



Addendum 1  
Kings Bluff Raw Water Transmission Main  
August 8, 2019

**BID DATE:** Tuesday, August 27, 2019 at 11:00 AM (as originally advertised)

**DEADLINE TO SUBMIT REQUESTS FOR SUBSTITUTIONS AND “OR-EQUALS”:**

Requests for substitutions and “or-equals” must be submitted to [bids@cfpua.org](mailto:bids@cfpua.org) by prime contractor by **Friday, August 16, 2019 at 3:00 PM.**

**DEADLINE FOR QUESTIONS: TUESDAY, AUGUST 20, 2019 AT 3:00 PM**

Inquiries concerning the bid shall be directed to the CFPUA Purchasing Division by email to [bids@cfpua.org](mailto:bids@cfpua.org). Deadline for questions is Tuesday, August 20, 2019 at 3:00 PM. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. (00211-6.01)

**TO ALL BIDDERS:**

Below are changes and or clarifications to the bid documents for this project. This Addendum forms a part of the Contract Documents and modifies the original bidding documents as noted below. Acknowledge receipt of this Addendum as required in the bid documents. Failure to do so may subject Bidder to disqualification.

**TERMS AND CONDITIONS:**

Bids shall remain open and valid for one hundred twenty (120) calendar days after the day of the Bid opening.

**BID FORM REVISIONS:**

A revised Bid Tab is attached. Bids must be submitted on the revised Bid Tab.

**DRAWINGS:**

Revised drawing C-16 is attached.

Revised drawing C-44 is attached.

**SPECIFICATIONS:**

SECTION 01720 1.1

Replace “ *Pipe elevations shall be provided at minimum 100-ft intervals along the pipe alignment and at all fitting locations.* ” with “ *Pipe elevations shall be provided at minimum 500-ft intervals along the pipe alignment and at all fitting locations.* ”

A revised Geotechnical Report is attached. The report includes all appendices.

Two (2) Duke Energy Transmission Encroachments are attached.

A Piedmont Natural Gas Encroachment is attached.

**QUESTIONS RECEIVED:**

Q1. Will all of the 48” Gate Valves have a 6” Bypass? Please Clarify.

A1. Yes.

Q2. Request for J&S Gate Valves to be approved as a substitution or equal.

A2. J&S Gate Valves are approved as an equal.

Q3. During the prequalification process we had to prequalify subcontractors, is it possible to add additional subcontractors to list. For example, if we were to need more than 1 welding subcontractor could we add another?

A3. Yes, GC must submit the additional subcontractor prequalification information as identified in the original Prequalification Package by Friday, August 16, 2019 at 3:00 PM. Subcontractor qualifications submitted after this date will not be reviewed or approved.

Q4. Can you provide the soil reports, I do not see them in the spec book.

A4. Attached Kings Bluff Water Main Geotechnical Report.

Q5. Please confirm that license numbers are not required for the subcontractor/supplier scopes as listed in Section 6 - Subcontracts of the Bid Form.

A5. Only if license number is not applicable.

Q6. May bidders write in multiple pipe suppliers on the bid form?

A6. No. Bidders are required to write in one (1) pipe supplier for the 54” raw water main.

Q7. Has any assessment been made to the existing pipe? If so, can that information be made available to the bidders

A7. In 2017, the LCFWSA completed a Smart Ball Assessment of 14 miles of 48-inch PCCP that is adjacent to the proposed 54-inch pipeline. The results of that assessment found no leaks in the pipeline system. A copy of the report will be included as part of Addendum No. 1.

Q8. When do you anticipate an addenda to address any current questions submitted through bids@cfpua.org or discussions had at the pre-bid? We’d like to have the soil borings as soon as possible.

A8. Geotechnical report attached.

- Q9. For replacement of topsoil, should the contractor replace width of the R/W?
- A9. The contractor shall replace any disturbed area in the right of way through all agricultural land so that the farmer is left with high quality soil after construction. Contractor may strip the topsoil where the plans call out agricultural land and place the topsoil back after construction.
- Q10. Where do you find the pipe embedment details and could you provide some clarity on how to determine where and when?
- A10. The pipe embedment detail on sheet D-5 shows 3 zone: Bedding and Haunching, Initial Trench Backfill, and Final Trench Backfill. The Geotechnical report specifies what material is allowing in each zone. (See Section 6 – Conclusions and recommendations)
- For Bedding and Haunching – *“Where open-cut is required, we recommend a minimum of 12 inches of washed stone (NCDOT select material class VI – No. 57 or 67) bedding be used to provide a level bottom for bearing of the pipe. The intent of these bedding procedures is to provide firm uniform bearing conditions for the water main.”*
  - For Initial Trench Backfill – *“The initial trench backfill above the bedding should consist of CFPUA Class II or III soils defined as GW, GP, SW, SP, GM, GC, SM or SC. The initial trench backfill will include the distance from 1 foot above the pipe down to the pipe bedding.”*
  - For Final Trench Backfill – *“The final backfill, extending from 1 foot above the pipe to ground surface should consist of, CFPUA Class II, III or IV soils defined as GW, GP, SW, SP, GM, GC, SM, SC, ML, MH, CH or CL.”*

Section 6.3 of the geotechnical report specifies compaction limits for each zone and where contractor may expect or not expect to find suitable soils for re-use based on the geotechnical investigations.

- Q11. A “high risk” item during the construction of the Kings Bluff Project will be the pre and post construction condition of the existing 48 Inch Water Line. Has there been an assessment on the existing 48 Inch Line (such as “Smart Ball”)? If so, would the Owner be willing to share the results of that assessment prior to the bid?? The specs discuss “special care” in regard to the existing line and in fact the contractor will lose a significant portion of the working easement during construction because of the layout of the existing line. The 48 Inch Line was installed between 1989 and 1994 - making it +/-30 years old. Understanding the current condition of the line will be important to assessing the risk of construction/vibration impact to the diaphragmed joints, interior/exterior concrete coating etc.....
- A11. Smart Ball report attached.

