

Field Investigation of Downdrag on Concrete Piles in Sandy Soil

BDV25 TWO977-67



GRIP 2021

Malaak Araujo, E.I. and Gray Mullins, Ph.D., P.E.

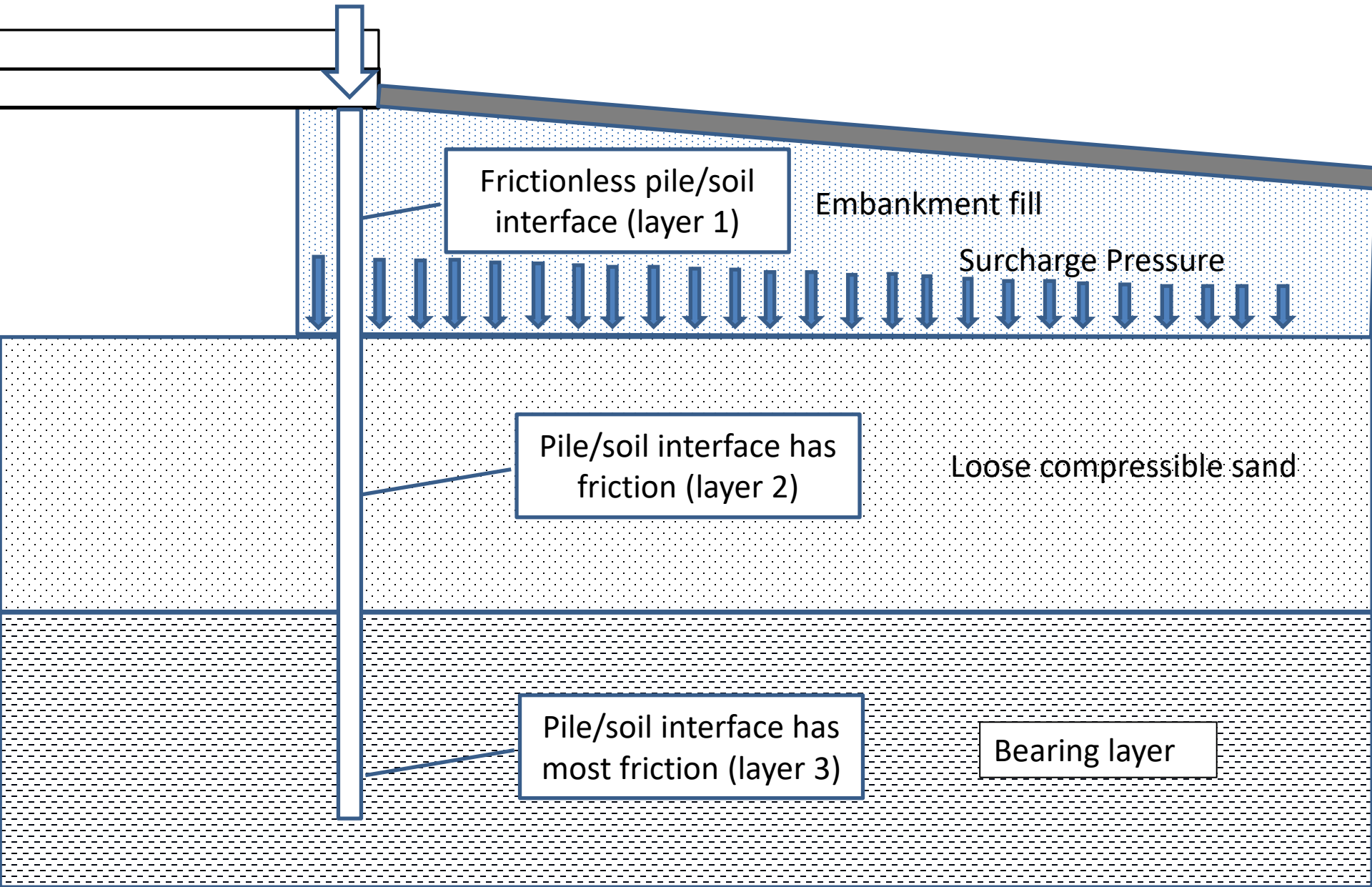


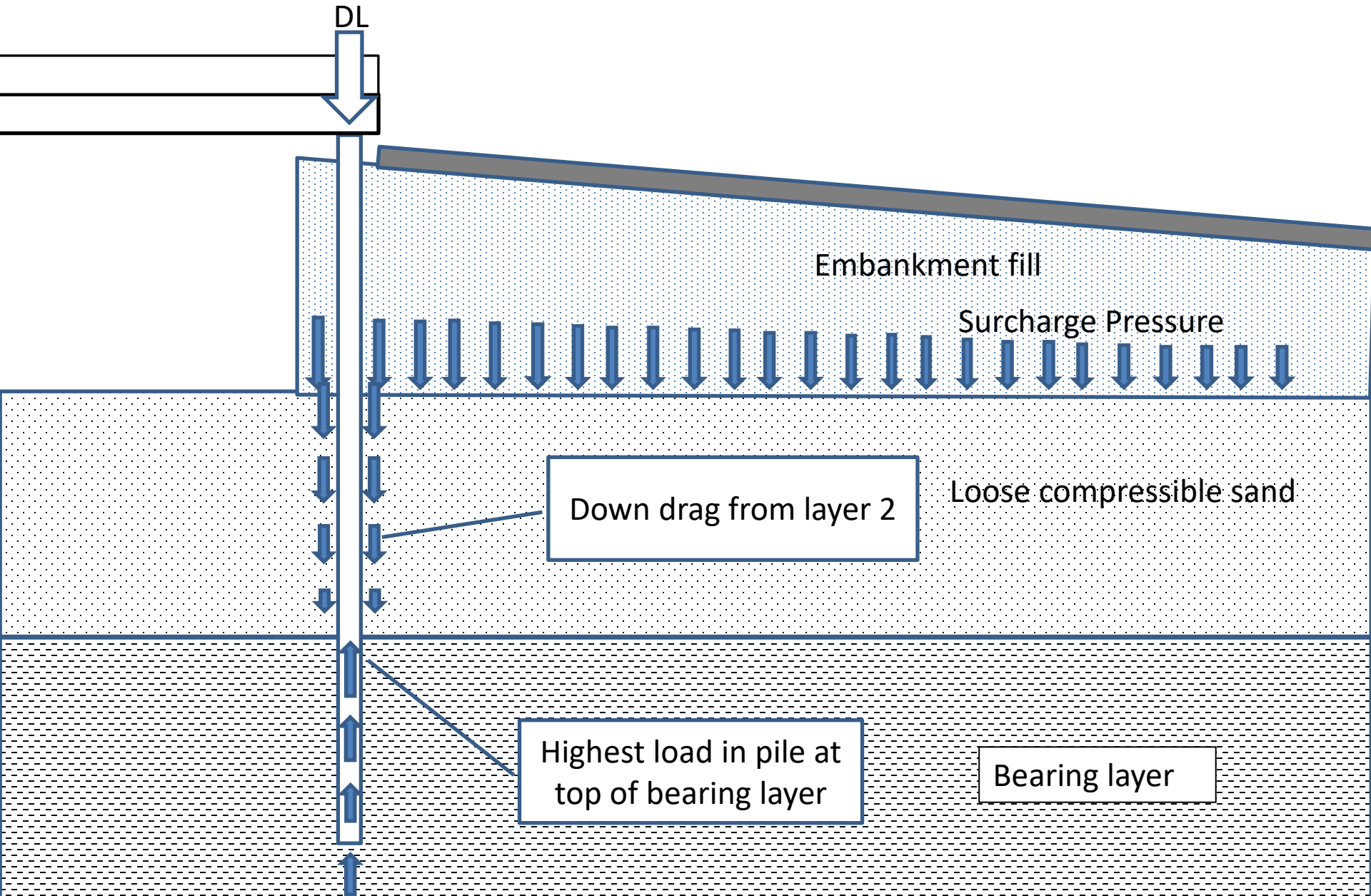
Civil & Environmental Engineering

Problem Statement

- Piles in end bents are often subjected to settlement induced surcharge loads in addition to structural bridge loads.
- Depending on the site-specific conditions it is conceivable that the additional loads may exceed the structural and/or geotechnical pile capacity.
- This study will investigate these conditions.
- Misconception: sandy soils settle immediately so there is no downdrag

Simple Embankment Model





DL

Embankment fill

Surcharge Pressure

Down drag from layer 2

Loose compressible sand

Highest load in pile at top of bearing layer

Bearing layer

Project Tasks

- Literature Review
- Instrumentation and Monitoring
- Data Analysis and Scenario Evaluation
- Develop Recommendations
- Draft Final Report
- Final Report

Task 2: Field Instrumentation and Monitoring

- Select sites with compressible soils beneath embankment
- Evaluate for potential downdrag
- Instrument piles for internal loads
- Instrument existing soils with settlement sensors.

