



To: John Egan, PE, GE
Ron Hamburger, PE, SE
Phil Lovett
Kristin Gonsar
Kelly McCormick
Andrew Weichert

From: Debra Murphy, PE (CA 77748)
Nathaniel Wagner, PE (CA 88778), PhD
Kelley Shaw, CEG (CA 2760)
Tamar Baumer

Date: May 3, 2023

Project Number: 19-009

Subject: 301 Mission Retrofit Monitoring Report 104: Results as of May 2, 2023

CONTEXT

This memorandum summarizes results from the monitoring plan implemented at the 301 Mission property. Instrumentation to monitor the structure prior to, during and after the retrofit was installed in January 2021, including piezometers and extensometers. Settlement markers installed in April 2009 and January 2017, survey prisms mounted on the exterior of the structure in December 2016, and crack gauges installed in April 2009 have also been monitored. Pile load cells were installed on the Mission Street piles in January 2023. Survey markers were installed on the Mission Street mat extension in January 2023. This memorandum is for review only. It only contains ongoing monitoring information. This memorandum does not contain recommendations based upon the ongoing monitoring information.

PRESENTATION OF DATA

Figure 01 presents the instrument locations as referenced in later figures.

Figure 02 presents the historical settlement data interpreted from settlement markers installed on the B-1 Level of 301 Mission Tower. In addition, data from surveys performed during the retrofit are included. Figure 03A presents settlement data since the start of production pile installation (May 12, 2021; baseline readings on May 10, 2021) through May 1, 2023. Figure 03B presents settlement data since January 11, 2021, through May 1, 2023. Figure 04 presents current settlement contours (in inches) on May 1, 2023.

Figure 05 presents historical lateral roof deflections in the project north-south and project east-west directions interpreted from survey prisms mounted on the exterior of the Tower, from InSAR data, and from a planar fit of the settlement marker data. In addition, data from surveys performed during the retrofit are included. Figure 06A presents lateral roof deflection data from a planar fit of the settlement marker data and from survey prisms mounted on the exterior of the Tower since the start of production pile installation (May 12, 2021; baseline readings on May 10 and 13, 2021, respectively) through May 2, 2023. Figure 06B presents lateral roof deflection data from a planar fit of the settlement marker data and from survey prisms mounted on the exterior of the Tower since January 11, 2021, through May 2, 2023.

Figure 07 presents the historical groundwater elevation interpreted from piezometer readings at locations near 301 Mission. In addition, data from piezometers installed to monitor groundwater elevation during the retrofit are included. Figures 08 and 09 present groundwater elevation interpreted from piezometer readings in the Marine/Colma Sand and the Old Bay Clay, respectively, for the time period prior to the start of production pile installation (January 1, 2021) through May 2, 2023.



Figure 10 presents extensometer data from within the Tower basement since the start of production pile installation (May 12, 2021) through May 1, 2023. Figure 11 presents extensometer data from Fremont Street since the start of production pile installation (May 12, 2021) through May 2, 2023. Figure 12 presents extensometer data from Mission Street since the start of production pile installation (May 12, 2021) through April 29, 2023.

Figure 13 presents pile load cell data since the start of the First Stage Load Transfer (January 23, 2023) through May 2, 2023.

CLOSING

Note that one of the Mission Street piezometers, PB-2, has been offline since October 3, 2022. One of the Fremont Street piezometers, PB-1, has been offline since February 8, 2023; another has been offline since April 3, 2023. The Fremont Street extensometers, EB-1, were damaged on February 8, 2023, but are still operational. Repairs are planned to occur after jet grouting operations are completed. The Mission Street extensometers, EB-2, have been offline since April 29, 2023; work to correct this is ongoing. Please contact us if you have any comments or questions, or if you would like to discuss the results presented in this memorandum.

FIGURES

- Figure 01A – Instrument Location Map: Settlement Markers, Piezometers, Extensometers
- Figure 01B – Tower Survey Prism Location Schematic
- Figure 02 – Historical Settlement Marker Data
- Figure 03A – Settlement Marker Data since 05/10/2021 through 05/01/2023
- Figure 03B – Settlement Marker Data since 01/11/2021 through 05/01/2023
- Figure 04 – Settlement Contours since 05/10/2021 through 05/01/2023
- Figure 05 – Historical Lateral Roof Deflection Data
- Figure 06A – Lateral Roof Deflection Data since 05/10/2021 through 05/02/2023
- Figure 06B – Lateral Roof Deflection Data since 01/11/2021 through 05/02/2023
- Figure 07 – Historical Groundwater Elevation Measurements at Locations Near 301 Mission
- Figure 08A – Groundwater Elevation Measurements in Marine and Colma Sand since 01/01/2021 through 05/02/2023
- Figure 08B – Groundwater Elevation Measurements in Marine and Colma Sand since 05/10/2021 through 05/02/2023
- Figure 09A – Groundwater Elevation Measurements in Old Bay Clay since 01/01/2021 through 05/02/2023
- Figure 09B – Groundwater Elevation Measurements in Old Bay Clay since 01/01/2021 through 05/02/2023
- Figure 10A – Extensometer Data from within Tower Basement since 01/01/2021 through 05/01/2023
- Figure 10B – Extensometer Data from within Tower Basement since 05/10/2021 through 05/01/2023
- Figure 11A – Extensometer Data from Fremont Street since 01/01/2021 through 05/02/2023
- Figure 11B – Extensometer Data from Fremont Street since 05/10/2021 through 05/02/2023
- Figure 12A – Extensometer Data from Mission Street since 01/01/2021 through 04/29/2023
- Figure 12B – Extensometer Data from Mission Street since 05/10/2021 through 04/29/2023
- Figure 13 – Pile Load Cell Data since 01/23/2023 through 05/02/2023

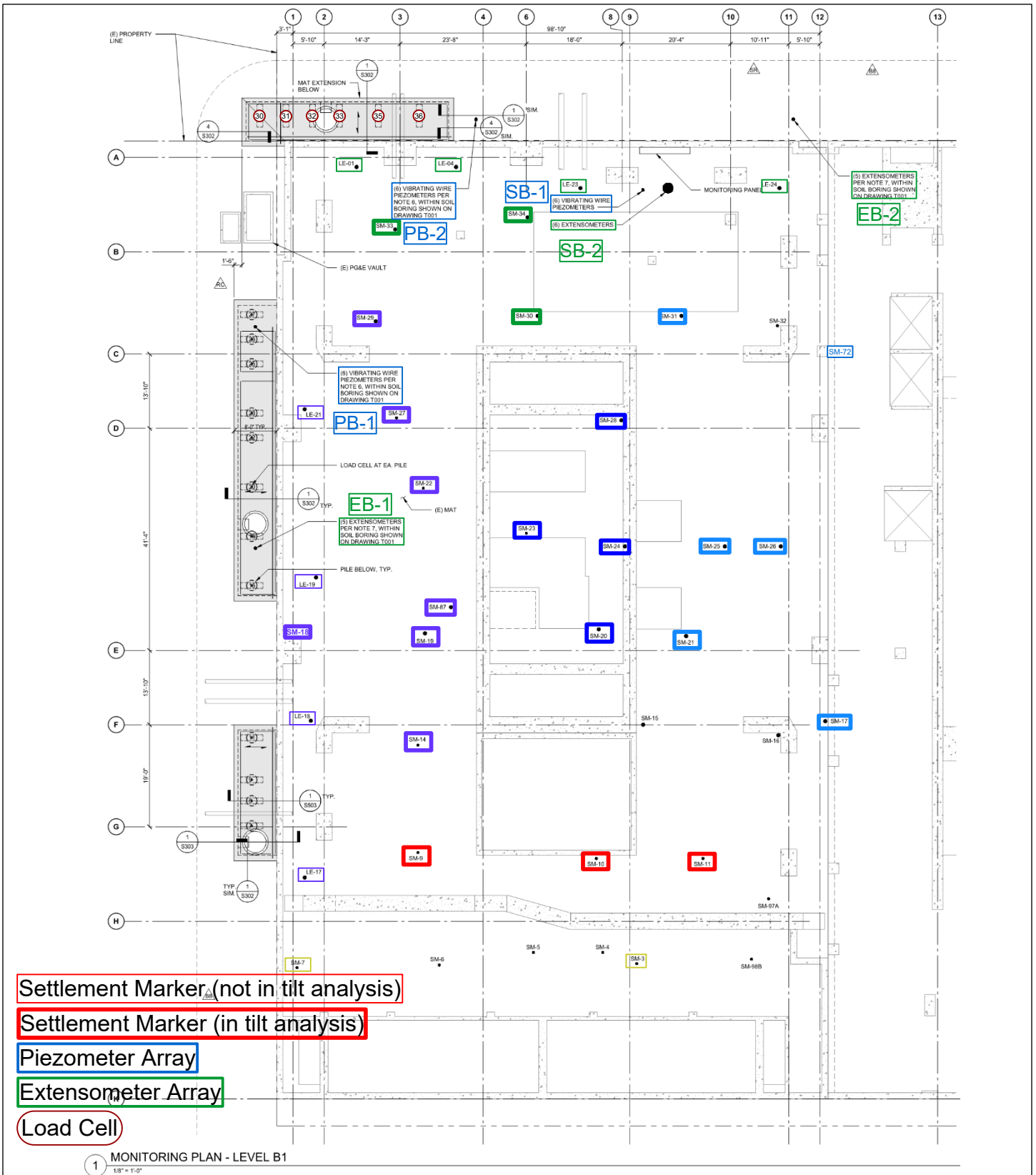
ATTACHMENTS

- Attachment 01 – Crack Gauge Report since 01/06/2021 through 05/02/2023




DATES

2021/05/12: Fremont St. 36" Casing Installation Start
2021/06/22: Fremont St. 36" Casing Installation End
2021/07/07: Mission St. 36" Casing Installation Start
2021/07/09: Fremont St. 24" Casing / Rock Socket Installation Start
2021/08/02: Mission St. 36" Casing Installation on Hold
2021/08/22: Fremont St. 24" Casing / Rock Socket Installation on Hold
2021/10/12-13: 36" Pile Installation / Vibration Test
2021/10/28: Mission St. 36" Casing Installation Restart
2021/11/15-19: 24" Pile Installation / Vibration Test
2021/12/01-05: 24" Pile Installation
2021/12/13-17: 24" Pile Installation
2022/01/10: 24" Pile Installation Restart
2022/02/23: 24" Pile Installation Restart
2022/03/12: 24" Pile Installation Completion
2022/04/26-28: Fremont St. Secant Pile Test Installation
2022/05/03: Fremont St. Shoring Pile Installation Start
2022/05/26: Fremont St. Shoring Pile Installation on Hold
2022/06/13: Mission St. Shoring Pile Installation Start
2022/08/05: Mission St. Shoring Pile Installation End
2022/09/08: Mission St. Jet Grouting Start
2022/10/05: Mission St. Jet Grouting End
2022/10/08: Fremont St. Shoring Pile Installation Resumed
2022/10/17: Mission St. Excavation Start
2022/11/12: Fremont St. Shoring Pile Installation End
2022/11/16: Mission St. Excavation to Mat Extension Depth
2022/12/07: Fremont St. Jet Grouting Start
2023/01/23-27: Mission St. First Stage Load Transfer
2023/02/03: Fremont St. Excavation Start
2023/03/30: Fremont St. Jet Grouting End



