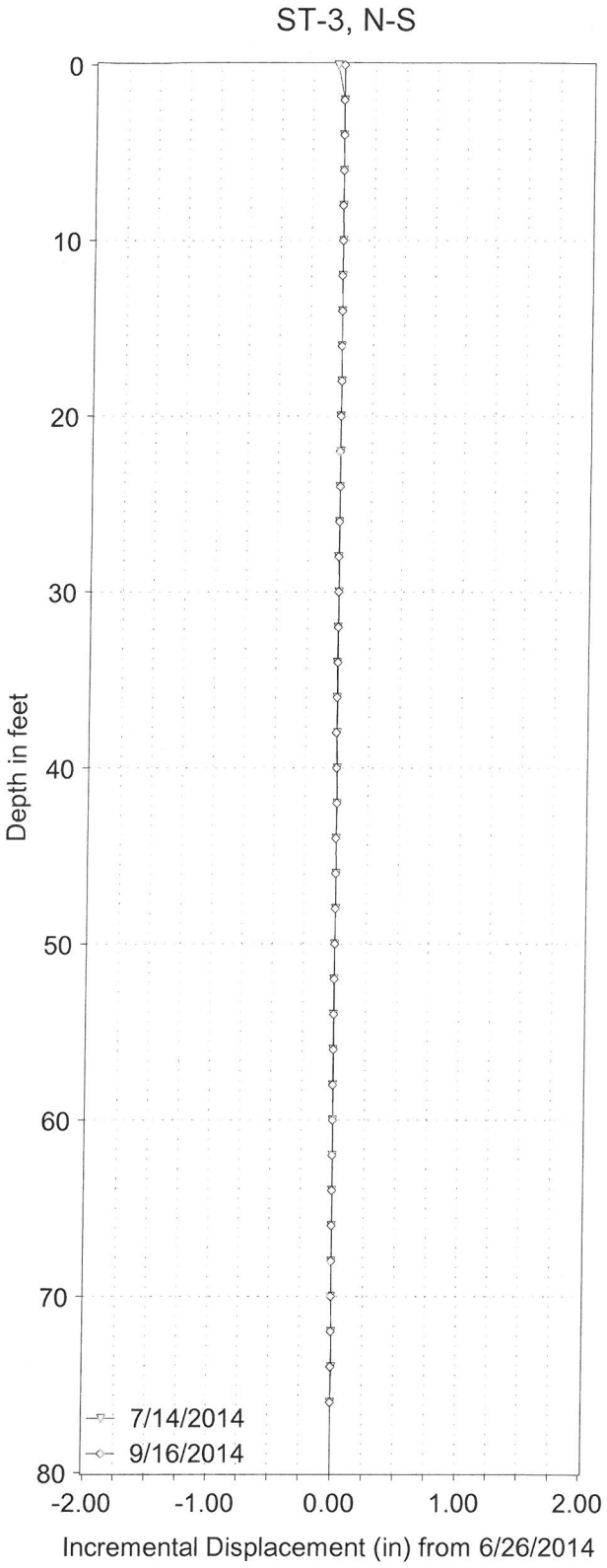
[Quoted text hidden]

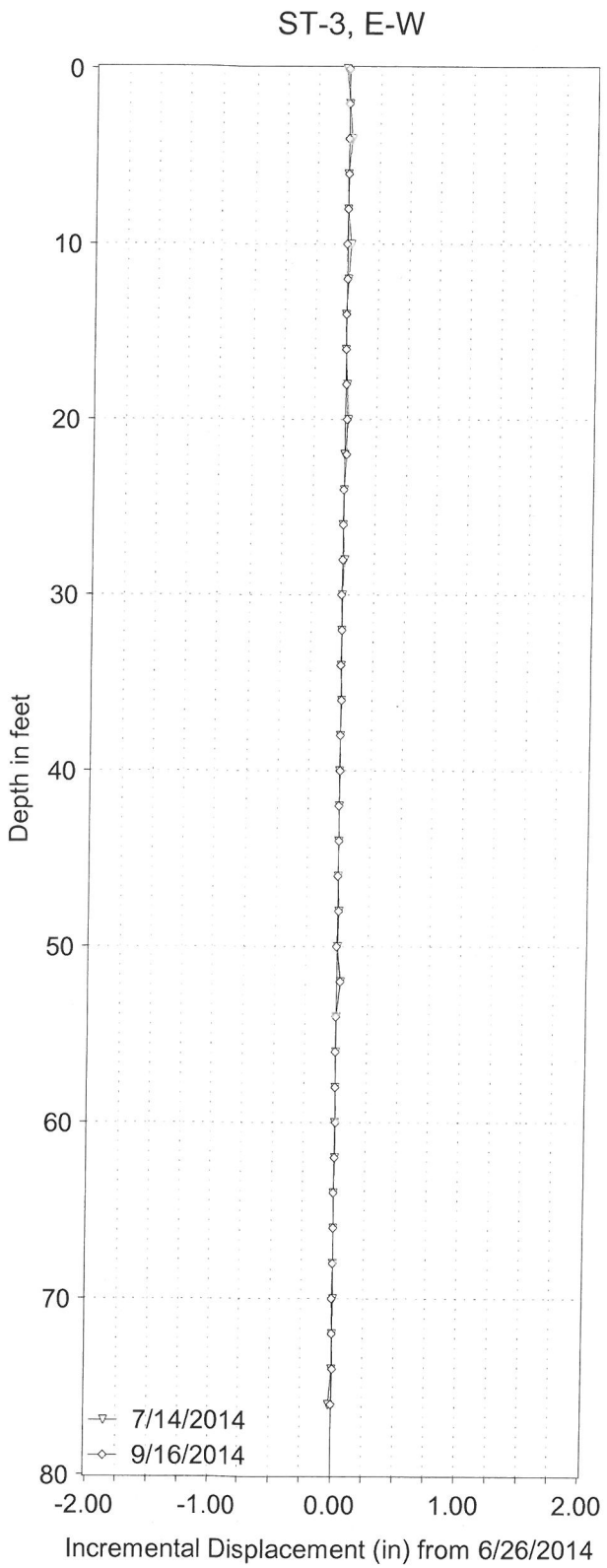
SKMBT_C55214091913200.pdf
1256K



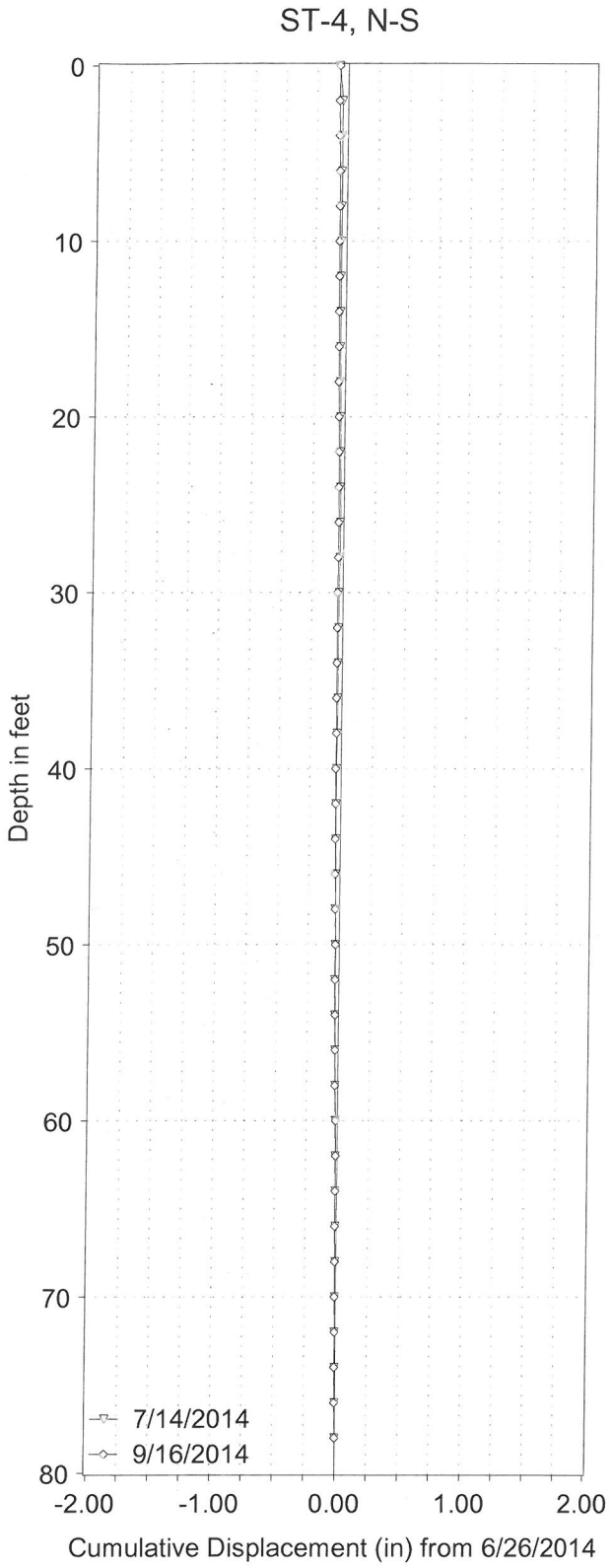


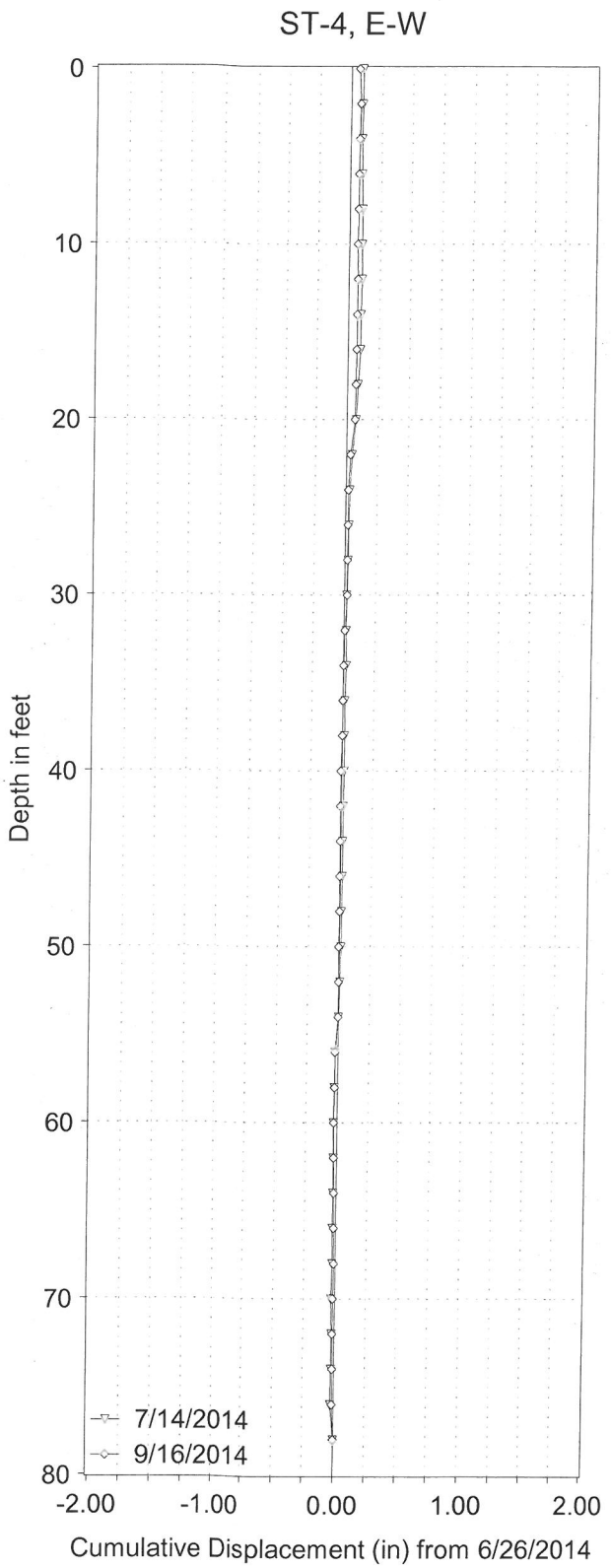
B14-03590 (formerly SP-09-04727)
LMRWD Stability Analysis
Eden Prairie, Minnesota



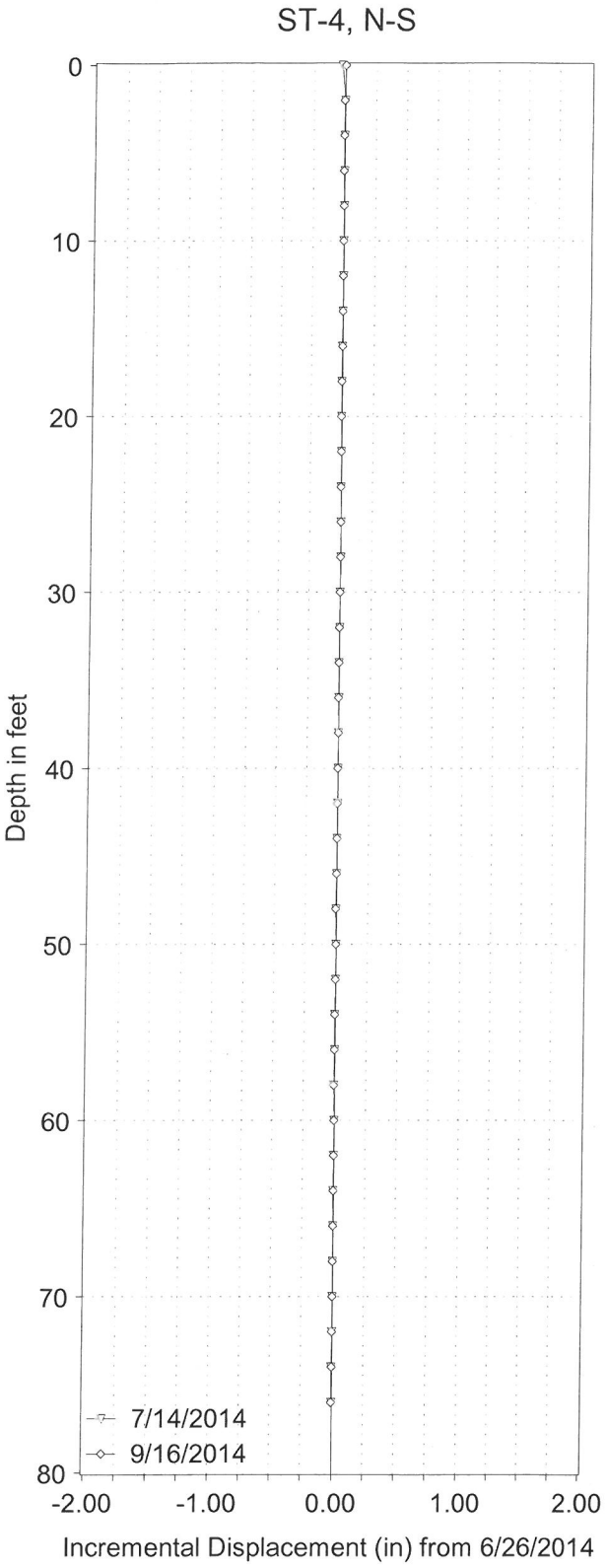


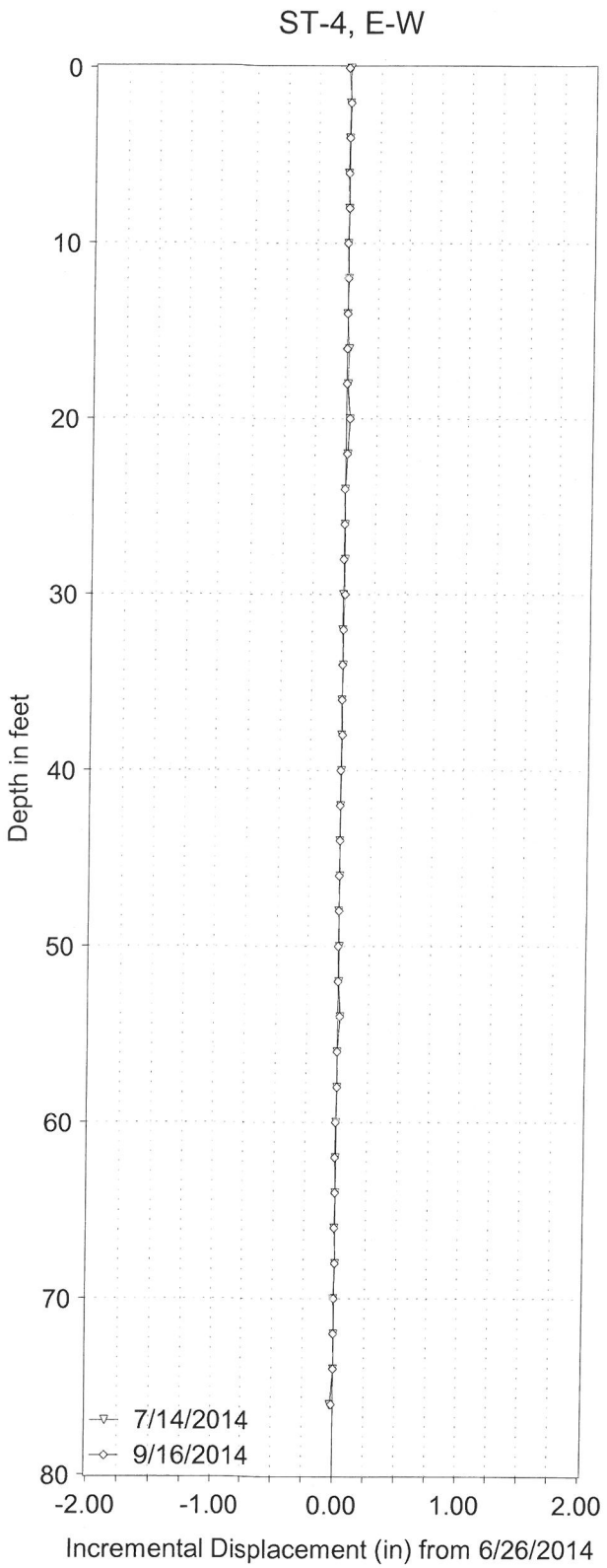
B14-03590 (formerly SP-09-04727)
LMRWD Stability Analysis
Eden Prairie, Minnesota





B14-03590 (formerly SP-09-04727)
LMRWD Stability Analysis
Eden Prairie, Minnesota





B14-03590 (formerly SP-09-04727)
LMRWD Stability Analysis
Eden Prairie, Minnesota

Gmail Linda Loomis <naiadconsulting@gmail.com>

Inclinometer readings

Holman, Bill <holmanbill@stanleygroup.com> Mon, Aug 3, 2015 at 1:39 PM
To: Linda Loomis <naiadconsulting@gmail.com>

Hi Linda,

The most recent readings are attached. Potentially some slight change (.1 inches or less) at depth, but I feel within the accuracy of the instrument. Nothing that alarms me. I suggest we take another set of readings next spring, or after a high water event.

Thanks,

Bill Holman

Senior Project Manager

Stanley Consultants, Inc.

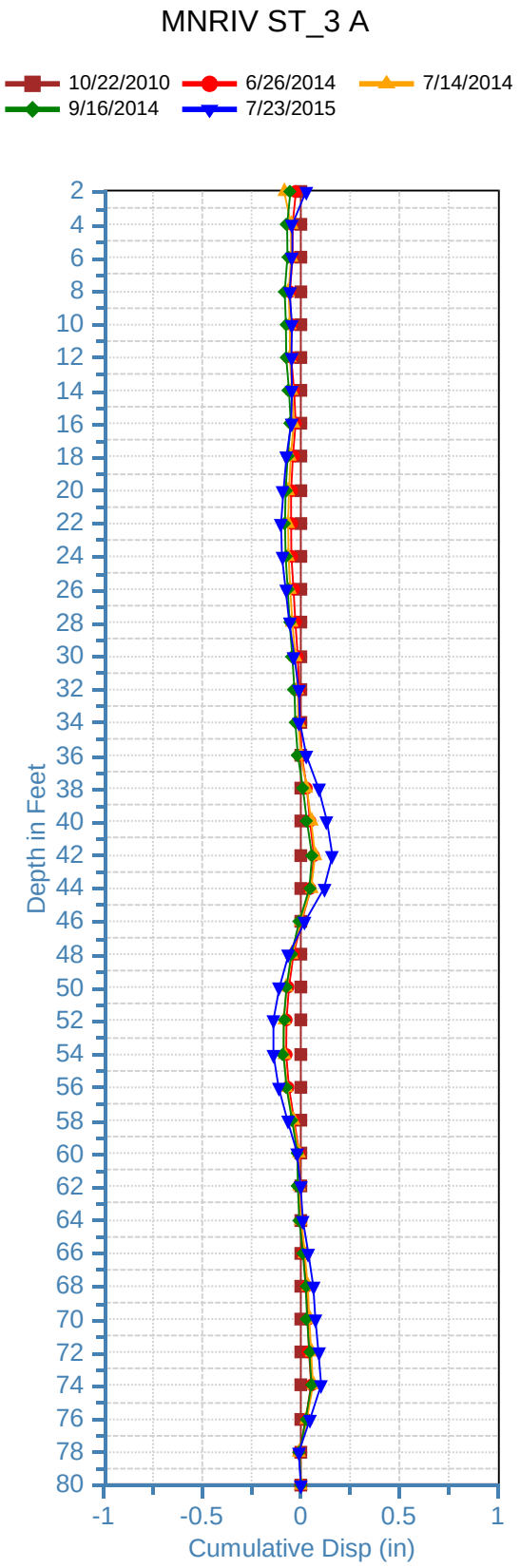
952-738-4331

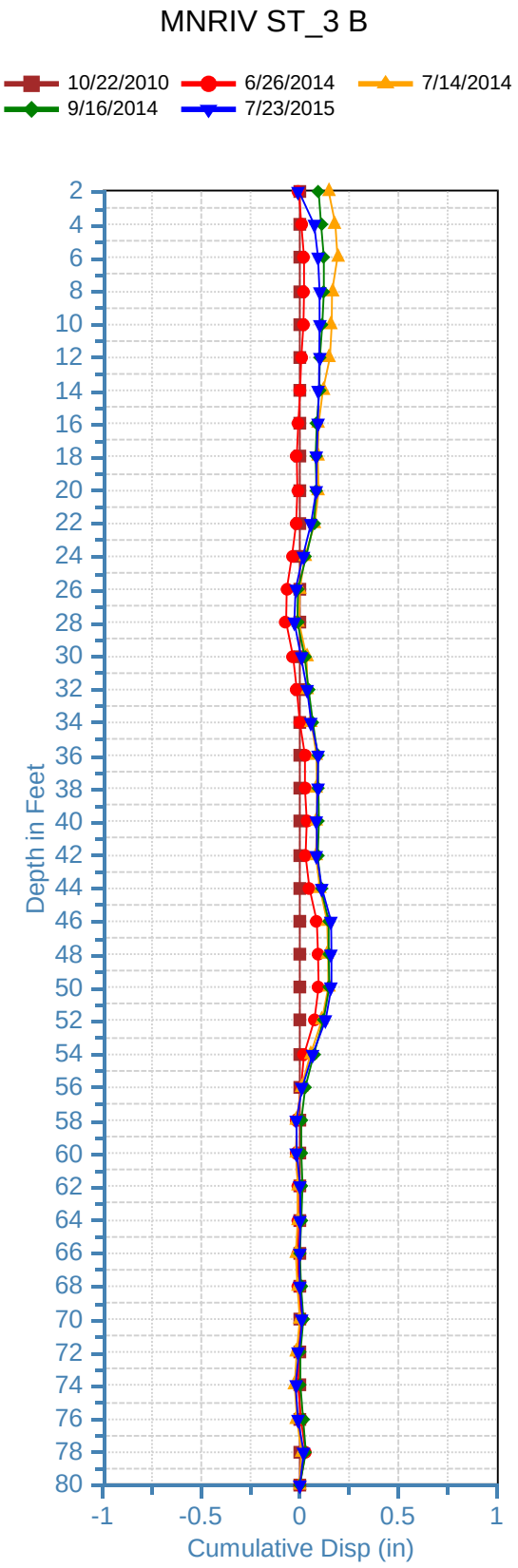
651-276-4102 (cell)

[Quoted text hidden]