SR 23 Northbound over CR-739B Sandridge Road

- Clay County, District 2
- Bridge No. 710113
- (6) 18-inch square prestressed concrete piles
- End Bent 1, Pile 4
- Pile instrumented: 3/29/21
- Site instrumented: 5/4 – 5/5

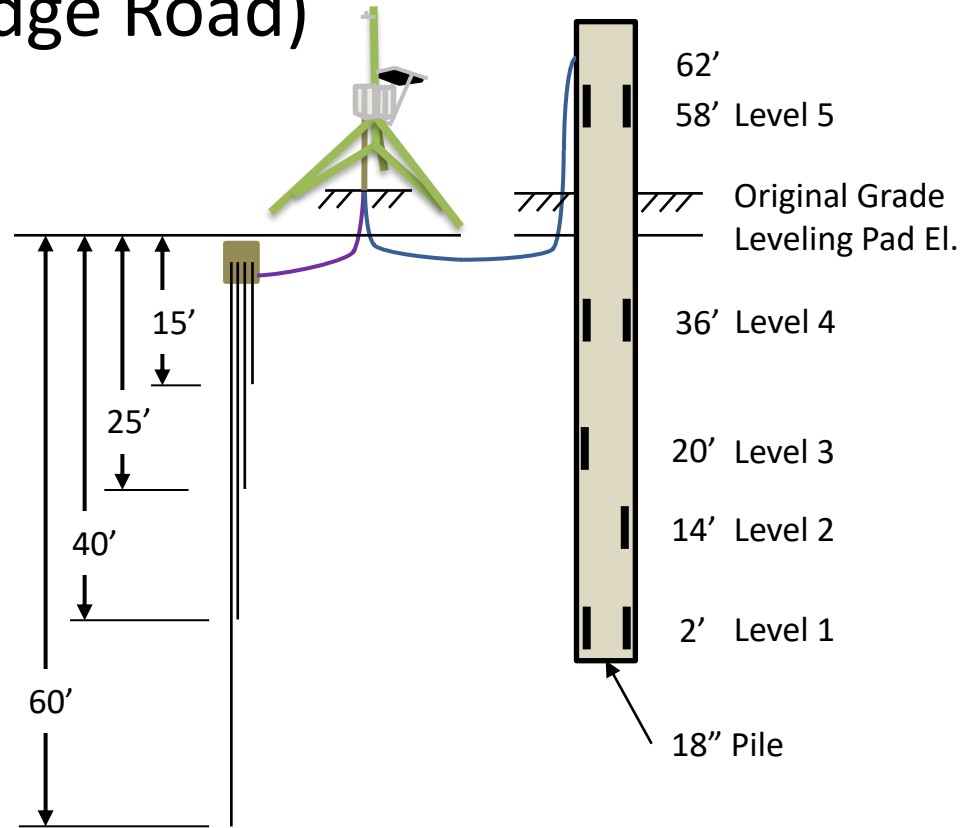
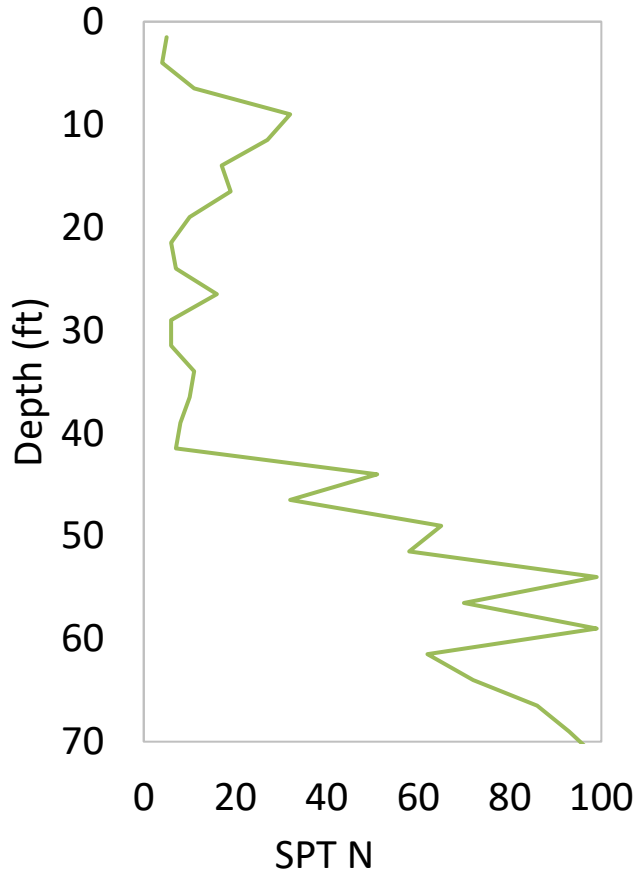
Paseo al Mar Boulevard I-75 Flyover

- Hillsborough County, District 7
- Bridge No. 104495
- (16) 24-inch square prestressed concrete piles
- End Bent 3, Pile 12
- Pile instrumented: 4/15/21
- Site instrumented: 5/1, 5/3

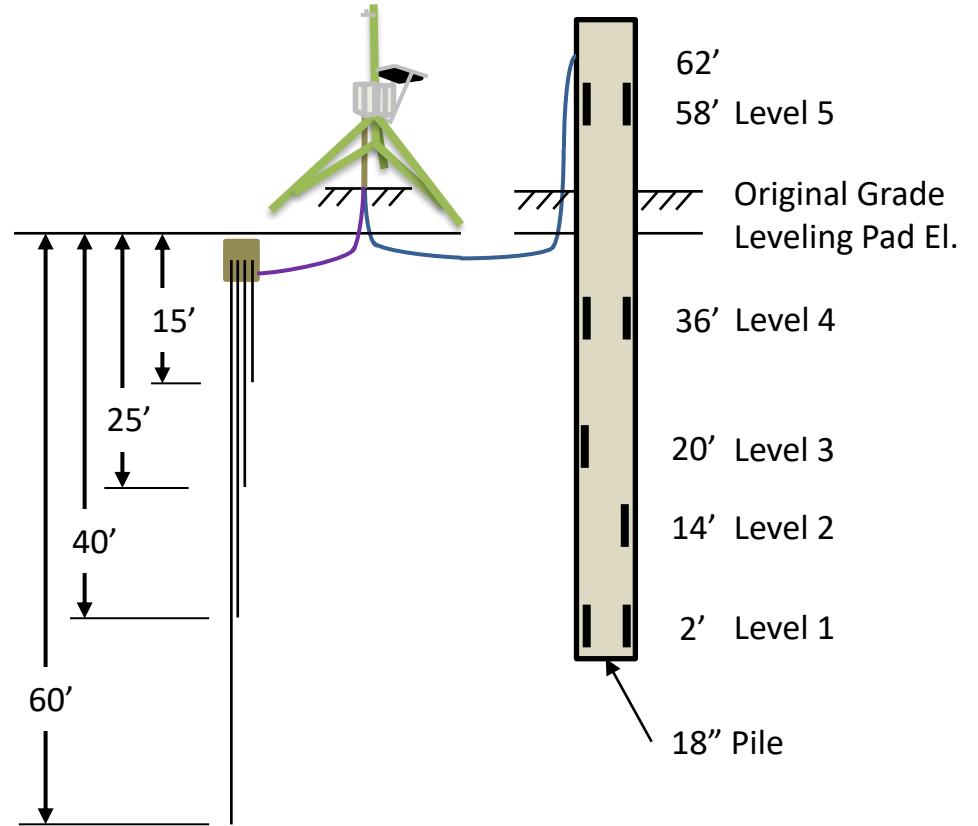
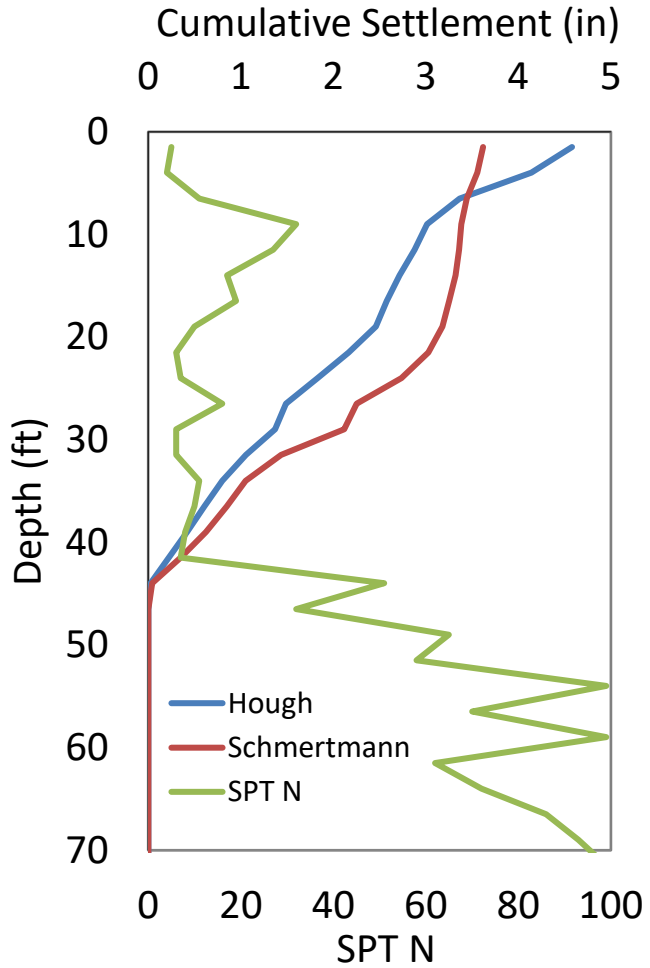
SR 23 Southbound over CR-739 Henley Road

- Clay County, District 2
- Bridge No. 710120
- (5) 24-inch square prestressed concrete piles
- End Bent 1, Pile 3
- Pile instrumented: 1/28/21
- Site instrumented: Sept 2021???