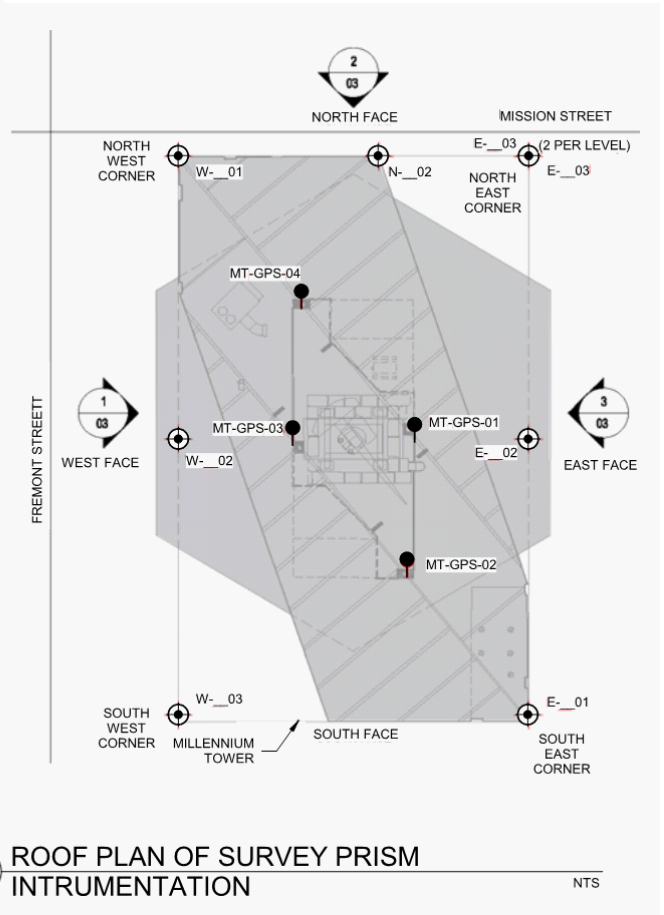
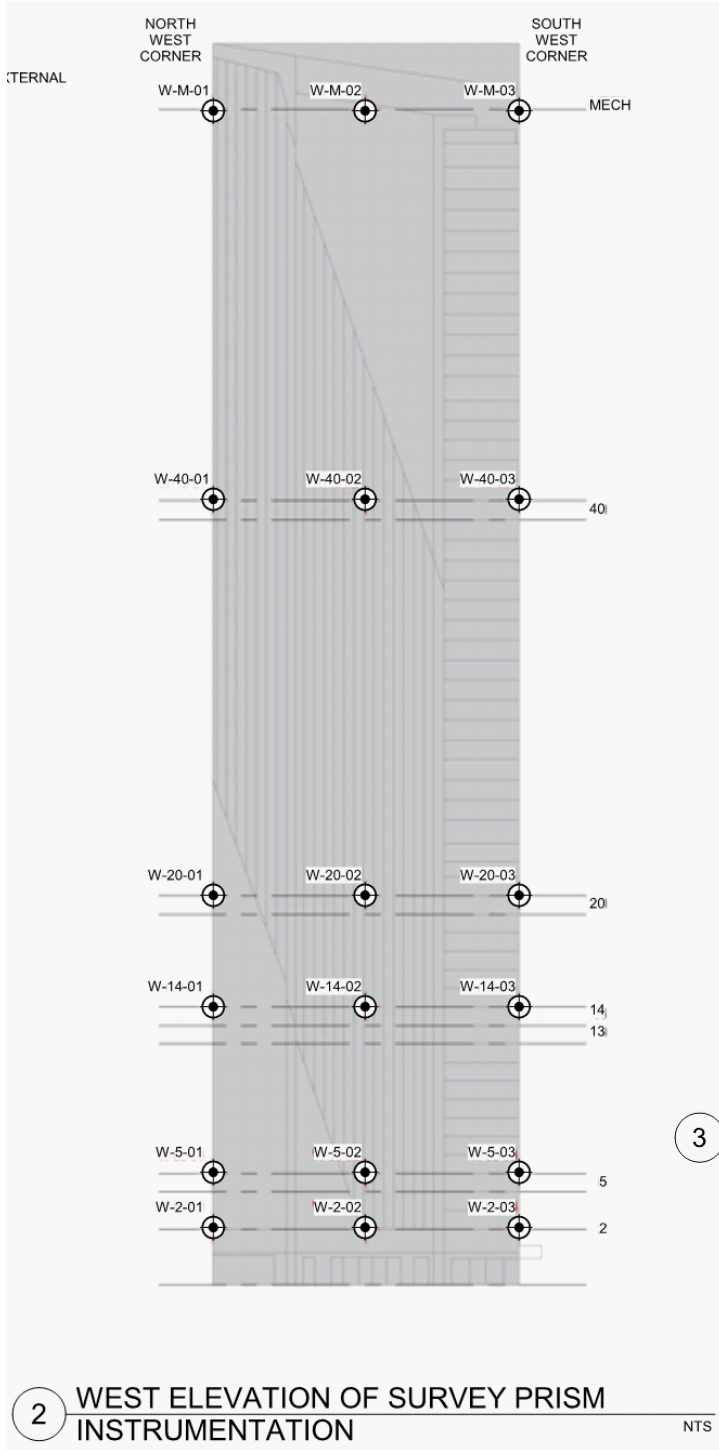
From 301 Mission Perimeter Pile Upgrade Sheet S 207 2022-06-06

| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------|
| Project No: 19-009.00 | Date: 2/1/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-01A |
|-----------------------|----------------|-----------------|-----------------|--------------------|



INSTRUMENT LOCATION MAP
SETTLEMENT MARKERS, PIEZOMETERS, EXTENSOMETERS, LOAD CELLS

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
 City and County of San Francisco, California



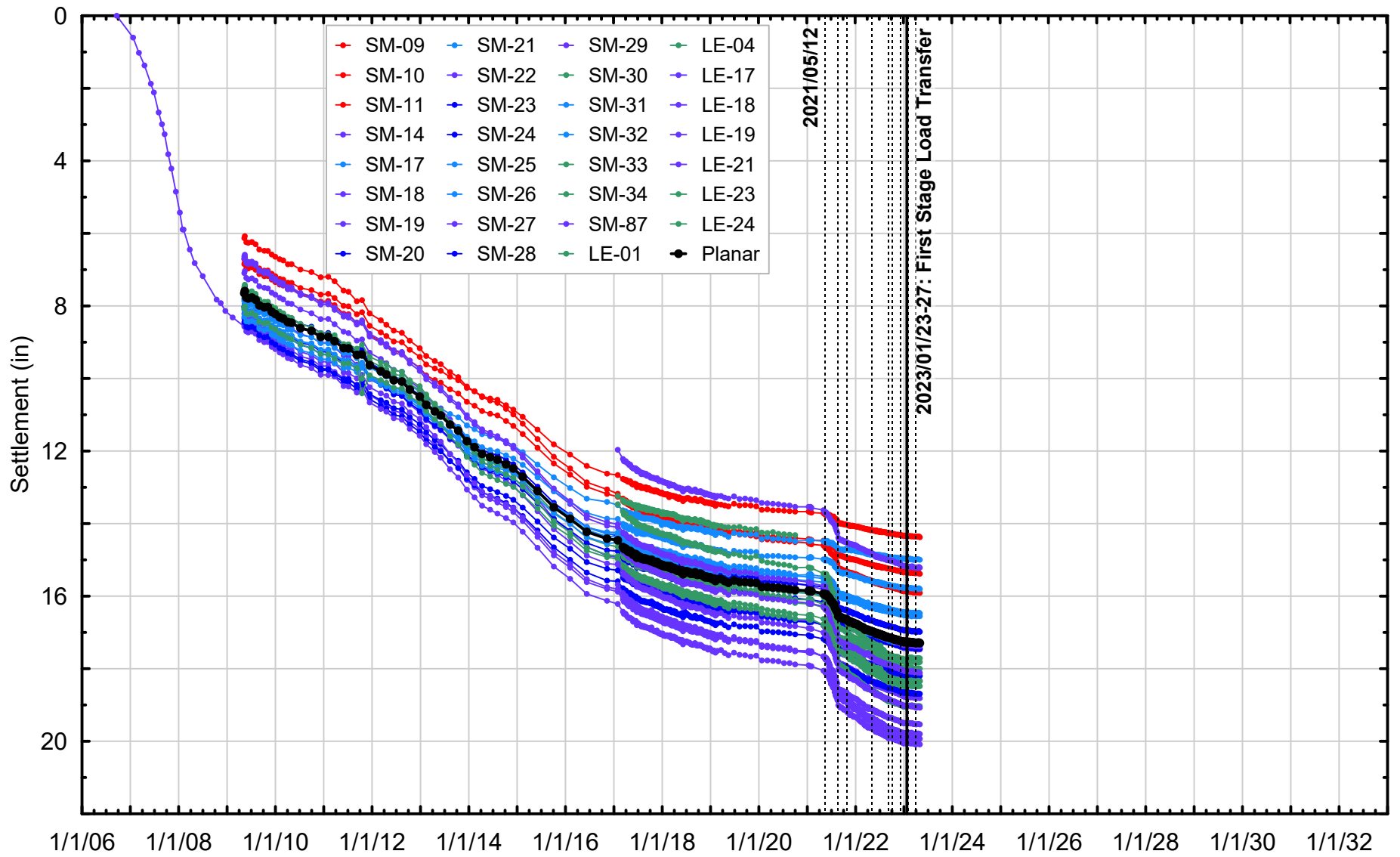
From 301 Mission Perimeter Pile Upgrade Bulletin 8 Set S 207 2021-06-15

| | | | | |
|-----------------------|-----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 7/26/2021 | Created By: NBW | Checked By: DGM | Figure No: 104-01B |
|-----------------------|-----------------|-----------------|-----------------|---------------------------|



TOWER SURVEY PRISM LOCATION SCHEMATIC

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

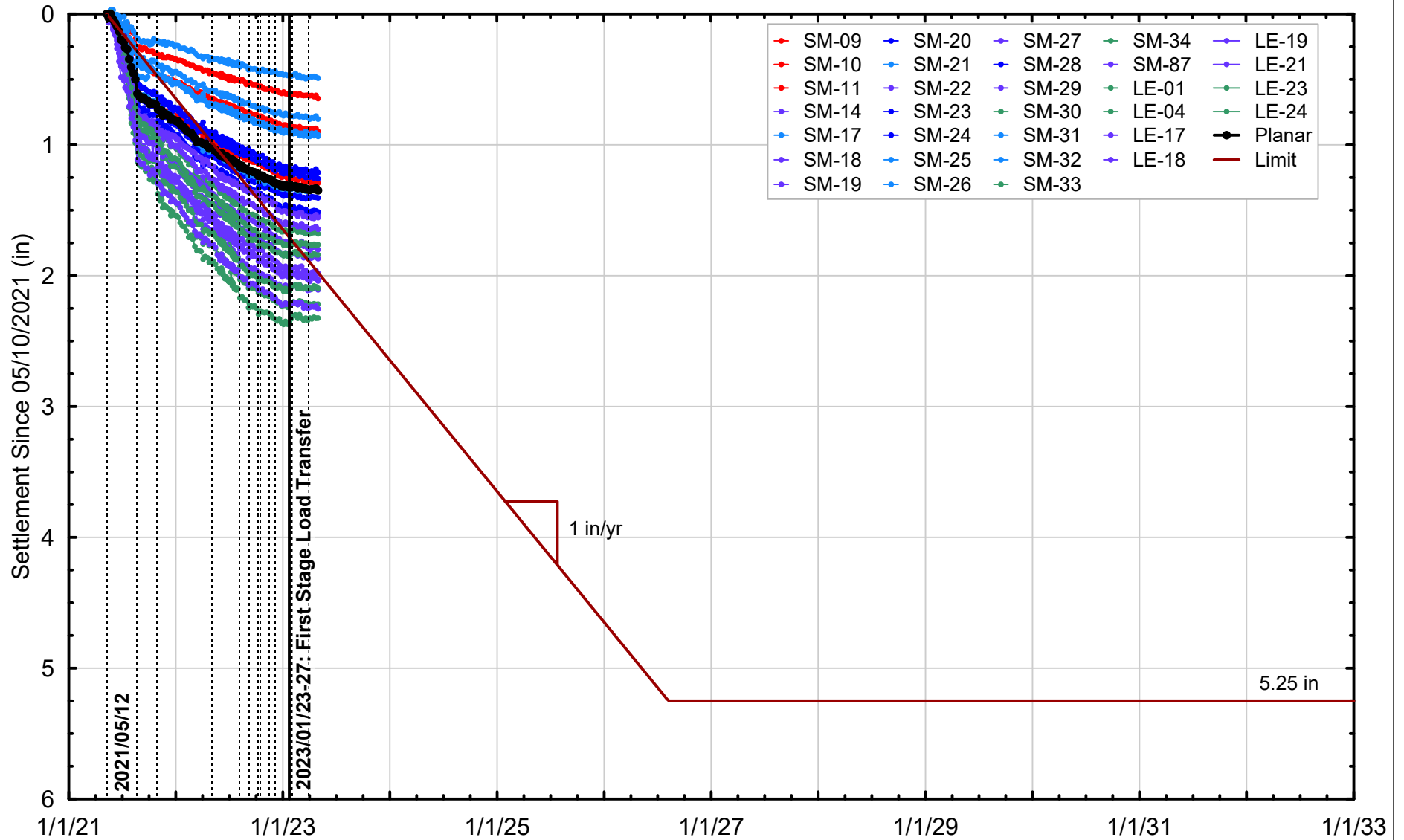


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-02 |
|-----------------------|----------------|-----------------|-----------------|--------------------------|



