Appendix B

Geotechnical Data Report

Battery Seawall Rehabilitation
Charleston, South Carolina

September 1, 2015
Terracon Project No. EN155074

Prepared for:
Johnson, Mirmiran & Thompson, Inc.
Charleston, South Carolina

Prepared by:
Terracon Consultants, Inc.
North Charleston, South Carolina

September 1, 2015

Johnson, Mirmiran & Thompson, Inc.
1 Poston Road, Suite 230
Charleston, SC 29407

Attn: Mr. James K. O'Connor, P.E.
P: [843] 556 2624
E: JO'Connor@jmt.com

Re: Geotechnical Data Report
Battery Seawall Rehabilitation
Charleston, South Carolina
Terracon Project Number: EN155074

Dear Mr. O'Connor:

Terracon has completed the geotechnical testing services for the above referenced project. These services were conducted in general accordance with Attachment A of the Subcontract Agreement. This data report presents an overview of our subsurface exploration and laboratory testing along with all testing data.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon

Thomas C. Smoak, III, P.E.
Project Geotechnical Engineer

Bryan T. Shiver, P.E.
Department Manager

Enclosures
cc: 1 – Client (PDF)
1 – File

TABLE OF CONTENTS

GEOTECHNICAL DATA REPORT
BATTERY SEAWALL REHABILITATION
Charleston, South Carolina

Terracon Project No. EN155074
September 1, 2015

1.0 INTRODUCTION

Johnson, Mirmiran & Thompson, Inc. (JMT) has contracted Terracon to perform geotechnical sampling and testing for the Battery Seawall Rehabilitation project in Charleston, South Carolina.

Terracon has compiled a Geotechnical Data Report for the proposed Battery Seawall Rehabilitation. This report contains a summary of our field exploration and laboratory testing. No geotechnical recommendations are presented herein.

The purpose this exploration is to provide subsurface and laboratory testing information relative to:

- subsurface soil conditions
- condition of existing concrete seawall
- other geotechnical considerations that may affect the proposed construction

2.0 PROJECT INFORMATION

2.1 Project Description

The portion of the existing Battery Seawall known as the Low Battery is in a condition such that strengthening and/or replacement options need to be developed. The purpose of these geotechnical sampling and testing scope of services is to obtain data to aid in the development of strengthening and/or replacement options.

3.0 GEOTECHNICAL TESTING

3.1 Field Exploration

Our field exploration at the site consisted of ten (10) Cone Penetration Tests (CPT's), two (2) Soil Test Borings (STB's) with Standard Penetration Test (SPT) sampling, four (4) test pits, and six (6) concrete core samples of the existing wall. Test locations were provided to Terracon by JMT. A description of our testing methods and graphical logs outlining the soil conditions at each test location and existing condition sketches of the seawall at the four test pit locations are presented in the report Appendix. Test locations were established in the field by Terracon and JMT.

3.2 Laboratory Testing

The following corrosion series laboratory tests were performed on soil samples collected at the site.

- Three (3) Chloride- Water Soluble Tests (AASHTO T-291 / ASTM D1140)
- Three (3) pH Tests (AASHTO T298-91)
- Three (3) Resistivity Tests (AASHTO T288-91)
- Three (3) Sulfate- Water Soluble Tests (AASHTO T290-91 / ASTM D4327)

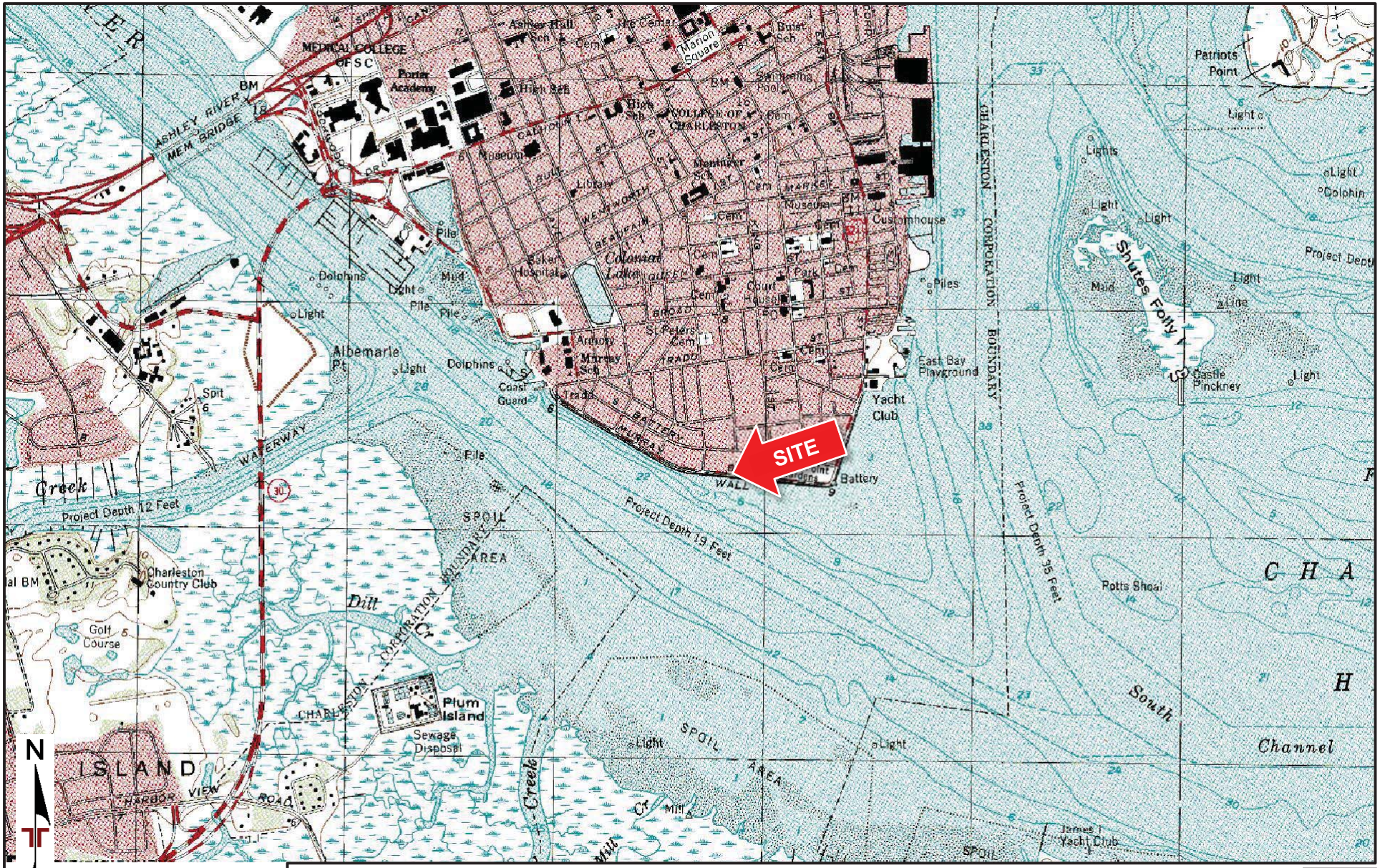
The following laboratory tests were performed on the concrete core samples collected from the Battery Seawall.