Site Evaluations (Sandridge Road)



Sandridge Road



Pile Instrumentation



Pile Instrumentation





Settlement Instrumentation

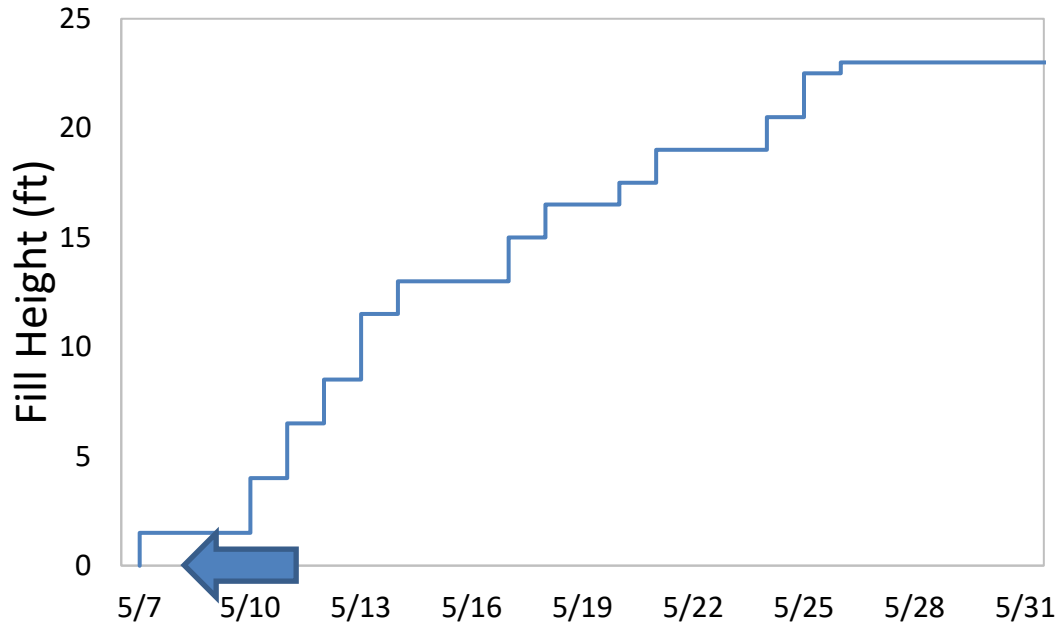
Settlement Instrumentation



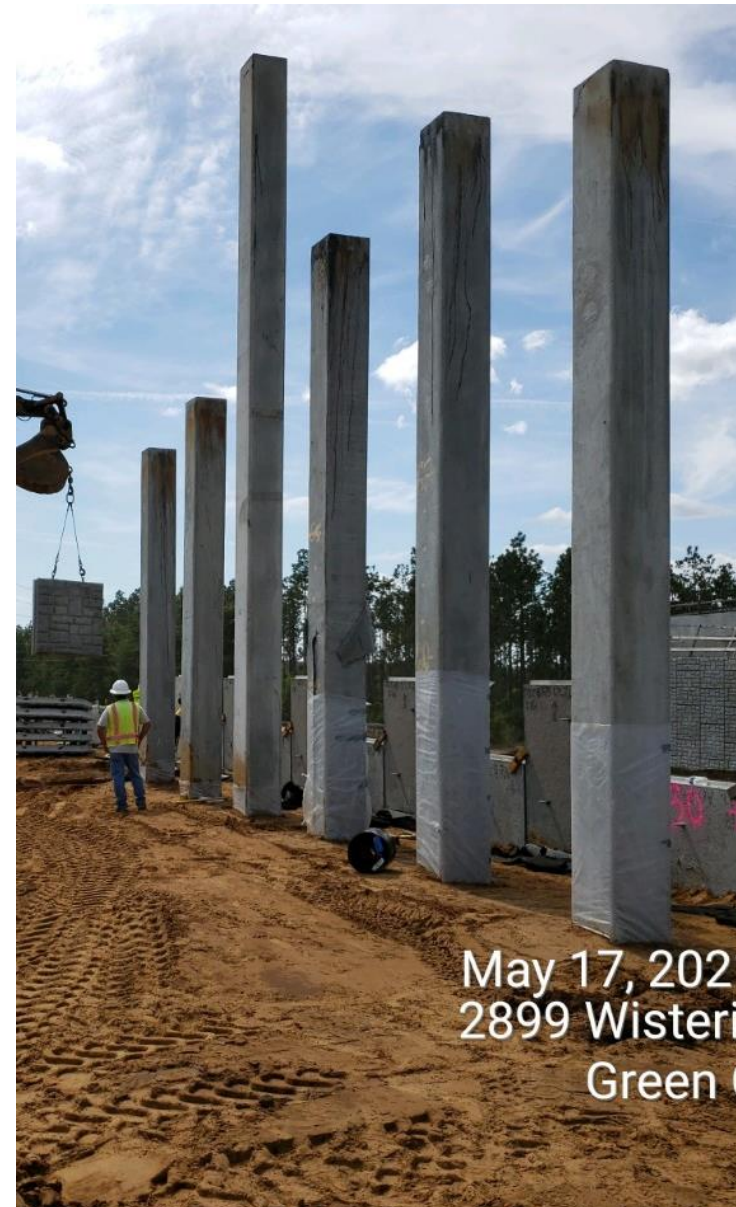
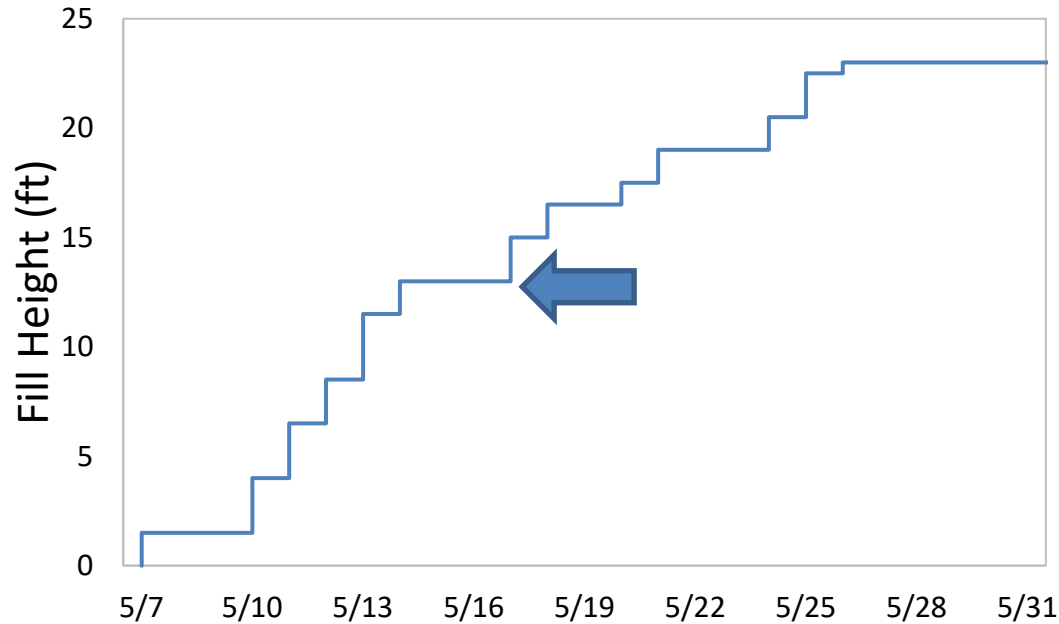
Monitoring Systems