HISTORICAL SETTLEMENT MARKER DATA

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

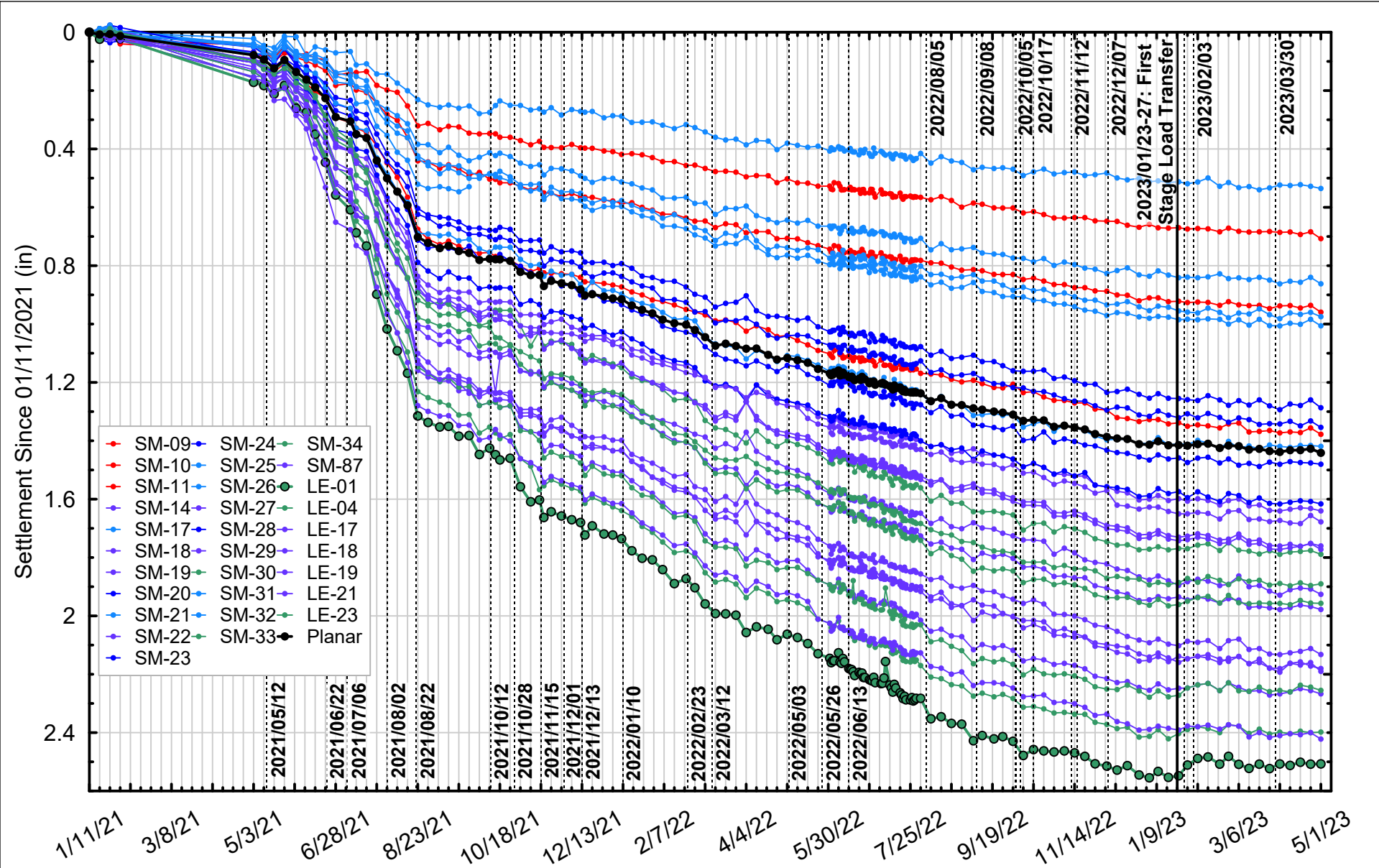


| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-03A |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



SETTLEMENT MARKER DATA
SINCE 05/10/2021 THROUGH 05/01/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

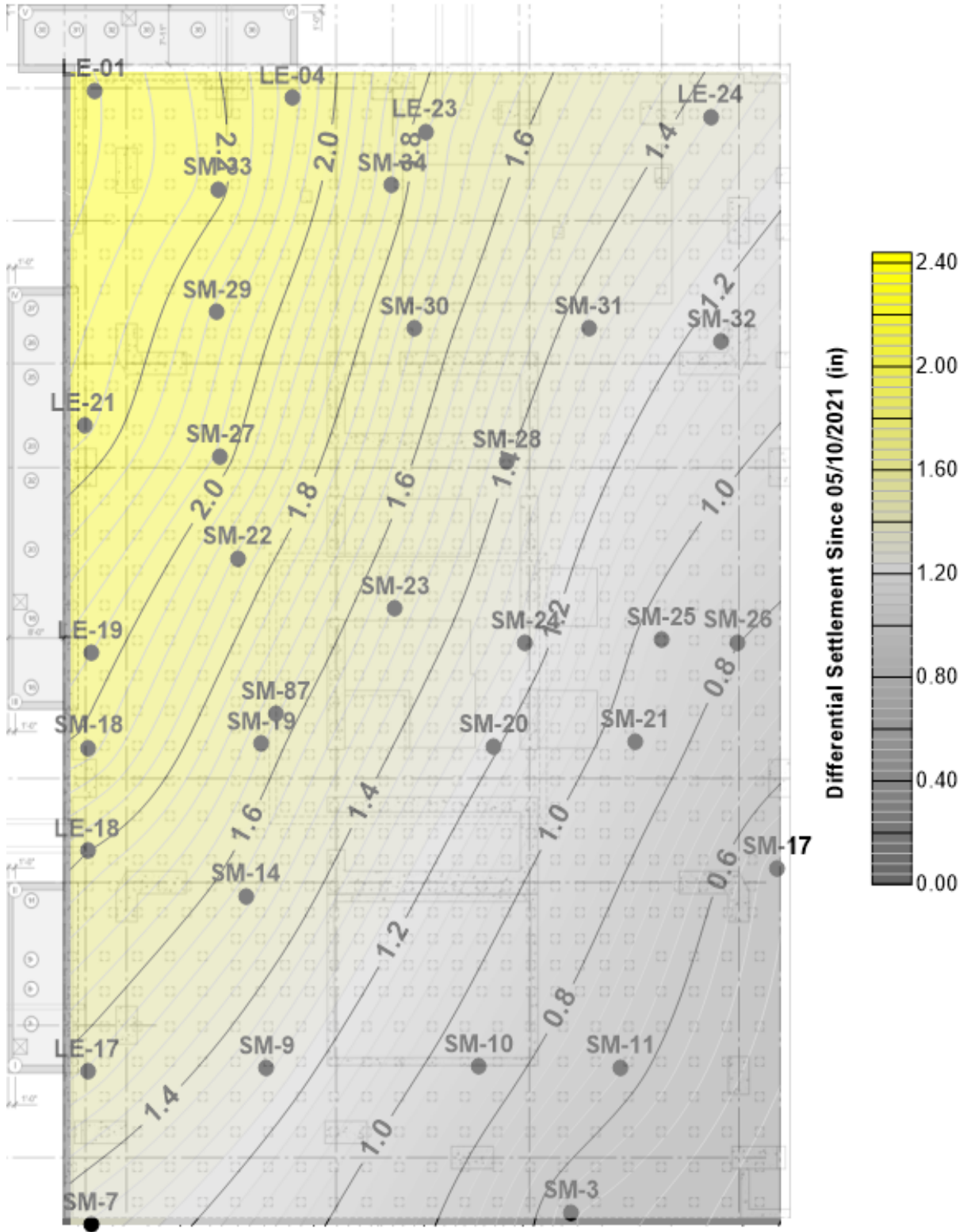


| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-03B |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



SETTLEMENT MARKER DATA
SINCE 01/11/2021 THROUGH 05/01/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



Project No: 19-009.00

Date: 5/3/2023

Created By: NBW

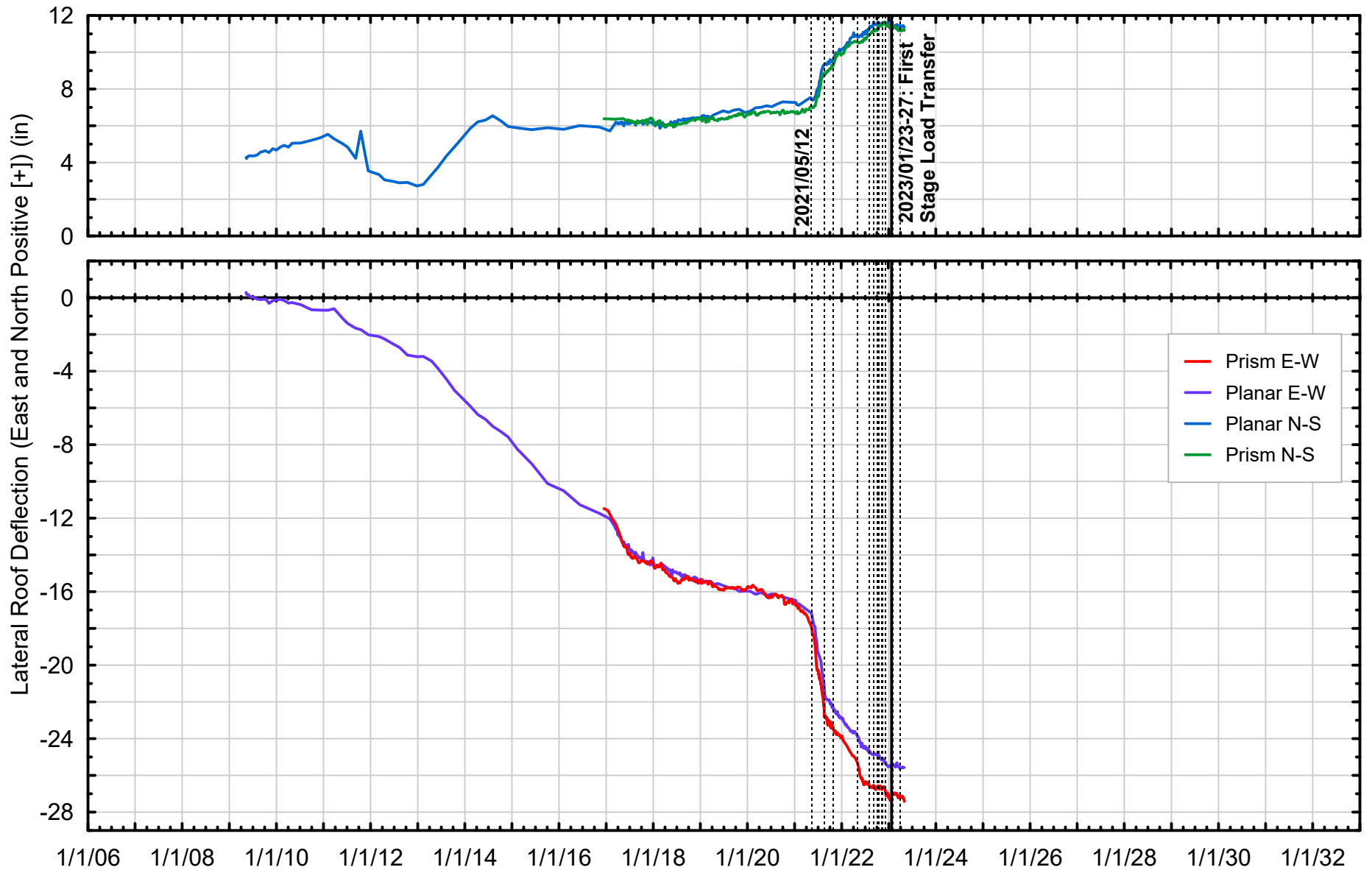
Checked By: DGM

Figure No: **104-04**



SETTLEMENT CONTOURS
SINCE 05/10/2021 THROUGH 05/01/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