- Four (4) Petrographic Analyses of Concrete w/Hardened Air Content (ASTM C856/ASTM C457)
- Five (5) Compressive Strength Testing of Cylindrical Concrete Specimens (ASTM C39)
- Five (5) Density of Hardened Concrete (ASTM C642)

Laboratory testing frequency was determined by JMT. The laboratory procedures and results of the laboratory tests are presented in Appendix A-9.

APPENDIX A

EXHIBIT A-1: SITE VICINITY



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: CHARLESTON, SC (1/1/1994).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	TCS
Drawn by:	TCS
Checked by:	WBW
Approved by:	BTS

Project No.	EN155074
Scale:	1"=24,000 SF
File Name:	A-1
Date:	August 2015

Terracon
1450 5th St. West
North Charleston, SC 29405

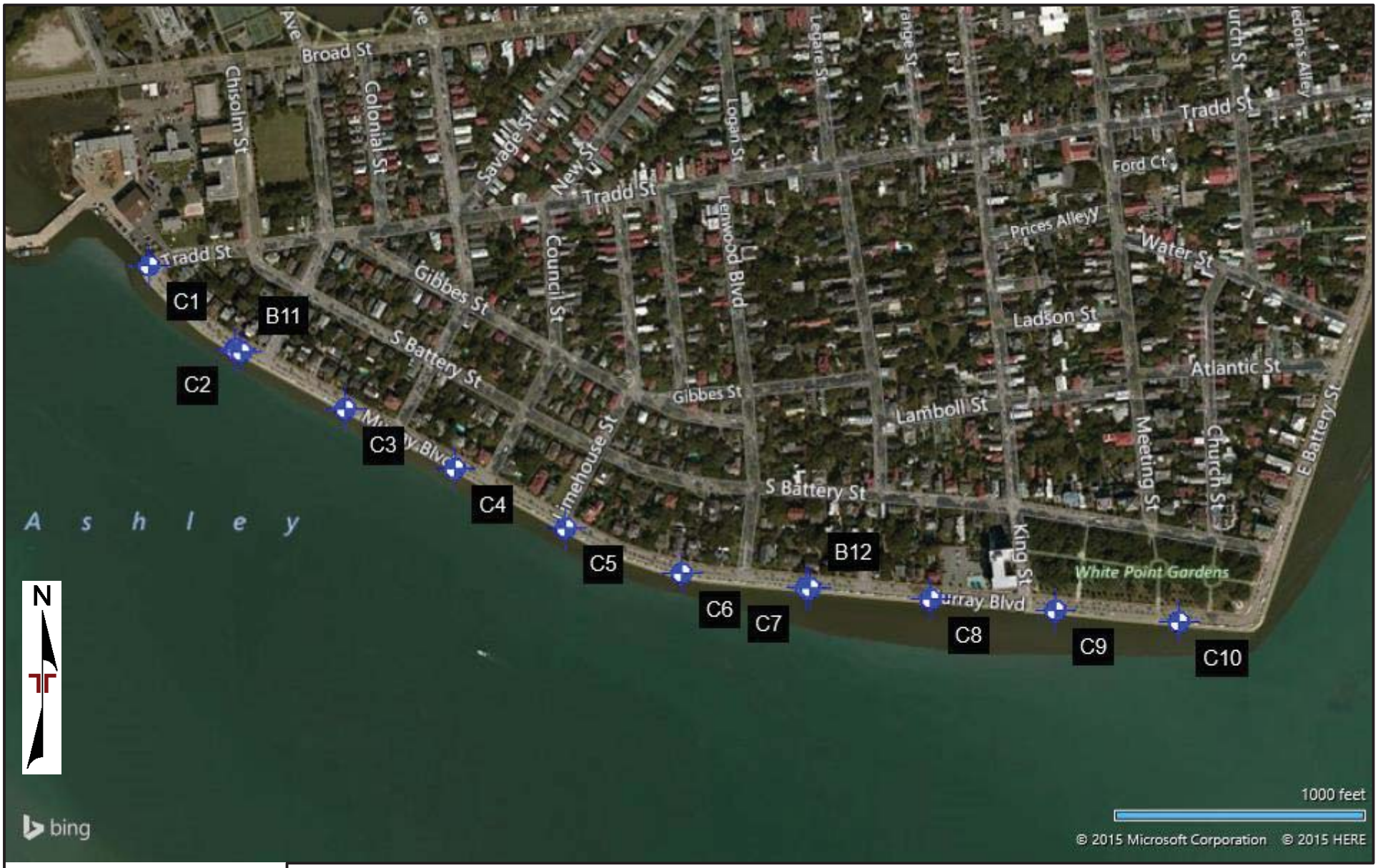
SITE VICINITY

Battery Seawall Rehabilitation
Murray Boulevard
Charleston, SC

Exhibit

A-1

EXHIBIT A-2: EXPLORATION PLAN



AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	TCS
Drawn by:	TCS
Checked by:	WBW
Approved by:	BTS

Project No.	EN155074
Scale:	AS SHOWN
File Name:	A-1
Date:	August 2015

Terracon
1450 5th St. West
North Charleston, SC 29405

EXPLORATION PLAN

Battery Seawall Rehabilitation
Murray Boulevard
Charleston, SC

Exhibit
A-2

EXHIBIT A-3: FIELD EXPLORATION DESCRIPTION

Field Exploration Description

Overview

The testing locations were provided by JMT and located in the field by JMT and Terracon by taking measurements from existing survey markings. A field log of each Soil Test Boring (STB) and Test Pit were prepared by field personnel. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs based on visual observation.

Cone Penetration Test (CPT) Soundings

Cone Penetration Test soundings were conducted in accordance with ASTM D5778 Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils.

Soil Test Borings (STB)

All boring and sampling operations were conducted in accordance with the following procedures:

- ASTM D5783, "Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration"
- ASTM D1586 "Test Method for Penetration Test and Split-Barrel Sampling of Soils"
- ASTM D4220 "Standard Practices for Preserving and Transporting Soil"

Borings B-11 and B-12 were advanced to depths of 100 feet and 75 feet, respectively, below the ground surface using rotary wash drilling techniques. Soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler, also known as standard split-spoon. The sampler is advanced into the soil a total of 18 inches by striking the drill rod using a 140-pound safety or automatic hammer falling 30 inches. The number of blows required to advance the sampler for each of three 6 inch increments is recorded. The sum of the number of blows for the second and third increments is called the "Standard Penetration Value", or N-value (Nmeas) (blows per foot). The N-Value, when properly evaluated, is an index to the soil strength.