ACKNOWLEDGEMENT BY BIDDER. Bidder shall acknowledge receipt of this Addendum No. 1 in the space provided in the Bid Form.

All other terms & conditions remain unchanged.

Julia Faircloth  
Cape Fear Public Utility Authority  
Procurement Manager  
End of Addendum 1

Craig Wilson  
Cape Fear Public Utility Authority  
Engineering Manager  
Project Management



**BID FORM**

<b>CFPUA Project Name:</b>	Kings Bluff Raw Water Transmission Main
<b>Bid Opening Date/Time:</b>	Tuesday, August 27, 2019 t 11:00 AM
<b>Bid Opening Location:</b>	Engineering Conference Room
<b>Bids may be submitted and received prior to the Bid opening at this location:</b>	Cape Fear Public Utility Authority 235 Government Center Drive Wilmington, NC 28403

**1. GENERAL**

- 1.01 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to complete all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the Bidding Documents.
- 1.02 Terms contained in the Bidding Documents, including this Bid Form, have the same meaning as defined in the general and supplementary conditions made part of the Bidding Documents.
- 1.03 Bidder accepts all the terms and conditions of the Advertisement for Bid and Instruction to Bidders, including without limitation those dealing with the disposition of Bid Security. This bid will remain open and valid for one hundred twenty (120) calendar days after the day of the Bid opening. Bidder will sign the Agreement and submit insurance, bonding and other documents required by the Contract Documents within ten (10) calendar days from the date Owner gives notice to apparent lowest, responsive responsible Bidder.

**2. PROJECT EXPECTATIONS**

- 2.01 In submitting this Bid, Bidder represents, as fully set forth in the Agreement, that:
  - A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged.

No. \_\_\_\_\_ Dated \_\_\_\_\_

No. \_\_\_\_\_ Dated \_\_\_\_\_

No. \_\_\_\_\_ Dated \_\_\_\_\_

No. \_\_\_\_\_ Dated \_\_\_\_\_

- B. The undersigned Bidder agrees that Bidder has carefully examined and become familiar with the expectations of the Work described in the Bidding Documents, and agrees that he/she has met the bidding responsibilities stated in Section 4 of the Instructions to Bidders.

**3. NON-COLLUSION, NON-SUSPENSION, AND NON-CONVICTION**

- 3.01 Bidder represents that this Bid is genuine and is non-collusive.
- 3.02 Bidder further represents that he/she is not suspended or debarred from bidding on this Work, and that Bidder has not been convicted of any charges or engaged in any unlawful act of trade in Federal or any state jurisdiction.
- 3.03 Bidder is fully aware that Bid is not considered responsive, if CFPUA's Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction is not properly executed and submitted with Bid Form.

**4. CONTRACT TIMES**

- 4.01 Bidder agrees to the contract times and liquidated damages stated in the Agreement made part of the Bidding Documents.

**5. BID AMOUNT**

- 5.01 Bidder agrees to perform all the work described in the Bidding Documents for the unit and/or lump sum prices found in the Bid tabulation. *(Bid tabulation to be completed by Bidder can be found on next page. If Bid tabulation intentionally excluded by Owner and Owner is requesting one lump sum price for the complete Work, Bidder shall write out the lump sum amount in both word format and number format at the bottom of this page. Ex: one hundred twenty-five and 12/100 dollars; \$125.12)*