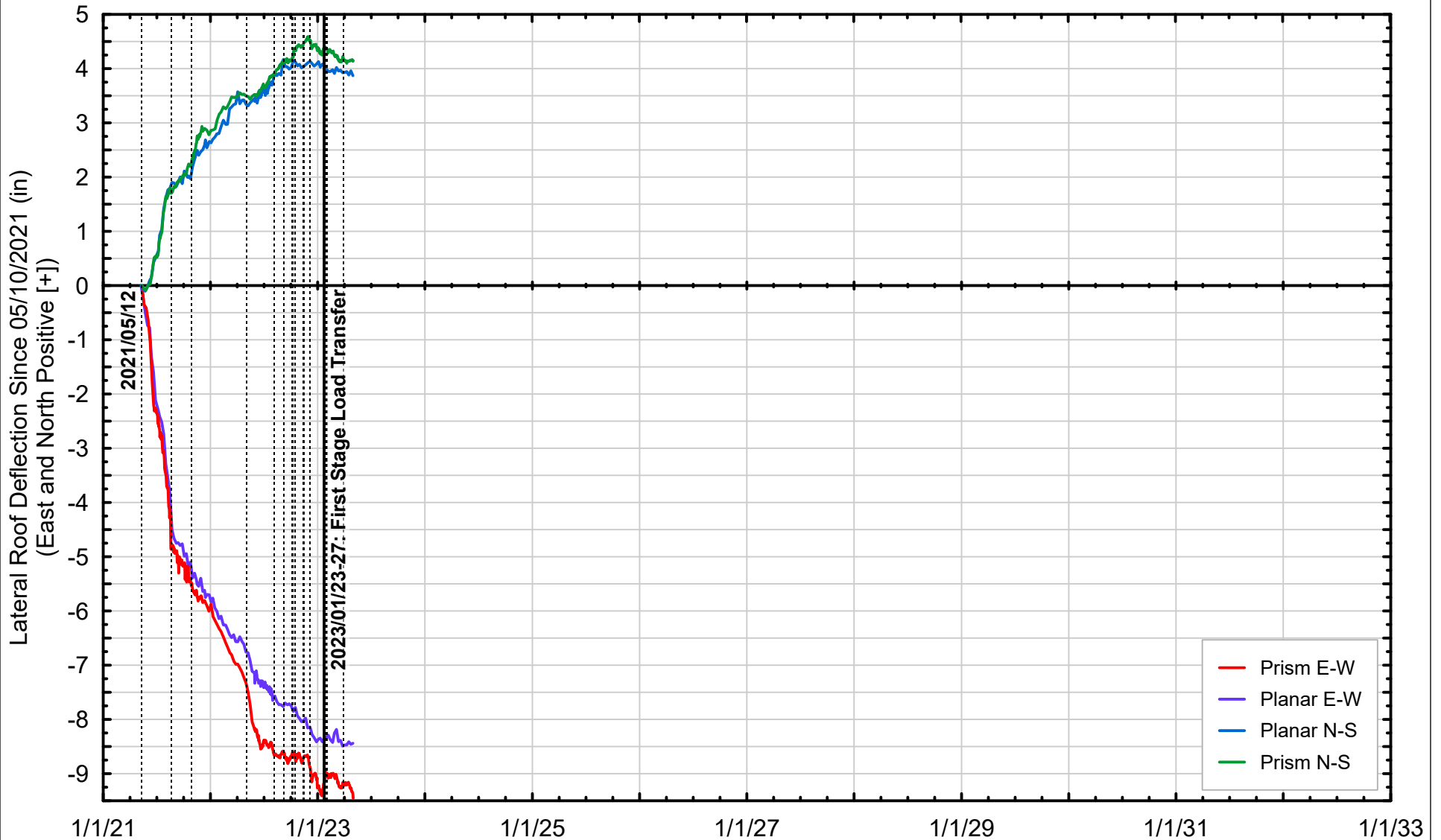


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-05 |
|-----------------------|----------------|-----------------|-----------------|--------------------------|



HISTORICAL LATERAL ROOF DEFLECTION DATA

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

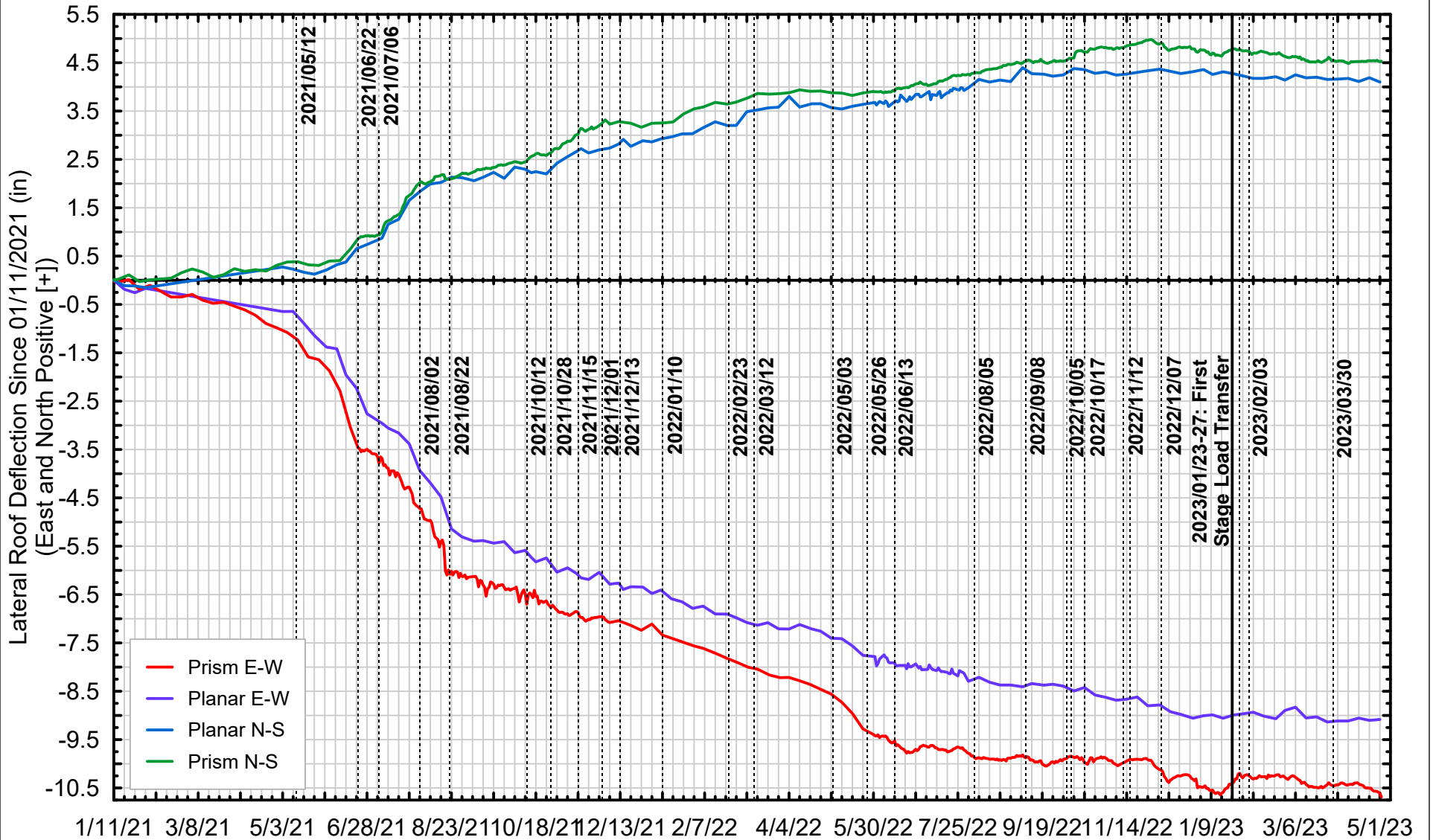


| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-06A |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



LATERAL ROOF DEFLECTION DATA
SINCE 05/10/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

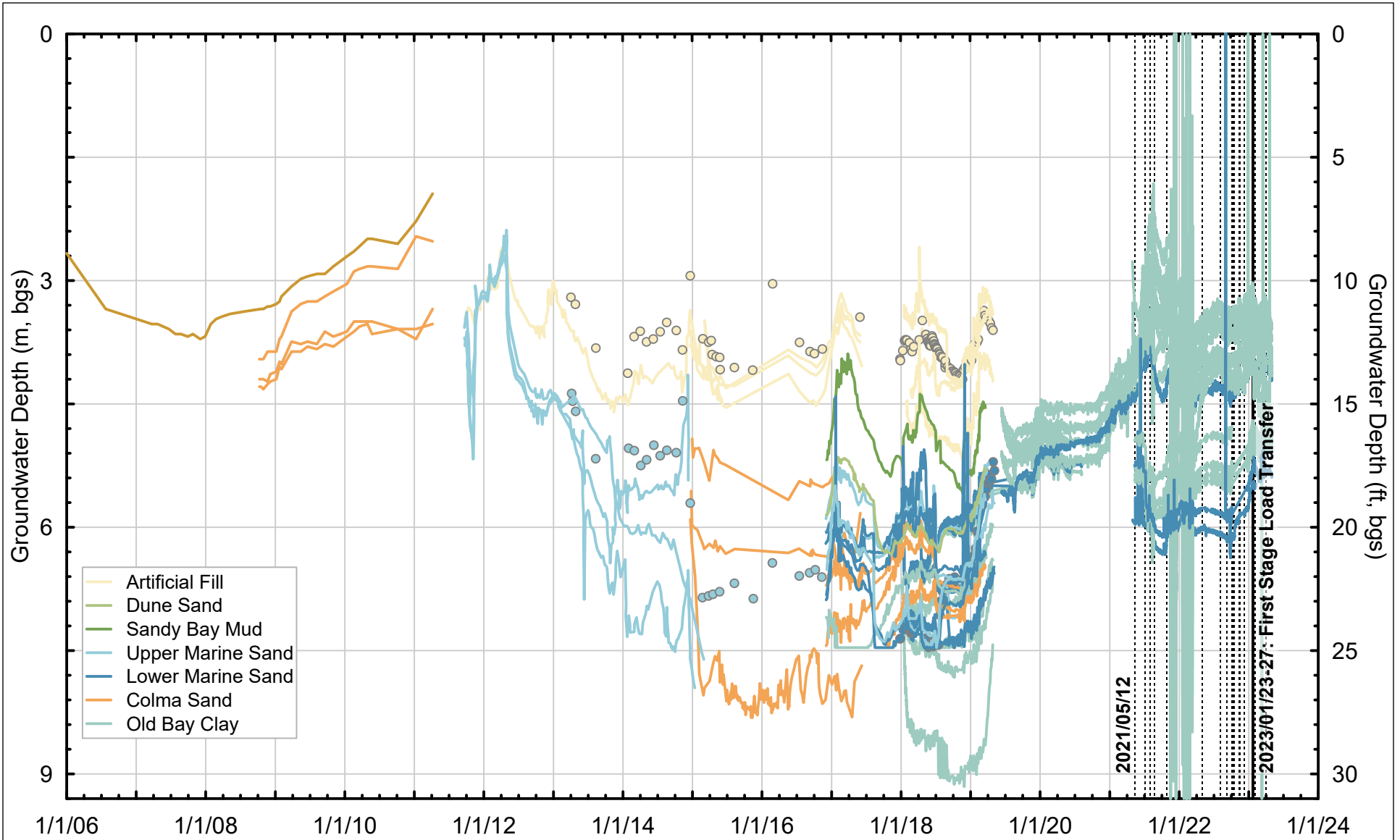


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-06B |
|-----------------------|----------------|-----------------|-----------------|--------------------|