Soil Classification provides a general guide to the engineering properties of various soil types and enables the engineer to apply his experience to current situations. In our exploration, samples obtained during drilling operations are examined and visually classified by a geotechnical engineer using the procedures outlined in ASTM D2487 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). The soils are described according to color, texture, and relative density or consistency (based on standard penetration resistance). The designations shown on the logs are described on the following page.

Test Pits

Test pits were performed under the existing sidewalk along the seawall at locations selected by JMT. The City of Charleston removed the concrete sidewalk and the excavation was performed by either the City of Charleston or Terracon. The test pits were logged by Terracon's project engineer. The results of the test pit excavations are provided in Exhibit A-6. The condition of existing seawall was observed and documented in the existing condition sketches in Exhibit A-7.

Concrete Cores

Concrete cores were obtained from the Battery Seawall at six locations in accordance with *ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*. Two cores were obtained from the face of the wall and four cores were obtained from the base step of the wall.

EXHIBIT A-4: CONE PENETRATION TEST LOGS

CPT LOG NO. C1

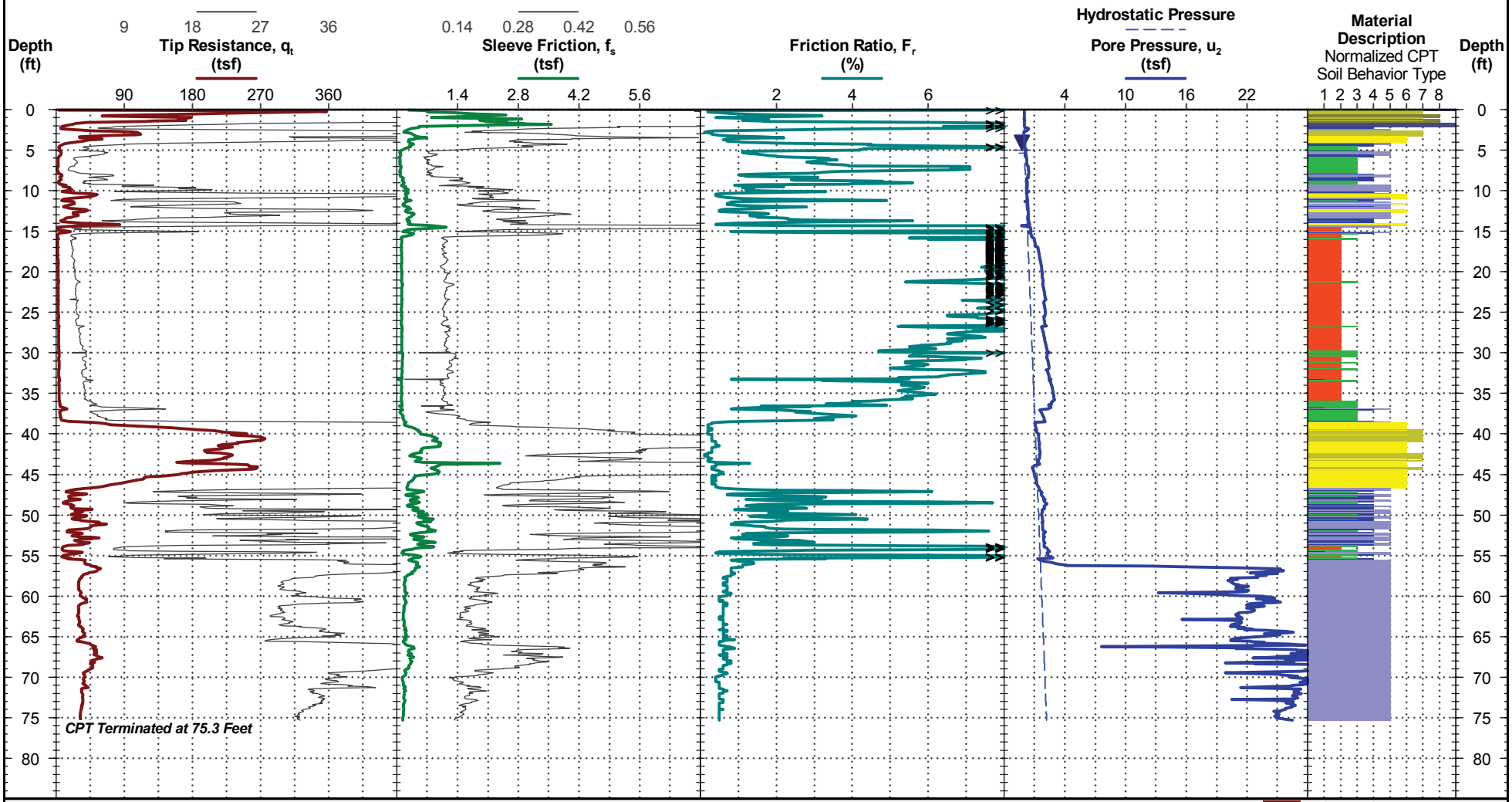
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.77319°
Longitude: -79.94327°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4526 with net area ratio of 0.83
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 11/12/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C2

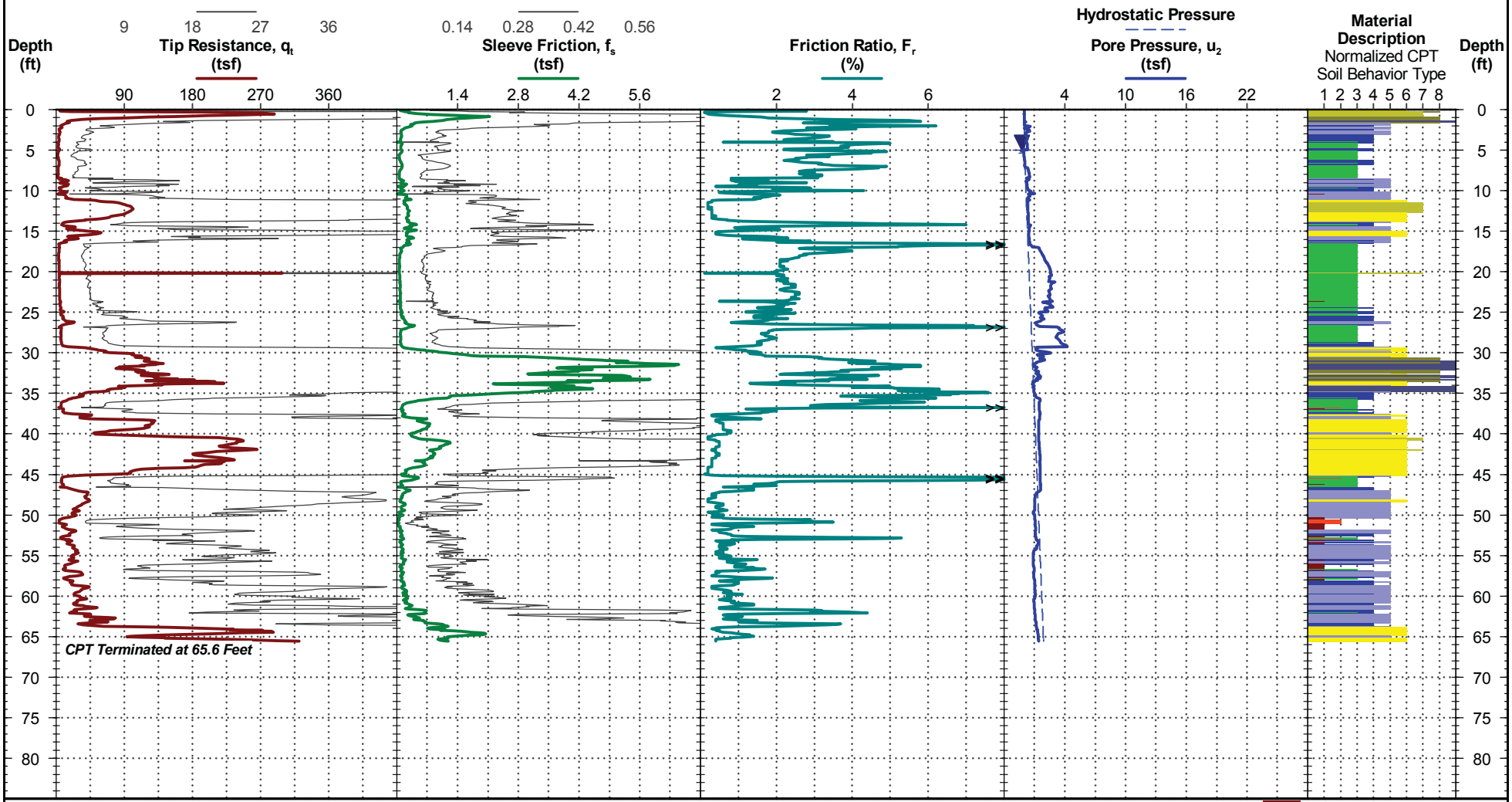
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.77227°
Longitude: -79.94215°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4526 with net area ratio of 0.83
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 11/12/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C3