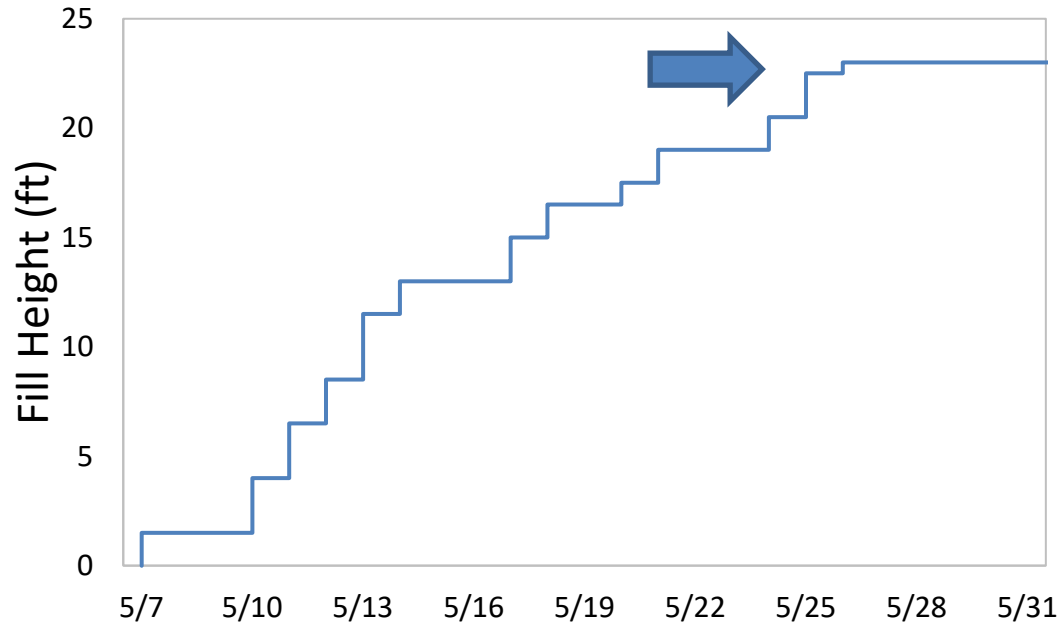
Sandridge Road Backfill



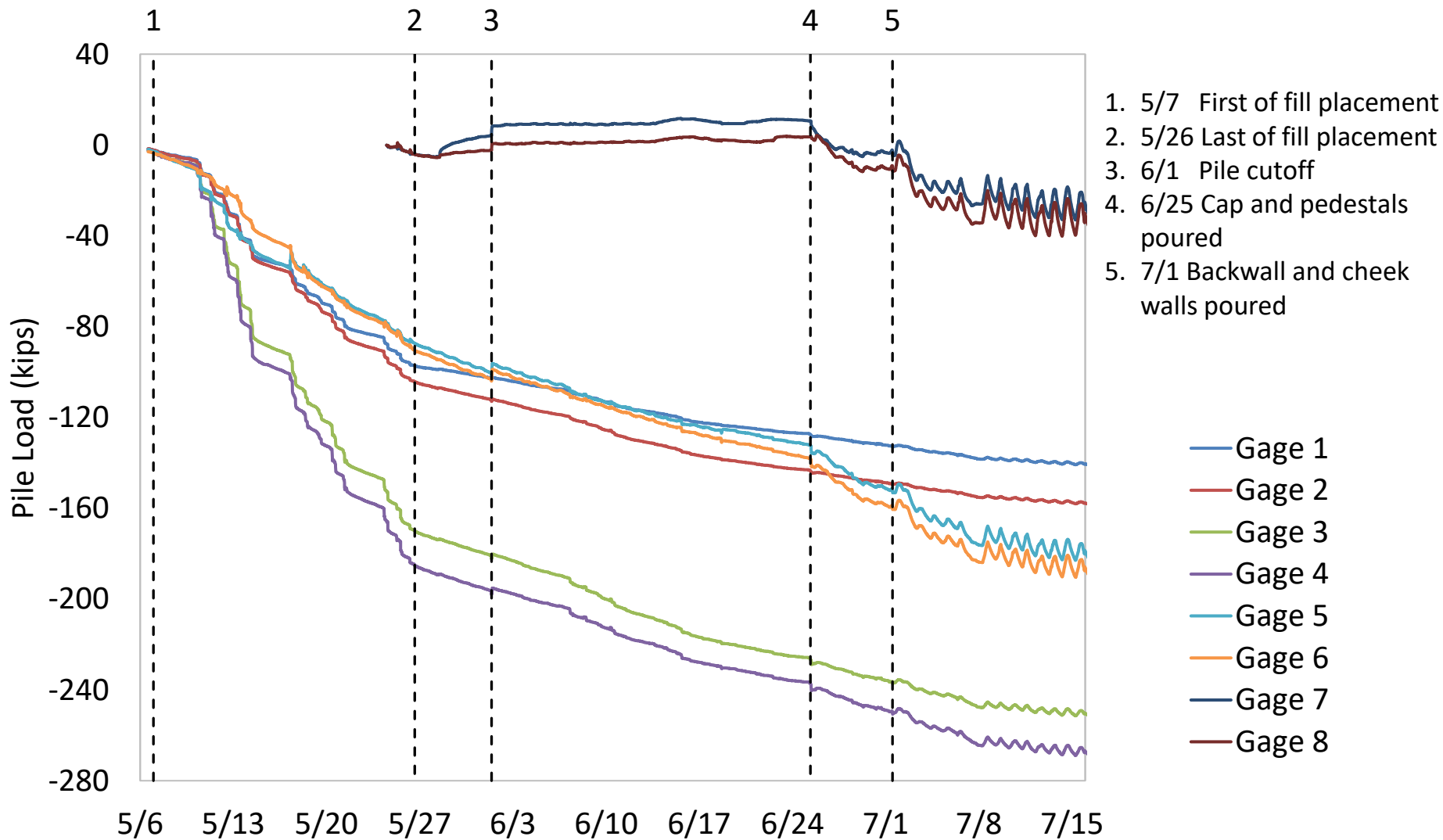
Sandridge Road Backfill



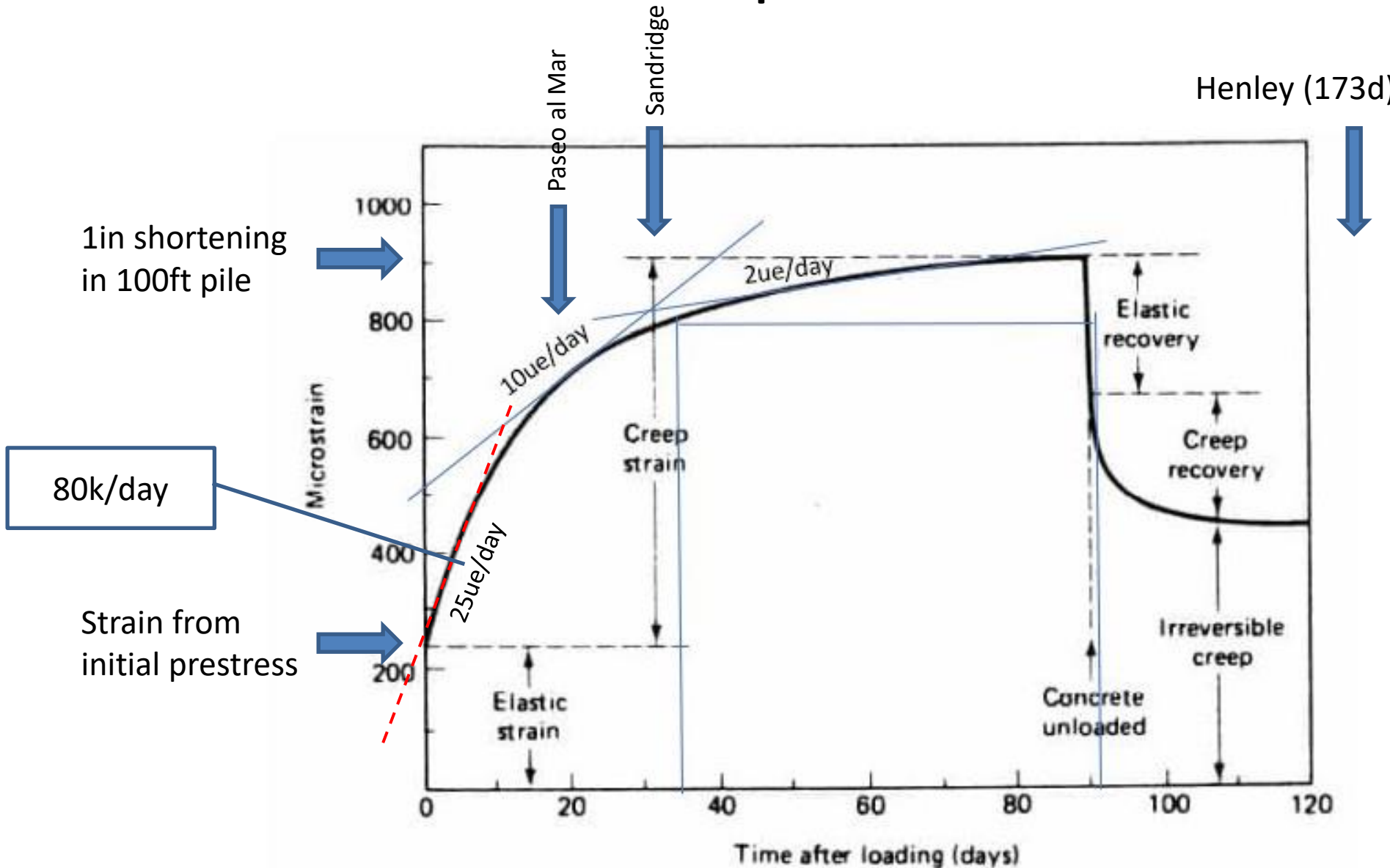
Sandridge Road Backfill



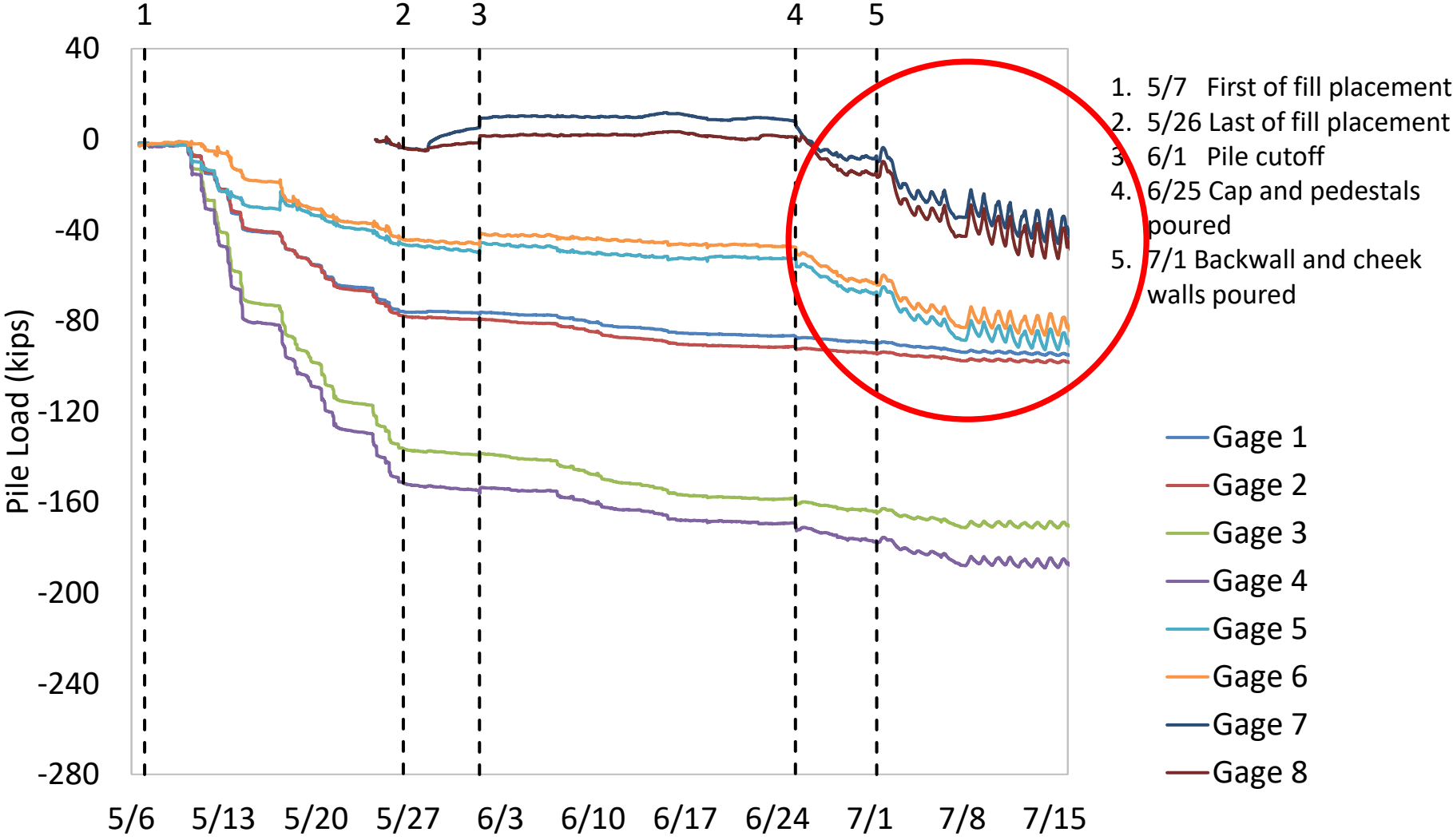
Sandridge Road (Raw Pile Force)