4 attachments

- **ST4 ID.PDF** 229K
- **ST4 CD.PDF** 232K
- **ST3 CD.PDF** 232K
- **ST3 ID.PDF** 229K


MNRIV ST_3 A
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Cumulative Disp (in)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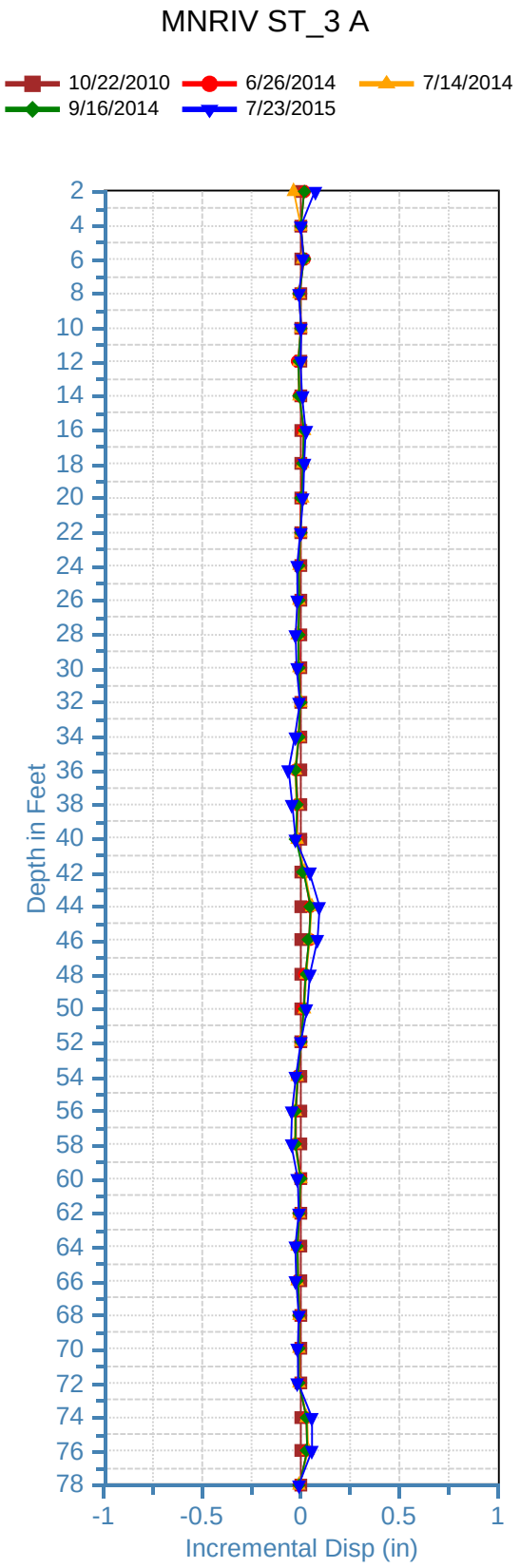
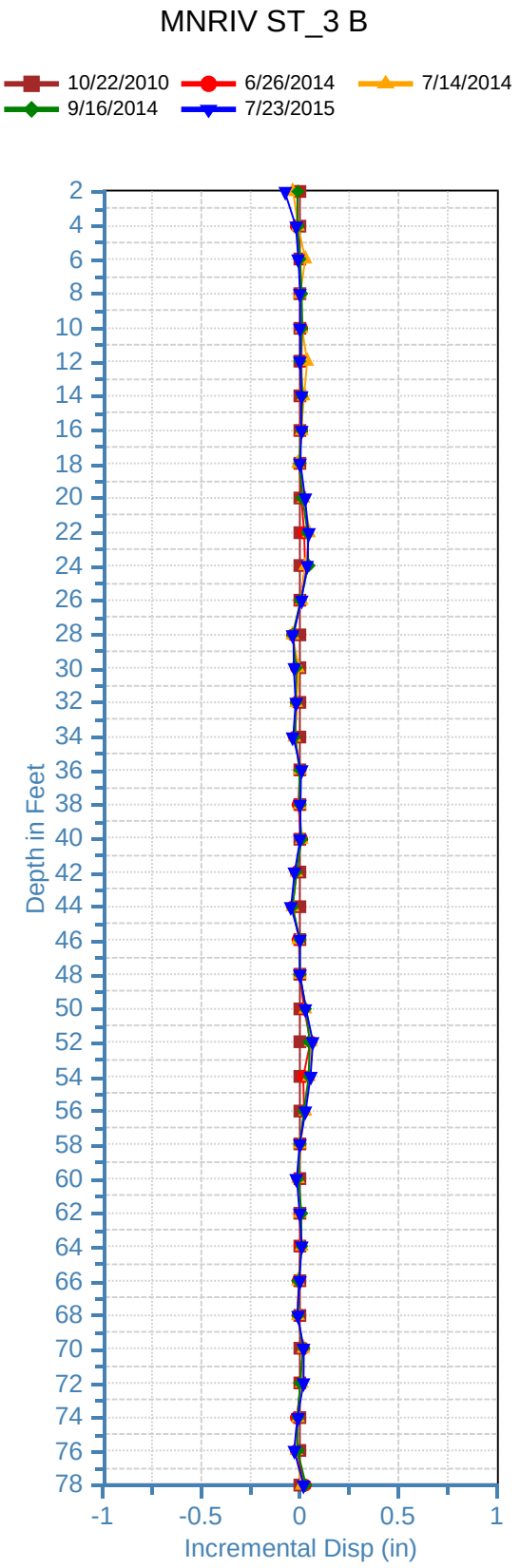
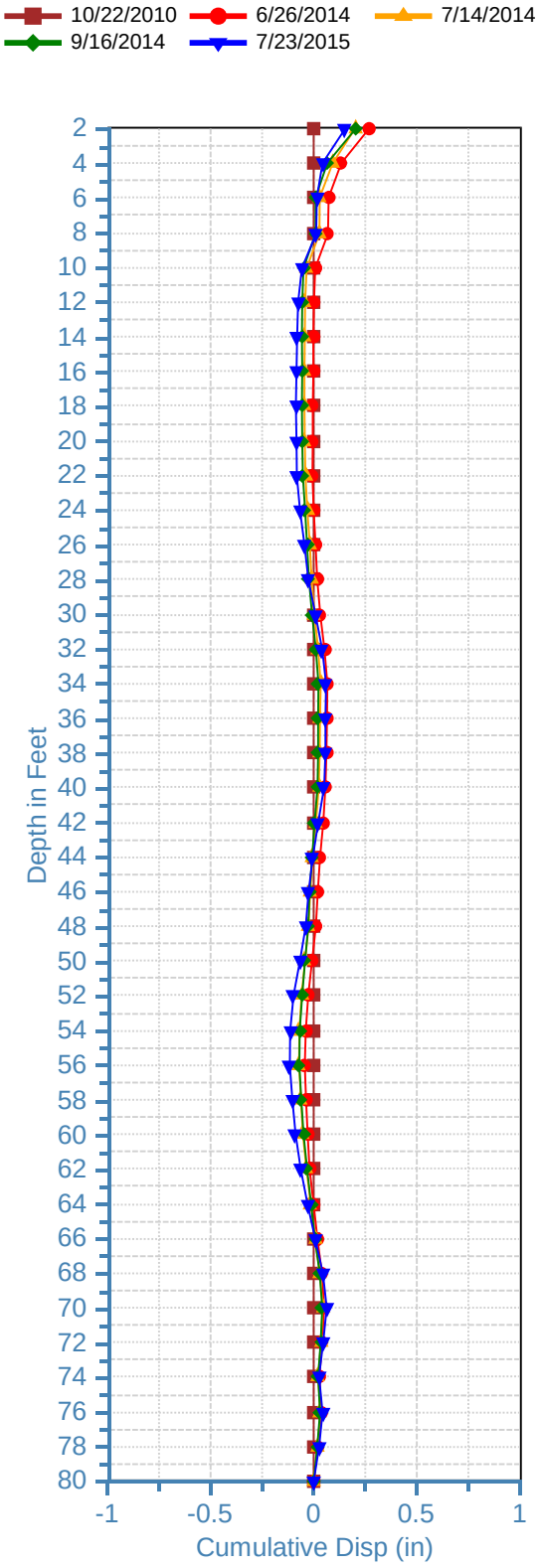
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Cumulative Disp (in)


MNRIV ST_3 A
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Incremental Disp (in)
-1
-0.5
0
0.5
1


MNRIV ST_3 B
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Incremental Disp (in)
-1
-0.5
0
0.5
1

MNRIV ST_4 A



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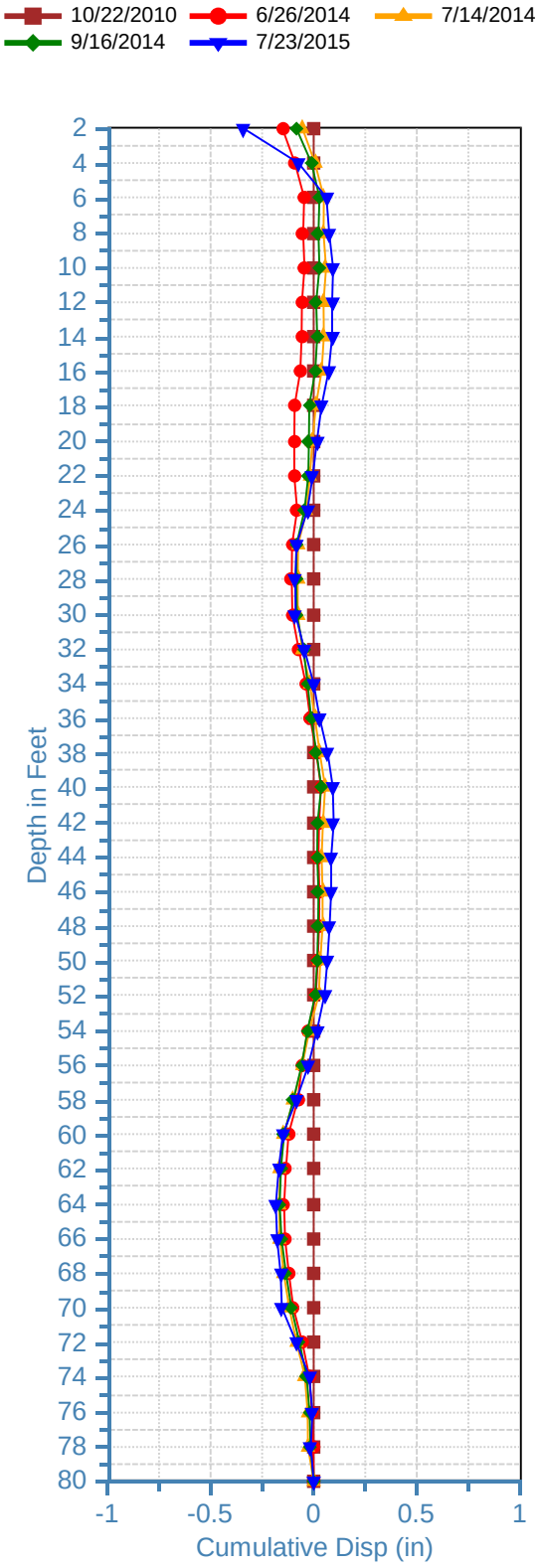

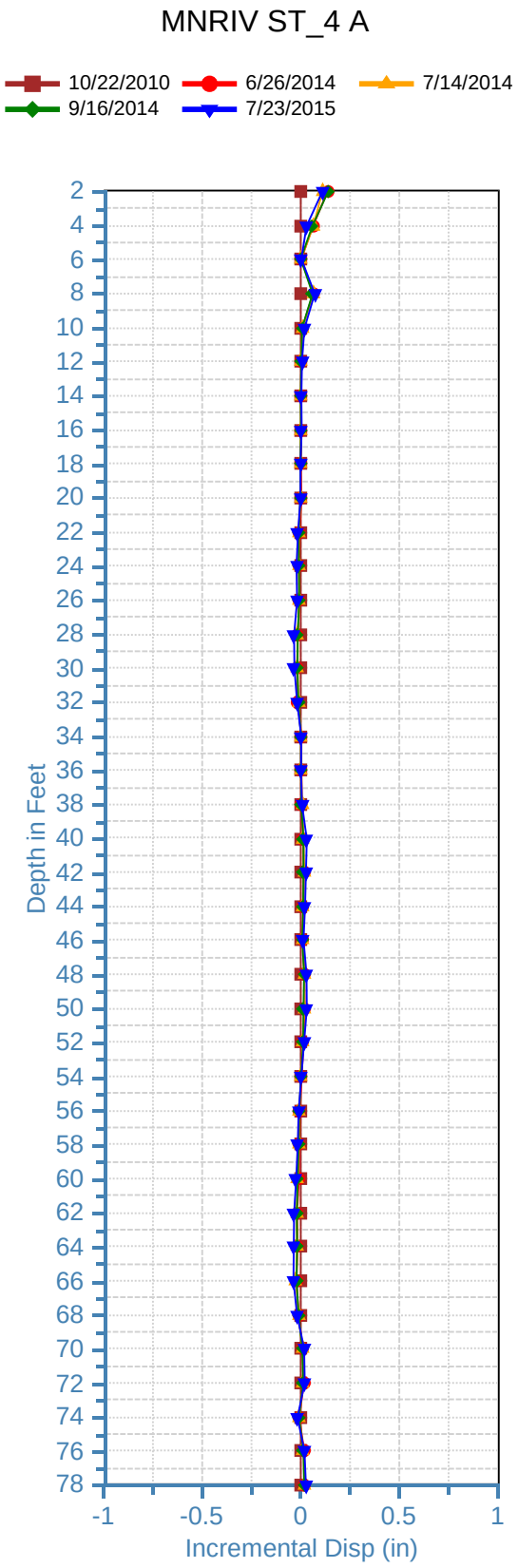
MNRIV ST_4 A
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Incremental Disp (in)
2
4
6
8
10
12
14
16
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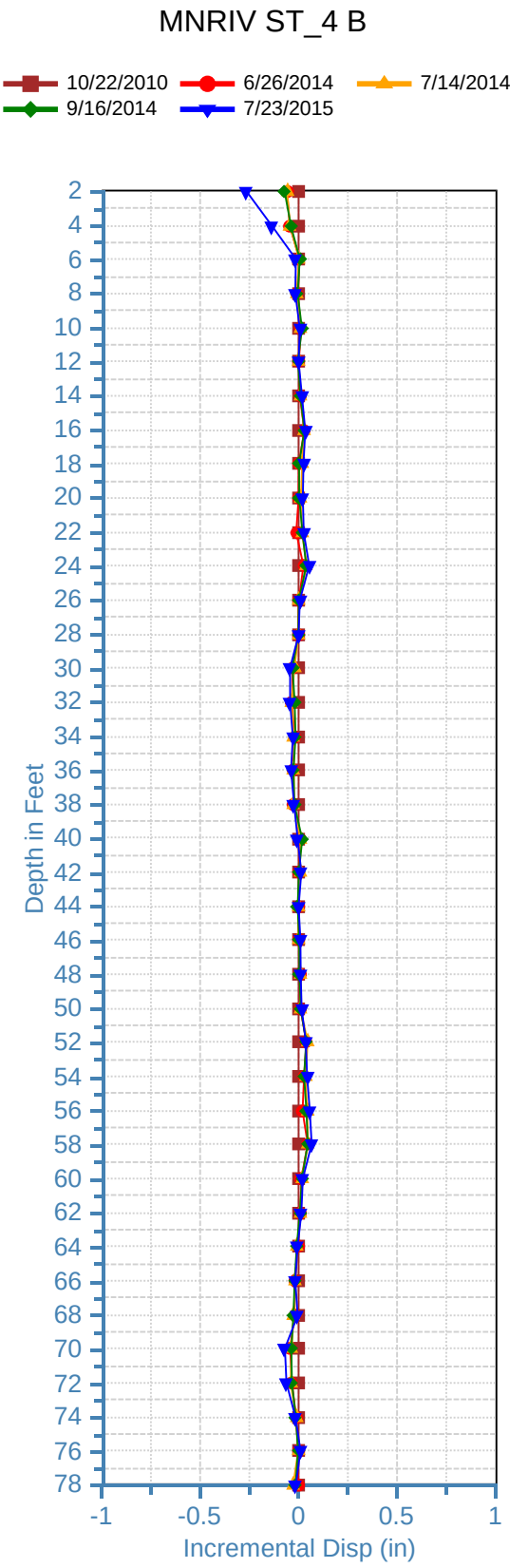
MNRIV ST_4 B
10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
Depth in Feet
Incremental Disp (in)
2
4
6
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54
56
58
60
62
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76
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-1
-0.5
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0.5
1

Gmail

Linda Loomis <naiadconsulting@gmail.com>

Inclinometer readings

Ripp, Bryan <BRipp@braunintertec.com> Tue, Nov 15, 2016 at 2:14 PM
To: Linda Loomis <naiadconsulting@gmail.com>

Linda

Attached are the inclinometer readings that we took last Friday. Little if any movement was recorded for ST-3.

However one of the readings for ST-4 appears to be off. We suspect the reason is that the bottom of ST-4 has some sediment in it. It appears that the cap and top showed signs of deer chewing on it (see attached image). When we made some adjustments to the bottom reading, the movement was more in line with the other readings, showing a 0.5 inch or less movement since the beginning of the recordings.

It is our opinion that the inclinometers are showing no appreciable movement. However we can go back out again this year to get a new set of readings at ST-4. Also during that time, we can slip over sections of capped PVC pipe to protect both inclinometers.

Please let me know if we should go back out there.

BRAUN INTERTEC

Employee Ownership working for you

Bryan J. Ripp, PE, PG

Senior Geotechnical Engineer
11001 Hampshire Avenue S | Minneapolis, MN 55438
952.995.2236 direct | 612.845.4475 mobile
BRipp@braunintertec.com

braunintertec.com |Twitter: Braun Intertec | LinkedIn: Braun Intertec

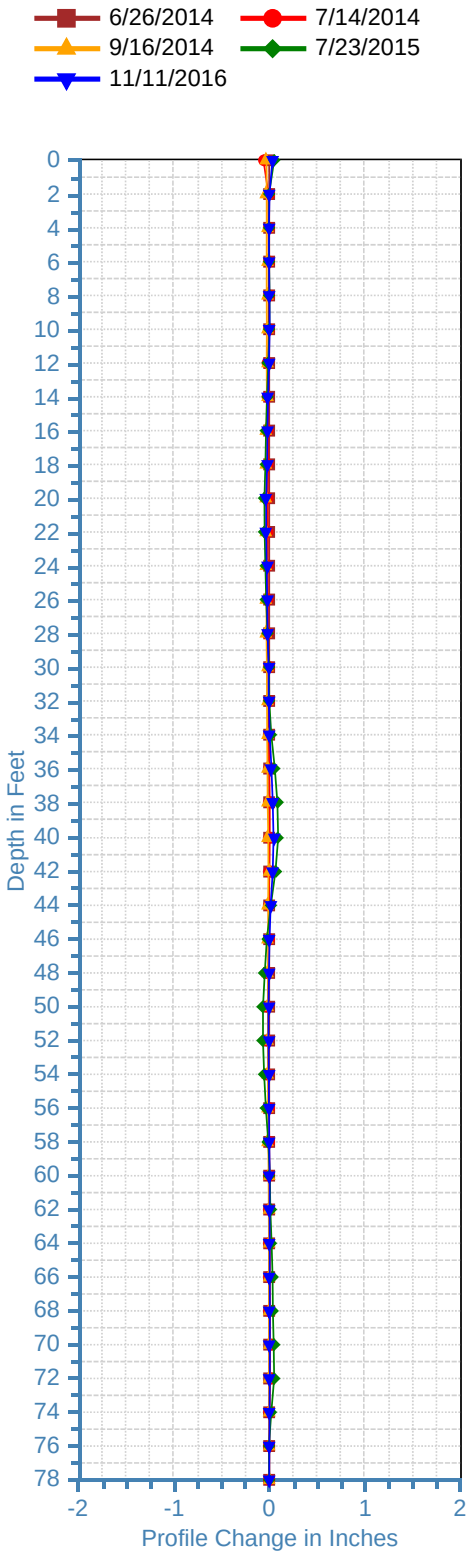
7 attachments

IMG_2938.jpg
4792K

ST3 CD 20161111.pdf
332K

ST3 ID 20161111.pdf
327K

ST-3, N-S


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
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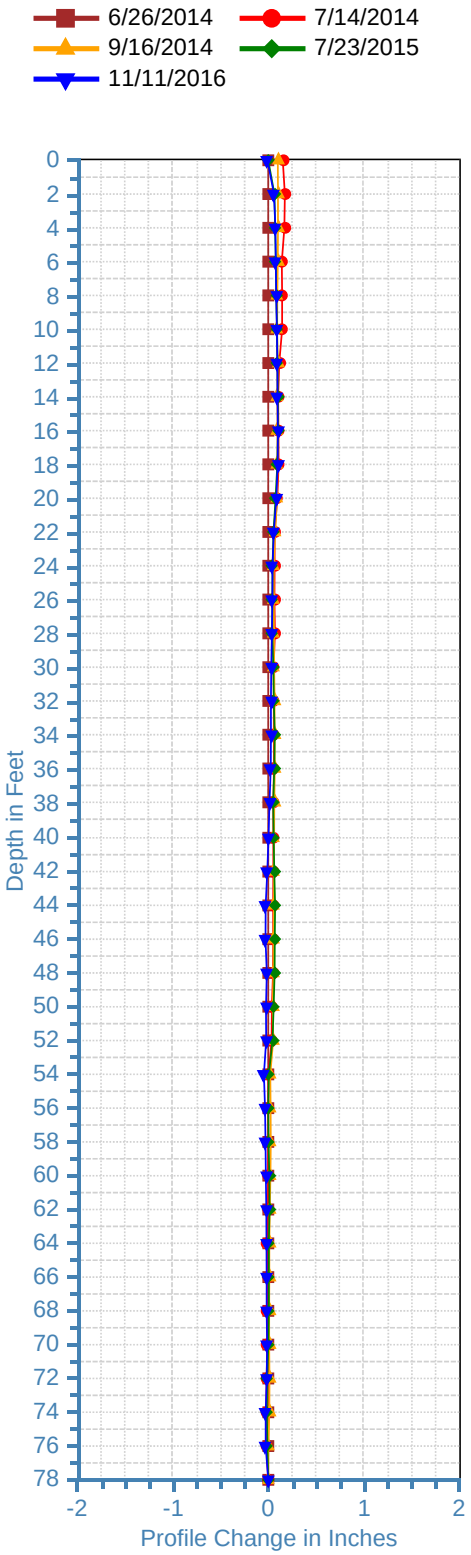
Profile Change in Inches

ST-3, E-W


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
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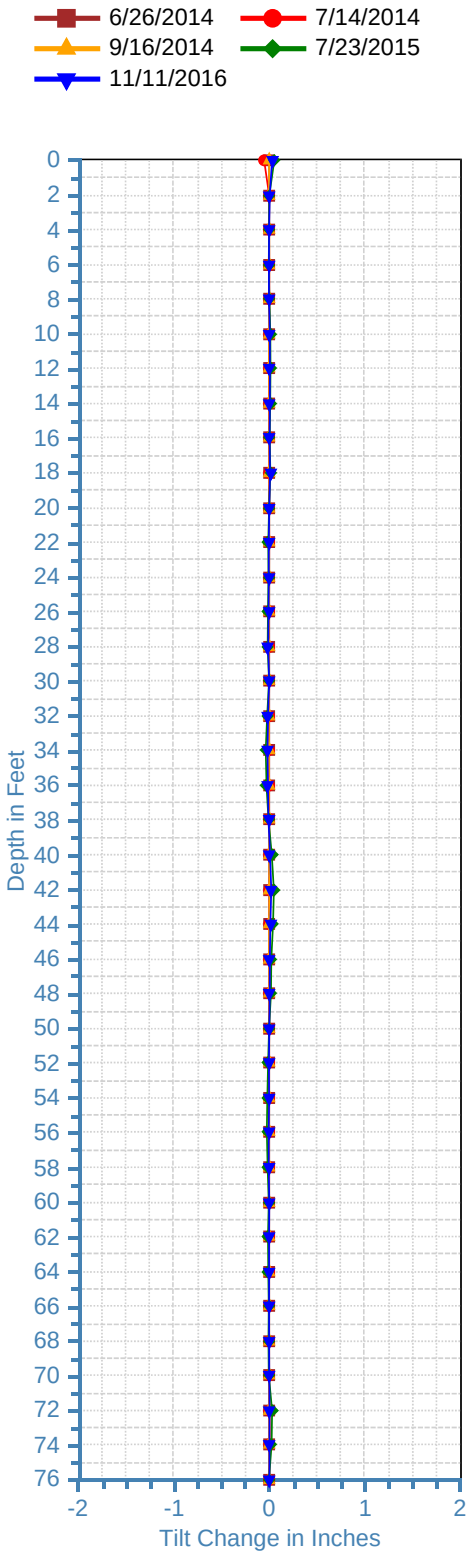
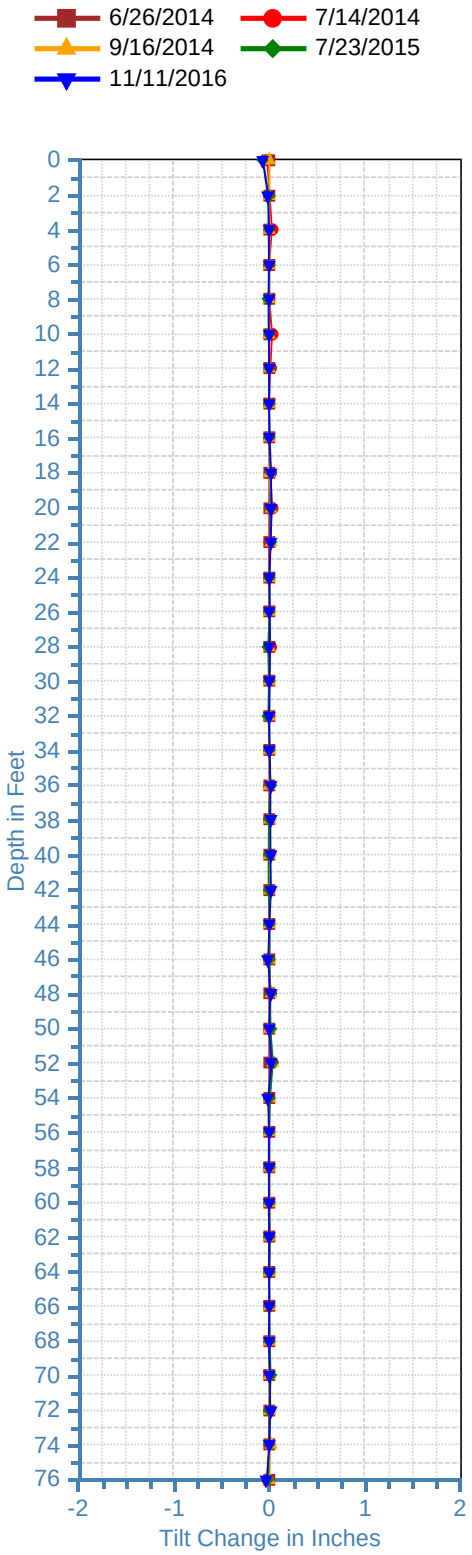
Profile Change in Inches