LATERAL ROOF DEFLECTION DATA
SINCE 01/11/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

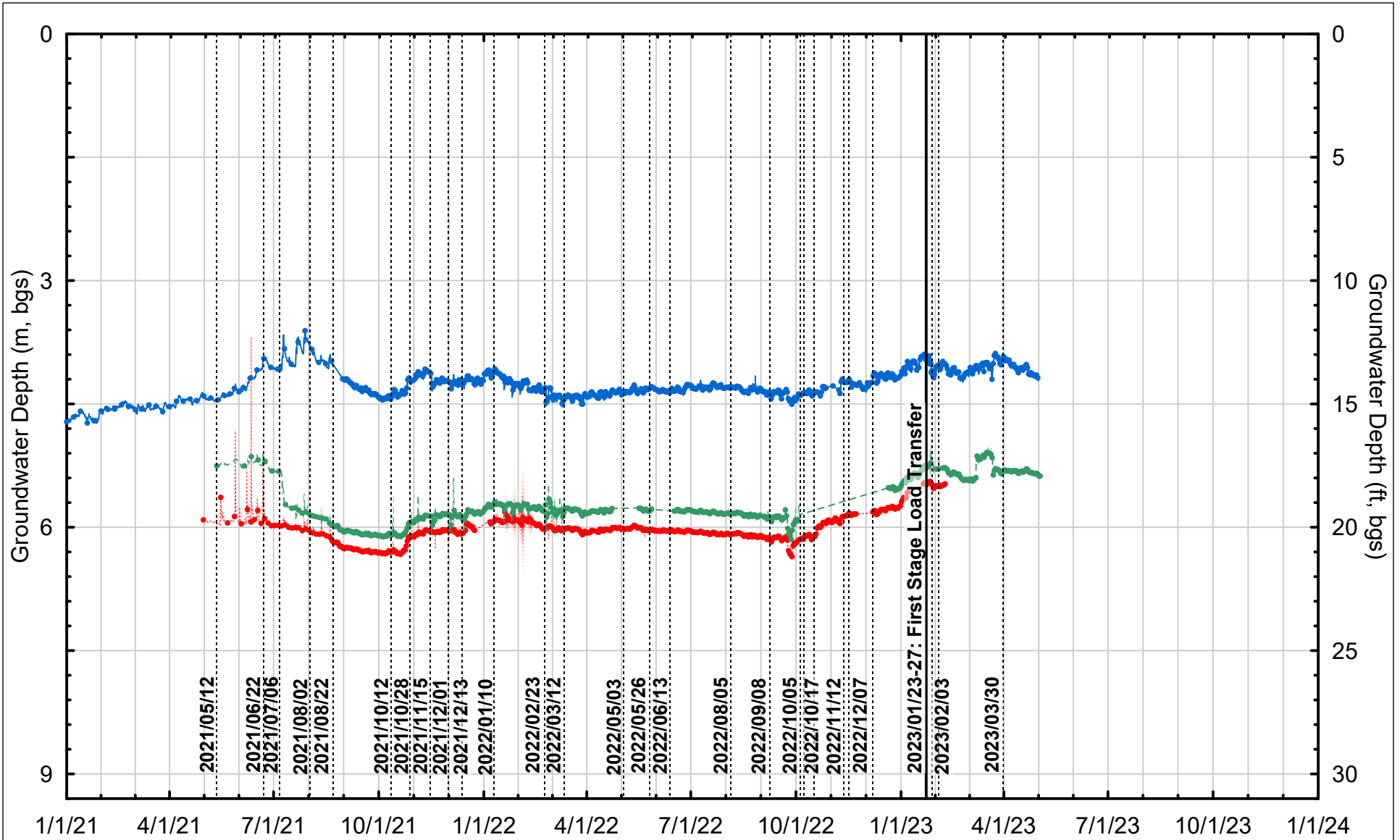


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-07 |
|-----------------------|----------------|-----------------|-----------------|--------------------------|



HISTORICAL GROUNDWATER ELEVATION MEASUREMENTS
AT LOCATIONS NEAR 301 MISSION

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



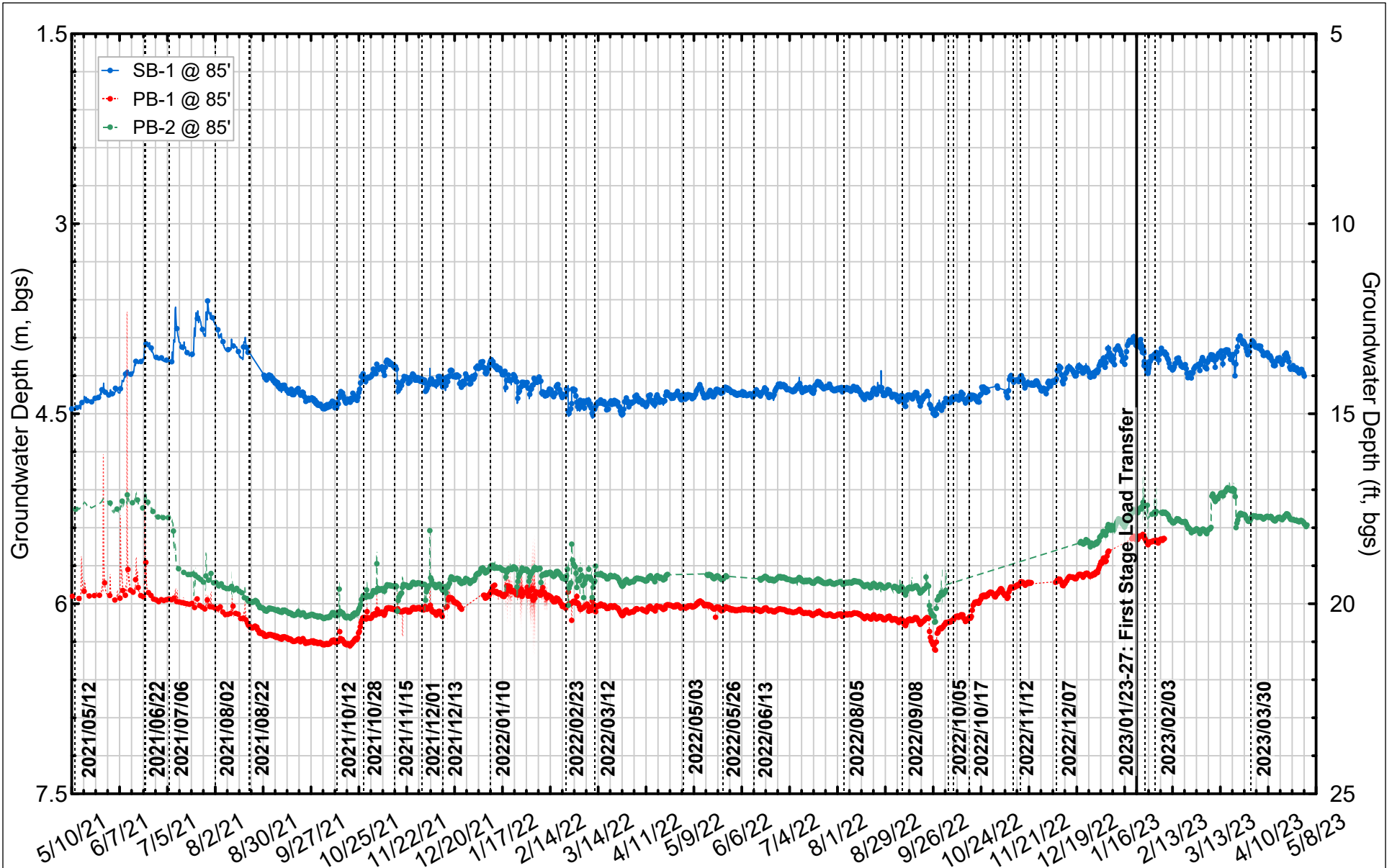
- SB-1 @ 85'
- PB-1 @ 85'
- PB-2 @ 85'

| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-08A |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



GROUNDWATER ELEVATION MEASUREMENTS IN MARINE AND COLMA SAND
SINCE 01/01/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



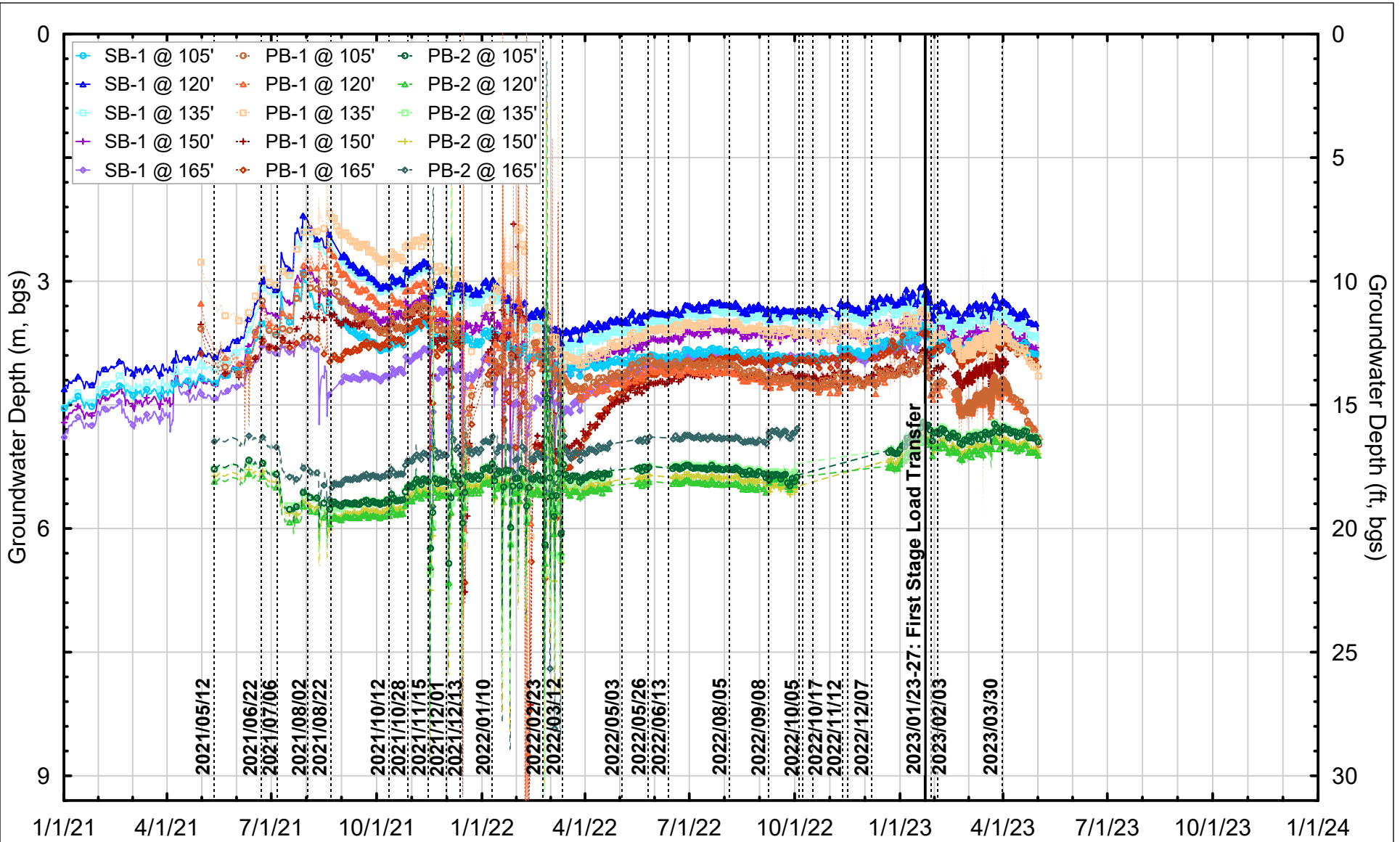
5/10/21 6/7/21 7/5/21 8/2/21 8/30/21 9/27/21 10/25/21 11/22/21 12/20/21 1/17/22 2/14/22 3/14/22 4/11/22 5/9/22 6/6/22 7/4/22 8/1/22 8/29/22 9/26/22 10/24/22 11/21/22 12/19/22 1/16/23 2/13/23 3/13/23 4/10/23 5/8/23