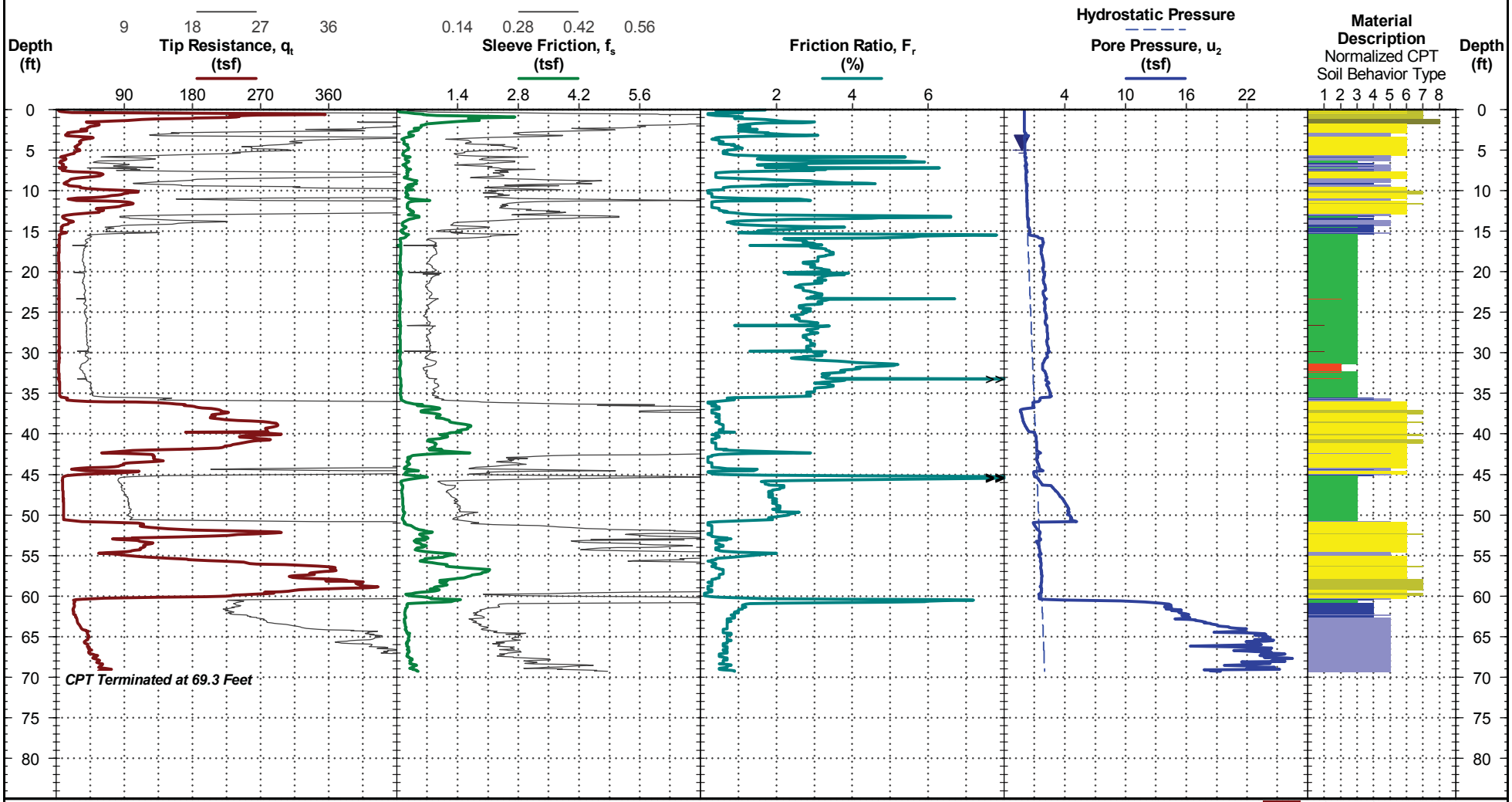
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.77162°
Longitude: -79.94072°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C4