ST-3, N-S


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
Tilt Change in Inches

ST-3, E-W


6/26/2014
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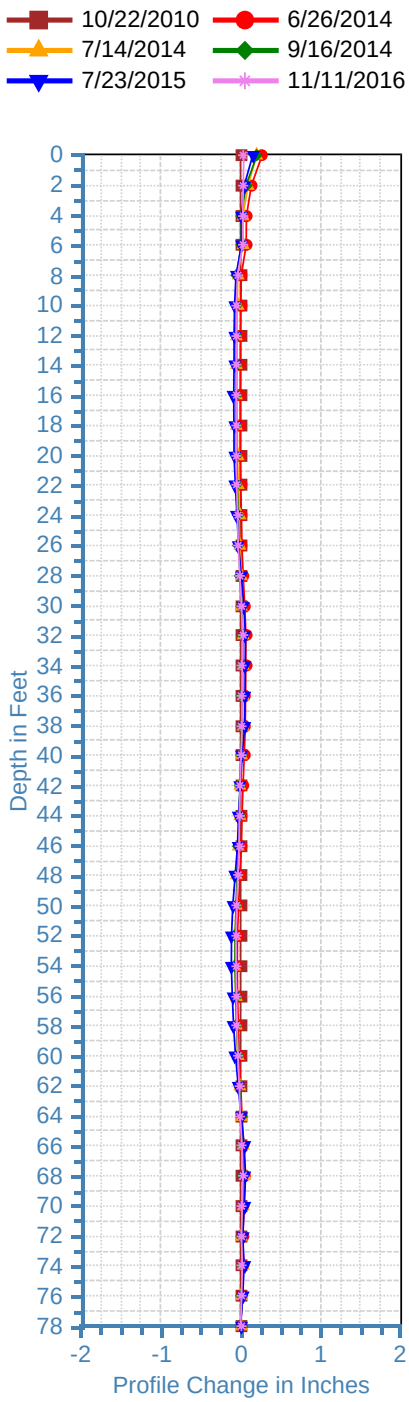
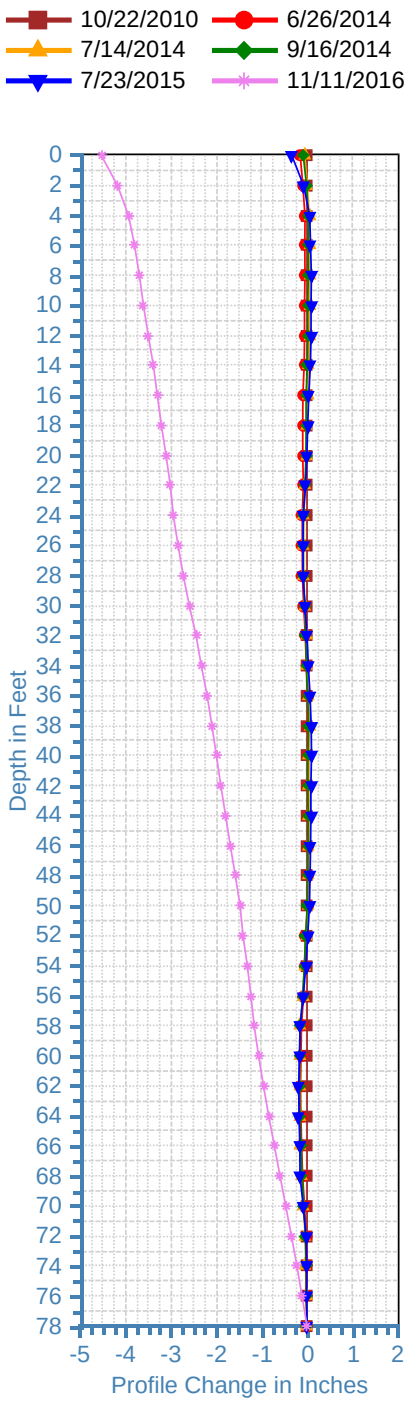
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
Tilt Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78
-2 -1 0 1 2
Profile Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
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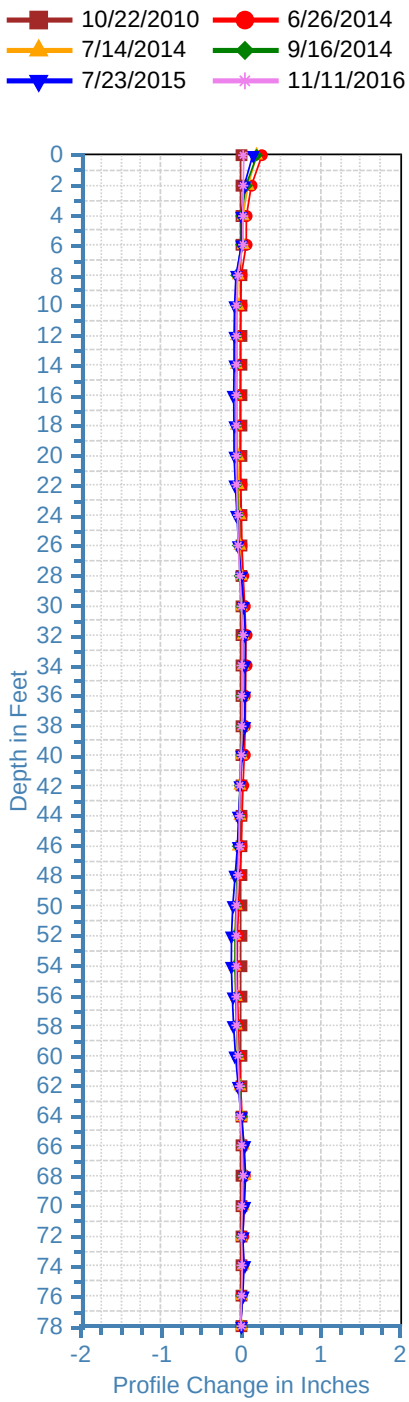
Profile Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
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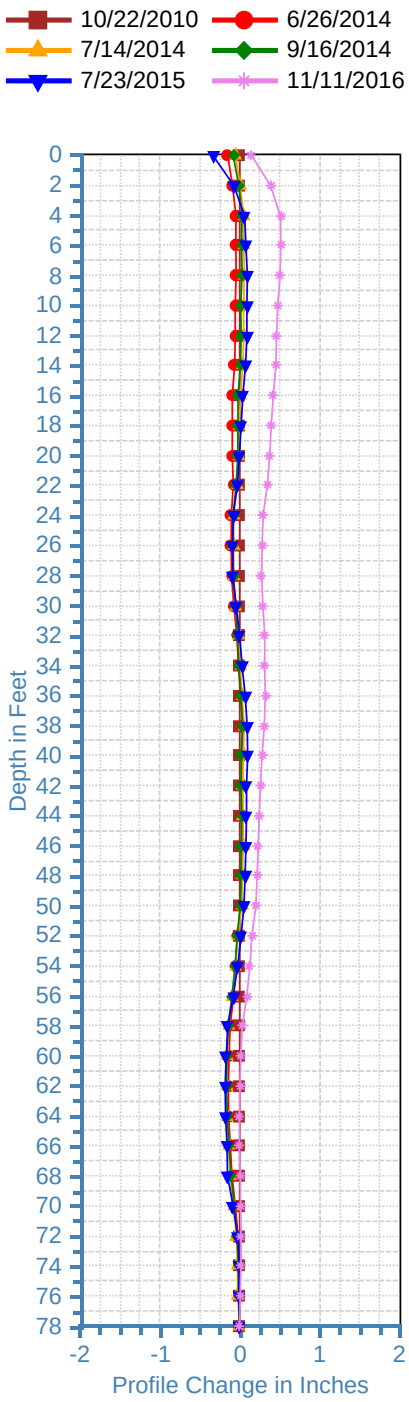
Profile Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
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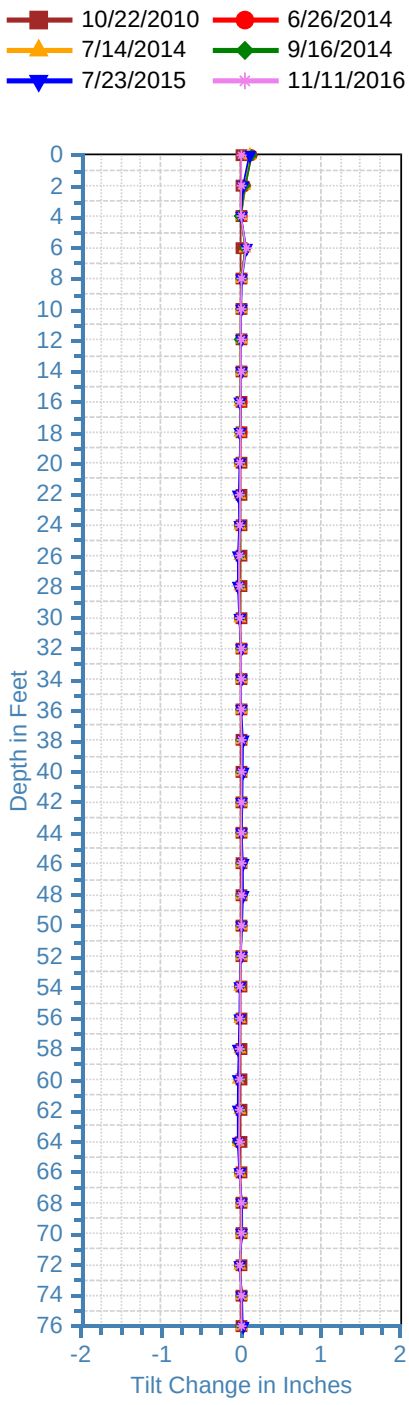
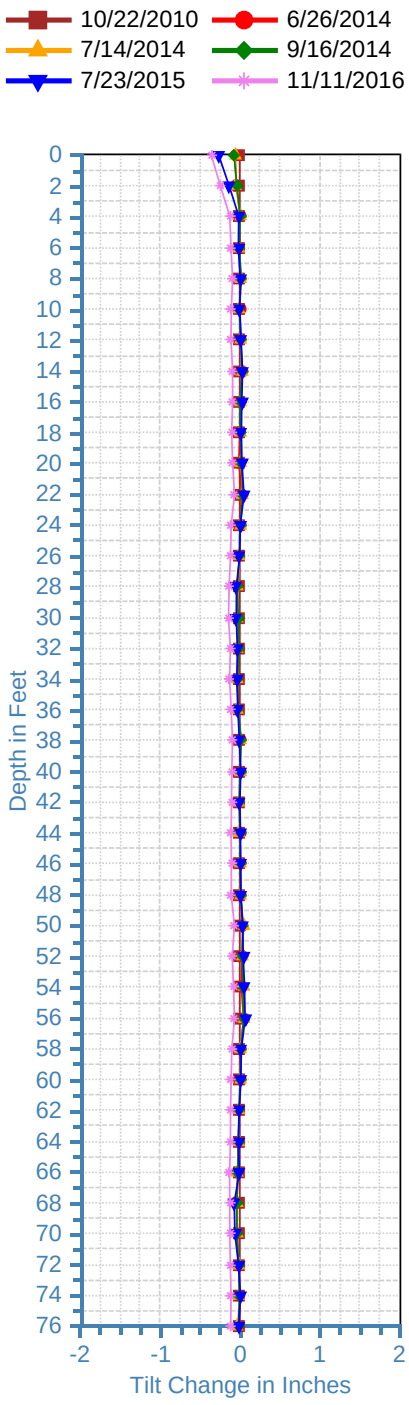
Profile Change in Inches

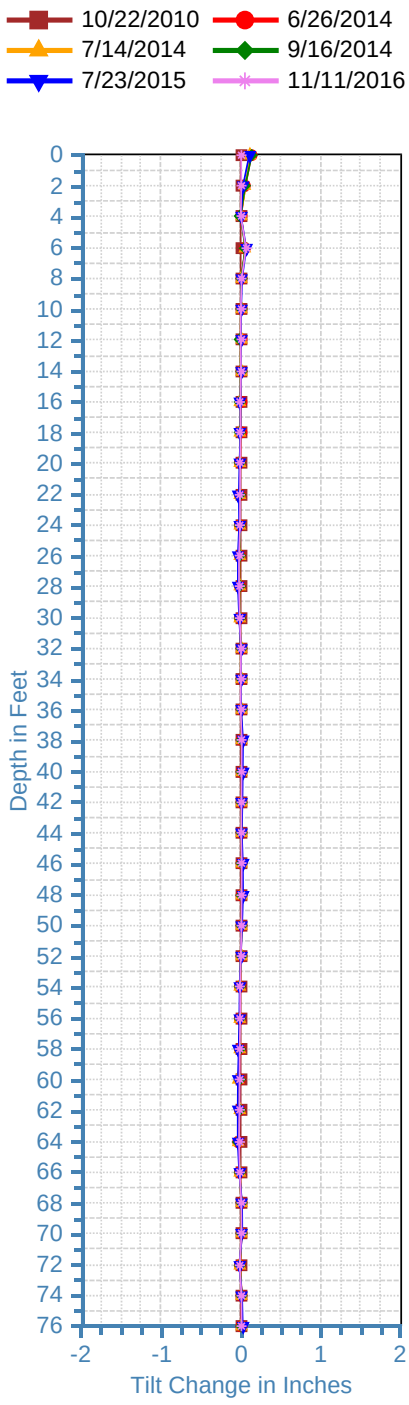
ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

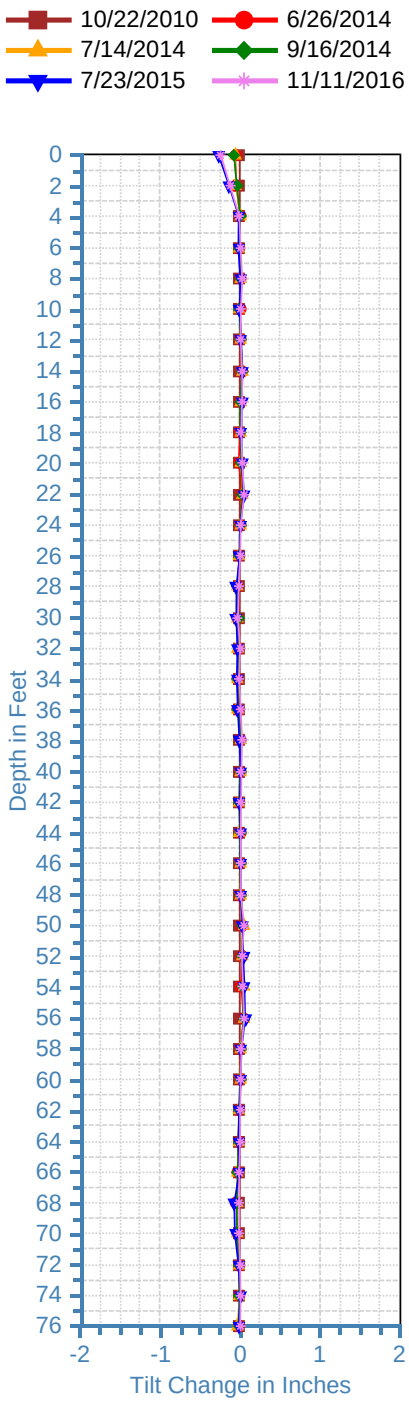
ST-4, E-W


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

Gmail

Linda Loomis <naiadconsulting@gmail.com>

Additional Inclinometer Reading for ST-4

Ripp, Bryan <BRipp@braunintertec.com> Wed, Dec 21, 2016 at 5:57 PM
To: Linda Loomis <naiadconsulting@gmail.com>

Linda

Attached are the follow-up readings for ST-4 which shows little if any movement. We did not have to alter the data this time. The sediment/leaves at the bottom of the inclinometer must have moved out of the grooves.

Each inclinometer case is now capped with 3-inch PVC sticking up approximately 18 inches and spray painted orange

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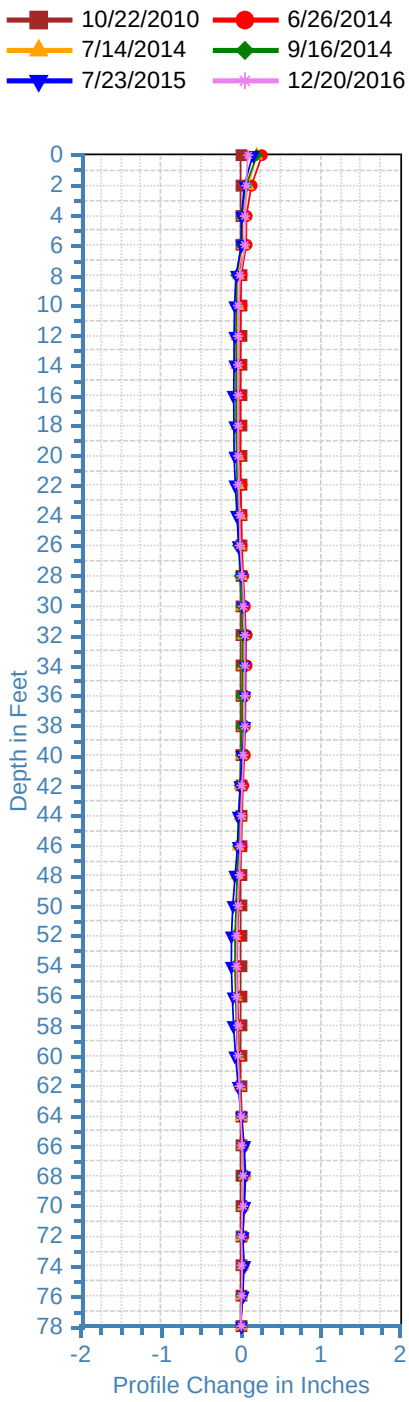
2 attachments

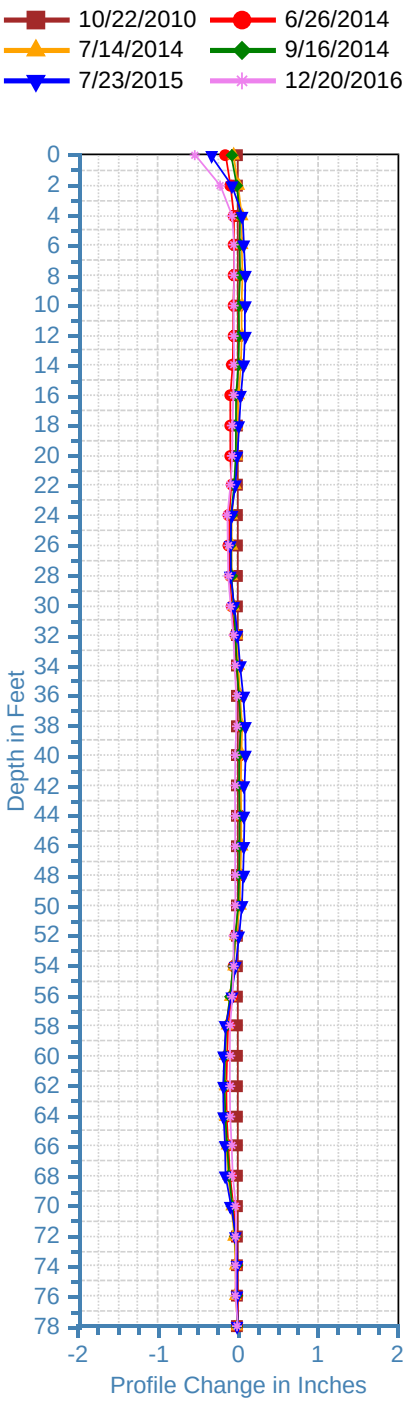
ST4 CD 20161220.pdf
284K

ST4 ID 20161220.pdf
281K

ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78
-2 -1 0 1 2
Profile Change in Inches

ST-4, E-W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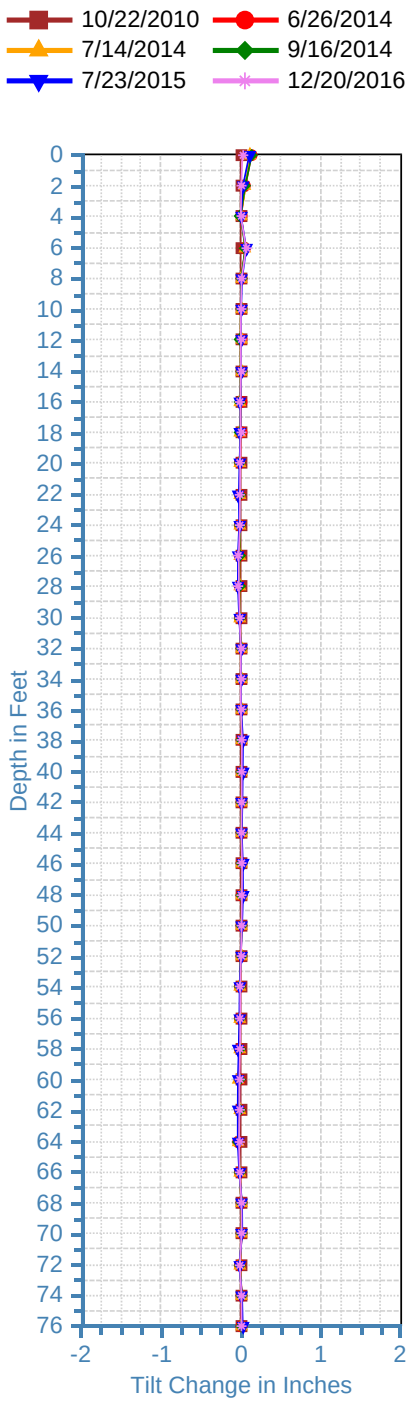
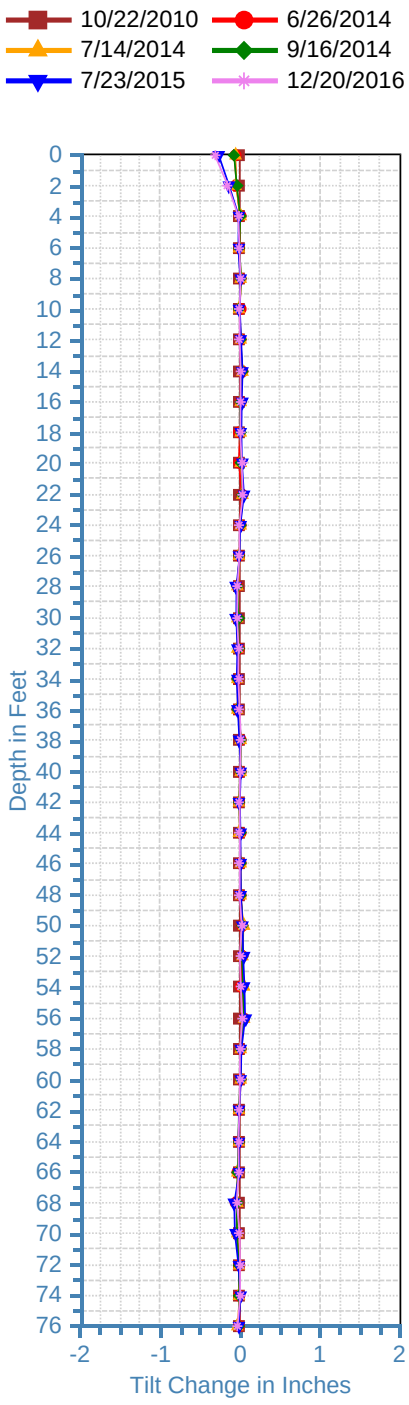
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78
-2 -1 0 1 2
Profile Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
Depth in Feet
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76
-2 -1 0 1 2
Tilt Change in Inches

Gmail

Linda Loomis <naiadconsulting@gmail.com>

Inclinometer Readings Riverview Road

Ripp, Bryan <BRipp@braunintertec.com> Thu, Dec 7, 2017 at 3:26 PM
To: Linda Loomis <naiadconsulting@gmail.com>

Linda

Attached are the inclinometer readings that we took this fall. Little if any movement was recorded for ST-3 or ST-4.