Project No: 19-009.00 Date: 5/3/2023 Created By: NBW Checked By: DGM Figure No: **104-08B**



GROUNDWATER ELEVATION MEASUREMENTS IN MARINE AND COLMA SAND
SINCE 05/10/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

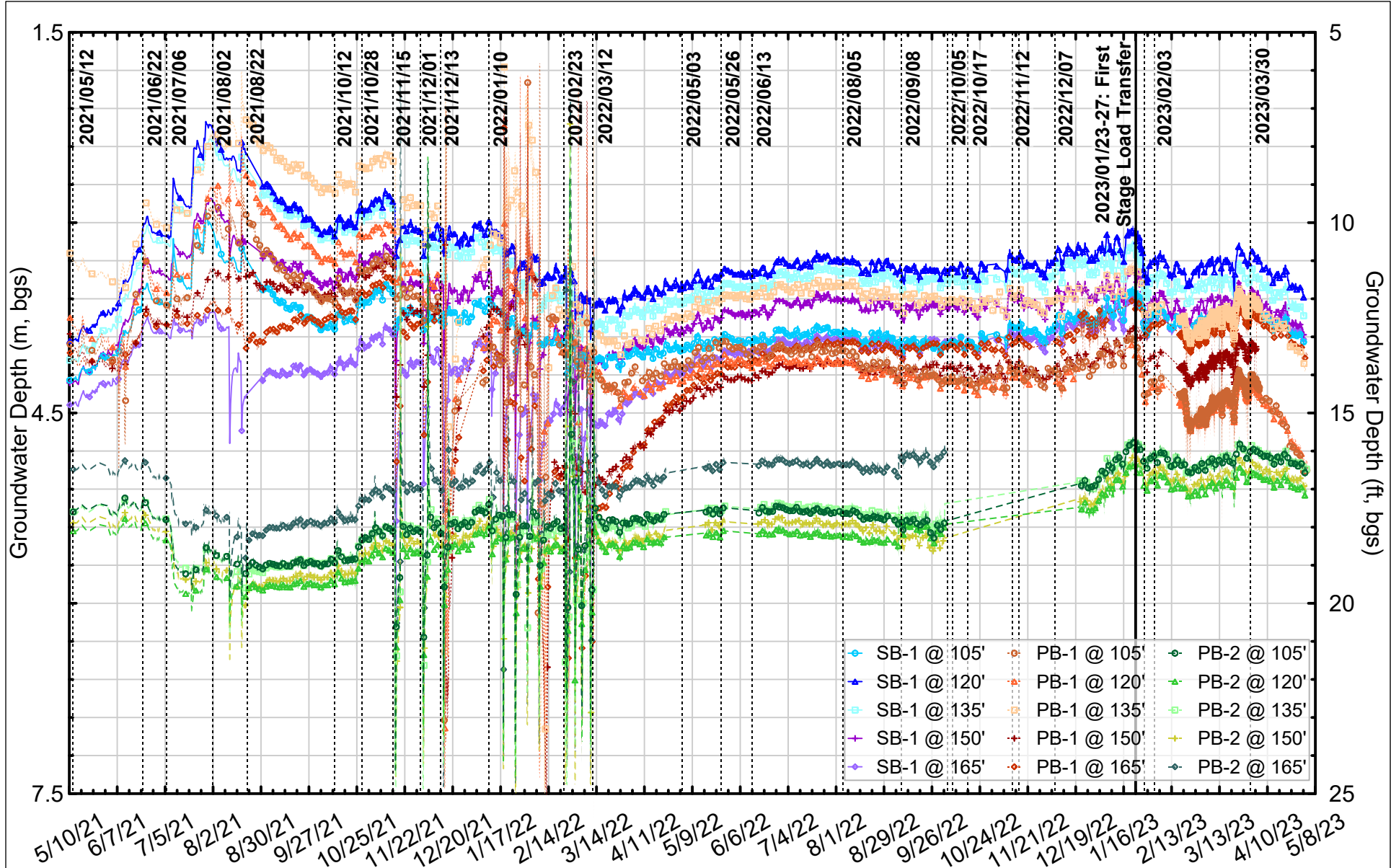


| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-09A |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



GROUNDWATER ELEVATION MEASUREMENTS IN OLD BAY CLAY
SINCE 01/01/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



- SB-1 @ 105'
- SB-1 @ 120'
- SB-1 @ 135'
- SB-1 @ 150'
- SB-1 @ 165'
- PB-1 @ 105'
- PB-1 @ 120'
- PB-1 @ 135'
- PB-1 @ 150'
- PB-1 @ 165'
- PB-2 @ 105'
- PB-2 @ 120'
- PB-2 @ 135'
- PB-2 @ 150'
- PB-2 @ 165'

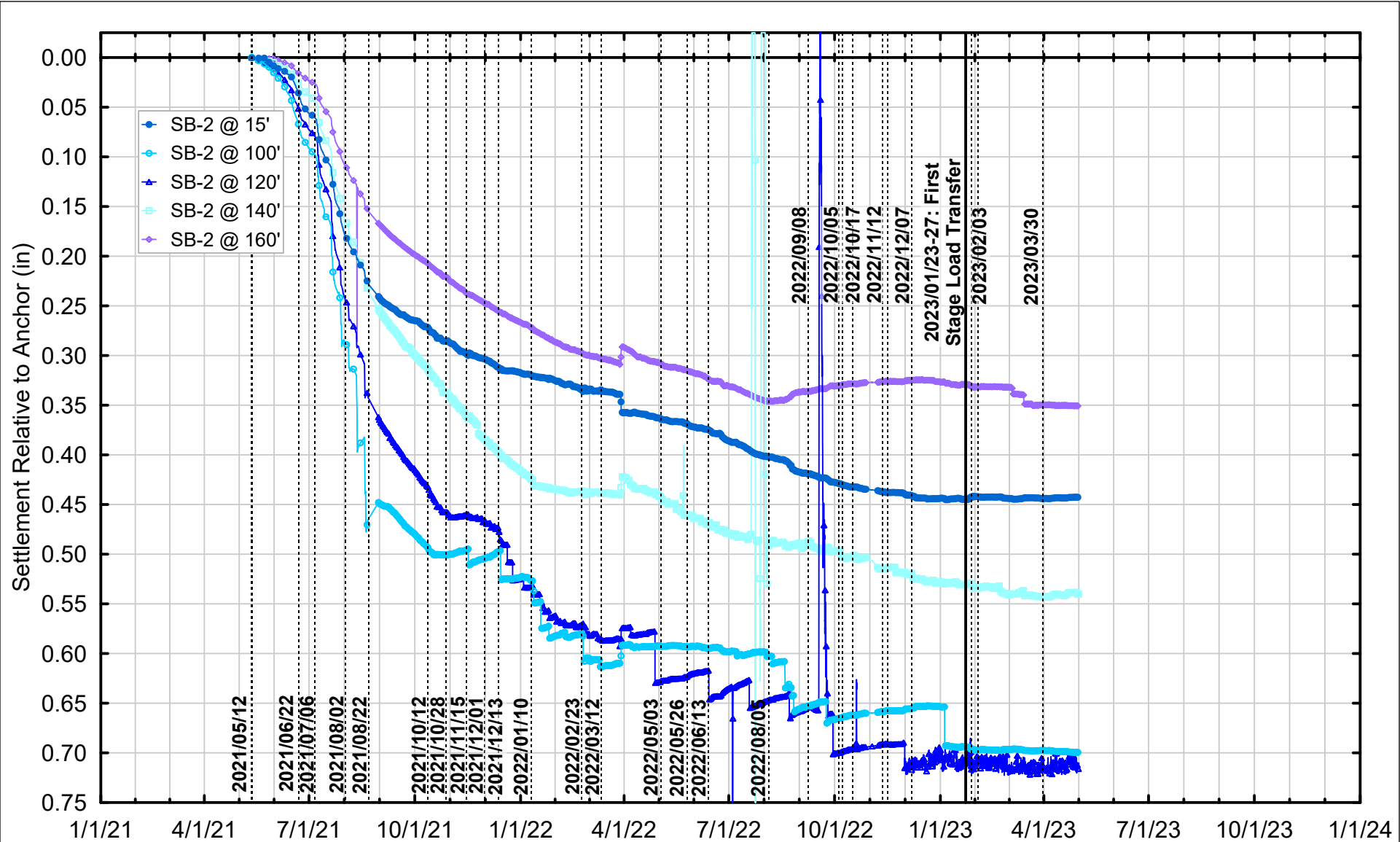
5/10/21 6/7/21 7/5/21 8/2/21 8/30/21 9/27/21 10/25/21 11/22/21 12/20/21 1/17/22 2/14/22 3/14/22 4/11/22 5/9/22 6/6/22 7/4/22 8/1/22 8/29/22 9/26/22 10/24/22 11/21/22 12/19/22 1/16/23 2/13/23 3/13/23 4/10/23 5/8/23


Project No: 19-009.00 Date: 5/3/2023 Created By: NBW Checked By: DGM Figure No: **104-09B**