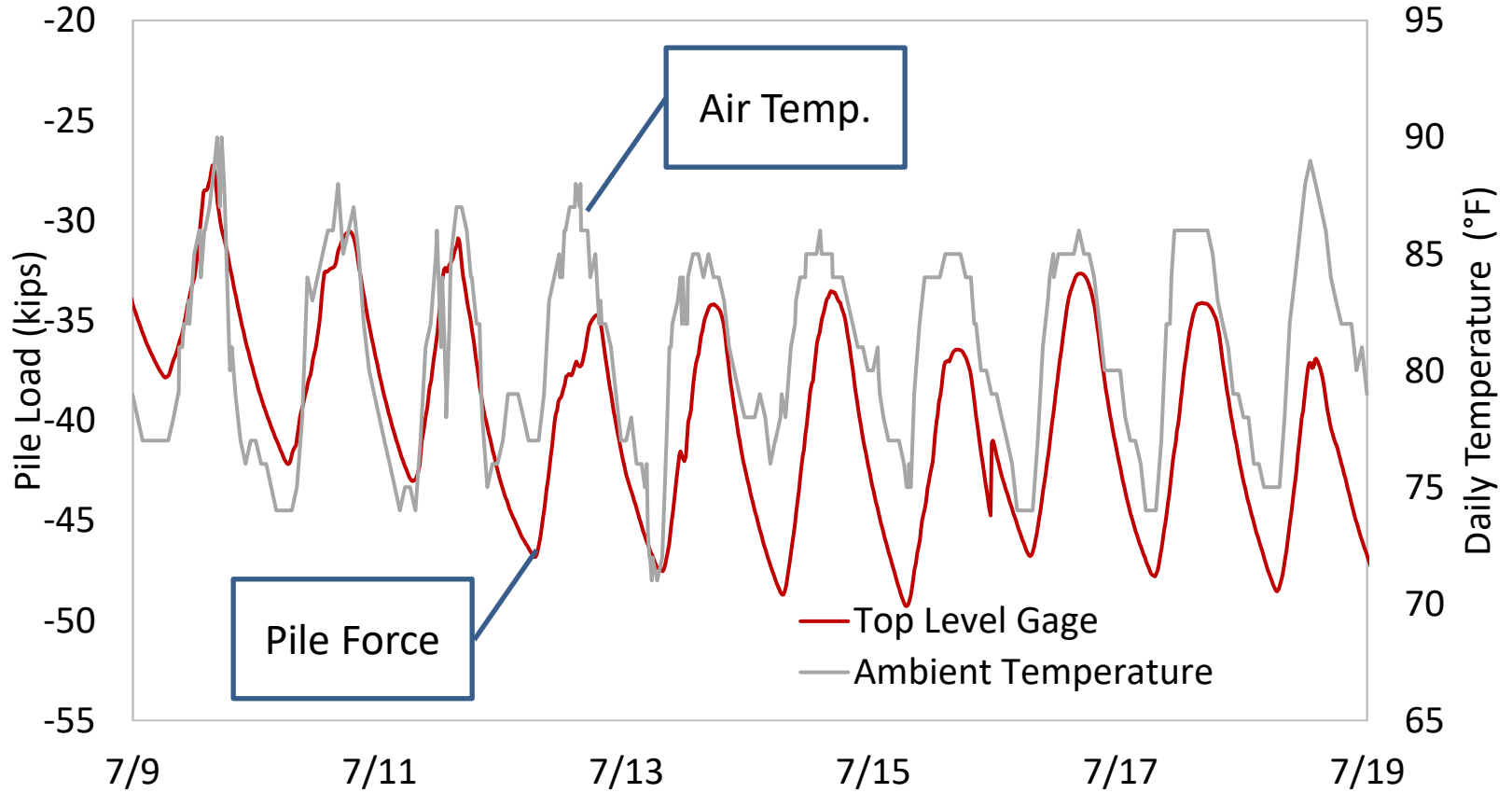
Creep



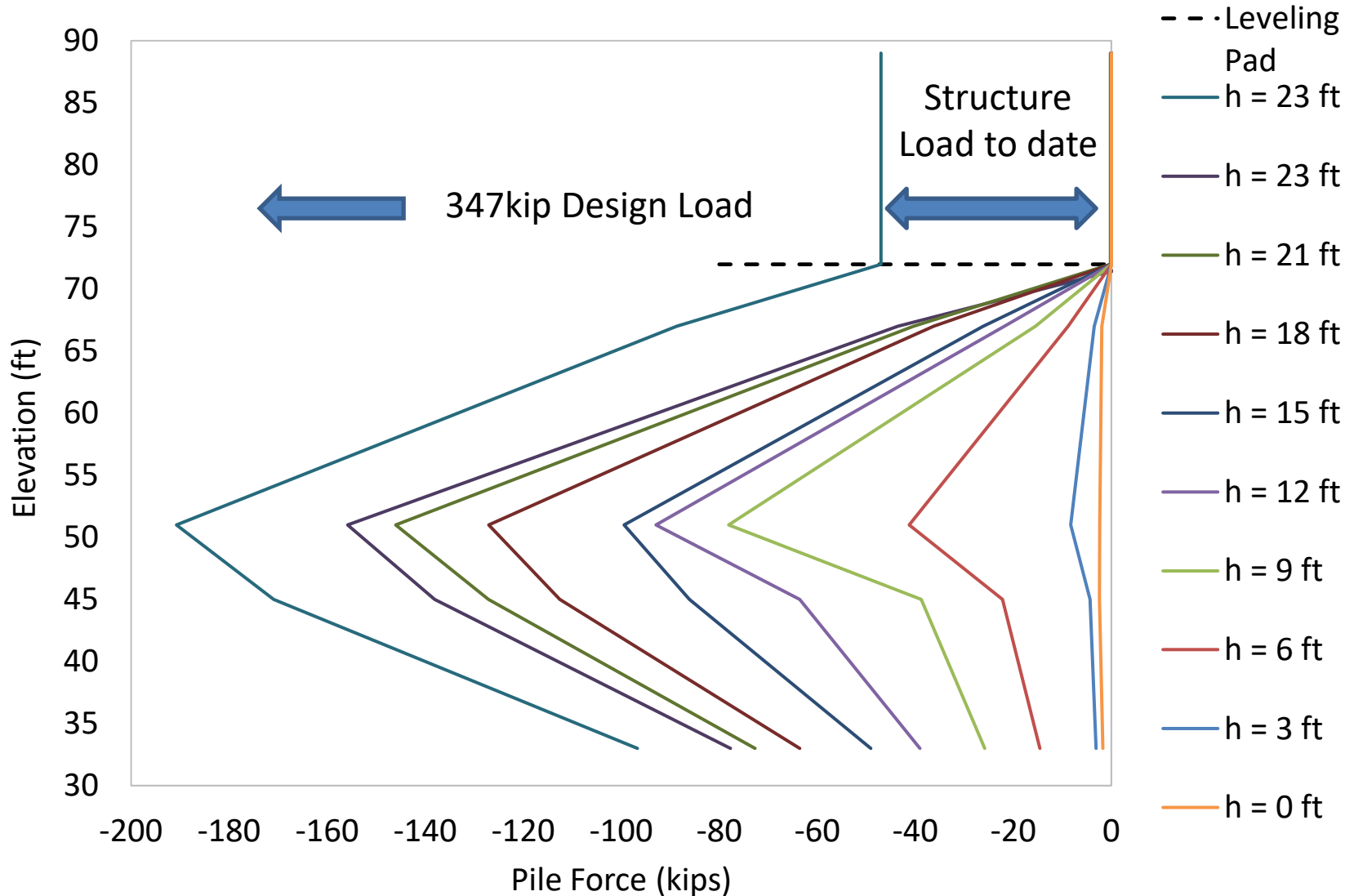
Sandridge Road (Corrected Pile Force)