The inclinometer probe that we have used is antiquated and the latest reading will be the last reading using that inclinometer. From now on the readings will be recorded with our newer model probe.

We will not charge you for this transition because it was because of our decision to switch equipment.

Please let me know if the Watershed District wants to continue taking readings on an annual basis.

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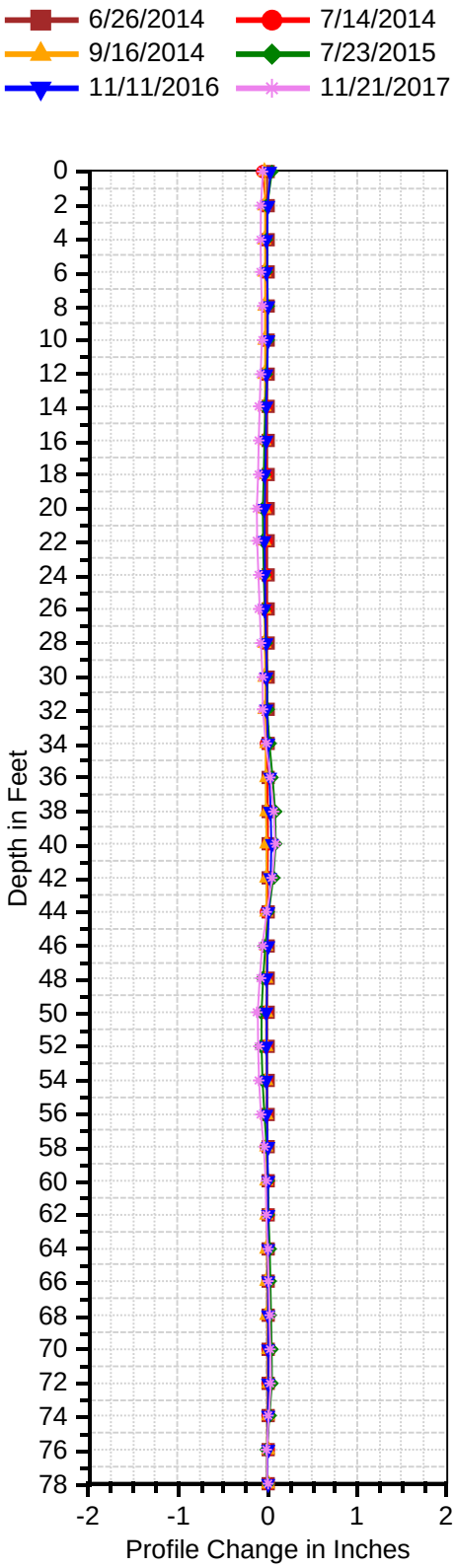
4 attachments

- **ST3 ID 20171121.pdf** 278K
- **ST4 ID 20171121.pdf** 278K
- **ST3 CD 20171121.pdf** 282K
- **ST4 CD 20171121.pdf** 283K

ST-3, N-S


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
11/21/2017
Depth in Feet
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-2
-1
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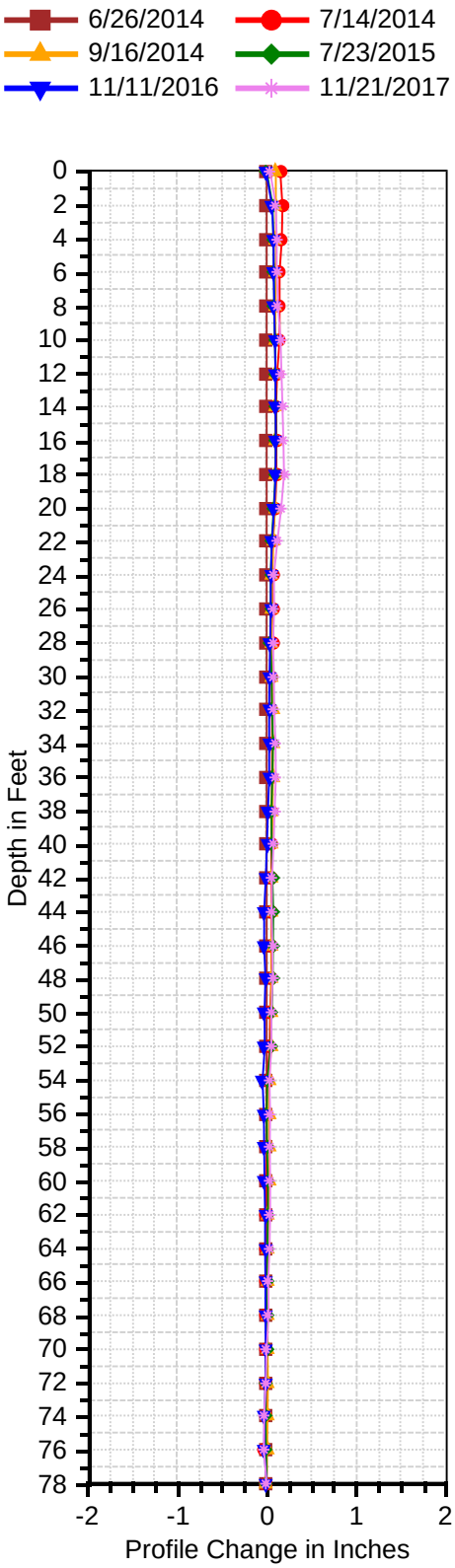
1
2
Profile Change in Inches

ST-3, E-W


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
11/21/2017
Depth in Feet
0
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76
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-2
-1
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1
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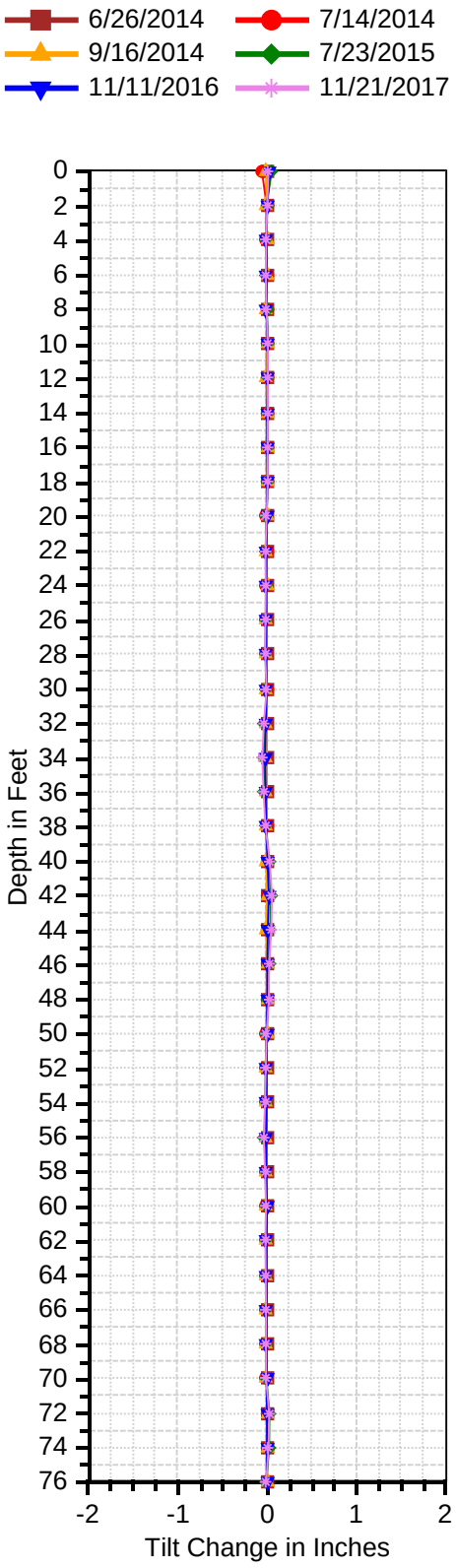
Profile Change in Inches

ST-3, N-S


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
11/21/2017
Depth in Feet
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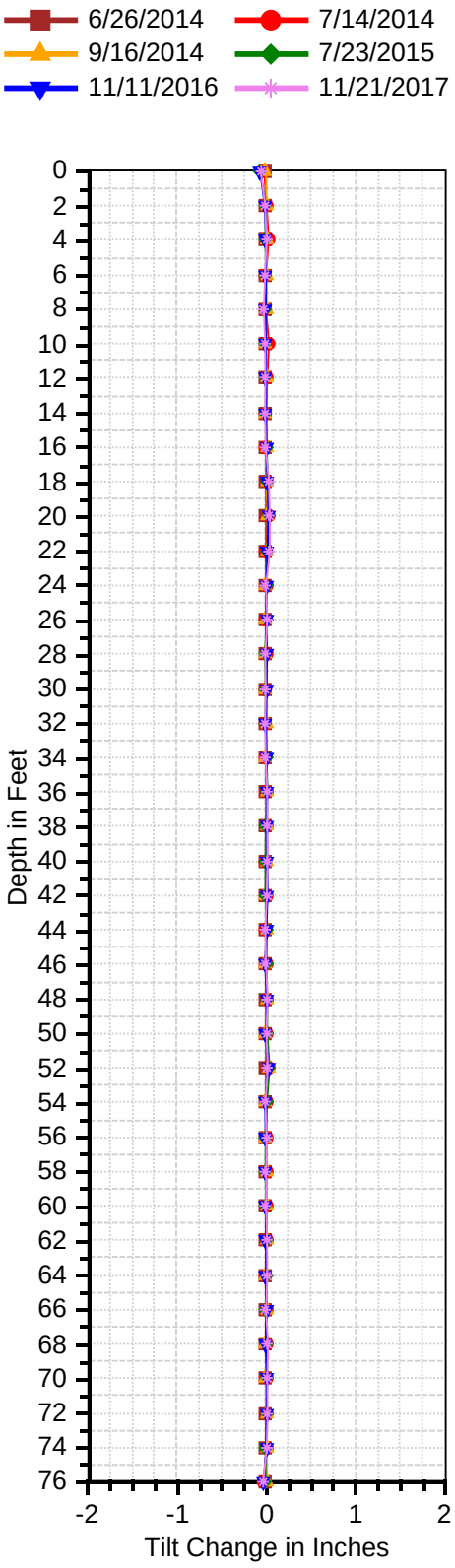
Tilt Change in Inches

ST-3, E-W


6/26/2014
7/14/2014
9/16/2014
7/23/2015
11/11/2016
11/21/2017
Depth in Feet
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-2
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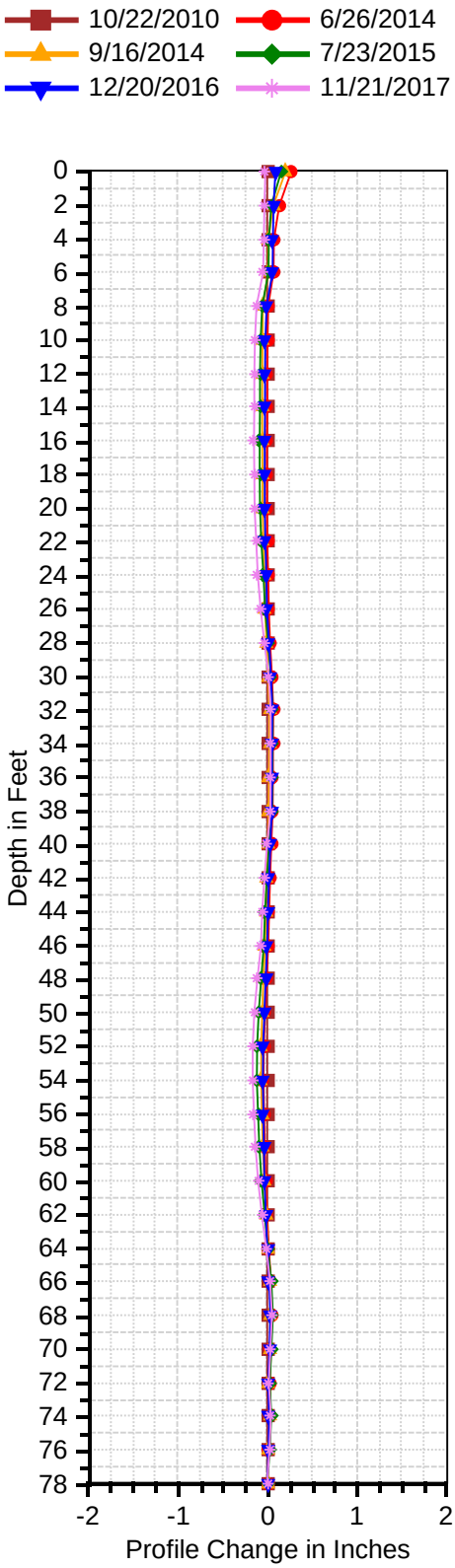
Tilt Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
Depth in Feet
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-1
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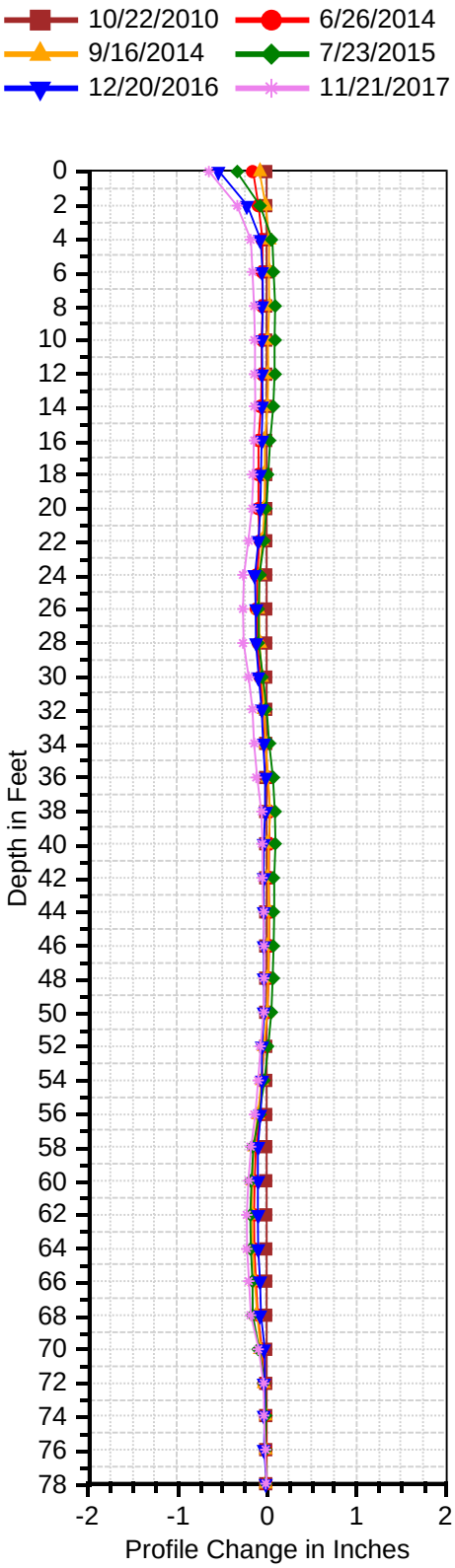
Profile Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
Depth in Feet
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-2
-1
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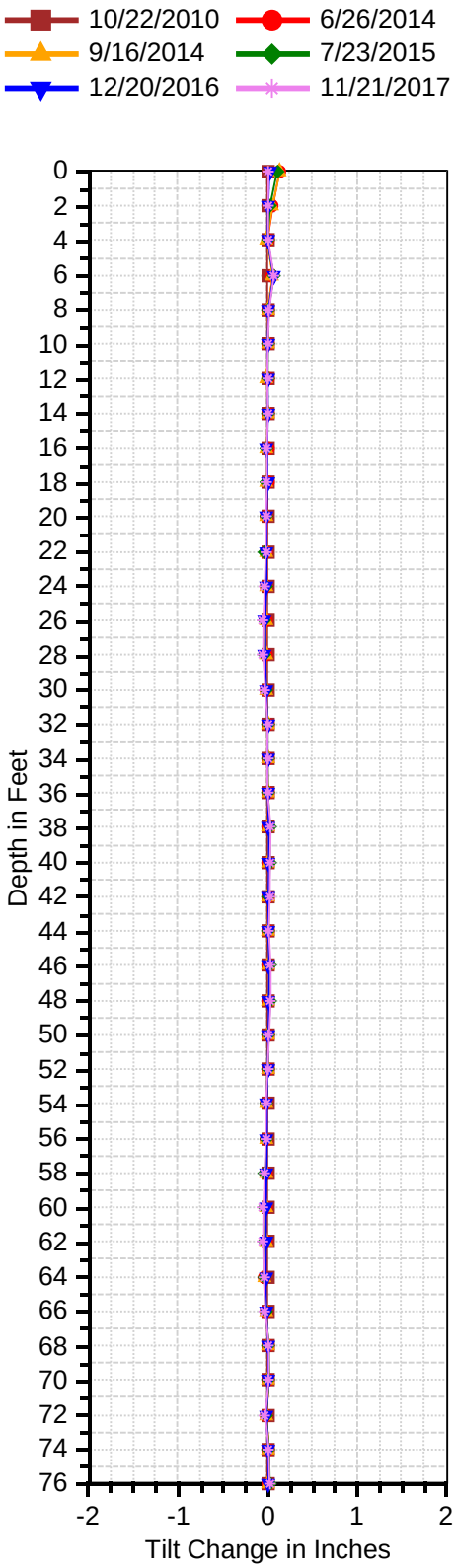
1
2
Profile Change in Inches

ST-4, N-S


10/22/2010
6/26/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
Depth in Feet
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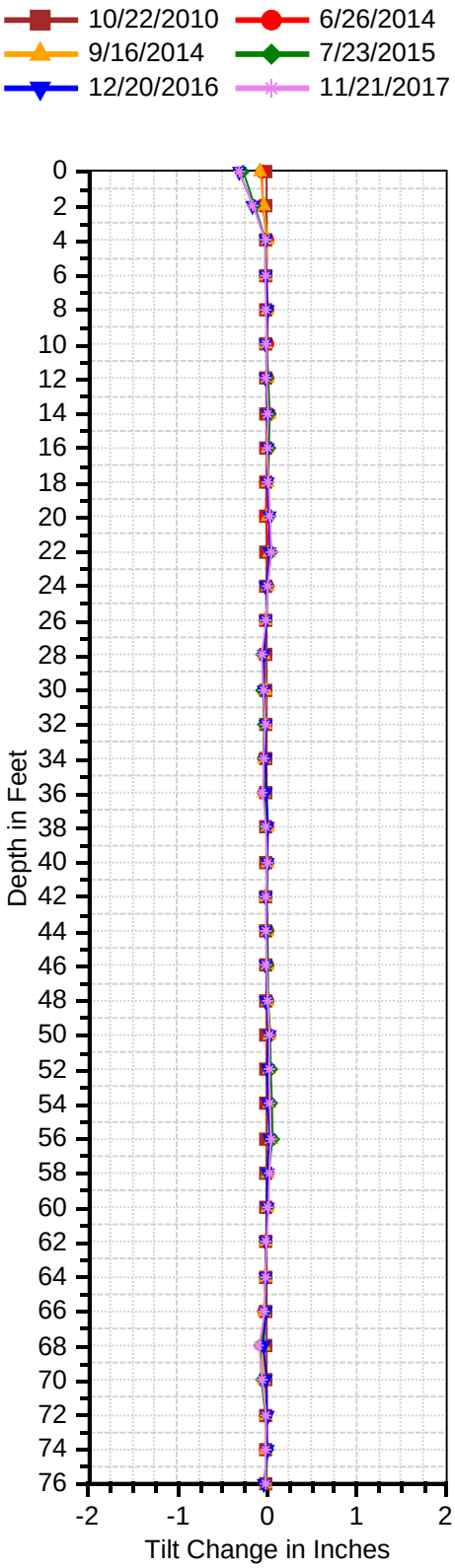
74
76
-2
-1
0
1
2
Tilt Change in Inches

ST-4, E-W


10/22/2010
6/26/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
Depth in Feet
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62
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68
70
72
74
76
-2
-1
0
1
2
Tilt Change in Inches

Gmail

Linda Loomis <naiadconsulting@gmail.com>

Inclinometers in Eden Prairie

Ripp, Bryan <BRipp@braunintertec.com>
To: Linda Loomis <naiadconsulting@gmail.com>

Fri, Mar 22, 2019 at 7:01 PM

Linda

We went out about a month ago and one of the inclinometers had an ice plug in it such that we could not lower the probe. Hopefully the ground will thaw sufficiently over the next few weeks such that we can get readings. Of the one we could read, little or no movement was measured.

[Quoted text hidden]

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952.995.2236 direct | 612.845.4475 mobile
BRipp@braunintertec.com

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Gmail Linda Loomis <naiadconsulting@gmail.com>

MN River Inclinometers

Ripp, Bryan <BRipp@braunintertec.com> Wed, May 29, 2019 at 11:27 AM
To: Linda Loomis <naiadconsulting@gmail.com>

Linda

Attached are the most recent plots. We are starting to see more movement in both inclinometers. As I wrote to you earlier there was ice in ST-4 inclinometer for the reading on February 14. However, as you can see, the readings for ST-3 on February 14 and April 22 are essentially identical. I recommend that we take another set of readings soon, say within the next couple of weeks to see if the movement has calmed down.