**KINGS BLUFF RAW WATER TRANSMISSION MAIN BID FORM**

**SCHEDULE I**

Item No.	Description	Unit	Estimated Quantity	Unit Cost		Total Cost
<b>1</b>	<b>Mobilization (3% Maximum)</b>	LS	1	\$ _____	/LS	\$ _____
<b>2</b>	<b>Construction Surveying and Staking</b>	LS	1	\$ _____	/LS	\$ _____
<b>3</b>	<b>Revised After Construction Surveying and Record Drawings</b>	LS	1	\$ _____	/LS	\$ _____
<b>4</b>	<b>Clearing and Grubbing</b>	LS	1	\$ _____	/LS	\$ _____
<b>5</b>	<b>54-inch Diameter Raw Water Main Pipe</b>					
a	STA 100+03+/- to STA 393+00+/- (Excludes Bore & Jack Installations)	LF	29,300	\$ _____	/LF	\$ _____
b	STA 393+00+/- to STA 488+43+/- International Paper Property (Excludes Bore & Jack Installation)	LF	9,600	\$ _____	/LF	\$ _____
c	STA 490+07+/- to STA 833+71+/- (Excludes Bore & Jack Installations & Livingston Creek Aerial Crossing)	LF	34,400	\$ _____	/LF	\$ _____
<b>6</b>	<b>Bore &amp; Jack 72-inch Steel Encasement Pipe</b>					
a	Sheet C-54 NC Highway 11 (Min. 0.625-inch Wall Thick.)	LF	160	\$ _____	/LF	\$ _____
b	Sheet C-54 SR 1817 John Reigel Road (Min. 0.625-inch Wall Thick.)	LF	90	\$ _____	/LF	\$ _____
c	Sheet C-56 SR 1426 Mt. Misery Road (Min. 0.625-inch Wall Thick.)	LF	145	\$ _____	/LF	\$ _____
d	Sheet C-57 International Paper Rail Yard (Min 1.0" Wall Thick.)	LF	300	\$ _____	/LF	\$ _____
<b>7</b>	<b>Sheet C-27 Livingston Creek Aerial Crossing</b>	LS	1	\$ _____	/LS	\$ _____
<b>8</b>	<b>Raw Water Main Fittings (Ductile Iron Pipe ONLY)</b>	LBS	280,000	\$ _____	/LB	\$ _____
<b>9</b>	<b>Pigging Facilities</b>					
a	Pig Launcher (Sheet C-1)	LS	1	\$ _____	/LS	\$ _____
b	Pig Retriever (Sheet C-50)	LS	1	\$ _____	/LS	\$ _____
<b>10</b>	<b>48-inch Raw Water Main Valves</b>	EA	22	\$ _____	/EA	\$ _____
<b>11</b>	<b>Raw Water Main Connections</b>					
a	Sheet C-1 Connection to Existing Raw Water Main Stub-Out at STA 100+03	LS	1	\$ _____	/LS	\$ _____
b	Sheet C-50 Connections (Two Total) to Existing 48-Inch Raw Water Main	LS	1	\$ _____	/LS	\$ _____
<b>12</b>	<b>48-inch Diameter Raw Water Main Pipe</b>	LF	300	\$ _____	/LF	\$ _____
<b>13</b>	<b>Combination Air Vacuum/ Air Release Valve and Vault</b>	EA	25	\$ _____	/EA	\$ _____
<b>14</b>	<b>Blow-Off / Drain Assembly</b>	EA	8	\$ _____	/EA	\$ _____
<b>15</b>	<b>30-inch Raw Water Main Pipe Replacement (Sheet C-2)</b>	LS	1	\$ _____	/LS	\$ _____
<b>16</b>	<b>Roadway Repair &amp; Restoration</b>					
a	Asphalt Roadway Trench Repair	LF	250	\$ _____	/LF	\$ _____
b	Asphalt Overlay	SY	2,400	\$ _____	/SY	\$ _____
c	Temporary Access Road (Reference Sheets C-51, C-52, C-53)	EA	5	\$ _____	/EA	\$ _____
<b>17</b>	<b>Cathodic Protection Installation and Testing (Complete)</b>	LS	1	\$ _____	/LS	\$ _____
<b>18</b>	<b>Utility Marker</b>	EA	13	\$ _____	/EA	\$ _____
<b>19</b>	<b>Subgrade Stabilization Stone As Required (Per LF Per 6-Inch Lift)</b>	LF	125,000	\$ _____	/LF	\$ _____
<b>20</b>	<b>Modify/Relocate 12" Raw Water Main Stub-Out &amp; Valve (Sheet C-2)</b>	LS	1	\$ _____	/LS	\$ _____
<b>21</b>	<b>Sheeting/Shoring at Duke Energy Transmission Structure (Sheet C-44)</b>	LS	1	\$ _____	/LS	\$ _____
<b>22</b>	<b>Restore Tennis Court (Sheet C-41)</b>	LS	1	\$ _____	/LS	\$ _____
<b>23</b>	<b>Erosion and Sedimentation Control</b>					
a	Temporary Silt Fence	LF	86,000	\$ _____	/LF	\$ _____
b	Check Dam	EA	50	\$ _____	/EA	\$ _____
c	Silt Curtains	EA	25	\$ _____	/EA	\$ _____
d	Seeding and Restoration	LF	75,000	\$ _____	/LF	\$ _____
<b>24</b>	<b>Replacement/Restoration of Driveways</b>					
a	Asphalt Driveway	EA	1	\$ _____	/EA	\$ _____
b	Concrete Driveway	EA	2	\$ _____	/EA	\$ _____
c	Gravel Driveway	EA	5	\$ _____	/EA	\$ _____
d	Compacted Soil Driveway	EA	30	\$ _____	/EA	\$ _____
<b>25</b>	<b>Geotechnical Instrumentation and Monitoring</b>					
a	Existing Structure	EA	15	\$ _____	/EA	\$ _____
b	IP Rail Yard Crossing	LS	1	\$ _____	/EA	\$ _____
<b>TOTAL BASE BID AMOUNT SCHEDULE I (ITEMS 1 THROUGH 25)</b>						\$ _____

**KINGS BLUFF RAW WATER TRANSMISSION MAIN BID FORM**

SCHEDULE II						
Item No.	Description	Unit	Estimated Quantity	Unit Cost		Total Cost
26	Sheet C-60 Connection to Brunswick Service Main and Meter to include Meter Installation, Valves Vault, Electrical, Controls, Bypass Piping, Fencing, and all Miscellaneous Appurtenances for a Complete Installation (STA. 809+50)	LS	1	\$ _____	/LS	\$ _____
27	<b>Pressure Reducing Valve Assemblies</b>					
a	Sheet C-59 30" Pressure Reducing Valve on Existing 48" PCCP Raw Water Main	EA	1	\$ _____	/EA	\$ _____
b	Sheet C-59 24" Pressure Reducing Valve on Existing 48" PCCP Raw Water Main	EA	1	\$ _____	/EA	\$ _____
28	<b>Raw Water Main Connections</b>					
a	Sheet C-10 Connection to Existing 48-inch Raw Water Main at STA 243+25	LS	1	\$ _____	/LS	\$ _____
b	Sheet C-22 Connection to Existing 48-inch Raw Water Main at STA 416+35	LS	1	\$ _____	/LS	\$ _____
c	Sheet C-36 Connection to Existing 48-inch Raw Water Main at STA 636+65	LS	1	\$ _____	/LS	\$ _____
29	<b>New Fences at Interconnections</b>					
a	6' Chain link Fence	LF	600	\$ _____	/LF	\$ _____
b	Double Hinge Access Gate	EA	3	\$ _____	/EA	\$ _____
c	6" Stone and Geofabric inside fenced area	SY	900	\$ _____	/SY	\$ _____
30	<b>Bollards</b>	EA	12	\$ _____	/EA	\$ _____
<b>TOTAL BASE BID AMOUNT SCHEDULE II (ITEMS 26 THROUGH 30)</b>						\$ _____
<b>TOTAL BASE BID AMOUNT SCHEDULE I AND SCHEDULE II (ITEMS 1 THROUGH 30)</b>						\$ _____

Raw Water Main Pipeline Material ( Circle One ) :

Ductile

Steel

Pipe Supplier:

\_\_\_\_\_

Gate Valve Supplier:

\_\_\_\_\_

**6. SUBCONTRACTS**

6.01 Bidder shall list all the subcontractors they have selected to perform the following subdivisions of work: Jack & Bore, Cathodic Protection, Welding, Welded Steel Pipe Supplier. Bidder shall also list the Work/Service to be performed, amount the subcontractor shall be paid, the percent of the total bid amount the subcontractor shall perform and the subcontractor’s NC license permitting them to perform this type of work (if applicable). Bidders shall only list one subcontractor for each work/service to be performed.