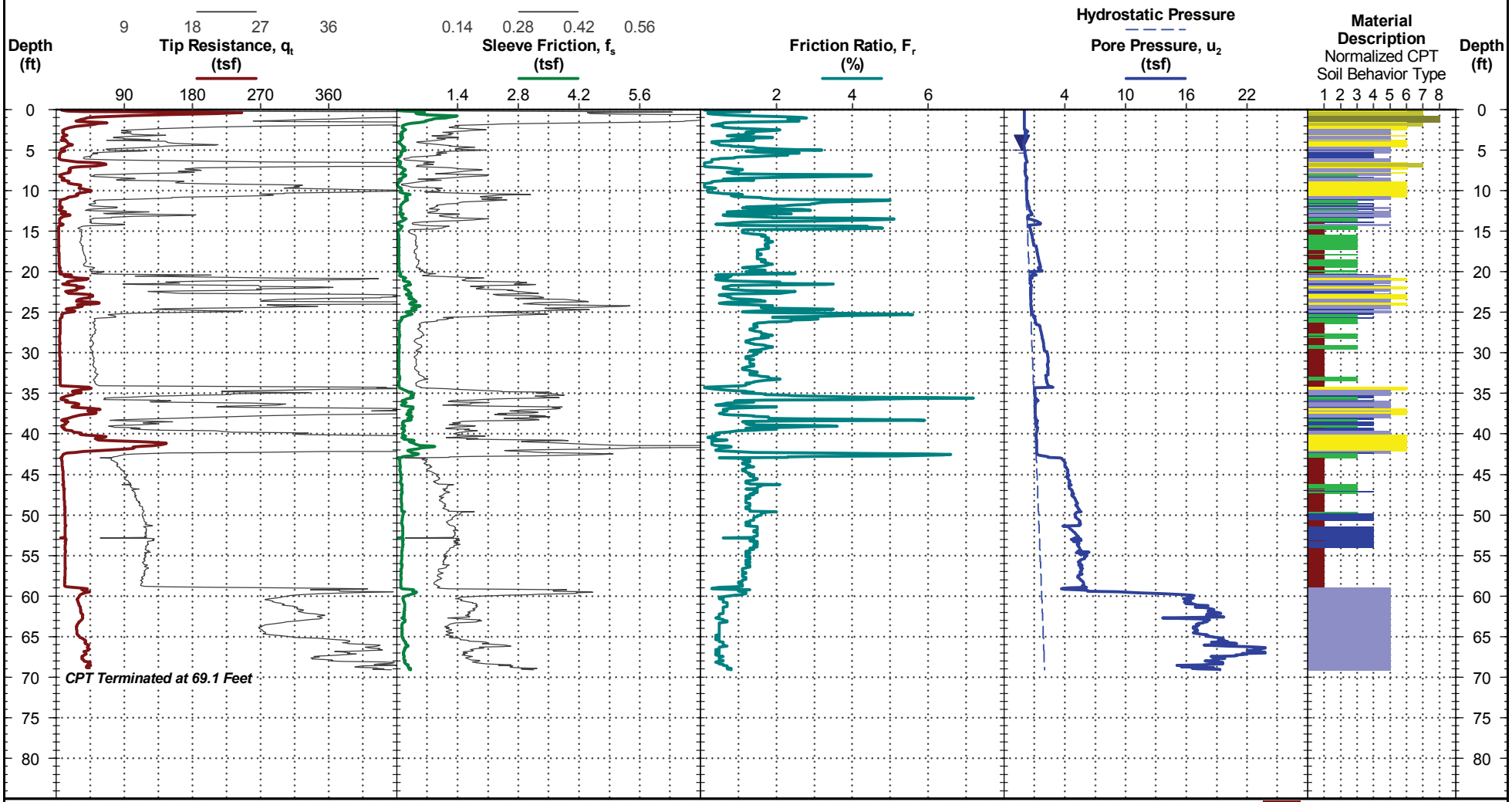
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.77097°
Longitude: -79.93929°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C5

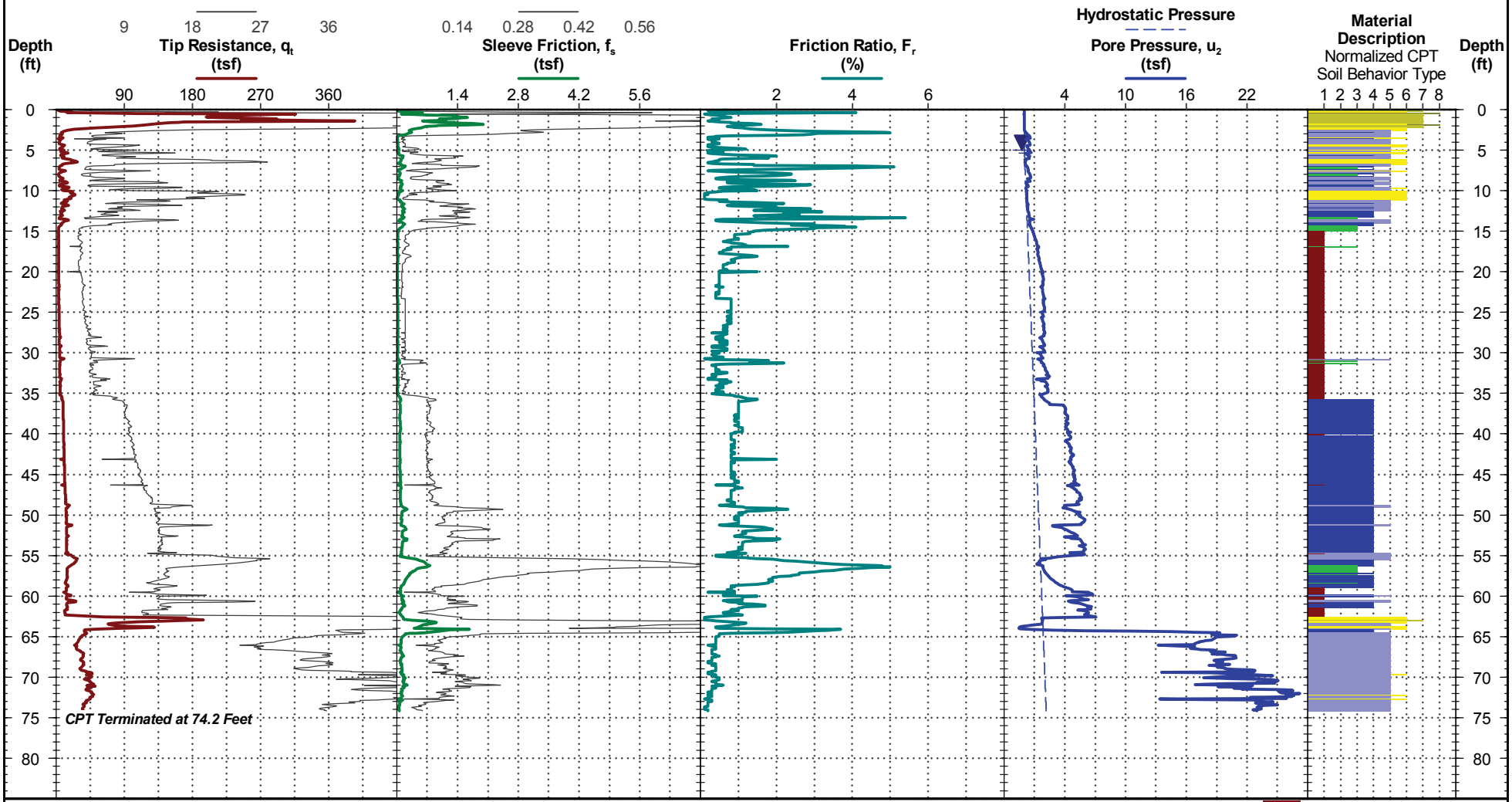
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.77032°
Longitude: -79.93785°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C6