BRAUN INTERTEC

Employee Ownership working for you

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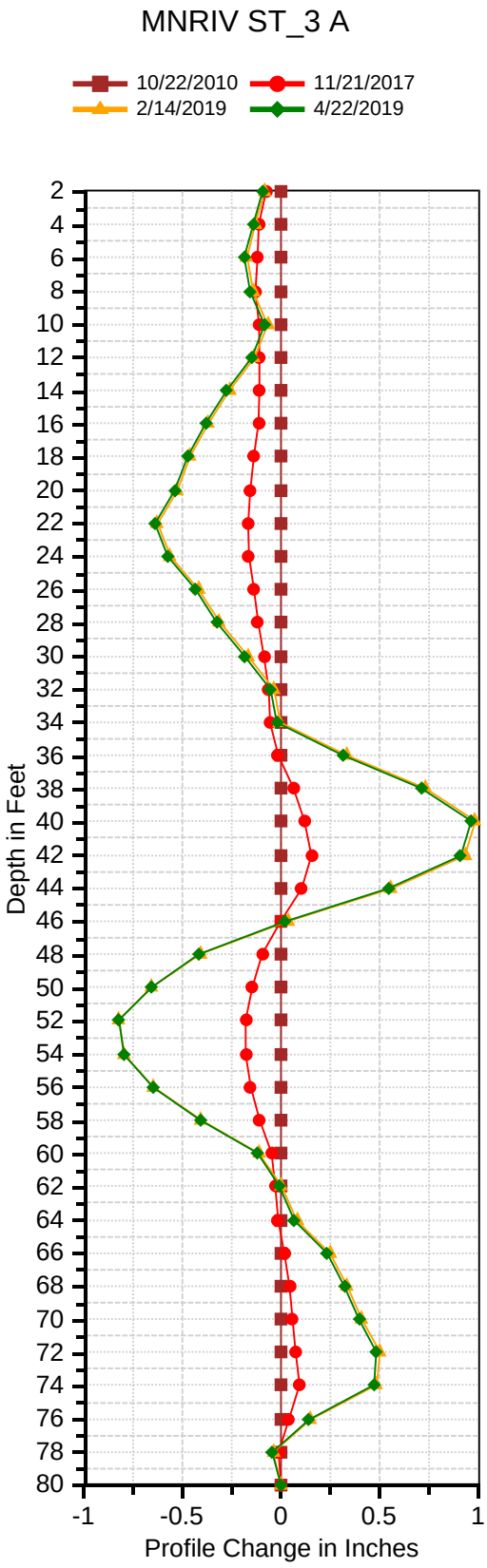
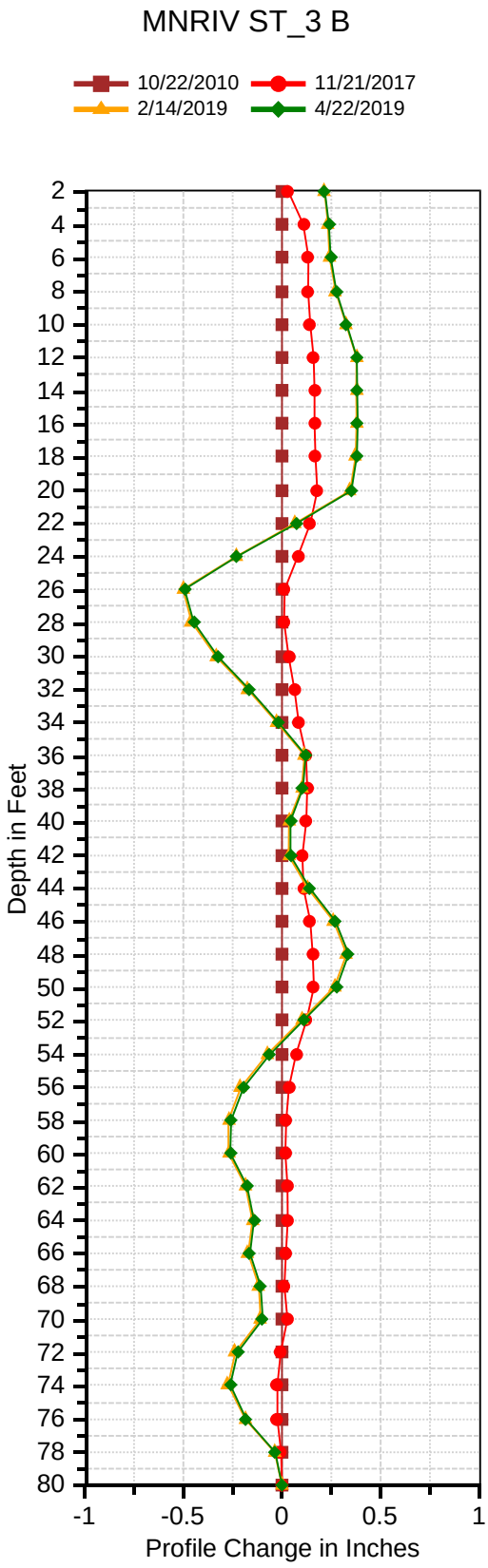
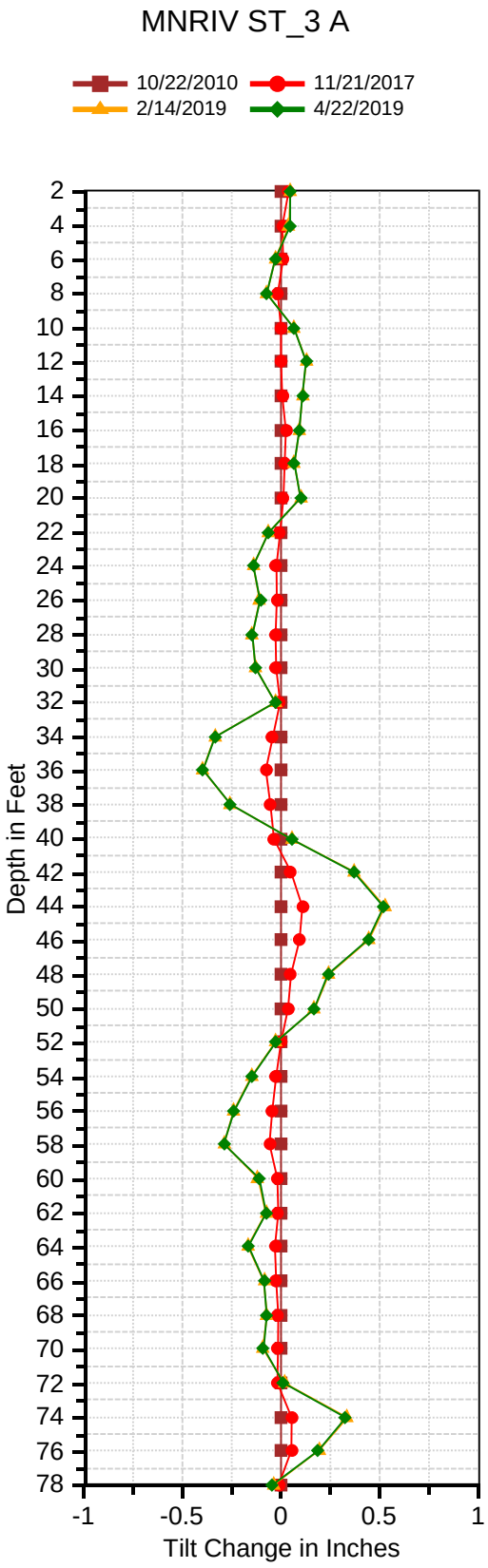
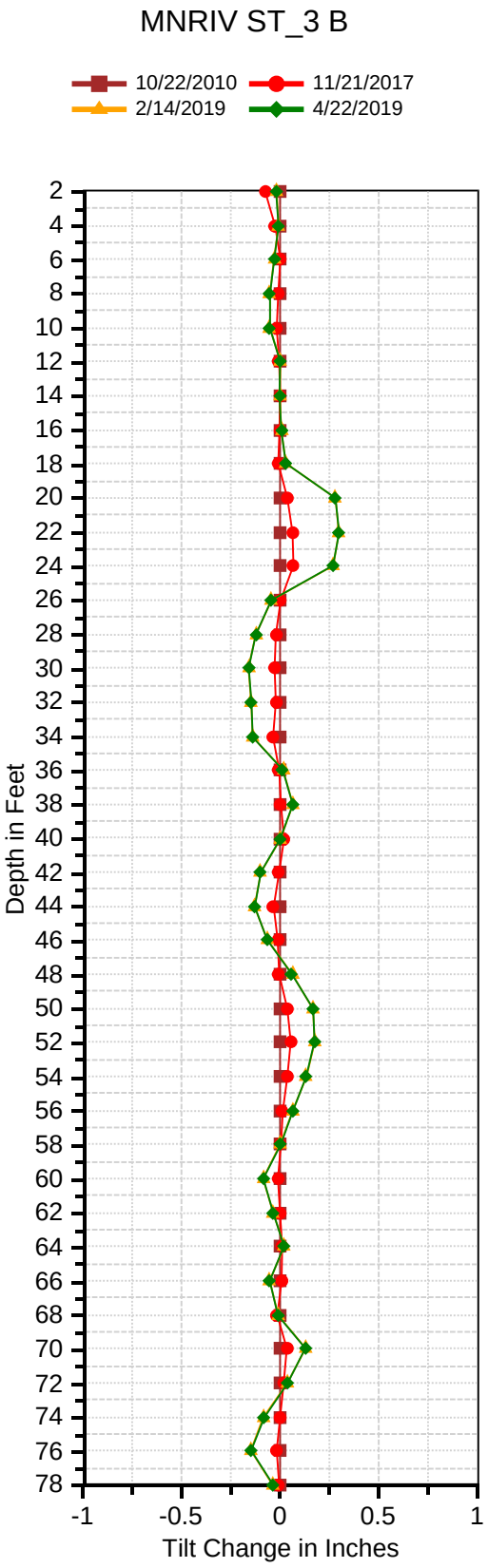
4 attachments

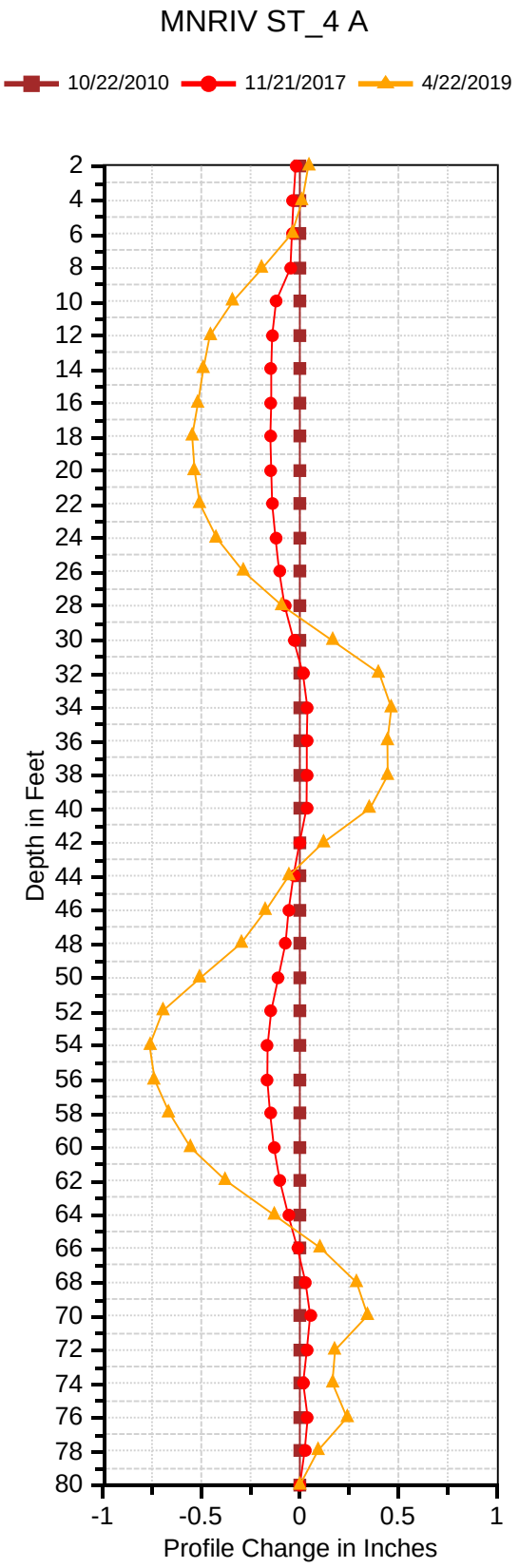
- **ST-4 CD 5_3_2019.pdf** 230K
- **ST-4 ID 5_3_2019.pdf** 226K
- **ST-3 CD 5_3_2019.pdf** 230K
- **ST-3 ID 5_3_2019.pdf** 228K


MNRIV ST_3 A
10/22/2010
11/21/2017
2/14/2019
4/22/2019
Depth in Feet
Profile Change in Inches


MNRIV ST_3 B
10/22/2010
11/21/2017
2/14/2019
4/22/2019
Depth in Feet
Profile Change in Inches


MNRIV ST_3 A
10/22/2010
11/21/2017
2/14/2019
4/22/2019
Depth in Feet
Tilt Change in Inches
-1
-0.5
0
0.5
1


MNRIV ST_3 B
10/22/2010
11/21/2017
2/14/2019
4/22/2019
Depth in Feet
Tilt Change in Inches
-1
-0.5
0
0.5
1


MNRIV ST_4 A
10/22/2010
11/21/2017
4/22/2019
Depth in Feet
Profile Change in Inches
2
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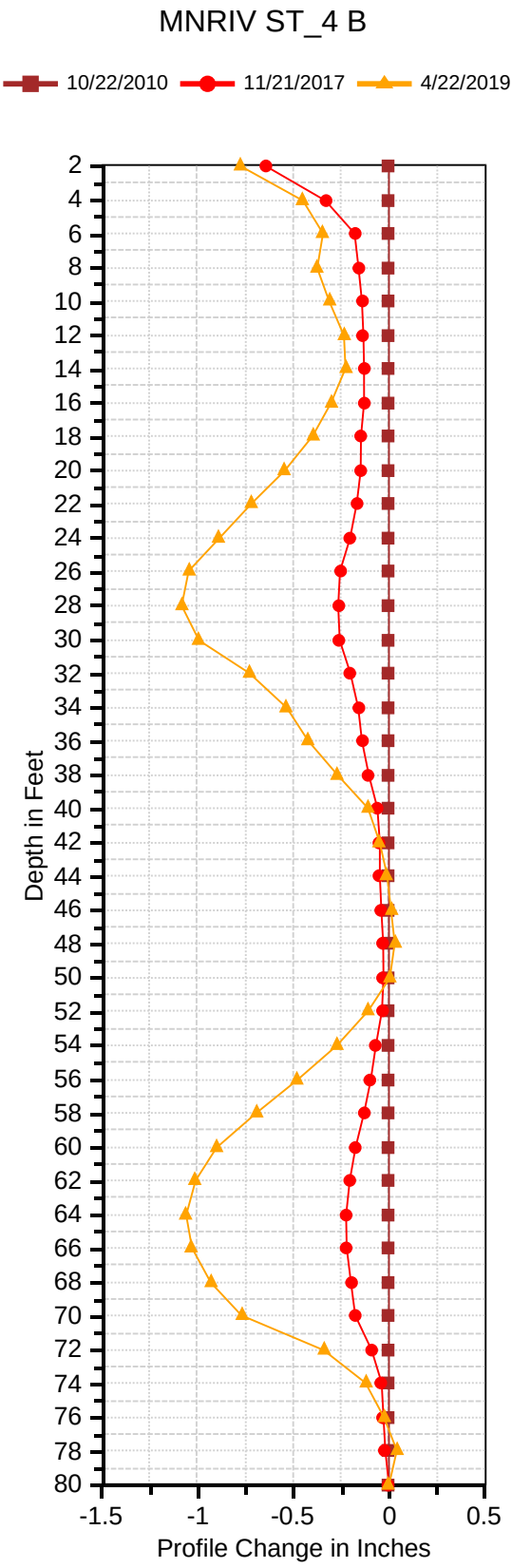
MNRIV ST_4 B
10/22/2010
11/21/2017
4/22/2019
Depth in Feet
Profile Change in Inches
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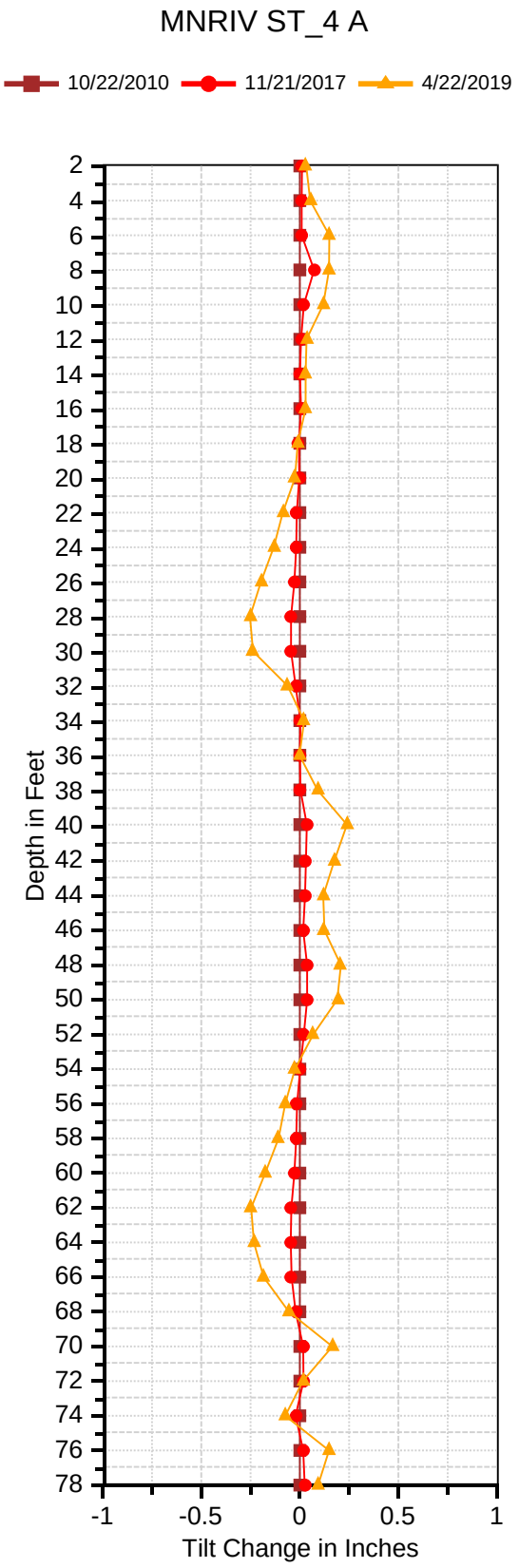
MNRIV ST_4 A
10/22/2010
11/21/2017
4/22/2019
Depth in Feet
2
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74
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78
-1
-0.5
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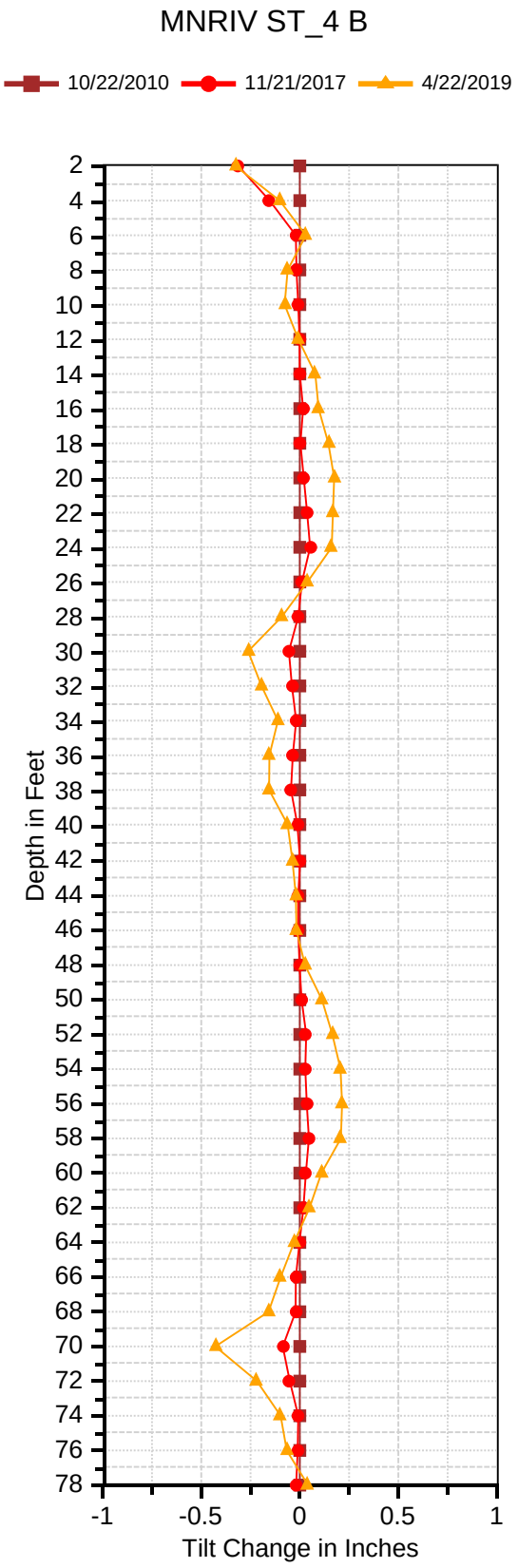
0.5
1
Tilt Change in Inches


MNRIV ST_4 B
10/22/2010
11/21/2017
4/22/2019
Depth in Feet
2
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16
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-1
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0
0.5
1
Tilt Change in Inches

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-3/INC3**

LOCATION: See attached sketch.

DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **12/1/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
771.0	0.0	FILL	FILL: Silt, black, moist.			108158.73 N, 486167.26 E
768.5	2.5	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, brown, moist.	3		
763.5	7.5	SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist, loose. (Glacial Outwash)	5		
758.5	12.5	SP	POORLY GRADED SAND, fine-grained, light brown, moist, loose. (Alluvium)	9		
				6		
				7		
741.0	30.0	ML	SILT, light brown, moist, medium dense. (Alluvium)	15		

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-3/INC3 (cont.)**

LOCATION: See attached sketch.

DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **12/1/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
739.0	32.0		SILT, light brown, moist, medium dense. (Alluvium) *(continued)*			
				23		
				21		
				22		
721.0	50.0	SM	SILTY SAND, fine-grained, light brown, moist, medium dense. (Alluvium)	25		* See attached Grain Size Accumulation Curve
				32		
				25		

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-3/INC3 (cont.)**

LOCATION: See attached sketch.

DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **12/1/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
707.0	64.0		SILTY SAND, fine-grained, light brown, moist, medium dense. (Alluvium) *(continued)*	34	▽	
				25		
				19		
				47		
690.0	81.0		END OF BORING. Water observed at 65 feet with 79 1/2 feet of hollow-stem auger in the ground. Inclinometer set to a depth of 80 feet.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-4/INC4**

LOCATION: See attached sketch.

DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **11/25/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
773.6	0.0					
772.6	1.0	SM	SILTY SAND, fine-grained, black, moist. (Topsoil)			108378.80 N, 485906.21 E
		ML	SANDY SILT, light brown, moist, loose. (Alluvium)	6		
763.6	10.0					
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose. (Alluvium)	7		
				9		
753.6	20.0					
		ML	SANDY SILT, light brown, moist, medium dense. (Alluvium)	11		
				16		
				11		

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-4/INC4 (cont.)**

LOCATION: See attached sketch.

DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **11/25/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
741.6	32.0		SANDY SILT, light brown, moist, medium dense. (Alluvium) *(continued)*			
738.6	35.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, light brown, moist, loose to very loose. (Alluvium)	8		
				3		
728.6	45.0	ML	SANDY SILT, light brown, moist, medium dense. (Alluvium)	23		
723.6	50.0	ML	SILT, gray to light brown, moist, medium dense. (Alluvium)	23		* See attached Grain Size Accumulation Curve
				28		
				28		

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31

BRAUN INTERTEC

LOG OF BORING

Braun Project SP-09-04727
Geotechnical Evaluation
LMR/WD Stability Analysis
Minnesota River Bluff
Eden Prairie, Minnesota

BORING: **SB-4/INC4 (cont.)**

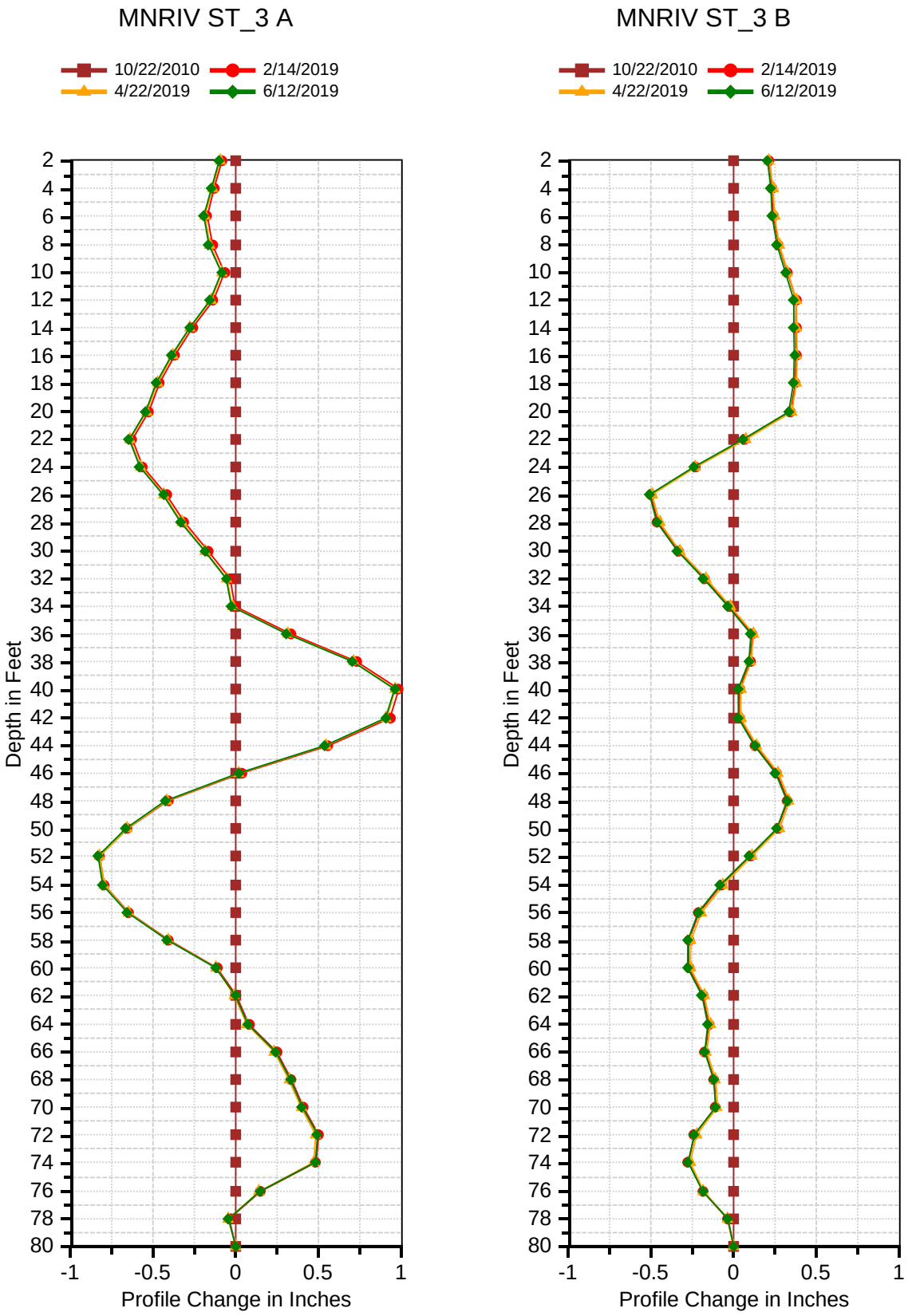
LOCATION: See attached sketch.