6.02 Subcontractor Summary Table

Subcontractor Name or indicate self-performing	Work/Service to be Performed	Amount to be Paid	Percentage of Total Bid	License Number (If applicable)
	Jack & Bore			
	Cathodic Protection			
	Welding			

Bidder acknowledges by signing below that all subcontractors performing the subdivisions of work as described in 6.01 are listed above in 6.02 the Subcontractor Summary Table. A contractor whose bid is accepted shall not substitute any person as a subcontractor in the place of the subcontractor listed in the original bid unless approved by CFPUA with justification from the contractor. Failure to comply with these terms may result in the bid being rejected based on non-responsiveness.

BIDDER SIGNATURE: \_\_\_\_\_

**7. BIDDER LICENSE**

7.01 The bidder must have the following North Carolina General Contractor’s License to be qualified to perform the work associated with this bid. Bidder must list License number below and provide copy of North Carolina General Contractors Certificate.

**Limitation: Unlimited**

**Classification(s): Public Utilities or Unclassified**

**NC License Number: \_\_\_\_\_ License Expiration Date: \_\_\_\_\_**

**8. BIDDER QUALIFICATIONS**

8.01 Other Qualifications: None

**9. BIDDER CONTACT**

9.01 Communications concerning this Bid shall be sent to the Bidder at the following:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**BIDDER SIGNATURE**

**Please see Section 9 of the Instruction to Bidder for additional information.**

**If a Corporation:**

Bidder Name: \_\_\_\_\_  
(As it appears on NC General Contractor's License)

By: \_\_\_\_\_ Date: \_\_\_\_\_  
(Officer as registered with the NC Secretary of State, or authorized person and provide evidence of authority to sign)

Printed Name: \_\_\_\_\_ Title: \_\_\_\_\_

Business Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Bidder is conducting Business under an Assumed Name (DBA) \_\_\_ Yes \_\_\_ No

If the above answer is Yes, please provide the Corporate Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

\_\_\_\_\_  
(Corporate Name as filed with NC Secretary of State)

**If a Limited Liability Company**

Bidder Name: \_\_\_\_\_  
(As it appears on NC General Contractor's License)

By: \_\_\_\_\_ Date: \_\_\_\_\_  
(Member-Manager)

Printed Name: \_\_\_\_\_ Title: \_\_\_\_\_

Business Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Bidder is conducting Business under an Assumed Name (DBA) \_\_\_ Yes \_\_\_ No

If the above answer is Yes, please provide the Company Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

\_\_\_\_\_  
(Name as filed with NC Secretary of State)

**If a Partnership**

Bidder Name: \_\_\_\_\_  
(As it appears on NC General Contractor's License)

By: \_\_\_\_\_ Date: \_\_\_\_\_  
(Partner)

Printed Name: \_\_\_\_\_ Title: \_\_\_\_\_

Business Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

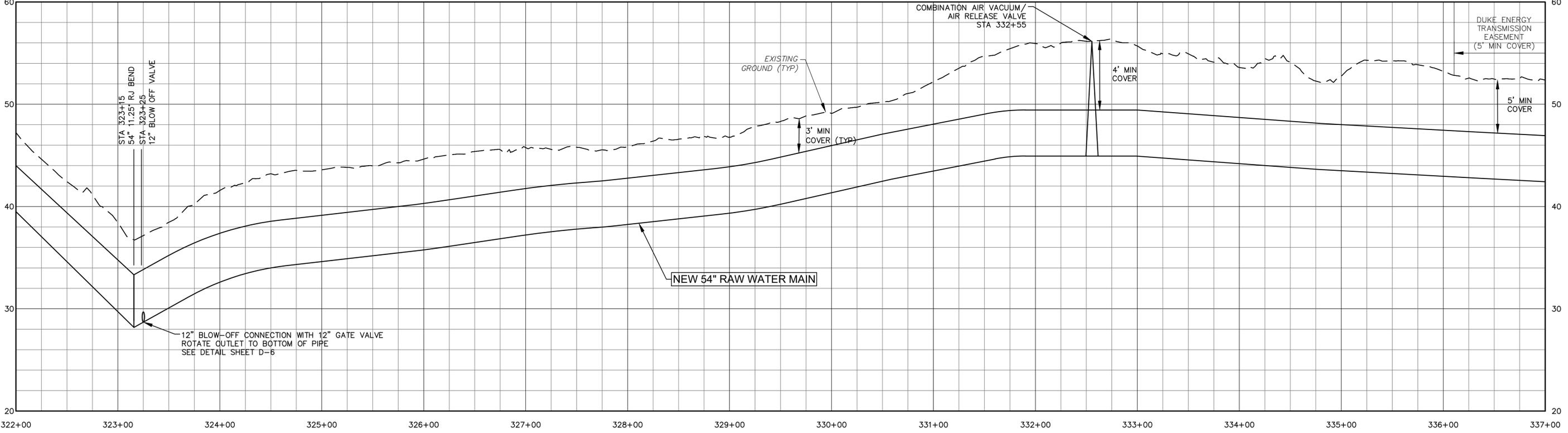
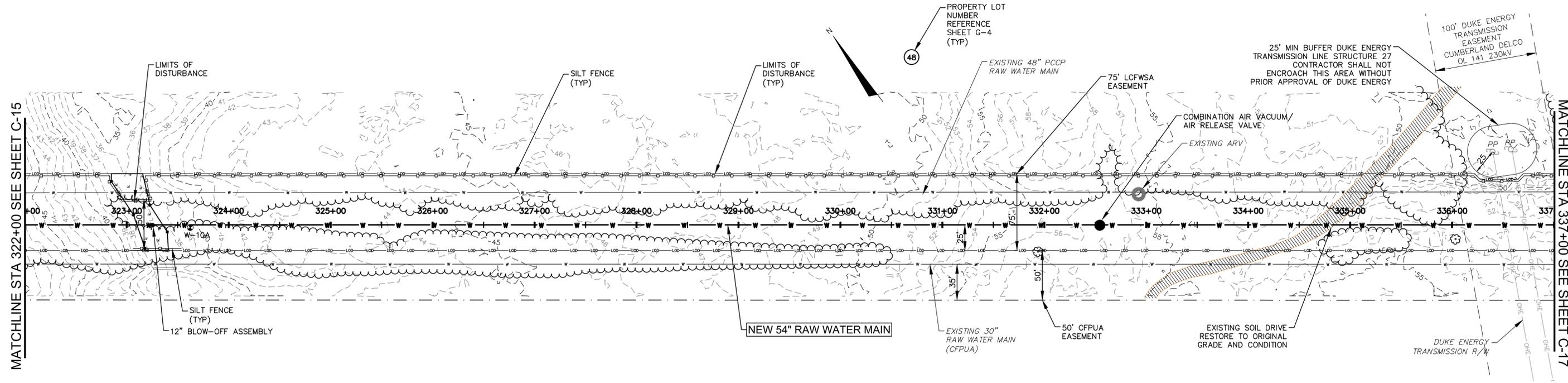
Bidder is conducting Business under an Assumed Name (DBA) \_\_\_\_ Yes \_\_\_\_ No