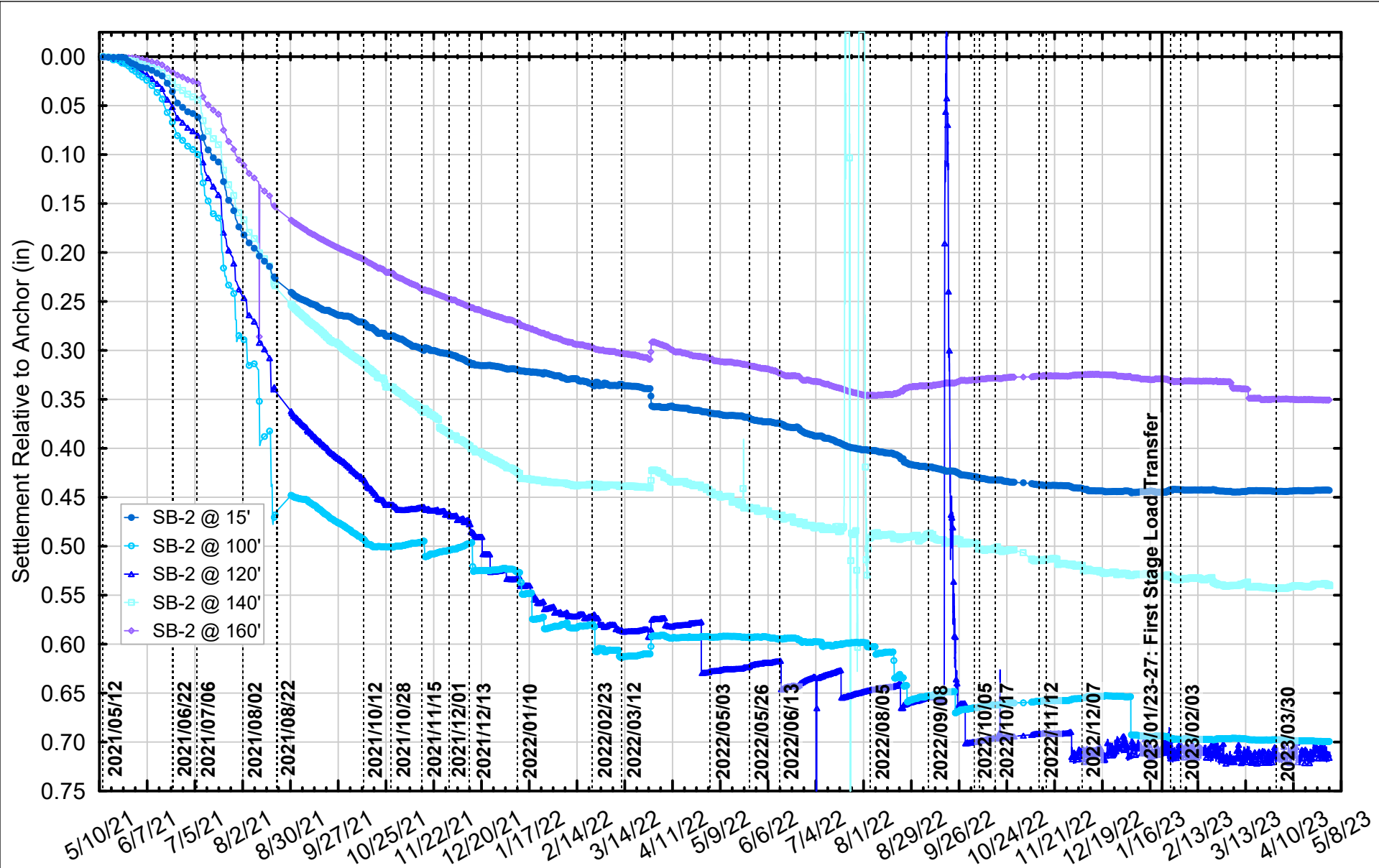


GROUNDWATER ELEVATION MEASUREMENTS IN OLD BAY CLAY
SINCE 05/10/2021 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



| | | | | |
|---|----------------|---|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-10A |
|  | | EXTENSOMETER DATA FROM WITHIN TOWER BASEMENT SINCE 01/01/2021 THROUGH 05/01/2023 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data City and County of San Francisco, California | | |



Project No: 19-009.00

Date: 5/3/2023

Created By: NBW

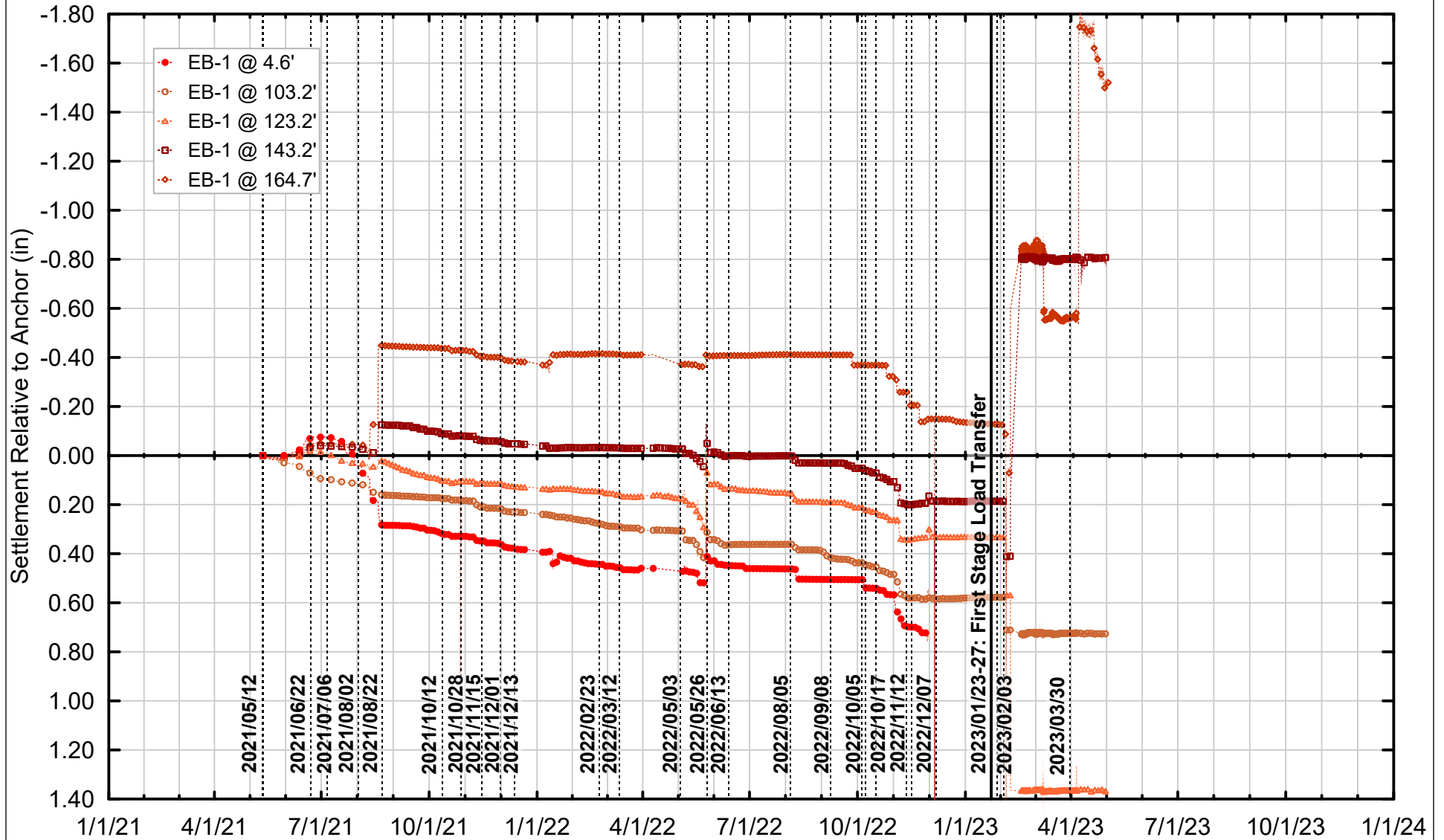
Checked By: DGM

Figure No: 104-10B



EXTENSOMETER DATA FROM WITHIN TOWER BASEMENT
SINCE 05/10/2021 THROUGH 05/01/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

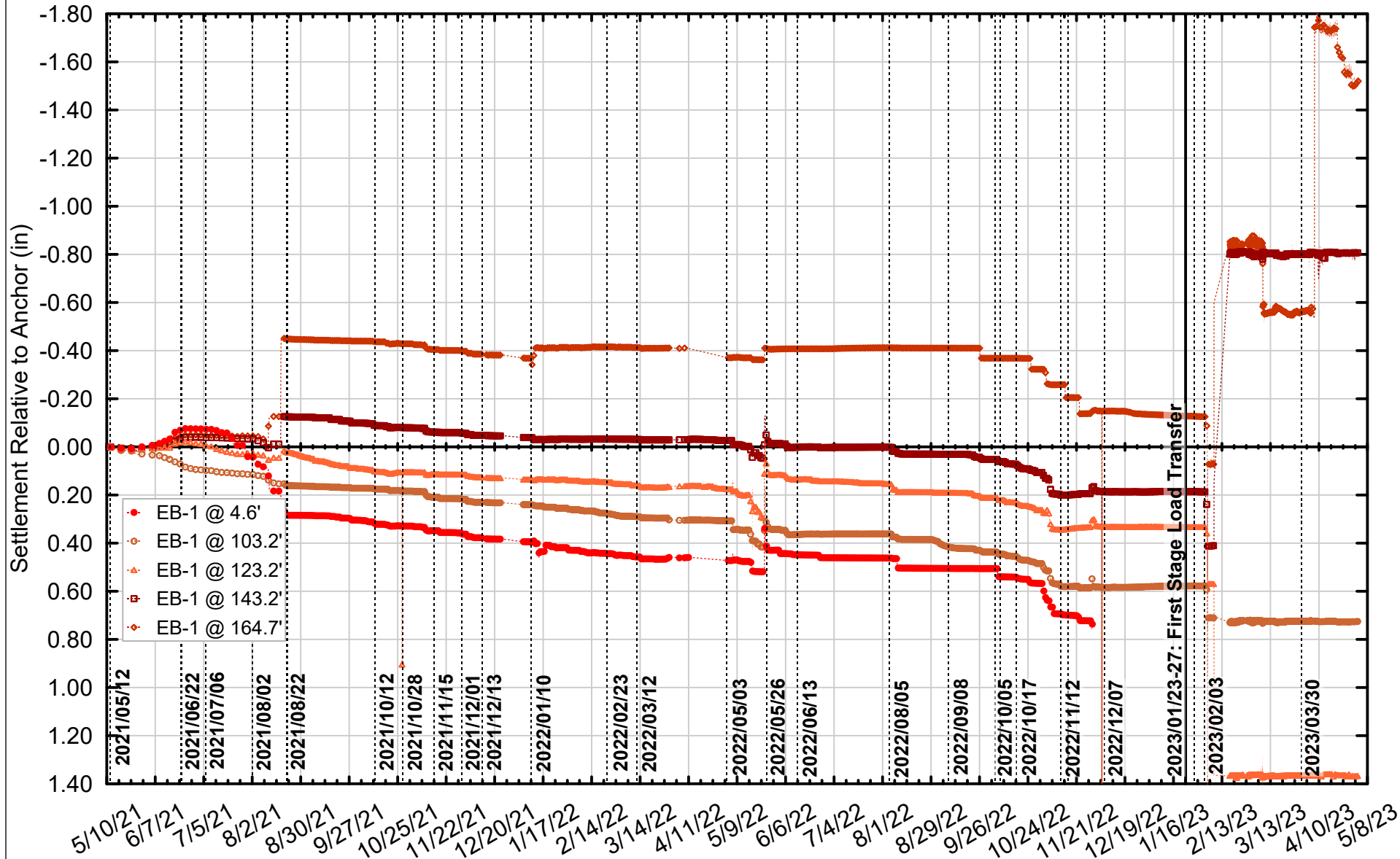


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-11A |
|-----------------------|----------------|-----------------|-----------------|--------------------|