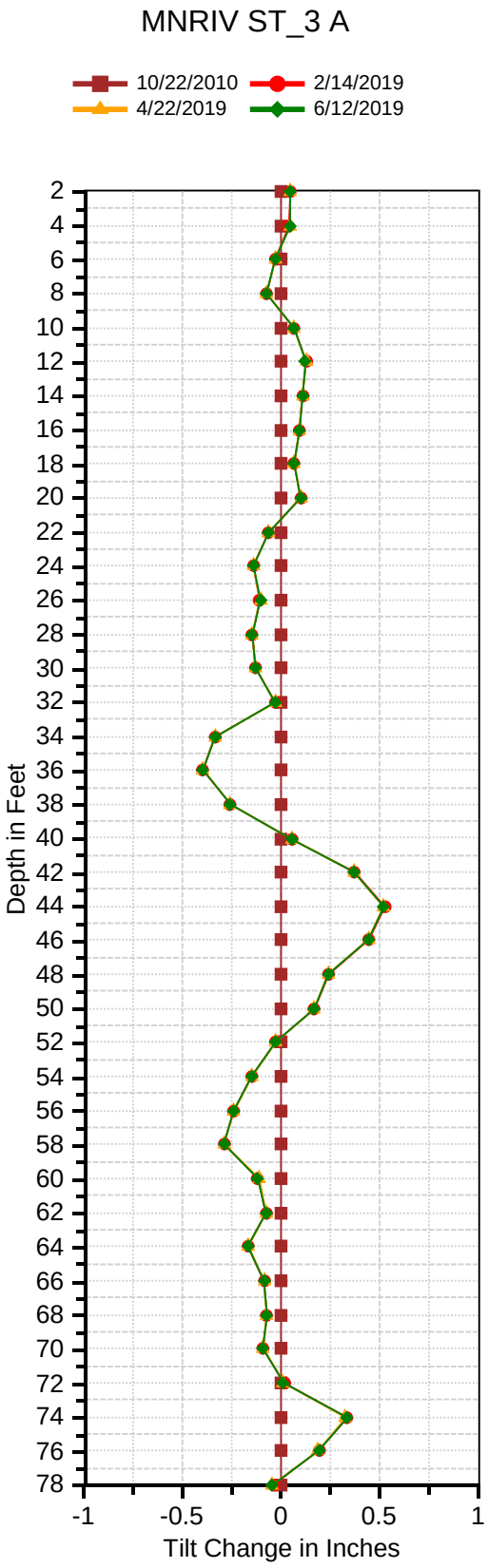
DRILLER: C. Powers | METHOD: 3 1/4" HSA, Autohammer | DATE: **11/25/09** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
709.6	64.0		SILT, gray to light brown, moist, medium dense. (Alluvium) *(continued)*	45		
				16		
					▽	
				WH		
693.6	80.0					
692.6	81.0	SP	POORLY GRADED SAND, reddish brown, with a trace of Gravel, brown, waterbearing, medium dense. (Glacial Outwash)	22		
			END OF BORING.			
			Water observed at 74 feet with 79 1/2 feet of hollow-stem auger in the ground.			
			Inclinometer set to a depth of 80 feet.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 04727.GPJ BRAUN_08.GDT 12/28/09 16:31


MNRIV ST_3 A
10/22/2010
2/14/2019
4/22/2019
6/12/2019
Depth in Feet
Profile Change in Inches
MNRIV ST_3 B
10/22/2010
2/14/2019
4/22/2019
6/12/2019
Depth in Feet
Profile Change in Inches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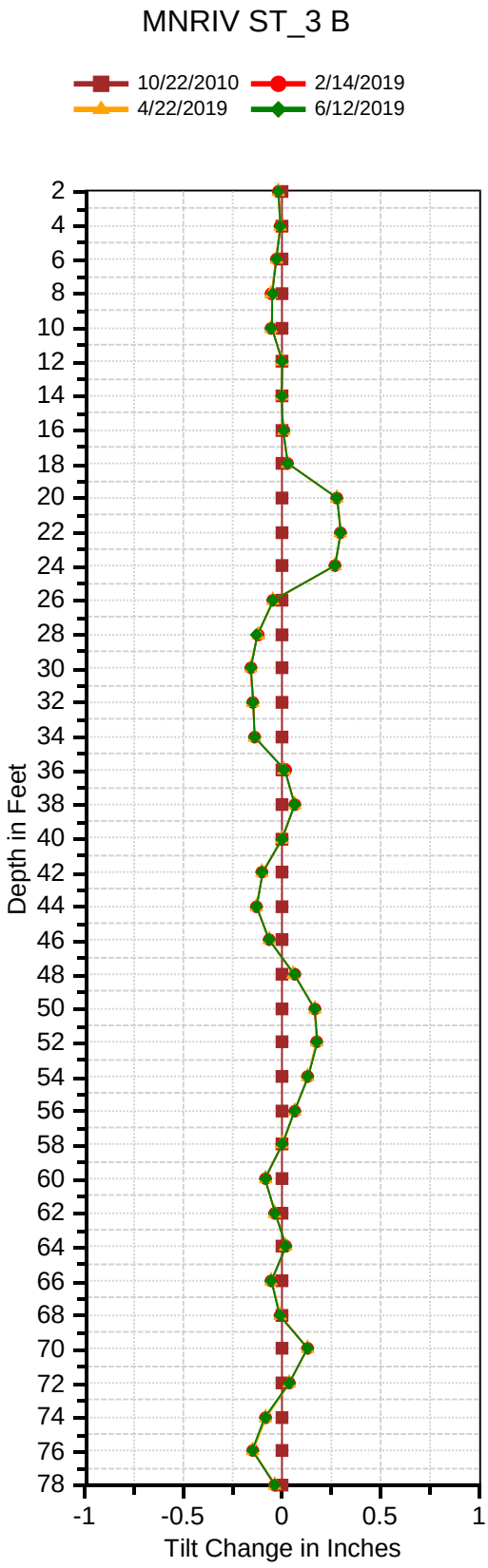
10/22/2010
2/14/2019
4/22/2019
6/12/2019
Depth in Feet
Tilt Change in Inches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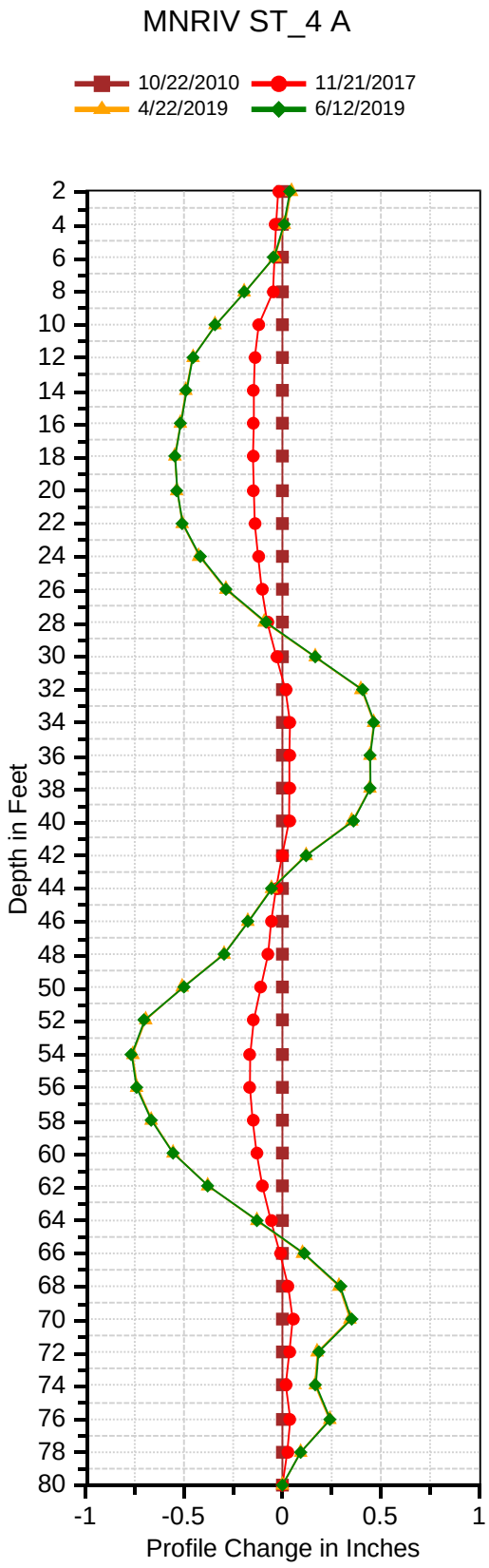
10/22/2010
2/14/2019
4/22/2019
6/12/2019
Depth in Feet
Tilt Change in Inches


MNRIV ST_4 A
10/22/2010
11/21/2017
4/22/2019
6/12/2019
Depth in Feet
Profile Change in Inches
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
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56
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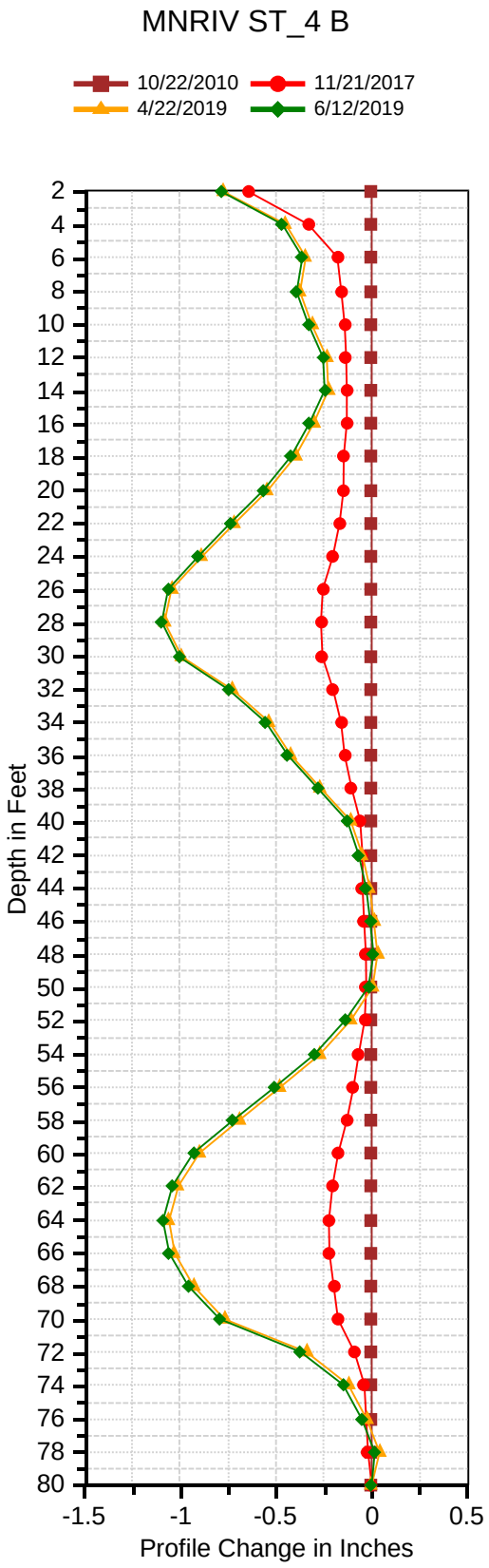
62
64
66
68
70
72
74
76
78
80
-1
-0.5
0
0.5
1


MNRIV ST_4 B
10/22/2010
11/21/2017
4/22/2019
6/12/2019
Depth in Feet
Profile Change in Inches
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
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42
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72
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80
-1.5
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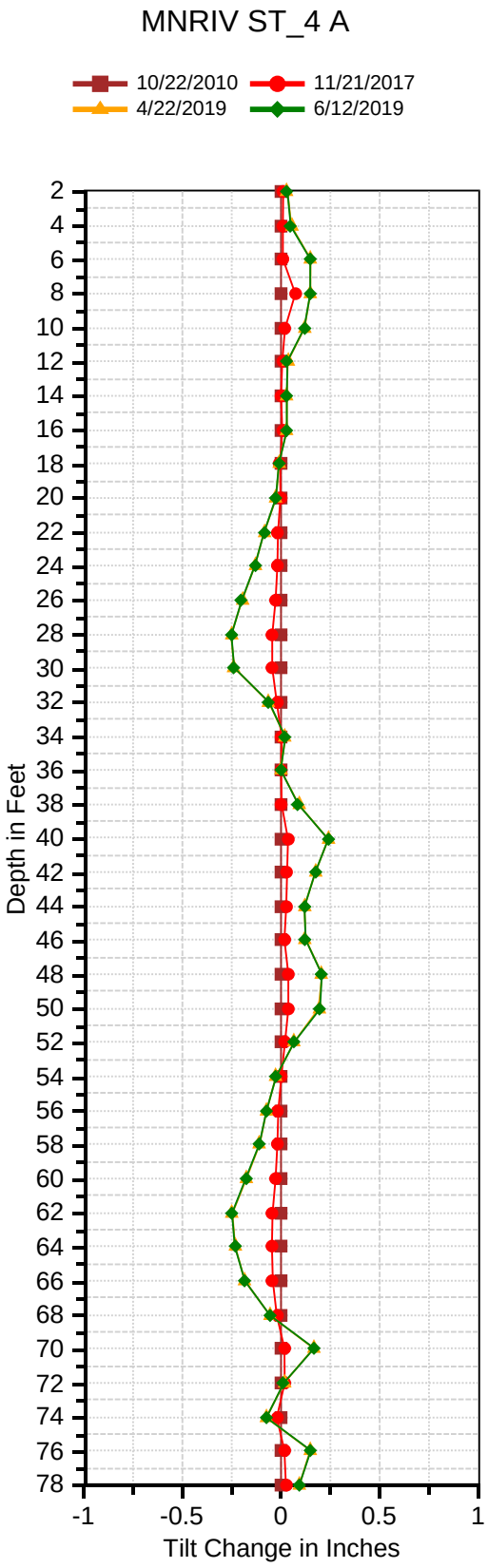
0
0.5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10/22/2010
11/21/2017
4/22/2019
6/12/2019
Depth in Feet
2
4
6
8
10
12
14
16
18
20
22
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26
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72
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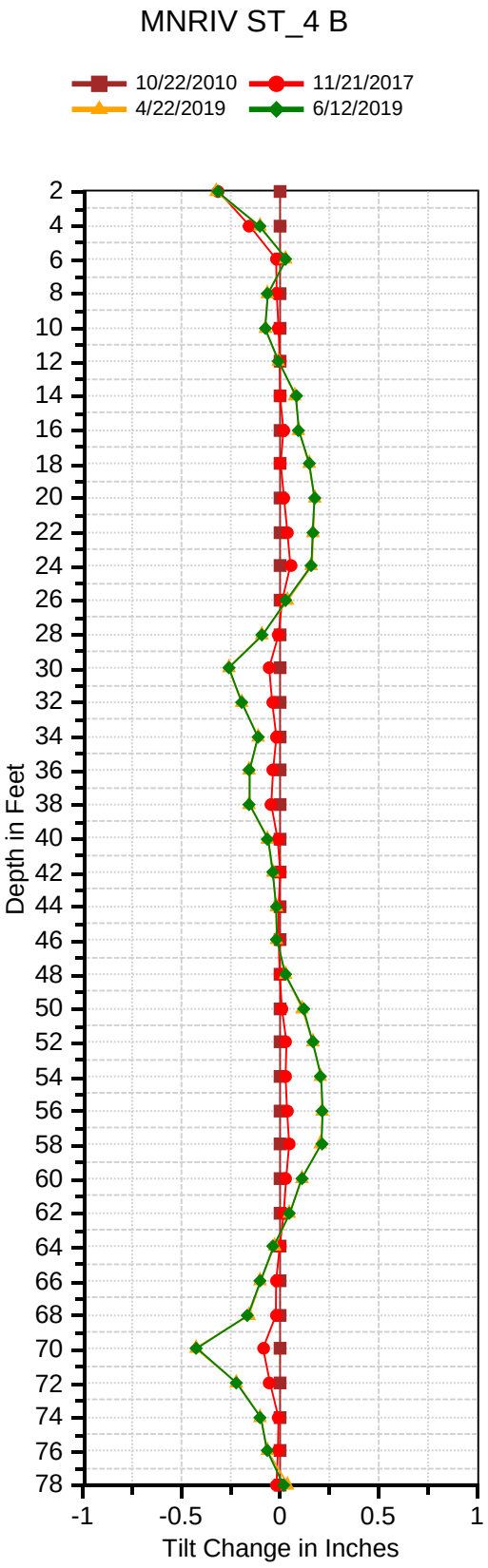
76
78
-1
-0.5
0
0.5
1
Tilt Change in Inches


MNRIV ST_4 B
10/22/2010
11/21/2017
4/22/2019
6/12/2019
Depth in Feet
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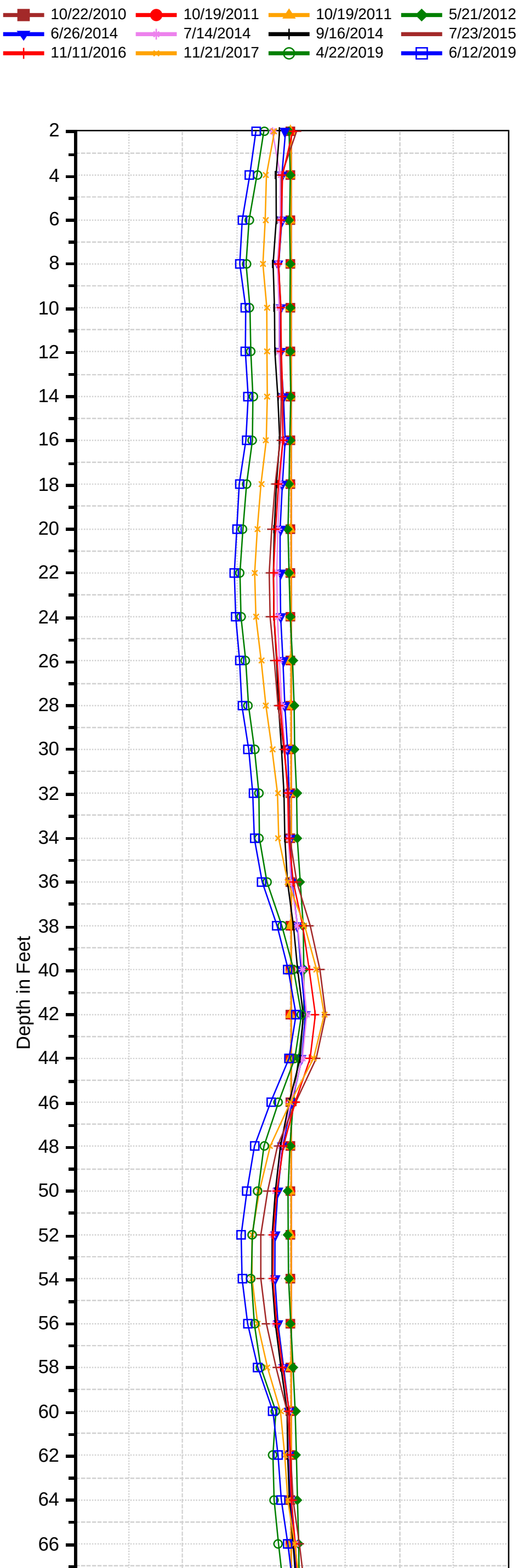
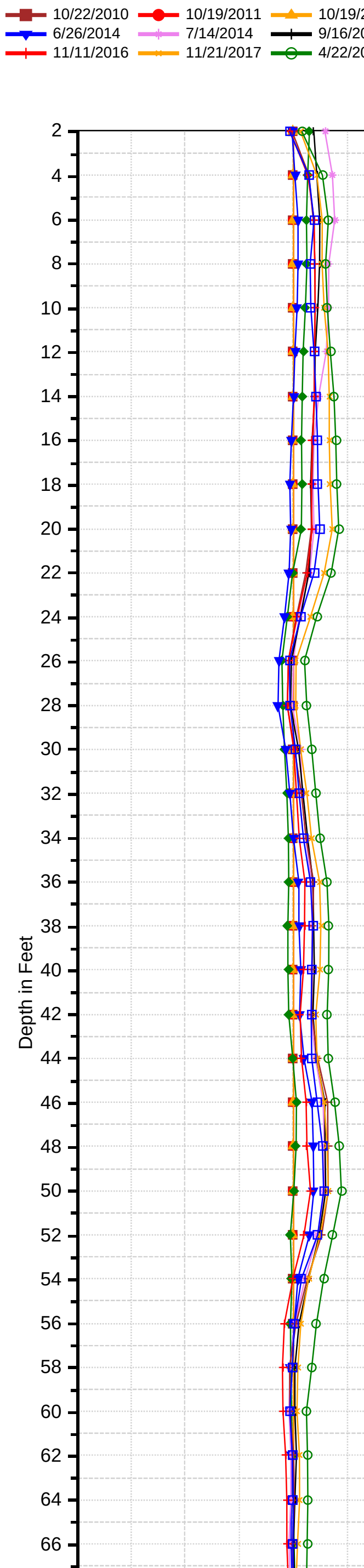
-1
-0.5
0
0.5
1
Tilt Change in Inches

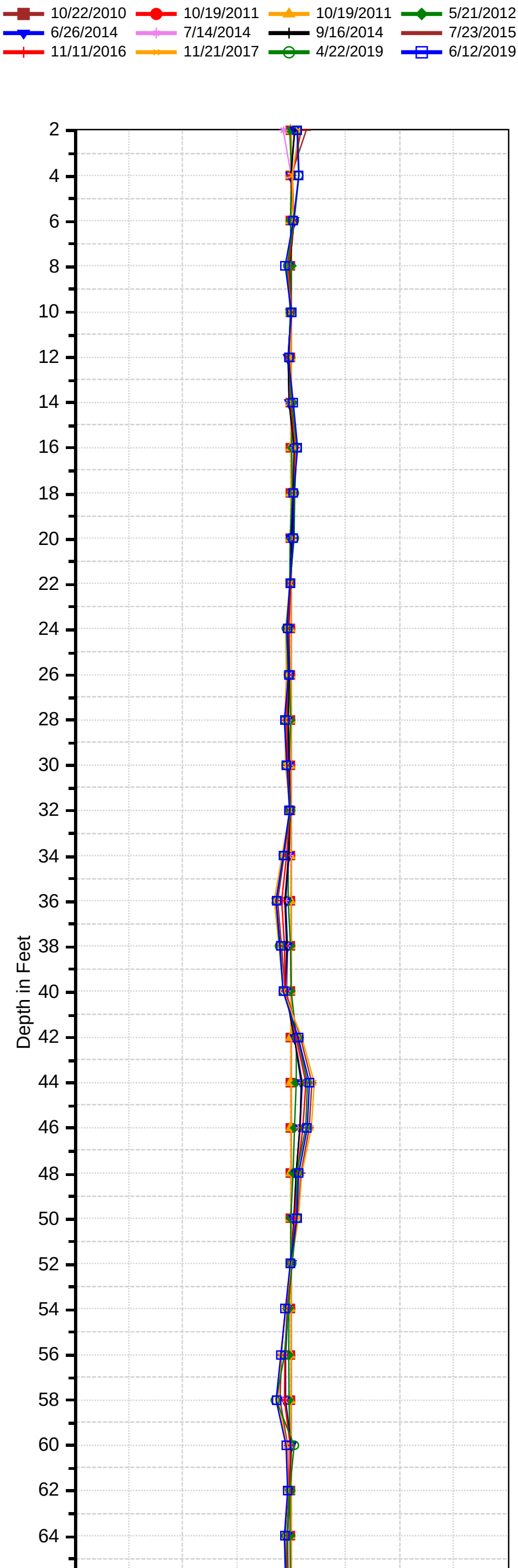
MNRIV ST_3 A



MNRIV ST_3 B



MNRIV ST_3 A



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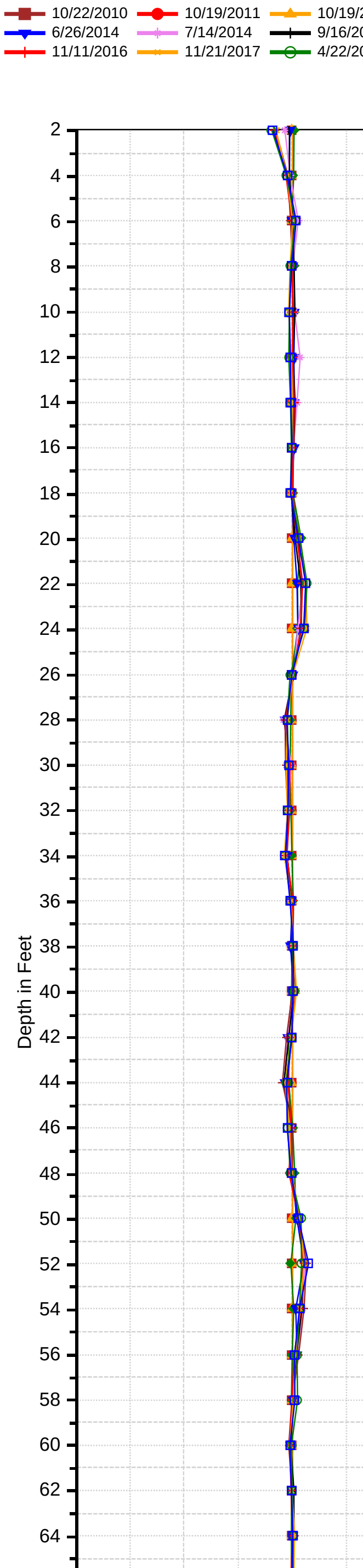