If the above answer is Yes, please provide the Partnership Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

\_\_\_\_\_  
(Name as filed with NC Secretary of State)

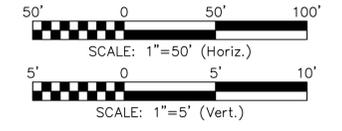
MATCHLINE STA 322+00 SEE SHEET C-15

MATCHLINE STA 337+00 SEE SHEET C-17



- GENERAL NOTES:**
- LAYOUT BASED ON STANDARD FITTING SIZES USING MAXIMUM JOINT DEFLECTION OF 2 DEGREES AND MINIMUM RADIUS OF 700 FT.
  - CONTRACTOR SHALL TAKE THE NECESSARY STEPS TO PROTECT THE EXISTING 48" RAW WATER MAIN.
  - ALL EXCAVATIONS (TRENCHING, BORING, BORE PITS, ETC) ARE UNCLASSIFIED. GEOTECHNICAL REPORT AND BORING LOGS HAVE BEEN PROVIDED IN PROJECT SPECIFICATIONS.
  - SITE SURVEY WAS PERFORMED BY MCKIM AND CREED IN 2017. ALL COORDINATES ARE TIED TO THE NORTH CAROLINA STATE PLAN COORDINATE SYSTEM (NAD 83 FEET).
  - THE LOCATION OF ALL EXISTING UTILITIES ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY LOCATIONS.
  - NEW 54" RAW WATER MAIN SHALL BE WELDED STEEL PIPE (THICKNESS MIN = 0.22, LINING = CEMENT MORTAR, COATING = POLYURETHANE) OR DUCTILE IRON PIPE (PC 150, LINING = CEMENT MORTAR, COATING = ZINC). CONTRACTOR SHALL UTILIZE ONLY ONE MATERIAL UNLESS APPROVED BY ENGINEER OR MATERIAL IS SHOWN ON PLANS.

- OSHA MINIMUM APPROACH DISTANCE IS 20 FEET. CONTRACTOR SHALL INSTALL PIPE WHILE MEETING OSHA MINIMUM APPROACH DISTANCE REQUIREMENTS.
- CONTRACTOR SHALL COORDINATE WITH DUKE TRANSMISSION MINIMUM OF 14 DAYS PRIOR TO CROSSING AND HOLD PRE-CONSTRUCTION CONFERENCE WITH BILL WILDER - DUKE ENERGY ASSET PROTECTION, CELL: 910-520-3911



**54" RAW WATER MAIN  
PLAN AND PROFILE  
STA 322+00 TO STA 337+00**



**CAPE FEAR  
PUBLIC UTILITY AUTHORITY  
KINGS BLUFF RAW  
WATER TRANSMISSION MAIN**

CAPE FEAR PUBLIC UTILITY AUTHORITY  
235 GOVERNMENT CENTER DRIVE  
WILMINGTON, NC 28403  
OFFICE: (910)332-6560

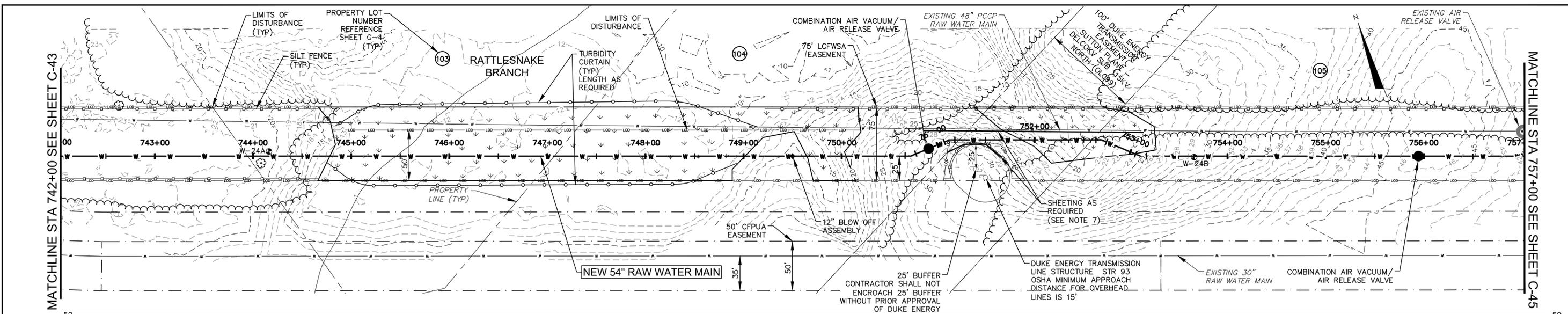
DATE: JUNE 2019  
SCALE: AS SHOWN  
DRAWN BY: JPV  
CHECKED BY: AWB  
PROJECT NO.: 5367-0038