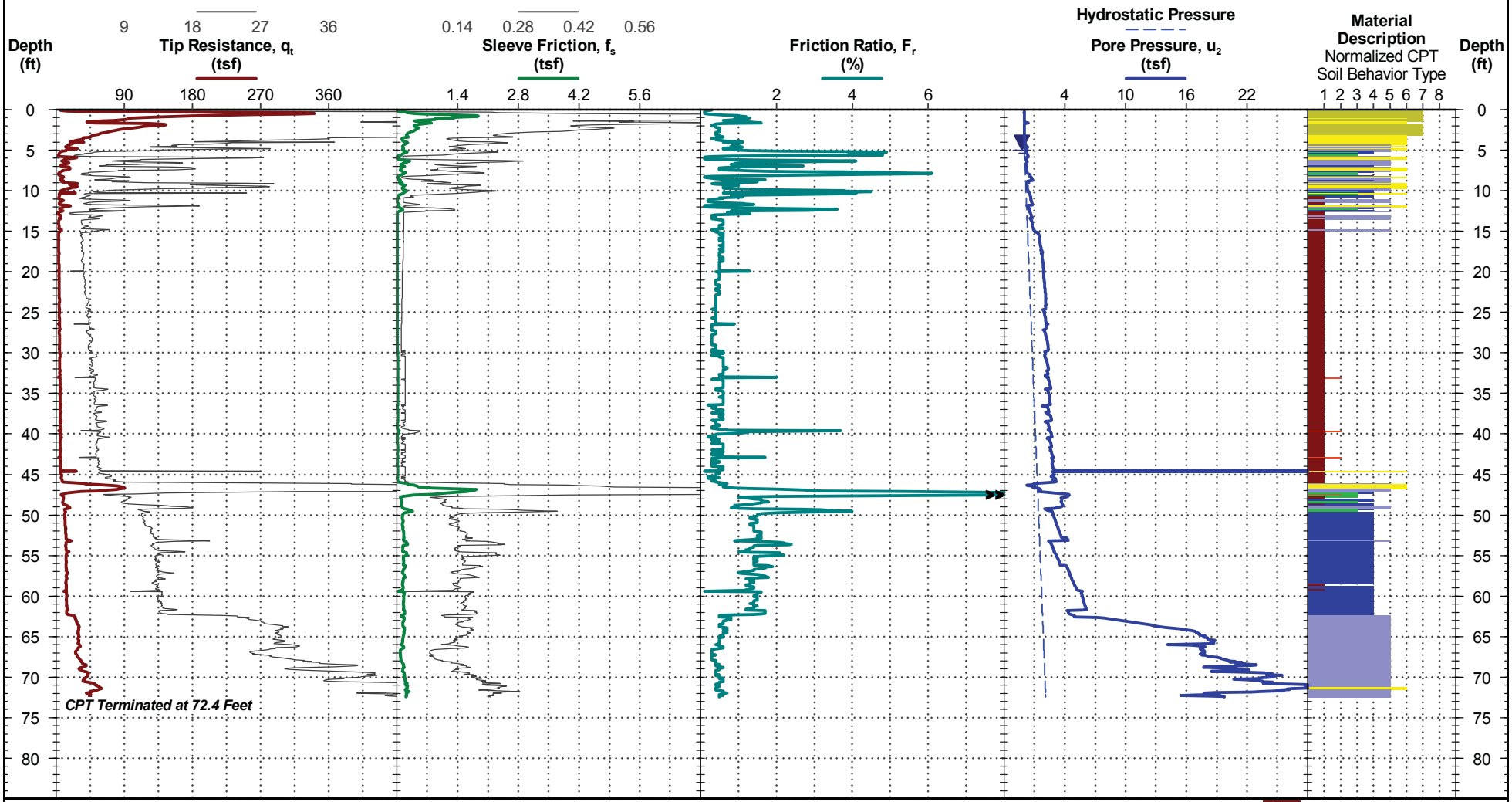
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.76982°
Longitude: -79.93634°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/17/2015	CPT Completed: 6/17/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C7

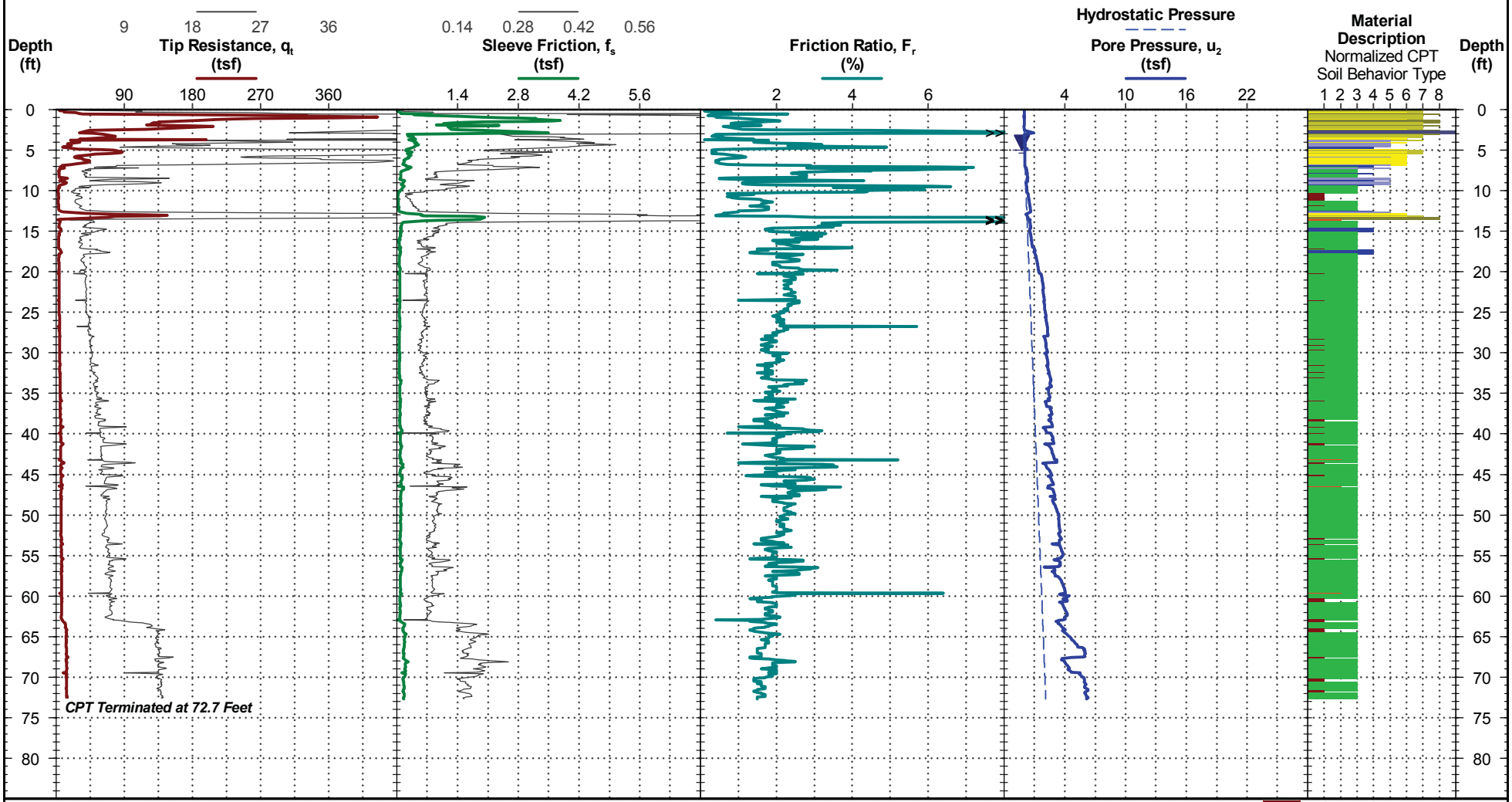
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.76967°
Longitude: -79.93472°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/18/2015
CPT Completed: 6/18/2015
Rig: Pagani TG73-200
Operator: J. Bandle
Project No.: EN155074
Exhibit: A-4