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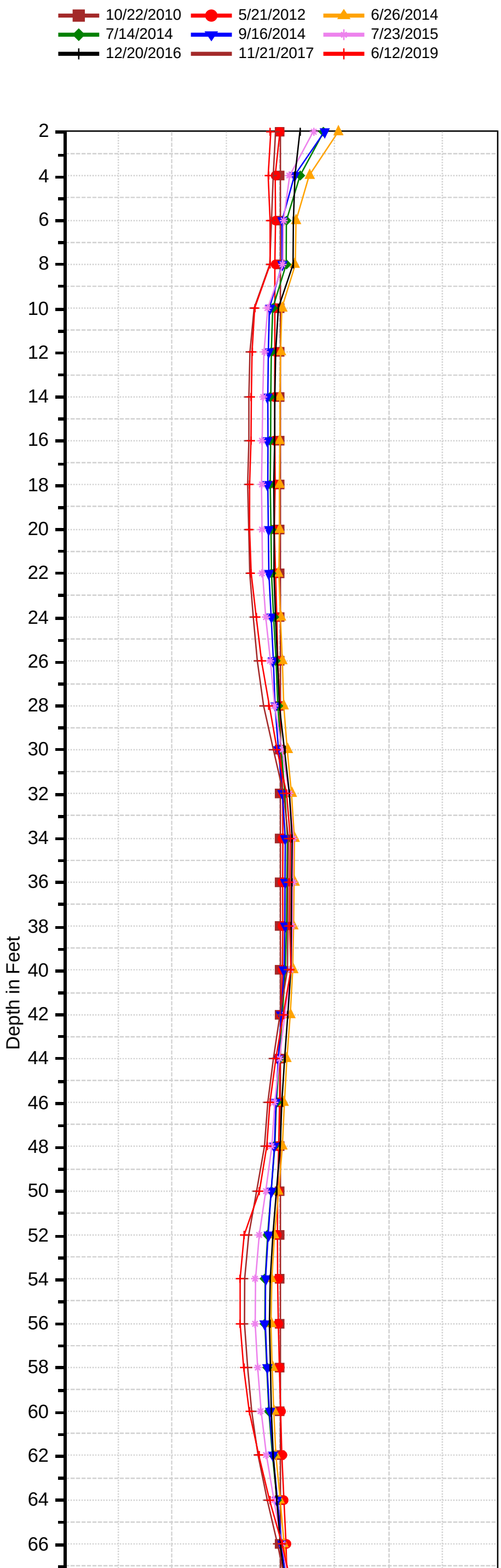

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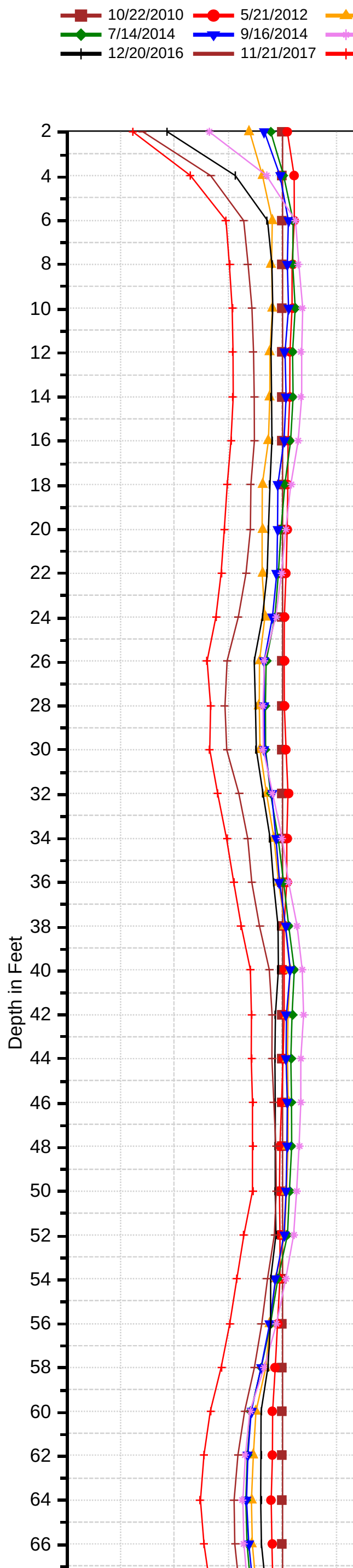

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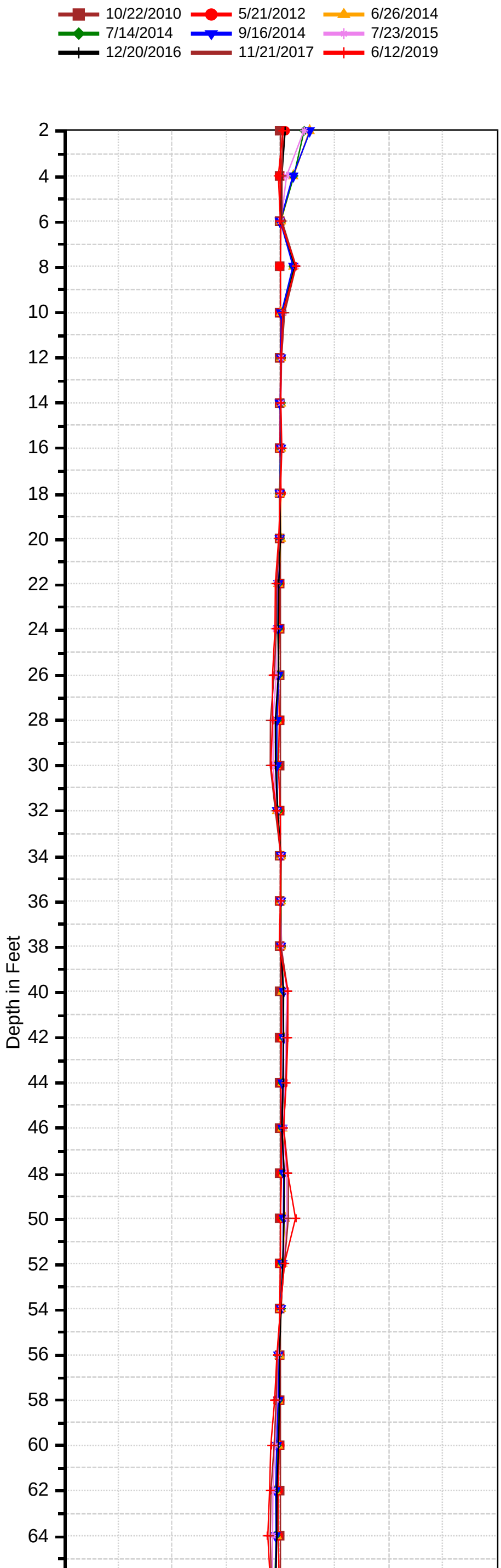

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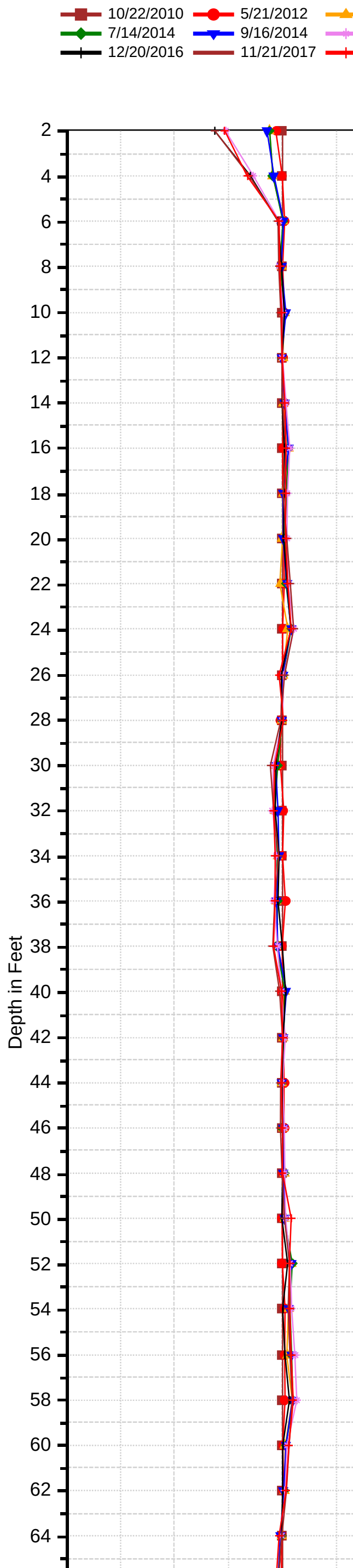

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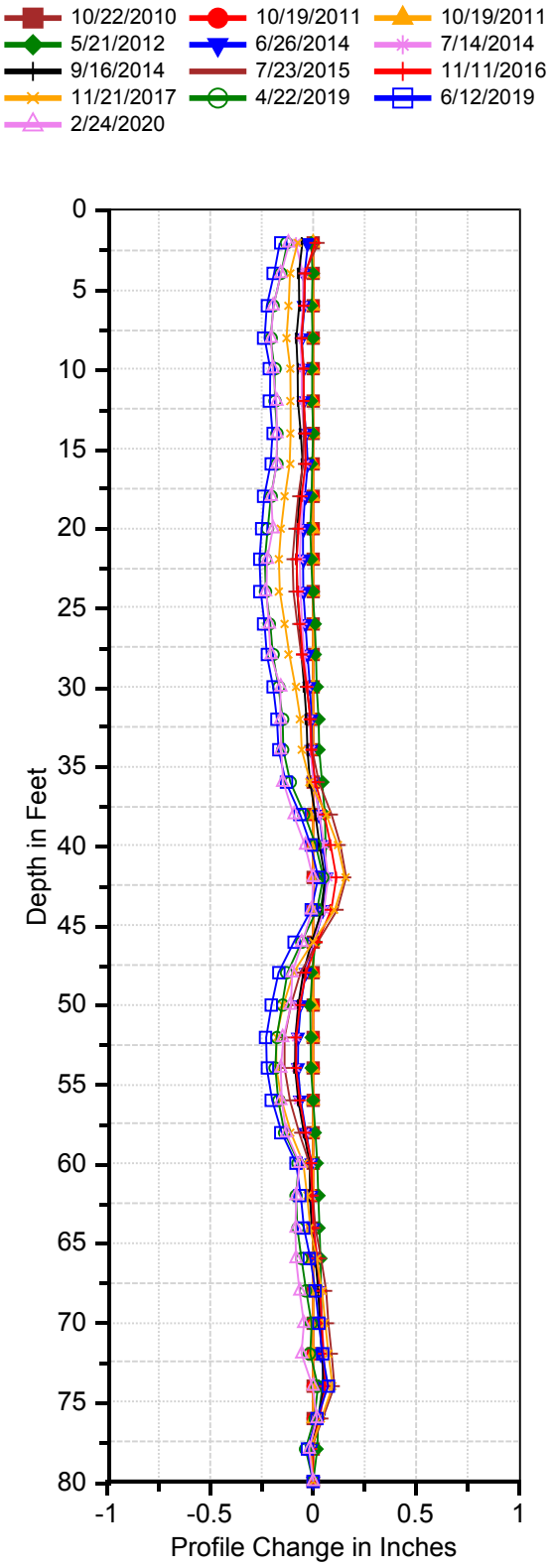

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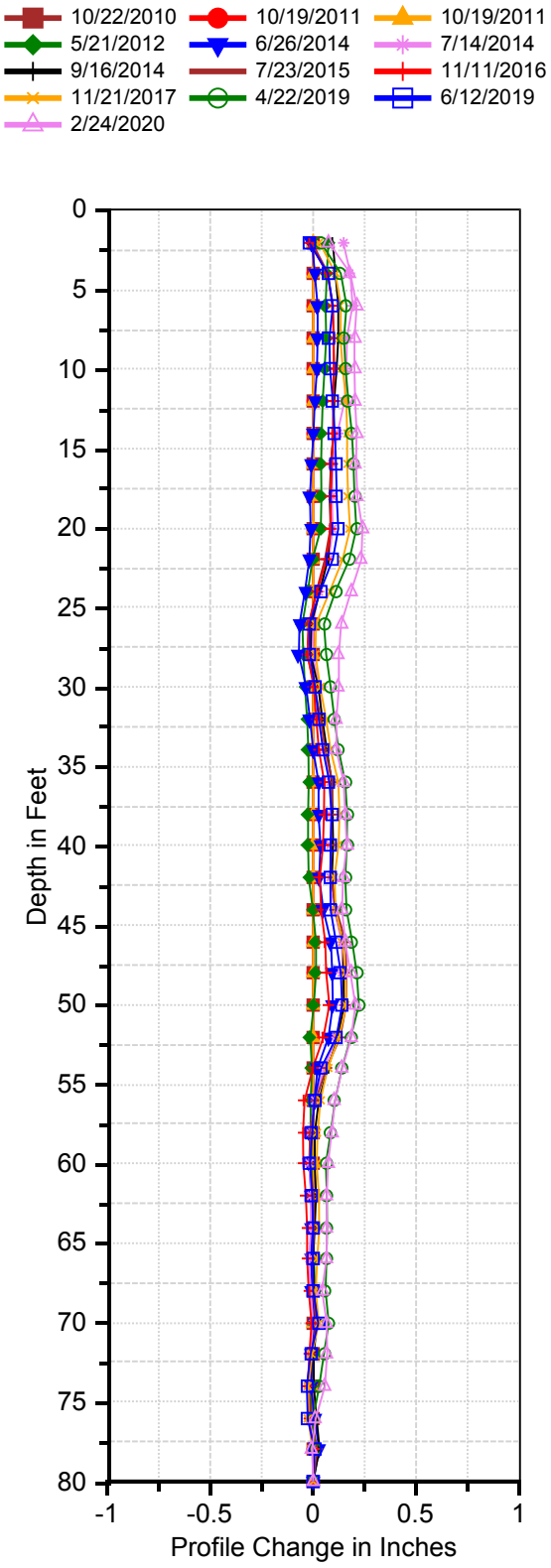
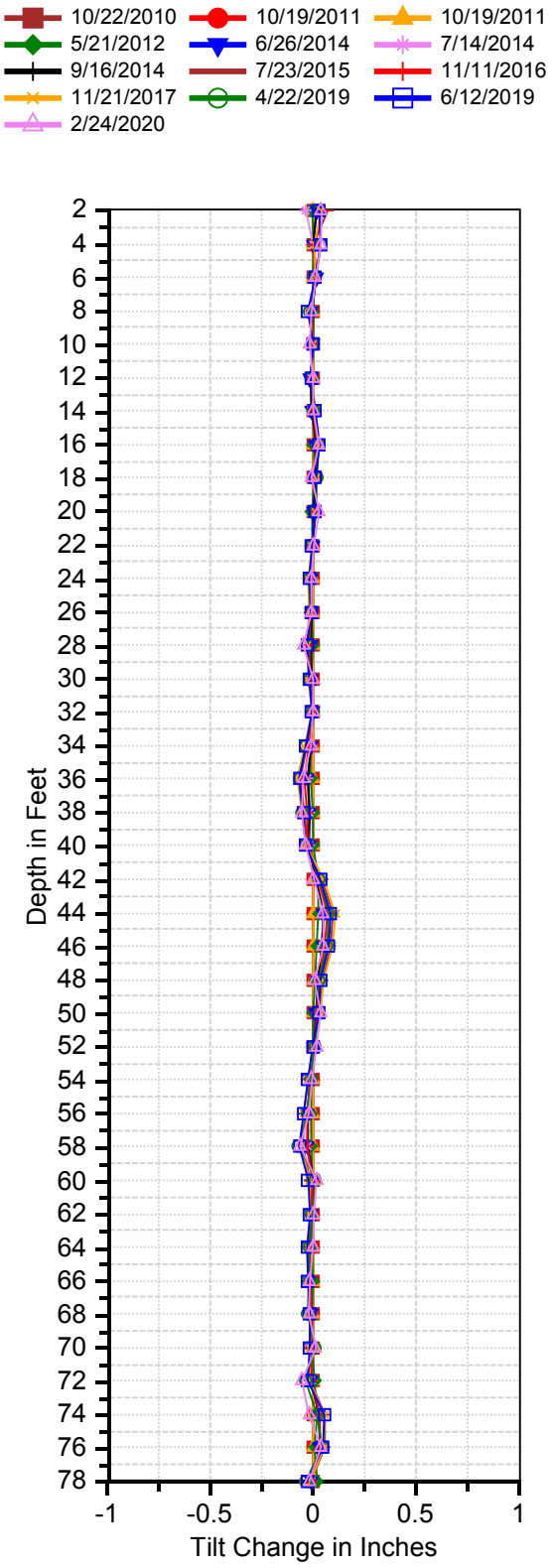


MNRIV ST_3 A



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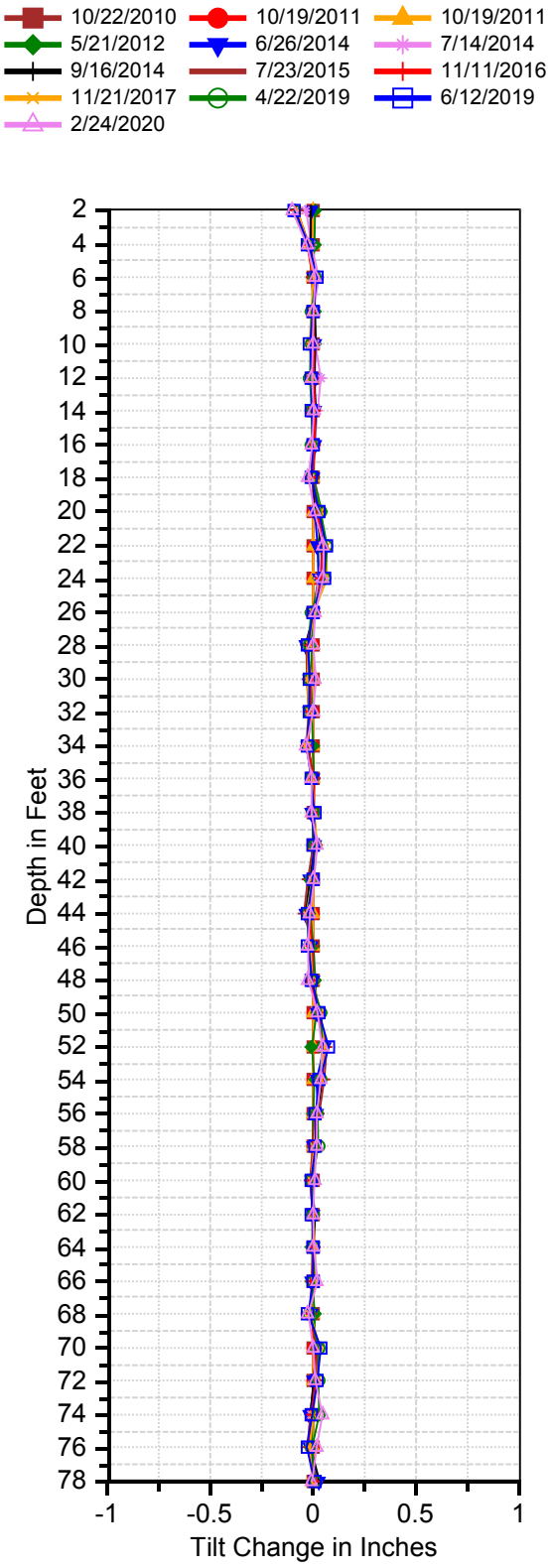
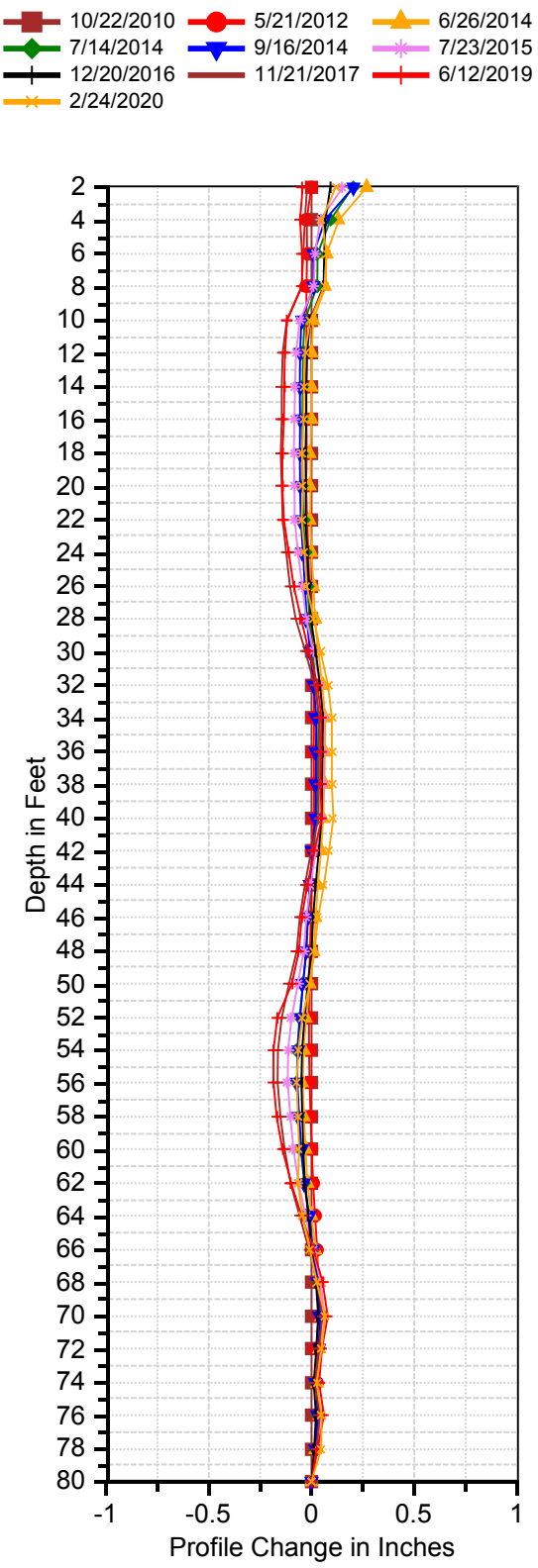