**SHEET NO:  
C-16**

**MCKIM & CREED**  
243 NORTH FRONT ST  
WILMINGTON, NORTH CAROLINA 28401  
TELE: (910) 343-1048  
FAX: (910) 251-8282  
LICENSE: F-1222

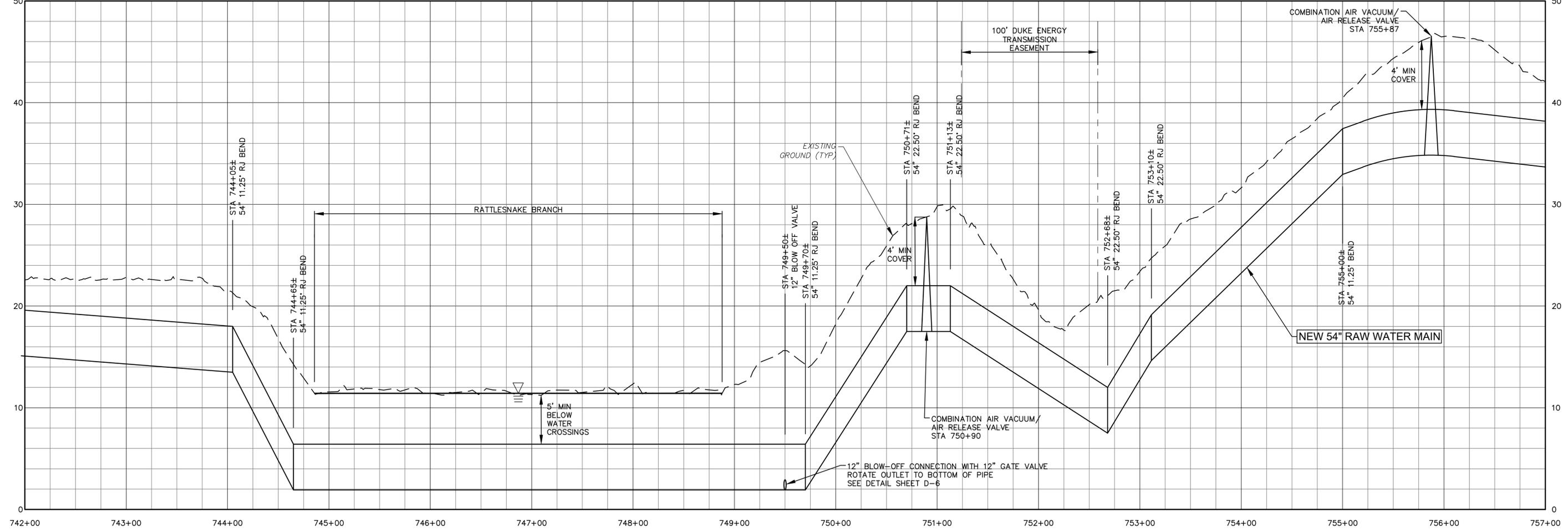


REV:	DESCRIPTION	DATE:
0	ISSUED FOR BID - NOT FOR CONSTRUCTION	JUN 2019



MATCHLINE STA 742+00 SEE SHEET C-43

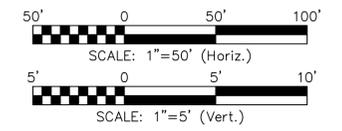
MATCHLINE STA 757+00 SEE SHEET C-45



- GENERAL NOTES:**
- LAYOUT BASED ON STANDARD FITTING SIZES USING MAXIMUM JOINT DEFLECTION OF 2 DEGREES AND MINIMUM RADIUS OF 700 FT.
  - CONTRACTOR SHALL TAKE THE NECESSARY STEPS TO PROTECT THE EXISTING 48" RAW WATER MAIN.
  - ALL EXCAVATIONS (TRENCHING, BORING, BORE PITS, ETC) ARE UNCLASSIFIED. GEOTECHNICAL REPORT AND BORING LOGS HAVE BEEN PROVIDED IN PROJECT SPECIFICATIONS. SITE SURVEY WAS PERFORMED BY MCKIM AND CREED IN 2017. ALL COORDINATES ARE TIED TO THE NORTH CAROLINA STATE PLAN COORDINATE SYSTEM (NAD 83 FEET).
  - THE LOCATION OF ALL EXISTING UTILITIES ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY LOCATIONS.
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- CONTRACTOR SHALL INSTALL SHEETING AS REQUIRED TO INSTALL THE NEW RAW WATER MAIN AND PROTECT THE EXISTING RAW WATER MAIN AND THE DUKE ENERGY OVERHEAD POWER STRUCTURES. CONTRACTOR SHALL SUBMIT A PROPOSED SHEETING/SHORING PLAN FOR REVIEW MIN 30 DAYS PRIOR TO CONSTRUCTION. ANY INSTALLED SHEETING SHALL BE REMOVED FROM DUKE ENERGY R/W.
- GROUND TO CONDUCTOR CLEARANCE AT DUKE TRANSMISSION CROSSING LOCATION IS APPROXIMATELY 35'. CONTRACTOR MUST HAVE NO EQUIPMENT HIGHER THAN 20' ABOVE GRADE IN THIS AREA. CONTRACTOR SHALL INSTALL PIPE AND ANY SHEETING/SHORING WHILE MEETING OSHA MINIMUM APPROACH DISTANCE REQUIREMENTS