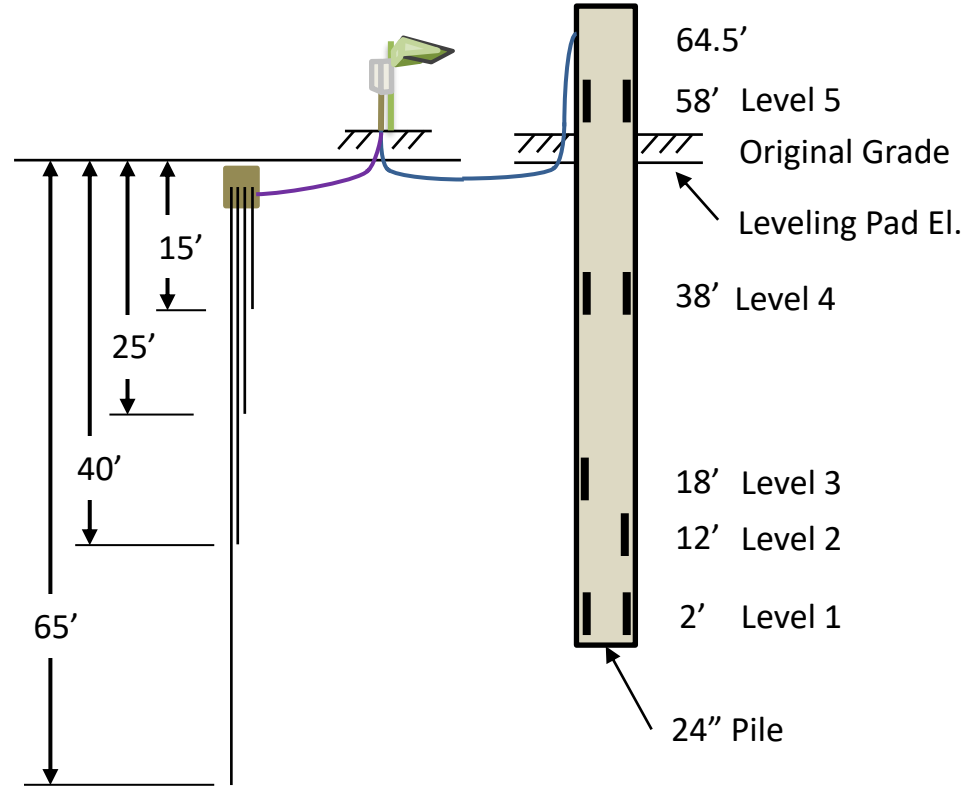
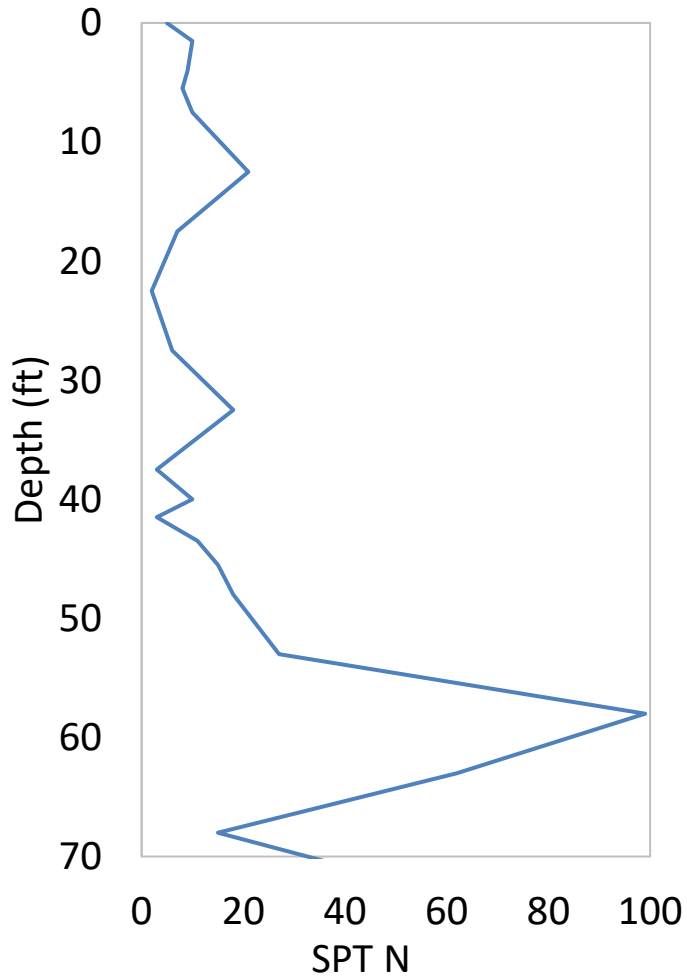
Sandridge Road



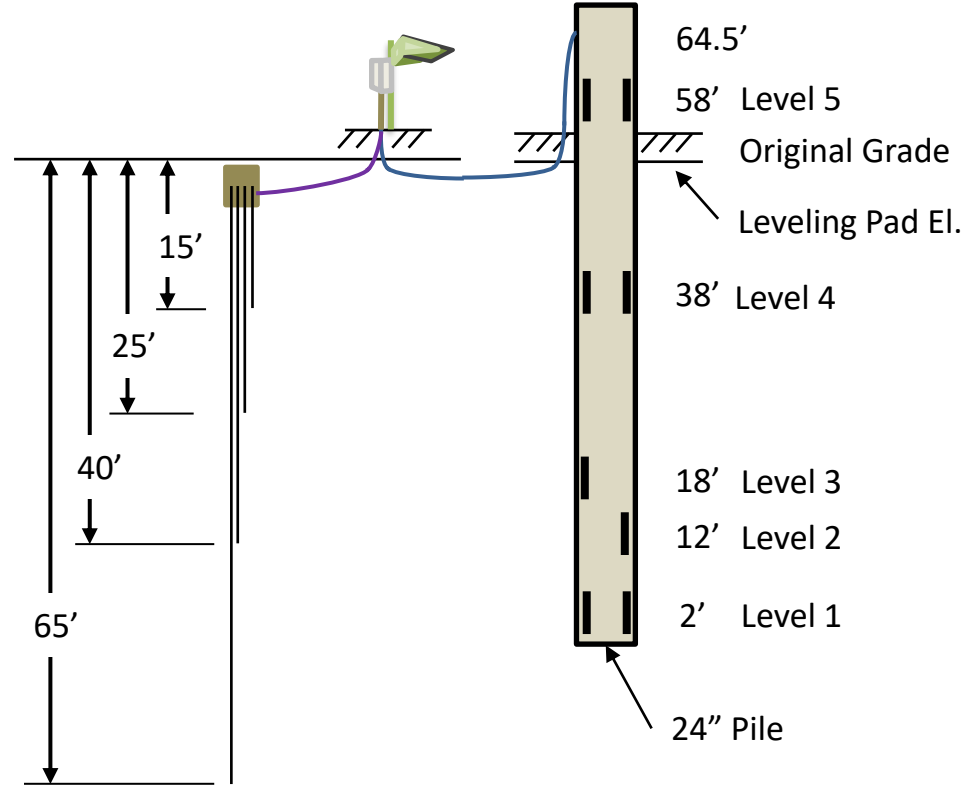
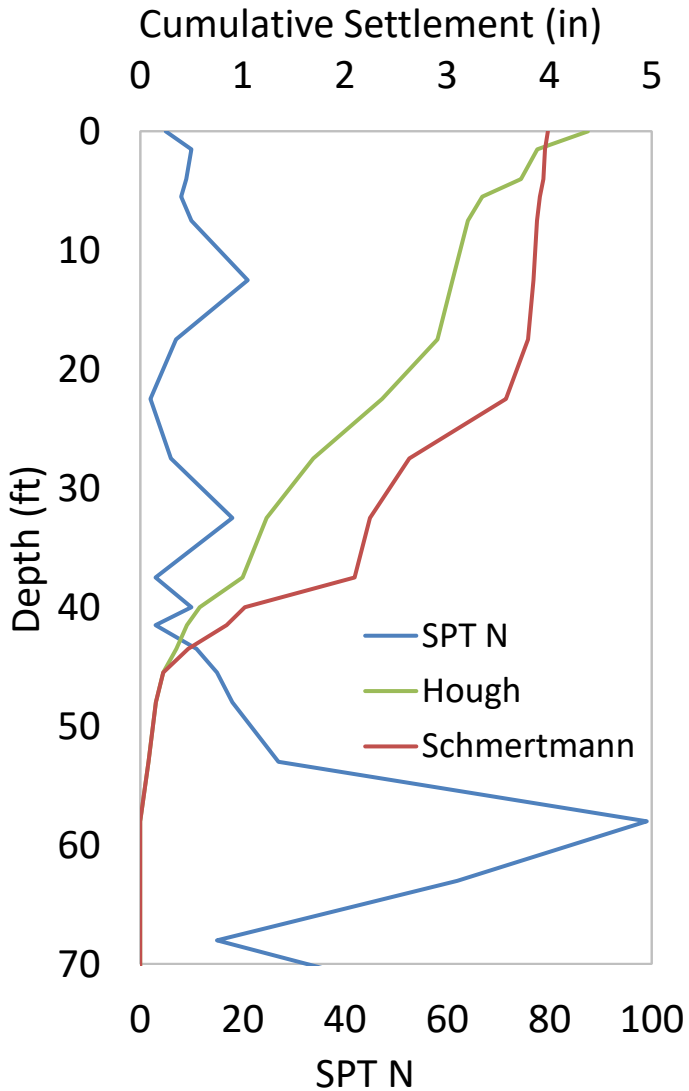
Sandridge Road Force Evolution