MNRIV ST_4 A



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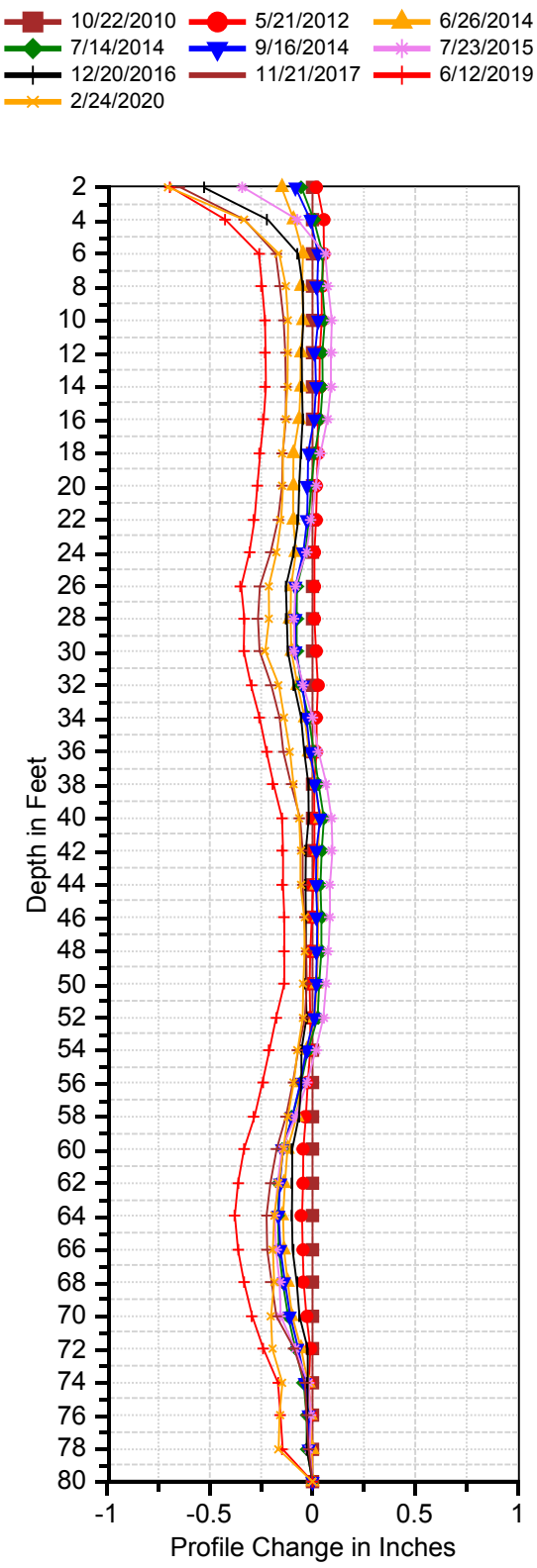
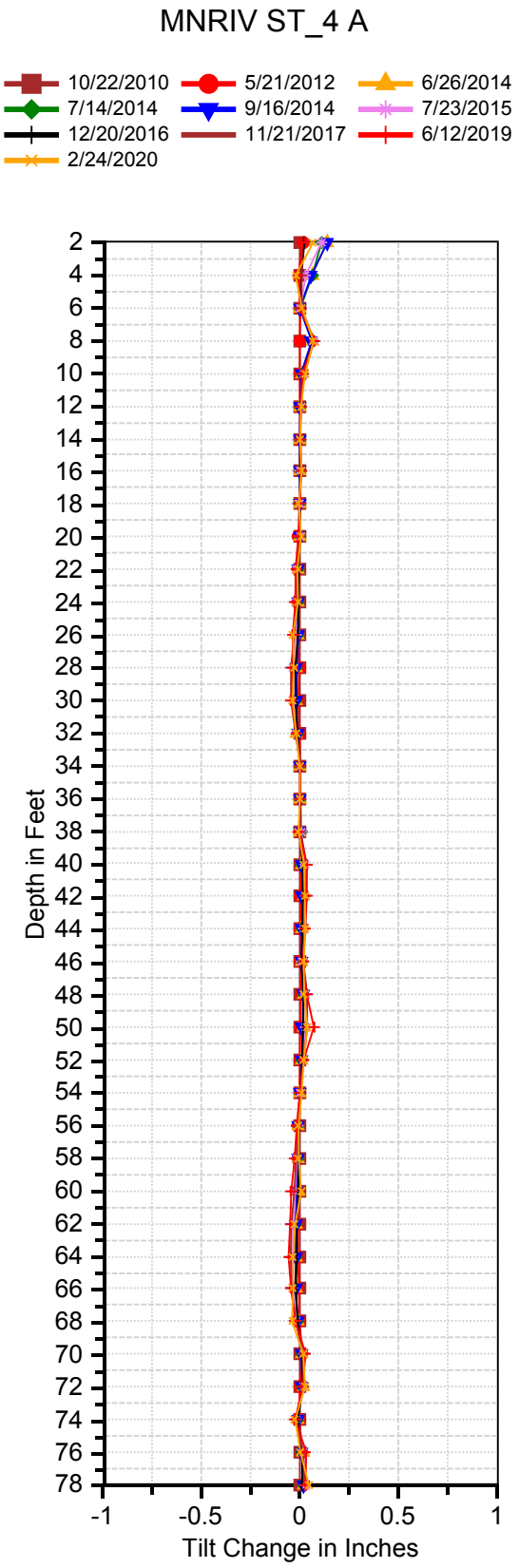
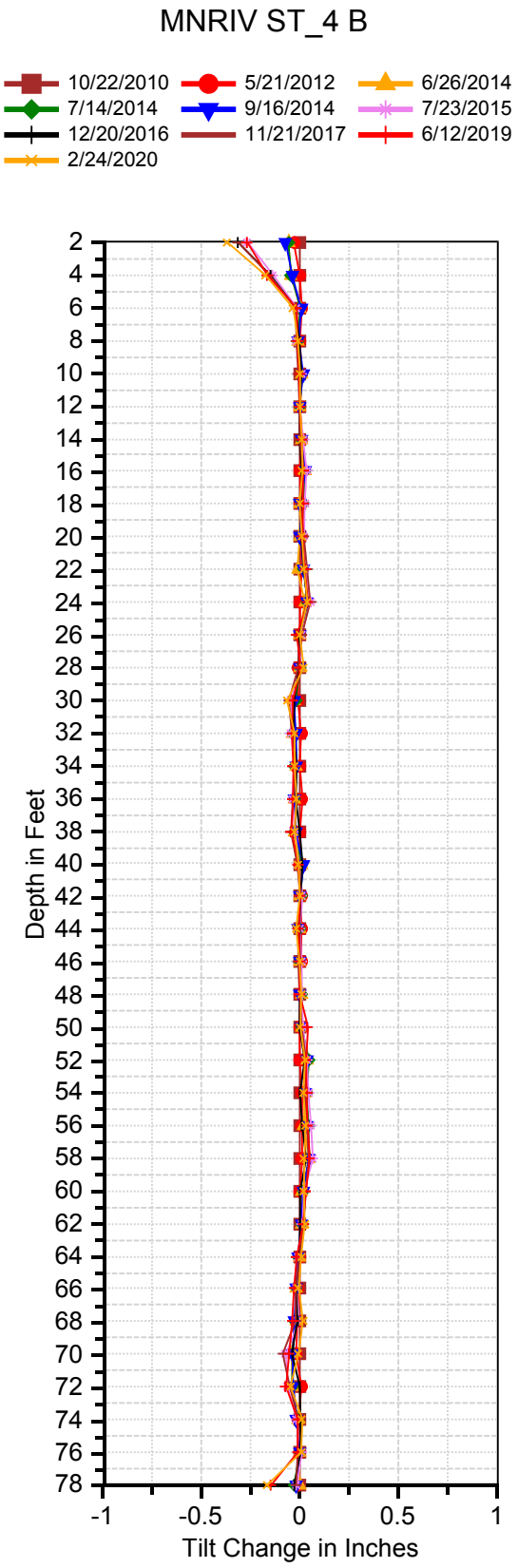



MNRIV ST_4 A
10/22/2010
5/21/2012
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
6/12/2019
2/24/2020
Depth in Feet
Tilt Change in Inches


MNRIV ST_4 B
10/22/2010
5/21/2012
6/26/2014
7/14/2014
9/16/2014
7/23/2015
12/20/2016
11/21/2017
6/12/2019
2/24/2020
Depth in Feet
Tilt Change in Inches

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Della Nyondi Schall Young – Young Environmental Consulting Group, LLC
From: Garrett Bayrd, Jacob Sharpe – Barr Engineering Co.
Subject: Monitoring Event – Fall 2020
Date: November 2nd, 2020
Project: LMRWD Eden Prairie Slope Monitoring

Barr Engineering Co. (Barr) staff performed two site visits to the Lower Minnesota River Watershed District Area 3 slope stability site in Eden Prairie, Minnesota on October 9th, 2020 and October 29th, 2020. During these site visits, Barr staff examined the site, took new initial readings on the two inclinometers, took a manual water level reading, installed a vibrating wire piezometer and datalogger at the well onsite, and downloaded the data from this datalogger.

1.0 Inclinometer Measurements

Barr staff took initial readings in both inclinometers at the site, SBINC-3 and SBINC-4. Barr understands from discussions with the client that these inclinometers have previously been read by Braun. During the initial readings, multiple readings in each inclinometer are performed to verify that accurate readings are gathered. Plots of the initial readings are attached to this memo as Attachment 1. Because both readings were taken on the same day, the plots are not expected to show any ground displacement. The plots will be updated during the next set of readings in spring of 2021.

Photo 1: Inclinometer SBINC-4

2.0 Groundwater Measurements

Barr staff located boring SB-6 during the October 9th, 2020 site visit. A well was installed by others during the initial drilling of boring SB-6 in November 2009. The well was still extant and accessible. The well is registered with the Minnesota Department of Health as unique well No. 772801.

Photo 2: Well SB-6

Barr staff took manual readings of the groundwater, which was present 40.0 feet below ground surface during the site visit. Staff installed a vibrating wire piezometer in the well at a depth of 76.9 feet below ground surface. The vibrating wire piezometer was connected to a local datalogger which will record the groundwater level every 12 hours. The calibration sheet for the vibrating wire piezometer is included in this memo as Attachment 2. Barr staff took a manual water level reading and downloaded the data from the datalogger during a subsequent site visit on Thursday, October 29th. The water level data is included in this memo as Attachment 3. As the plot shows, the water level in this well varied only a few feet over the 3 weeks of monitoring. During subsequent site visits Barr staff will continue to download data from this datalogger and update these plots.

Photo 3: Well SB-6 with vibrating wire piezometer cable (blue) and datalogger (grey) attached

Attachments

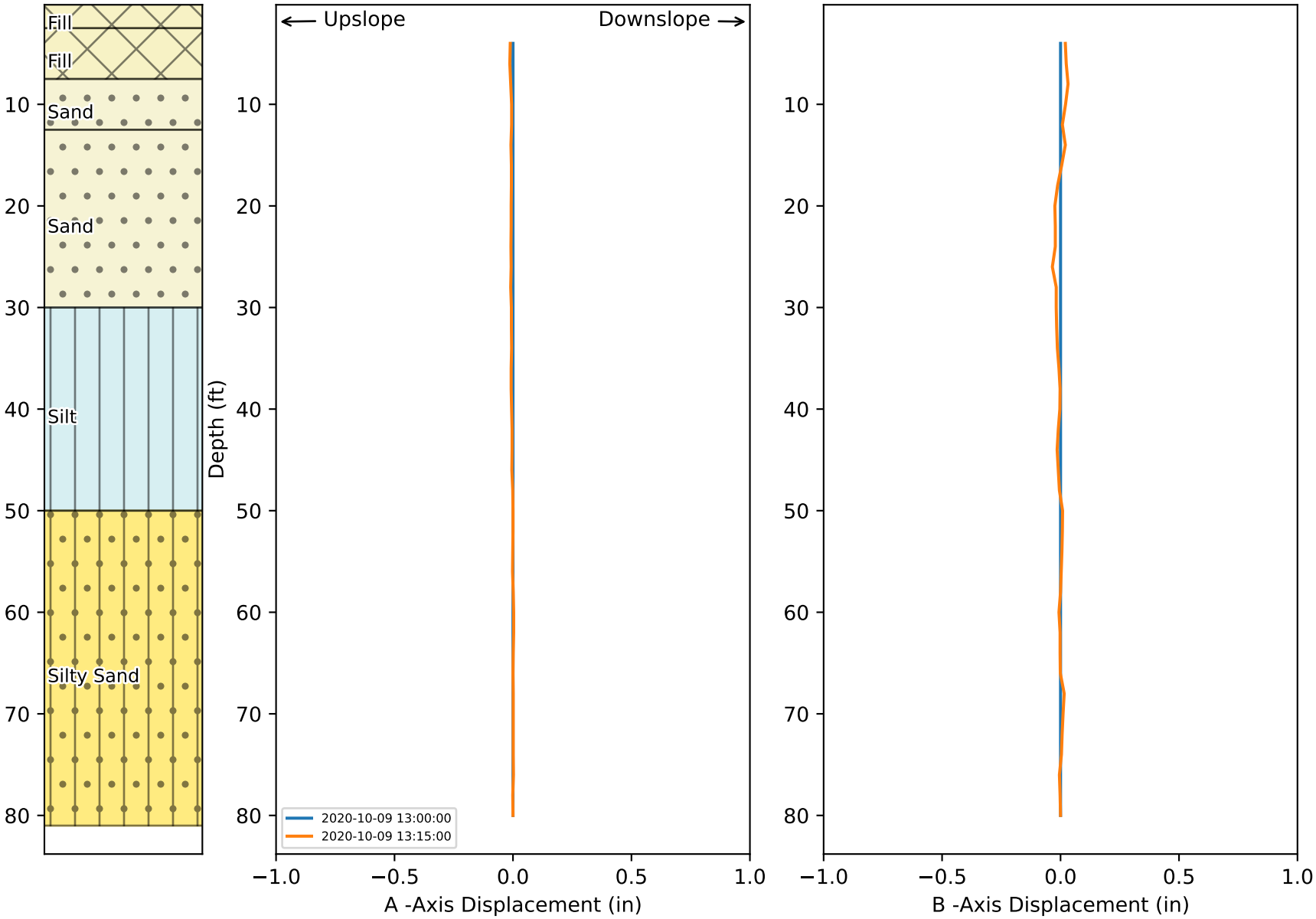
Attachment A **Inclinometer Plots**

Attachment B **Vibrating Wire Piezometer Calibration Document**

Attachment C **Water Depth in Boring SB-6**

Attachment A

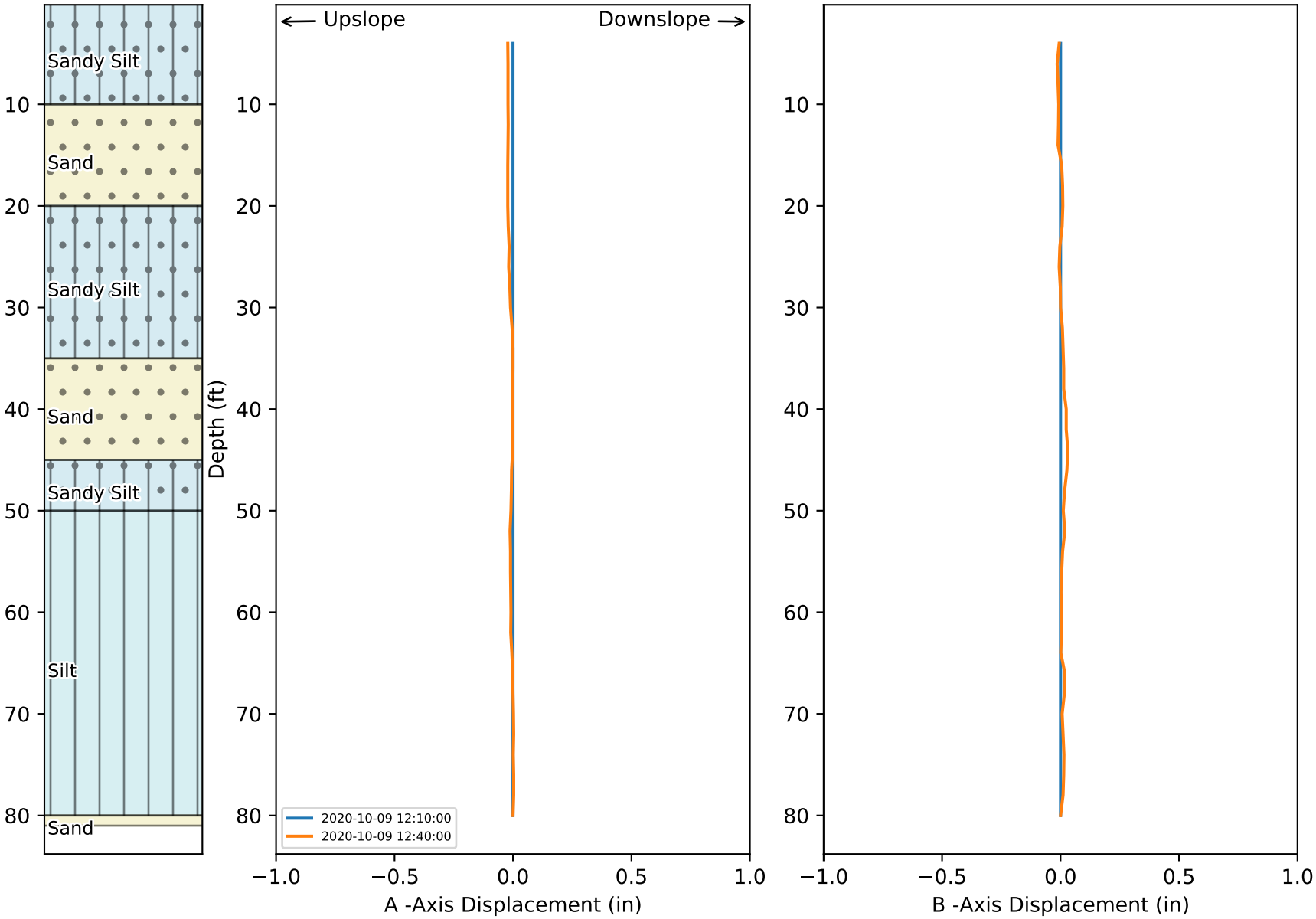
Inclinometer Plots



LMRWD Area 3 Slope Stability
Eden Prairie, Minnesota
SBINC-3 Inclinometer Data

October 2020
Profile-Change Plots

BARR



LMRWD Area 3 Slope Stability
Eden Prairie, Minnesota
SBINC-4 Inclinometer Data

October 2020
Profile-Change Plots

BARR

P:\Mpls\23 MN\10\23101028 LMRWD General Services\WorkFiles\TO7 - MN River Slope Stability\Barr Instrumentation\Inclinometer

Attachment B

Vibrating Wire Piezometer Calibration Document

GEOKON®

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-350 kPa

Date of Calibration: March 13, 2018

This calibration has been verified/validated as of 03/21/2018

Serial Number: 1806594

Temperature: 22.10 °C

Calibration Instruction: CI-Pressure Transducers 7 kPa~3.5 MPa

Barometric Pressure: 983.4 mbar

Cable Length: 25 feet

Technician:

Applied Pressure (kPa)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8892	8893	8893	0.281	0.08	0.081	0.02
70.0	8273	8273	8273	69.88	-0.03	69.86	-0.03
140.0	7651	7650	7651	139.8	-0.06	139.9	-0.03
210.0	7025	7026	7026	210.0	0.02	210.1	0.04
279.9	6402	6403	6403	280.0	0.02	280.0	0.02
350.0	5778	5778	5778	350.2	0.04	350.0	-0.02

(kPa) Linear Gauge Factor (G): -0.1123 (kPa/ digit)

Polynomial Gauge factors: A: -1.219E-07 B: -0.1106 C:

Thermal Factor (K): -0.07960 (kPa/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gauge Factor (G): -0.01629 (psi/ digit)

Polynomial Gauge Factors: A: -1.769E-08 B: -0.01603 C:

Thermal Factor (K): -0.01154 (psi/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)$*

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)$*

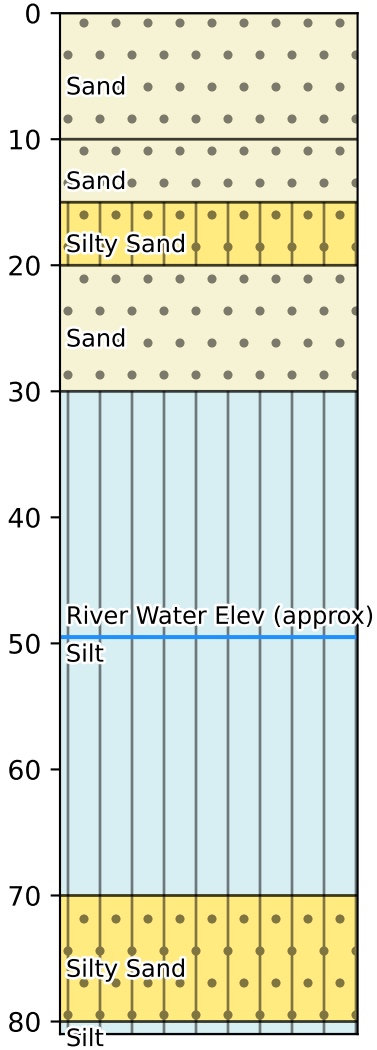
*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

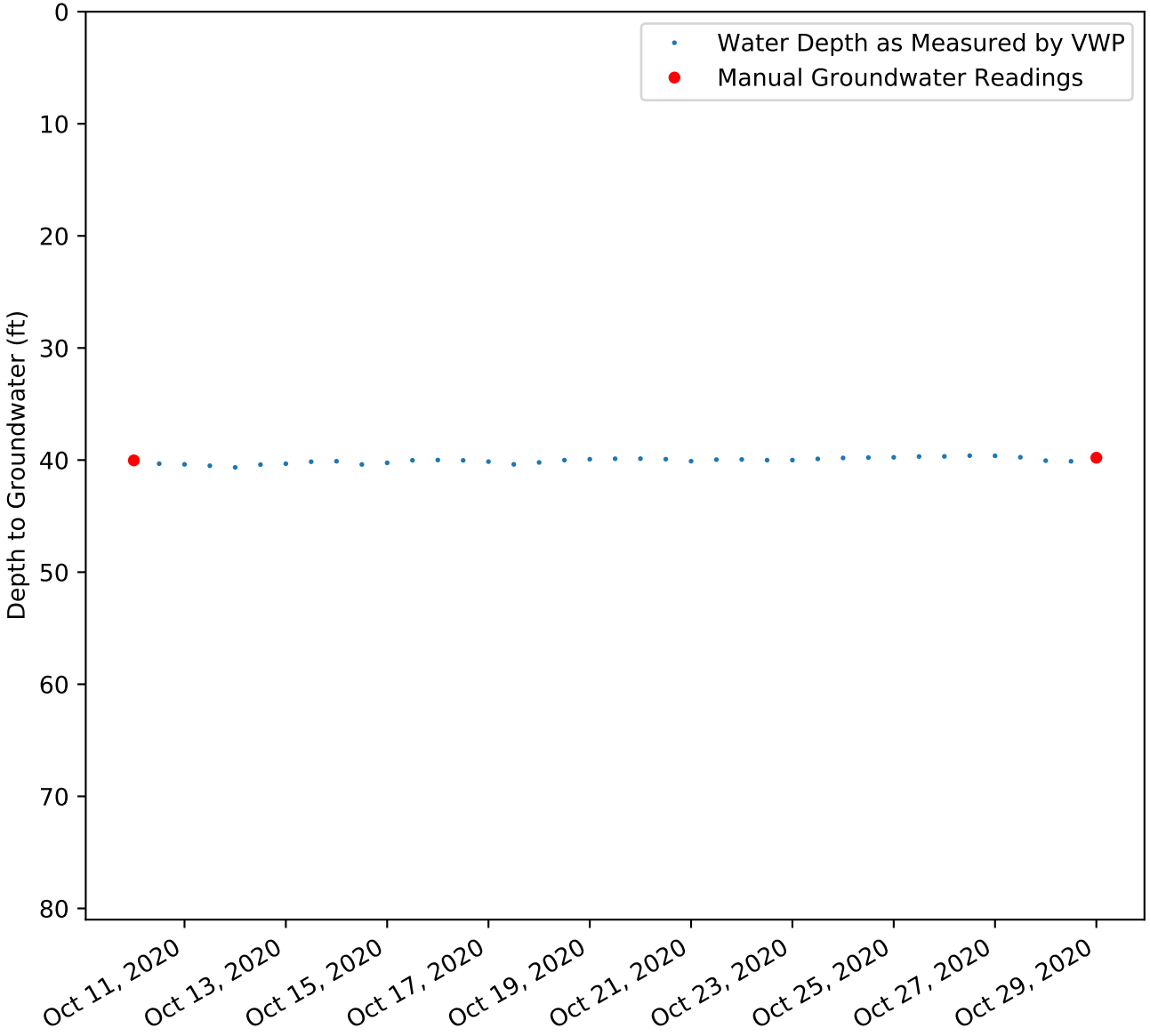
Factory Zero Reading: 8884 Temperature: 22.6 °C Barometer: 990.5 mbar

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

Attachment C

Water Depth in Boring SB-6





Note: Lithology source is Minnesota River Bank and Bluff Stabilization Report; Eden Prairie, Minnesota; February 10, 2010

LMRWD Area 3 Slope Stability
Eden Prairie, Minnesota
SB-6 Well Data

November 2020
Water Depth in Boring SB-6

BARR