- CONTRACTOR SHALL COORDINATE WITH DUKE TRANSMISSION MINIMUM OF 14 DAYS PRIOR TO CROSSING AND HOLD PRE-CONSTRUCTION CONFERENCE WITH BILL WILDER - DUKE ENERGY ASSET PROTECTION, CELL: 910-520-3911



**54" RAW WATER MAIN  
PLAN AND PROFILE  
STA 742+00 TO STA 757+00**



**CAPE FEAR  
PUBLIC UTILITY AUTHORITY  
KINGS BLUFF RAW  
WATER TRANSMISSION MAIN**

CAPE FEAR PUBLIC UTILITY AUTHORITY  
235 GOVERNMENT CENTER DRIVE  
WILMINGTON, NC 28403  
OFFICE: (910)332-6560

DATE: JUNE 2019  
SCALE: AS SHOWN  
DRAWN BY: JPV  
CHECKED BY: AWB  
PROJECT NO.: 5367-0038

**SHEET NO:  
C-44**

**MCKIM & CREED**  
243 NORTH FRONT ST  
WILMINGTON, NORTH CAROLINA 28401  
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REV:	DESCRIPTION	DATE:
0	ISSUED FOR BID - NOT FOR CONSTRUCTION	JUN 2019



Geotechnical Exploration Report  
CFPUA Kings Bluff Parallel Raw Water Main  
Bladen, Columbus, & Brunswick Co., NC  
S&ME Project No. 1306-17-013

PREPARED FOR:

**McKim & Creed**  
243 N. Front Street  
Wilmington, North Carolina 28401

PREPARED BY:

**S&ME, Inc.**  
3006 Hall Waters Drive, Suite 100  
Wilmington, NC 28405

**June 6, 2018**



June 6, 2018

McKim & Creed  
243 N. Front Street  
Wilmington, North Carolina 28401

Attention: Mr. Tony Boahn, P.E.

Reference: **Geotechnical Exploration Report**  
**CFPUA Kings Bluff Parallel Raw Water Main**  
Bladen, Columbus, and Brunswick Counties, North Carolina  
S&ME Project No. 1306-17-013  
NC PE Firm License No. F-0179

Dear Mr. Boahn:

S&ME, Inc. (S&ME) is pleased to submit this geotechnical exploration report for the referenced project. Work was conducted in accordance with our proposal number 13-1700223 dated July 11, 2017, along with the McKim & Creed Subcontract Services Work Order signed July 12, 2017. The purpose of the exploration was to evaluate subsurface conditions as they relate to water main installation. This report presents a summary of pertinent project information, exploration sampling methods, description of subsurface conditions encountered, and geotechnical conclusions and recommendations.

S&ME appreciates the opportunity to provide geotechnical engineering services for this project. If you have any questions or need additional information concerning this report, please contact us.

Sincerely,

**S&ME, Inc.**

A handwritten signature in blue ink, appearing to read 'J. Adam Browning'.

J. Adam Browning, P.E.  
Senior Engineer

Keith C. Brown, P.E.  
Senior Project Manager  
Registration No. 022540



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## 1.0 Project Information

Project information is based on the following sources of information:

- Emails between Mr. Tony Boahn of McKim & Creed and Mr. Keith Brown of S&ME between May 4 and July 7, 2017.
- Site plan showing water main alignment along with creek and wetlands crossings.

We understand that the Cape Fear Public Utility Authority (CFPUA) plans to install a 60-inch diameter raw water main. The raw water main will be installed along a 14-mile existing pipeline easement. Along the alignment are the following:

- 12 NCDOT Road Crossings
- 23 Wetlands/Creek Crossings
- Aerial Crossing of Livingston Creek – Approximately 120 feet with 4 bent locations
- 1 Crossing at the International Paper Rail Yard – Approximately 800 feet

We anticipate that water main installation methods will include cut and cover, bore and jack and a portion along Livingston Creek will be aerial. Invert elevations for the water main are anticipated to be approximately 10 feet below the existing ground surface where cut and cover is planned. Along NCDOT road cuts, a similar invert is anticipated except when conflicted by other utilities and a greater depth would then be required. At bore and jack locations construction will include installation of an 84 to 90 inch encasement pipe. Inverts are unknown at the writing of this report. Where bore and jack techniques are performed at road crossings, launching and receiving pits are constructed on either side of the run and could extend to depths of 20 feet below the existing ground surface. At the International Paper Rail Yard, starting and receiving pits could extend to depths of 30 feet below the existing ground surface. The aerial crossing of Livingston Creek will consist of 4 four pile bents. The piles will be either HP 10x57 or 12x53 steel H-Piles. The piles will be concrete encased above the mudline.

S&ME performed the majority of our exploration at either road crossings, wetland areas, creek crossings, the International Rail Yard and Livingston Creek. A portion of the borings were spaced sporadically across anticipated cut and cover alignment areas. The entire alignment is within an existing utility right of way. The actual alignment has not been determined. We anticipate the alignment will consist of open grassed lawn, farm fields, wooded areas, wetland areas and creeks.

## 2.0 Area Geology

The site is located within the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain Province is typically characterized by marine, alluvial, and eolian sediments that were deposited during periods of fluctuating sea levels and moving shorelines. The soils in this province are typical of those laid down in a shallow sloping near-shore marine environment. Alluvial sands, silts, and clays are typically present near rivers and creeks.



The alignment has varying thicknesses of undifferentiated Quarternary Deposits with possible Tertiary Deposits underlain by the Peedee Formation of the Cretaceous Period. The Peedee Formation is described as sand, clayey sand, and clay, greenish gray to olive black, massive, glauconitic, locally fossiliferous and calcareous. Patches of sandy molluscan-mold limestone are present in the upper part of the formation. The Peedee formation would be expected to trend down from west to east. The top of the Peedee is expected to range from 15 to 0 feet MSL.