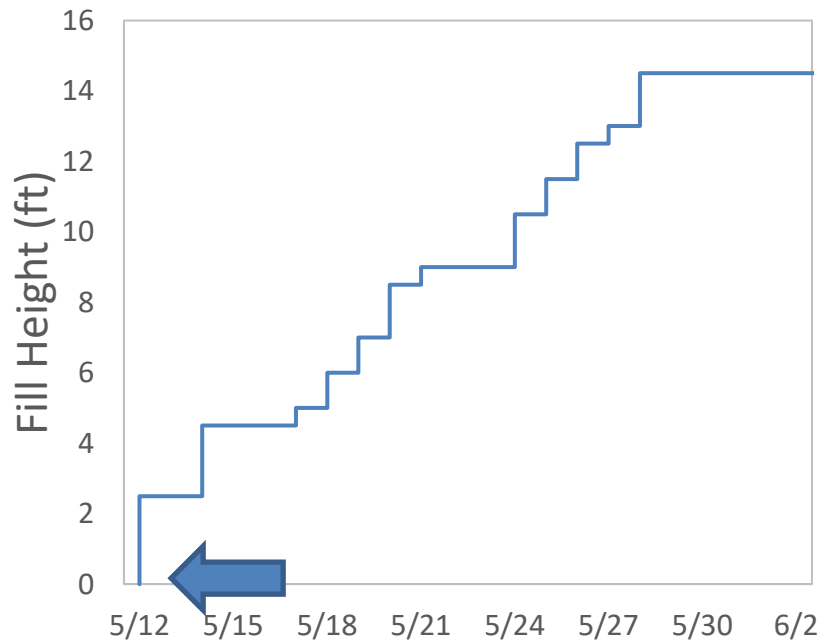
Paseo Al Mar Blvd



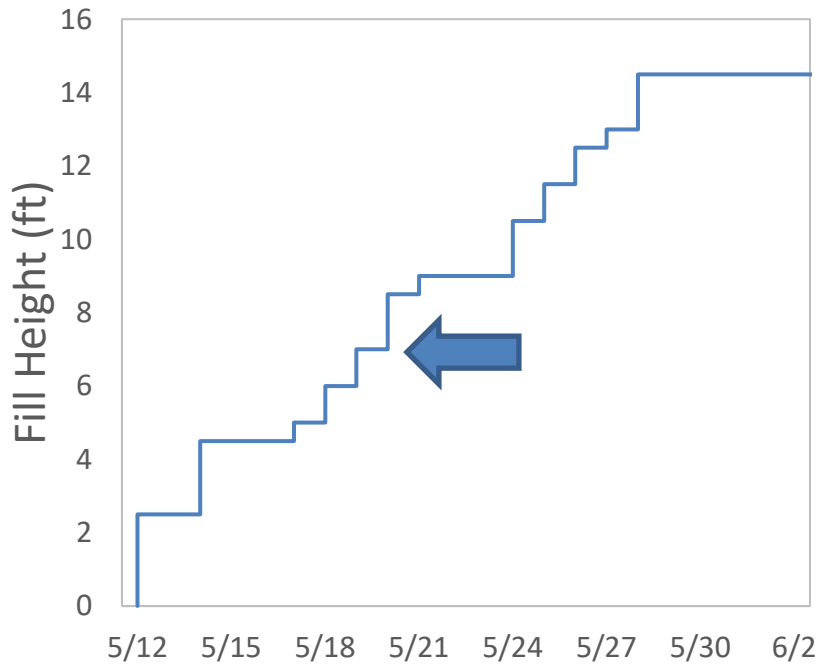
Paseo Al Mar Blvd



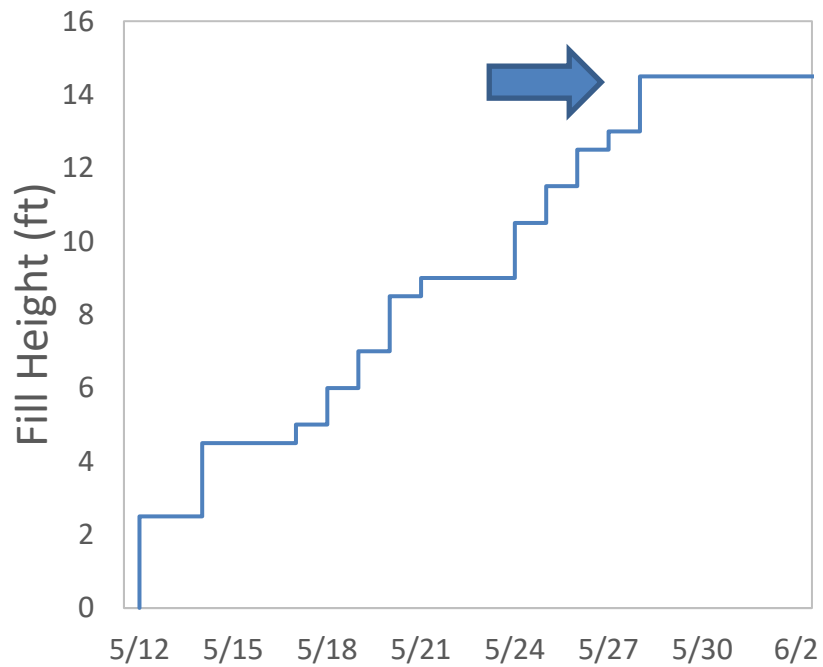
Paseo Al Mar Blvd Backfill



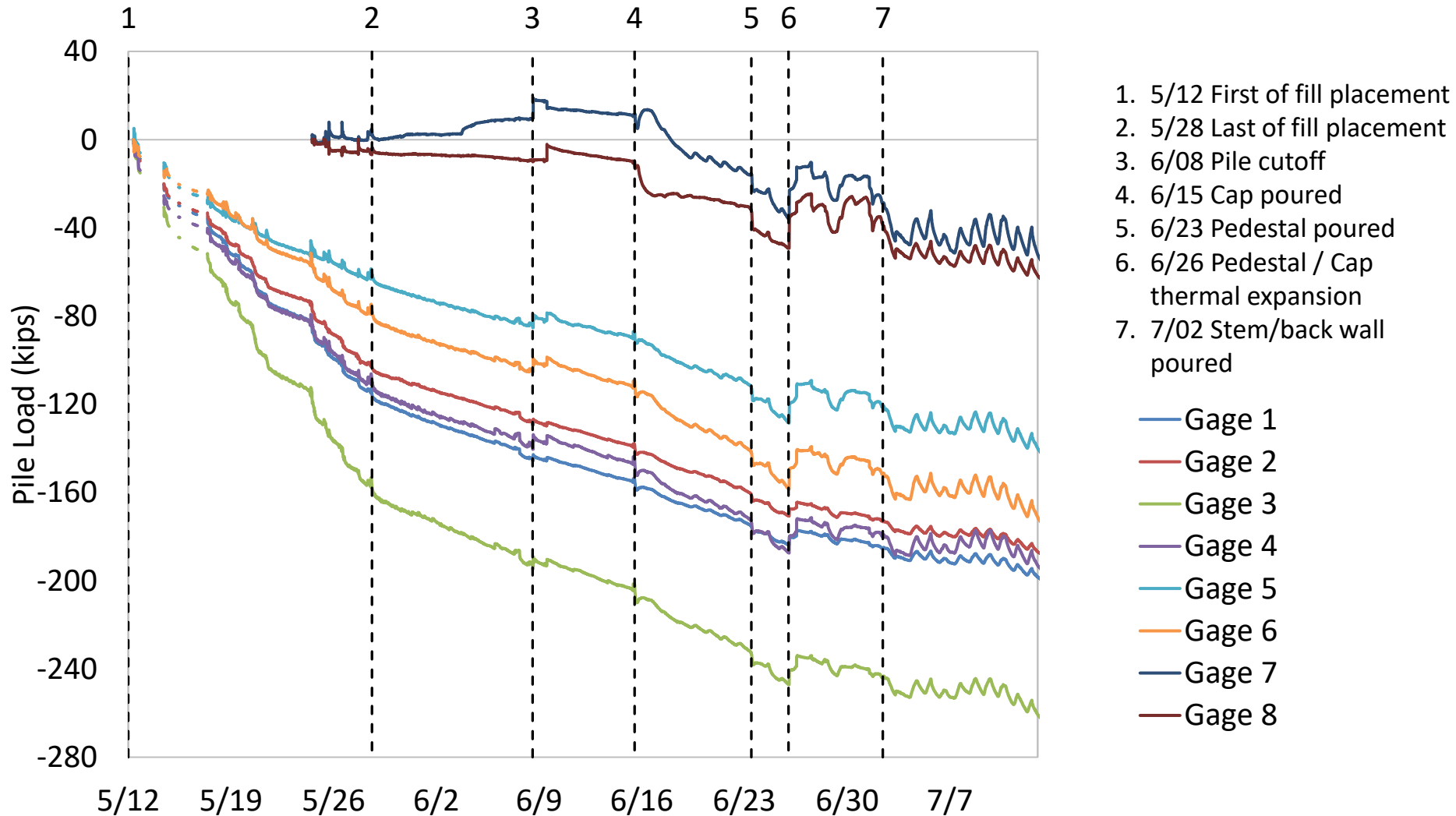
Paseo Al Mar Blvd Backfill



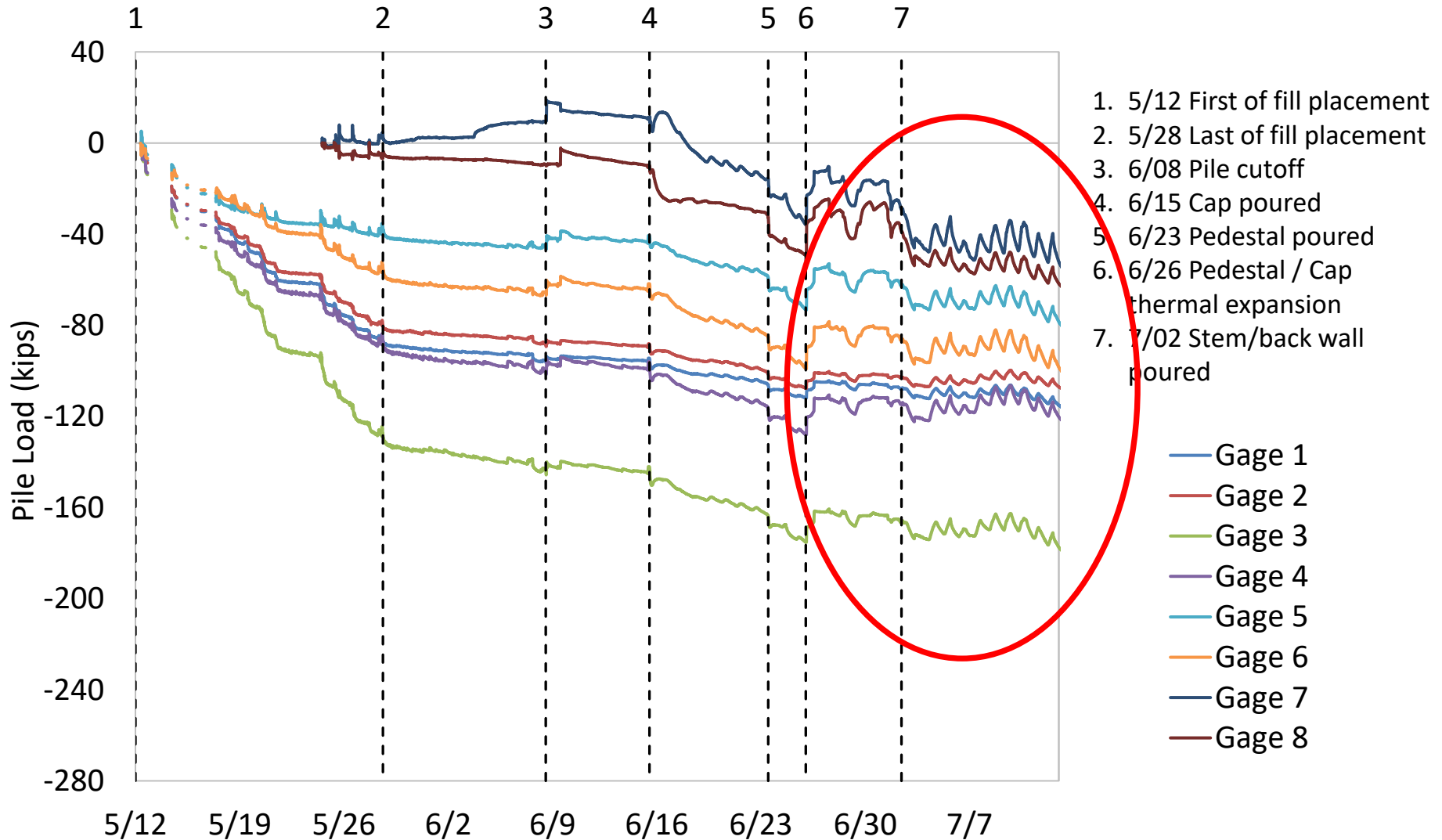
Paseo Al Mar Blvd Backfill



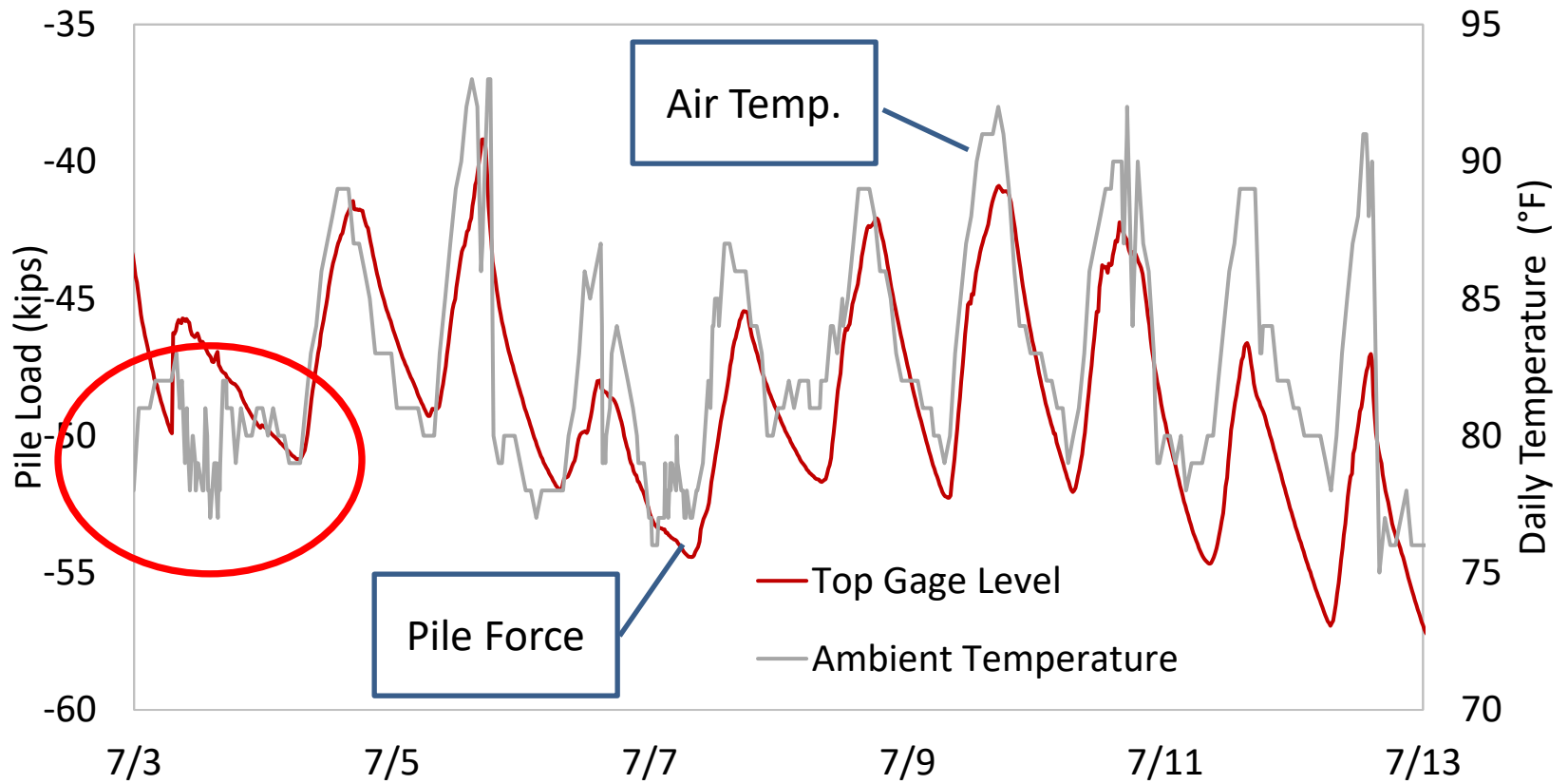
Paseo Al Mar Blvd (Raw Pile Force)



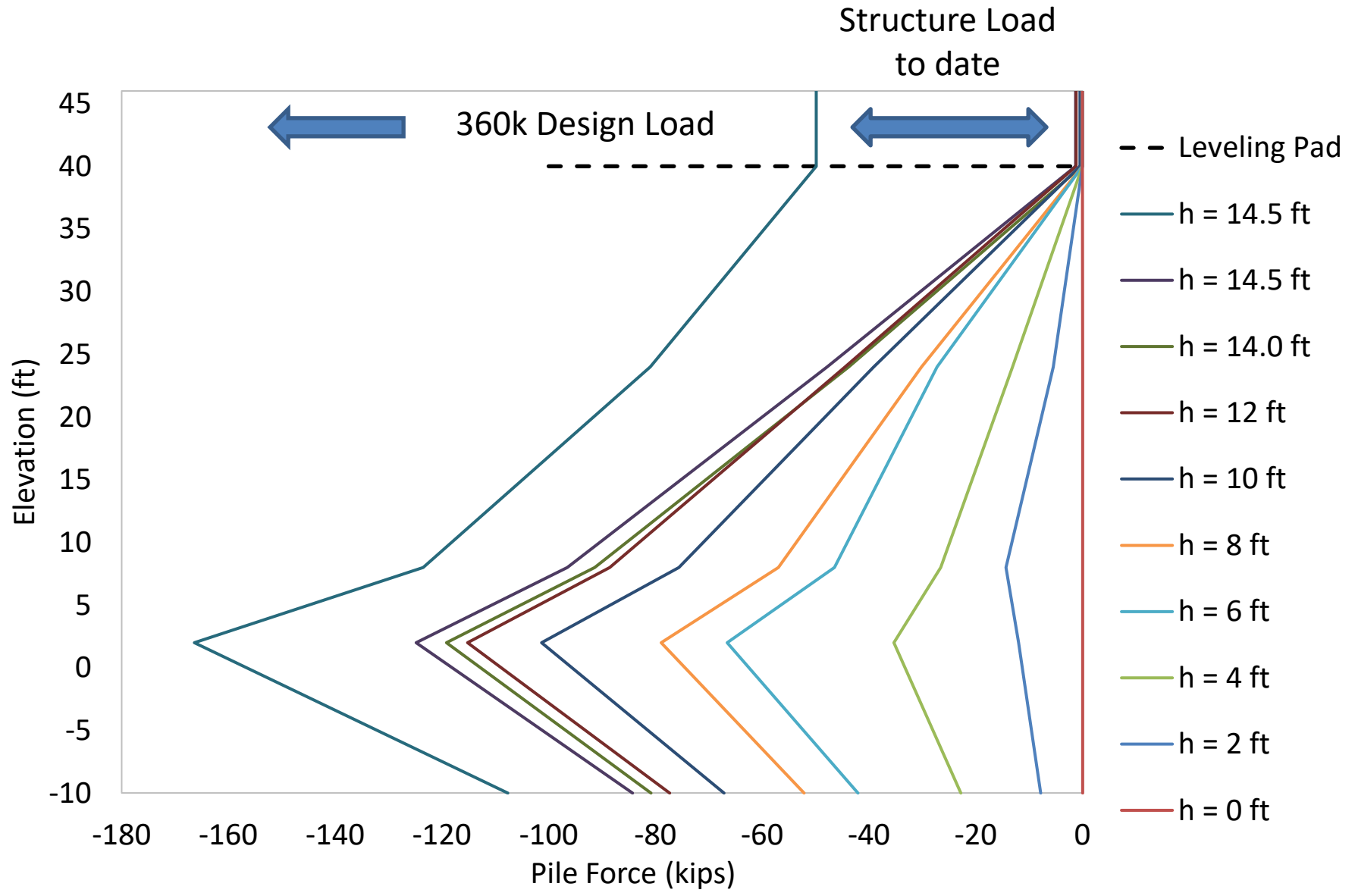
Paseo Al Mar Blvd (Creep corrected)



Paseo Al Mar Blvd



Paseo Al Mar Blvd Force Evolution



Moving Forward

- Henley Rd pile is installed; settlement and monitoring systems waiting
- Effects of structural load (side shear reversal) still to come
- High speed sampling of live loading events also pending but will help to identify appropriateness of load combinations.
- Project end date May 2022

Acknowledgments

- SMO Drill Crew
- Project Manager and Reviewers
- District Engineers
- HNTB Corporation
- EXP U.S. Services Inc.
- Prince Construction
- SACYR Construcccion
- Southern Concrete Products
- CSD Manufacturing
- and Numerous Graduate Students

Questions