CPT LOG NO. C8

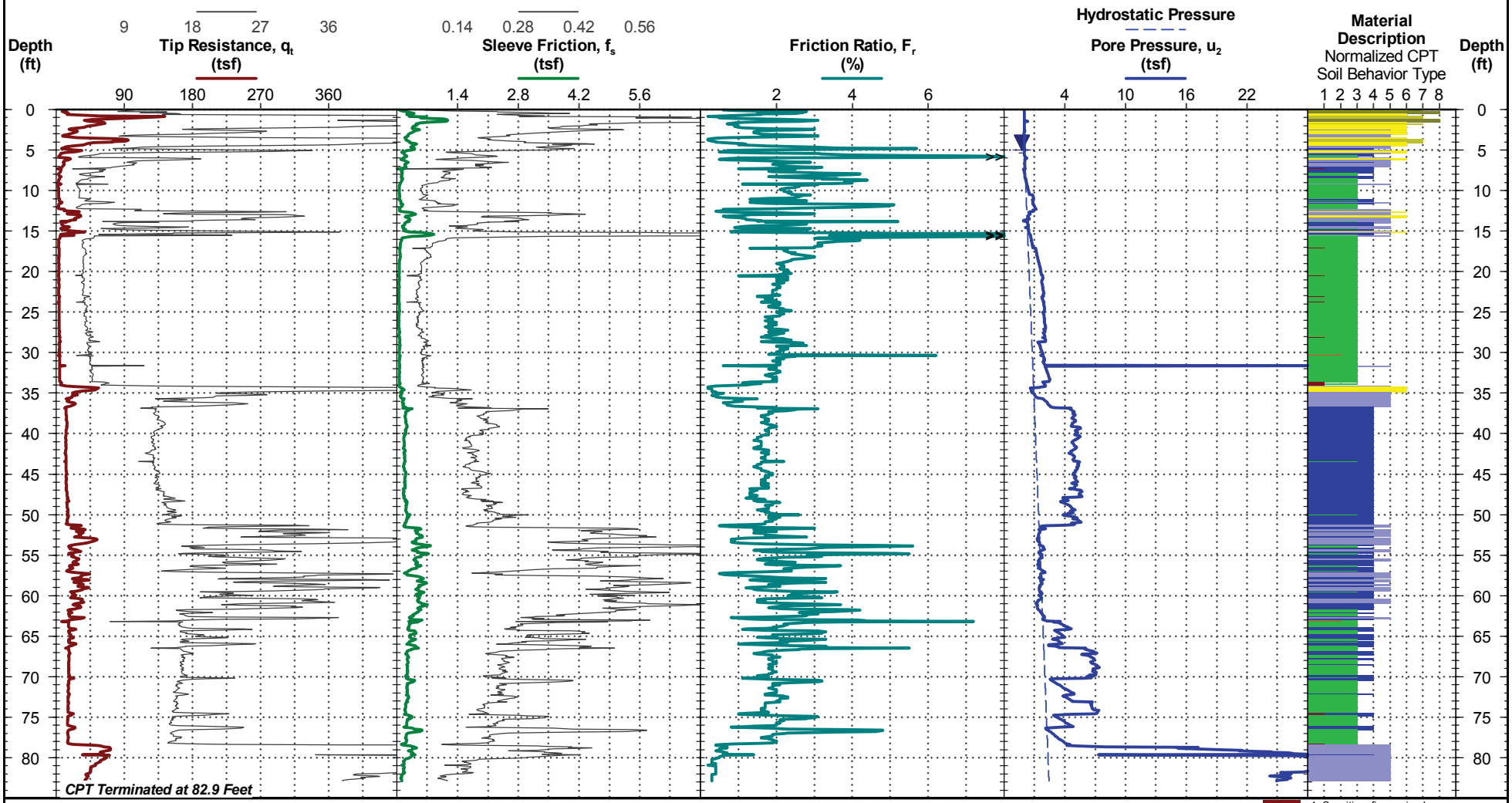
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.76954°
Longitude: -79.9331°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/18/2015	CPT Completed: 6/18/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C9