EXTENSOMETER DATA FROM FREMONT STREET
SINCE 01/01/2021 THROUGH 05/02/2023

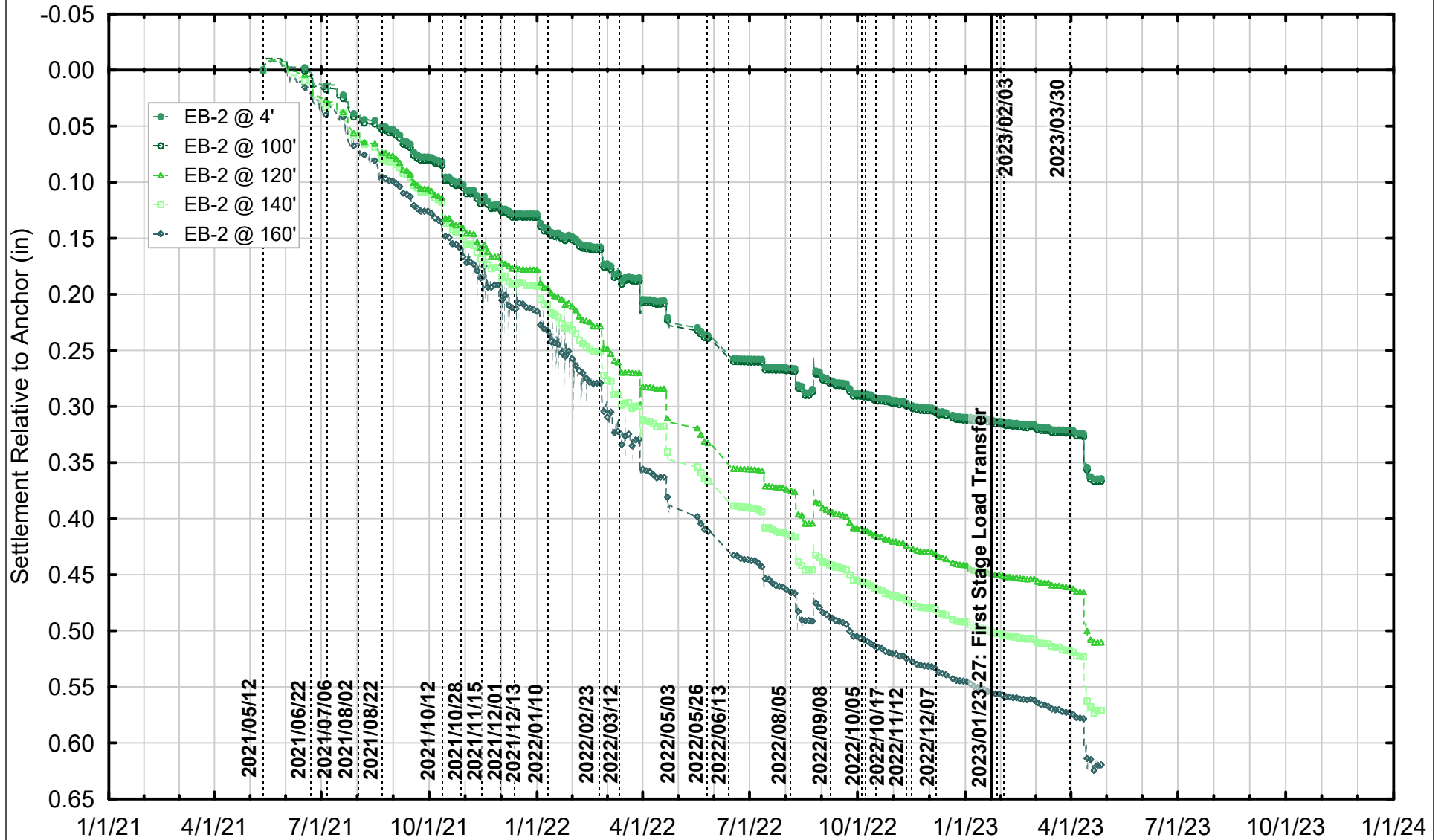
Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-11B



EXTENSOMETER DATA FROM FREMONT STREET
 SINCE 05/10/2021 THROUGH 05/02/2023
 Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
 City and County of San Francisco, California

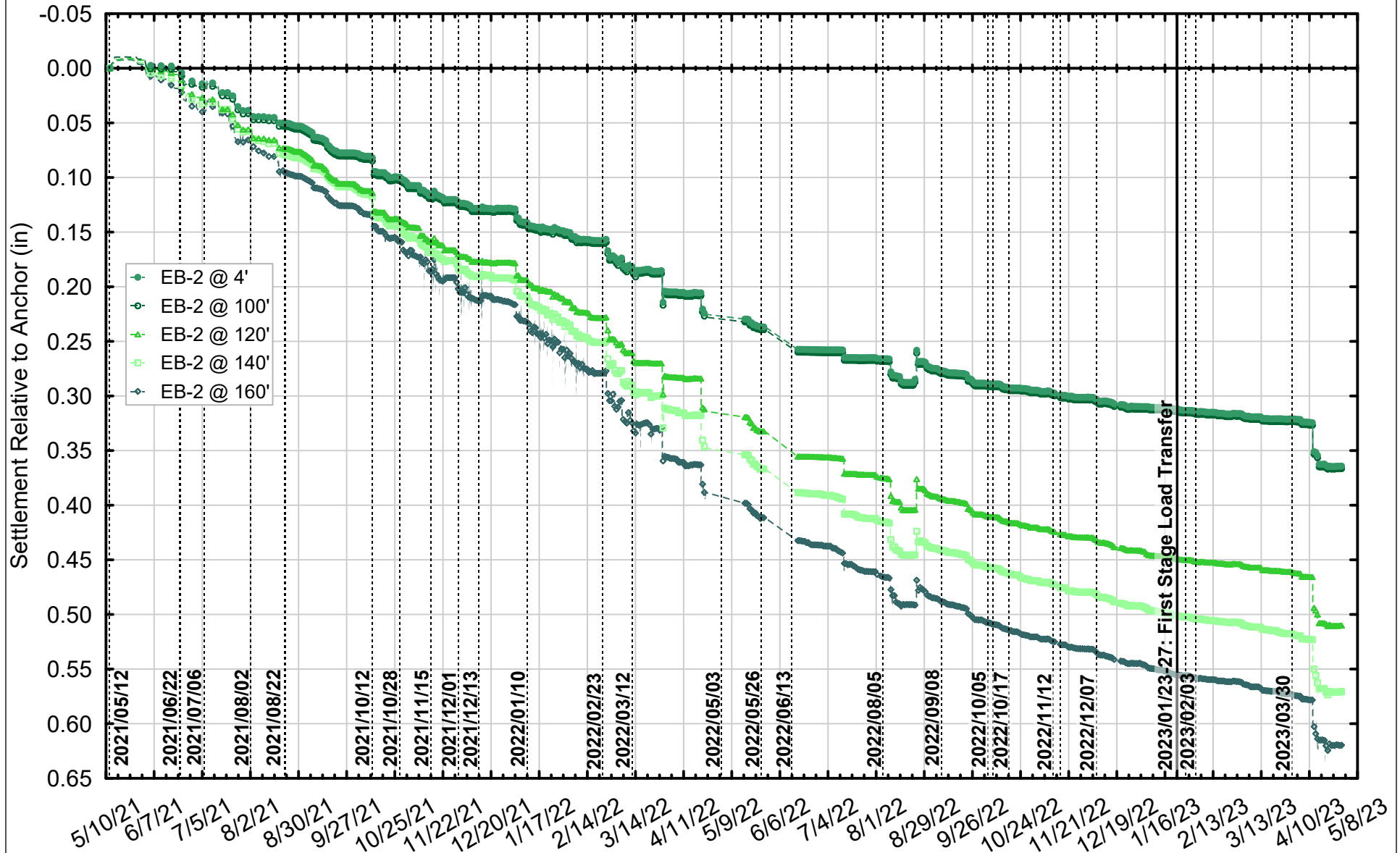


| | | | | |
|-----------------------|----------------|-----------------|-----------------|---------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-12A |
|-----------------------|----------------|-----------------|-----------------|---------------------------|



EXTENSOMETER DATA FROM MISSION STREET
SINCE 01/01/2021 THROUGH 04/29/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California

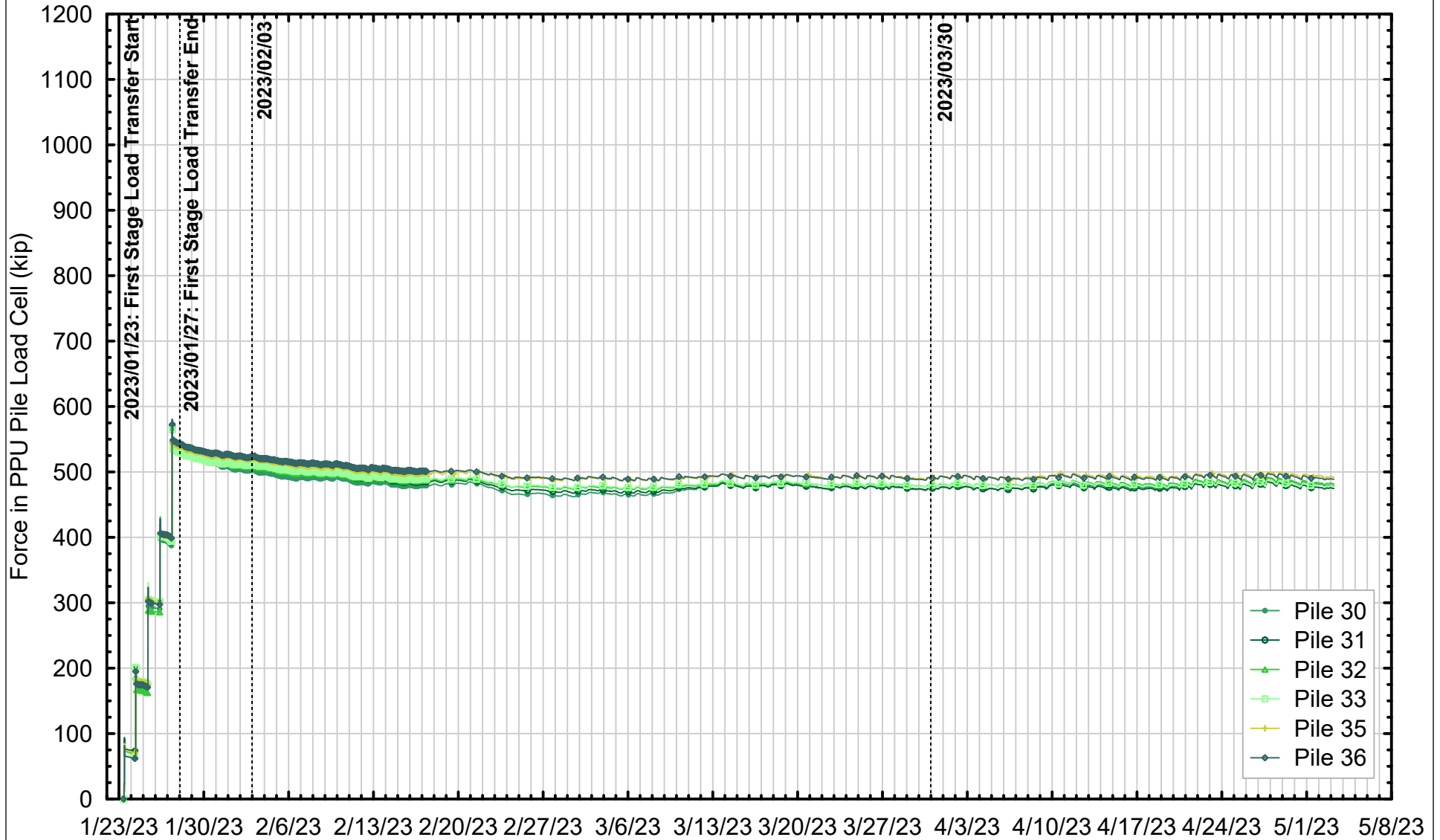


| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-12B |
|-----------------------|----------------|-----------------|-----------------|--------------------|



EXTENSOMETER DATA FROM MISSION STREET
SINCE 05/10/2021 THROUGH 04/29/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California



| | | | | |
|-----------------------|----------------|-----------------|-----------------|--------------------------|
| Project No: 19-009.00 | Date: 5/3/2023 | Created By: NBW | Checked By: DGM | Figure No: 104-13 |
|-----------------------|----------------|-----------------|-----------------|--------------------------|



PILE LOAD CELL DATA
SINCE 01/23/2023 THROUGH 05/02/2023

Millennium Tower Perimeter Pile Upgrade: Instrumentation Monitoring Data
City and County of San Francisco, California