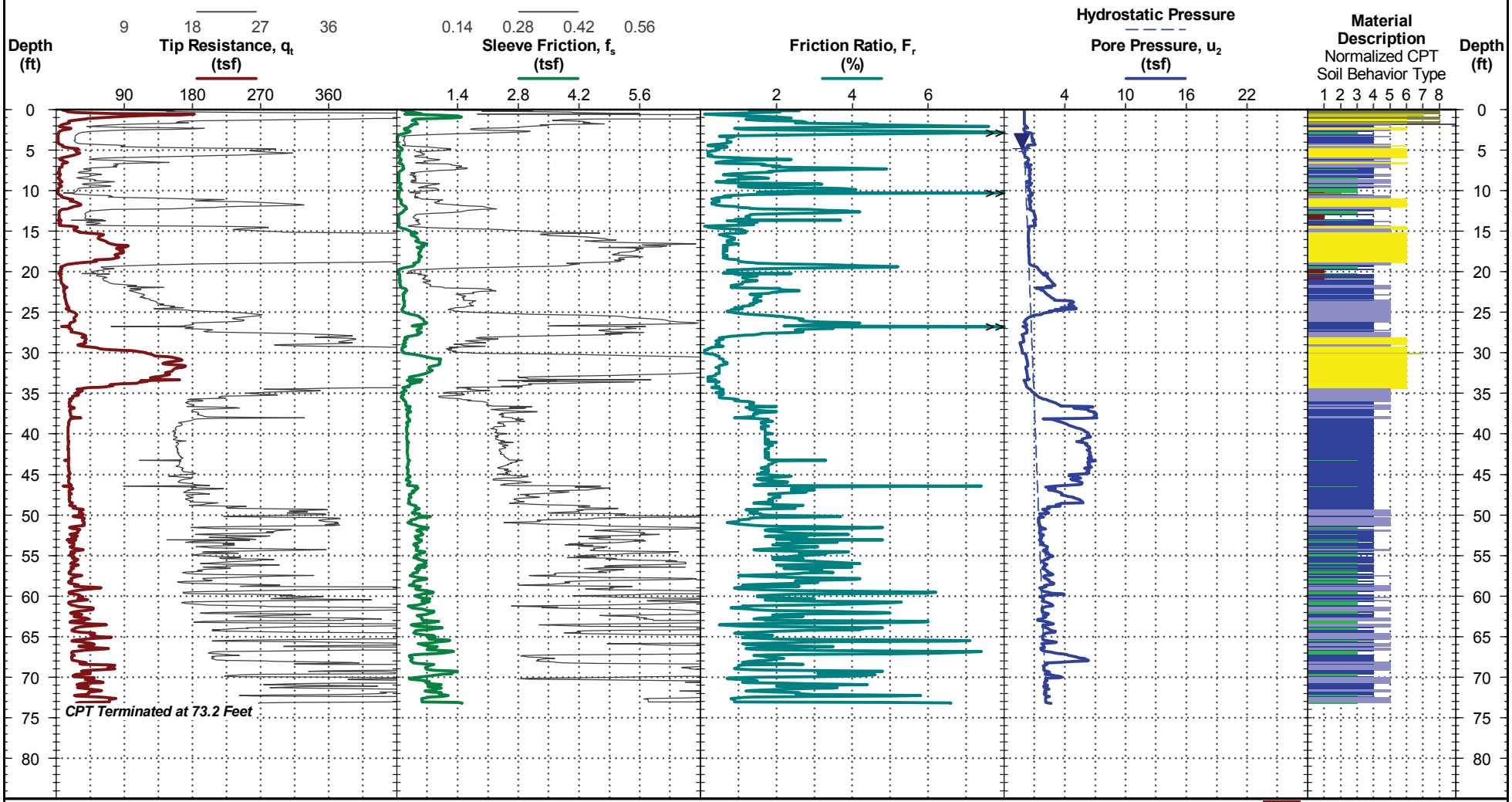
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.76942°
Longitude: -79.93148°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

4.8 ft measured water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/18/2015	CPT Completed: 6/18/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4

CPT LOG NO. C10

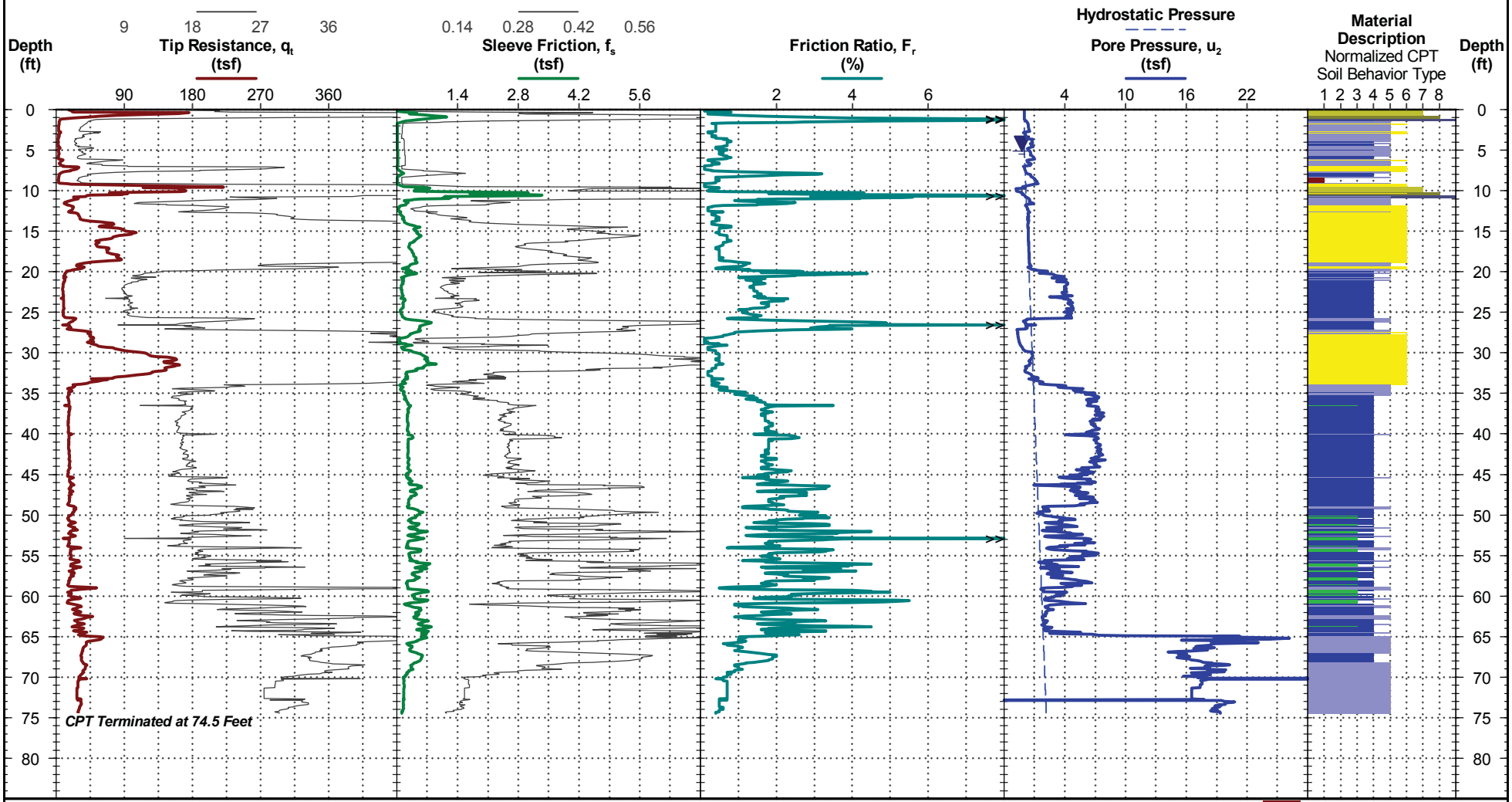
PROJECT: Battery Seawall Rehabilitation

CLIENT: Johnson, Mirmiran & Thompson
Charleston, SC

TEST LOCATION: See Exhibit A-2

SITE: Murray Drive
Charleston, South Carolina

Latitude: 32.76929°
Longitude: -79.92987°



See Exhibit A-3 for description of field procedures.
See Exhibit A-10 for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5.1 ft measured water depth
(used in normalizations and correlations; see Appendix B)

Probe no. 4675 with net area ratio of 0.839
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 9/2/2013
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
1450 5th Street West
North Charleston, South Carolina

CPT Started: 6/18/2015	CPT Completed: 6/18/2015
Rig: Pagani TG73-200	Operator: J. Bandle
Project No.: EN155074	Exhibit: A-4