### 3.0 Exploration Program

Field exploration services for this project included a visual site reconnaissance by representatives of S&ME and performance of 91 test borings, including the following:

- 20 Road Crossing Borings (labeled as R-#A, B, or C) to depths of 25 to 30 feet
- 2 Railroad Crossing Borings (labeled as RT-07A and RT-07B) to depths of 50 feet
- 4 Creek Crossing Borings (labeled as C-#A) to depths of 20 to 30 feet
- 47 Wetland Crossing Borings (labeled as W-#A, B, C, D, E, F, G, or H) to depths of 20 to 45 feet
- 18 General Alignment Borings (labeled as A-1 through A-18) to depths of 20 feet

The borings were marked with flags using GPS equipment. Approximate boring locations are shown on the Boring Location Plans in Appendix I.

Borings were performed using a CME 45 and Diedrich D-25 drill rigs and wash bore drilling methods. Split-spoon samples of subsurface soils were taken at approximate 2.5-foot intervals above a depth of 10 feet and 5-foot intervals thereafter. Standard penetration tests were conducted in conjunction with split-spoon sampling in general accordance with ASTM D 1586-11. Boreholes were observed for groundwater at termination of boring and after 24 hours in selected borings. At the completion of drilling operations, the boreholes were backfilled up to the original ground surface with auger cuttings.

Representative split-spoon soil samples were returned to our laboratory for visual classification in accordance with Unified Soil Classification System (USCS) guidelines. Laboratory testing was performed on selected split-spoon samples and included natural moisture content, grain size analyses, and Atterberg limits testing.

Generalized subsurface conditions profiles are included in Appendix I. Boring logs are included in Appendix II. Stratification lines shown on boring logs and the profiles are intended to represent approximate depths of changes in soil types. Naturally, transitional changes in soil types are often gradual and cannot be defined at particular depths. Ground surface elevations shown on the boring logs and profiles were obtained from Google Earth and should be considered approximate.

### 4.0 Subsurface Conditions

The following is a brief summary of subsurface conditions encountered in the borings. For more detailed information please reference the generalized subsurface conditions profiles in Appendix I and the boring logs in Appendix 2.



Surficial materials encountered in the borings typically consisted of a thin layer of topsoil or soils containing organic material. A wood layer, which extended to an approximate depth of 11.5 feet, was encountered at the ground surface of W-17D. Boring R-12 in a pavement area and encountered 4 inches of asphalt over 5.5 feet of structural fill consisting of medium dense sand (USCS classification SP).

Coastal Plain and Pee Dee formation soils were typically encountered below the surficial materials. These soils consisted of sands (SP, SP-SM, SP-SC, SM, SC), silts (ML, MH), and clays (CL, CH). Standard penetration test (SPT) N-values in these soils ranged from weight-of-rod (W.O.R.) and weight-of-hammer (W.O.H.) to 50 blows with 5 inches of penetration. Typical SPT N-values encountered ranged from about 5 to 20 blows per foot. The soils were visually observed as moist to wet.

In addition to the wood layer encountered in W-17D mentioned above, layers sampled as mostly wood were also encountered in W-09B (8 to 12 feet) and W-23A (8 to 12 feet).

Water level measurements were taken termination of drilling in most borings and after 24 hours in selected borings. Water was observed at approximate depths ranging from the ground surface to 15 feet below the existing ground surface. Water was measured at about 2 to 7.5 feet above the mudline in borings W-17C, W-17D, and W-17F. Water levels at termination of boring in borings drilled using the wash bore method should be considered approximate, due to the use of water during drilling operations. Water elevations can be expected to fluctuate due to seasonal variations in rainfall, evaporation, and other factors. Additionally, perched water may exist during wet periods of the year above less permeable fine-grained materials, such as silts, clays, or rock materials.

## **5.0 Laboratory Test Results**

The following is a brief summary of the laboratory test results. A summary of the laboratory test results along with individual laboratory test records is included in Appendix III.

Natural moisture contents on selected split-spoon samples tested ranged from 13.6 to 56.8 percent.

Grain size analysis testing indicated gravel size particle contents of 0 to 23.2 percent, sand size particle contents of 2.2 to 98.4 percent, and silt/clay size particle contents of 1.6 to 97.8 percent.

Several of the split-spoon samples selected for Atterberg limits testing were determined to be non-plastic. The remaining samples tested indicated liquid limits ranging from 25 to 76 percent, plastic limits ranging from 12 to 28 percent, and plasticity indices ranging from 10 to 52 percent.



## 6.0 Conclusions and Recommendations

### 6.1 Excavations

Based on the test borings and anticipated water main installation depths, we expect that the excavations will typically extend through low to moderate consistency soils that can be excavated by conventional excavation equipment. Layers sampled as mostly wood were encountered in W-09B (8 to 12 feet), W-17D (0 to 11.5 feet), and W-23A (8 to 12 feet). Very soft silts and clays and very loose to loose sands, below the groundwater, with caving potential, were encountered within anticipated excavation depths in a significant number borings.

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service, and under no circumstance should S&ME be assumed to be responsible for construction site safety. Excavation shoring and sloping for excavations deeper than 20 feet must be designed by a licensed Professional Engineer employed by the Contractor.

#### 6.1.1 Construction Groundwater Control

Groundwater was encountered in the borings at depths ranging from the ground surface to about 15 feet below the ground surface. Localized zones of perched water may also be present above the excavation depths. Groundwater control will be required for the proposed construction. The means and methods of groundwater control are typically left to the discretion of the Contractor. Excavations should be kept free of surface water and/or groundwater.

Potential groundwater control methods for the temporary construction excavations include open pumping, predrainage dewatering, and cutoff/exclusion. Open pumping utilizes submersible sump pumps in pits or trenches dug below the bottom of the excavation and backfilled with No. 57 stone. Submersible sump pumps placed in perforated or slotted plastic pipe installed in angled pits backfilled with No. 57 stone below the bottom of the excavation, called "stingers", are another type of open pumping. Pumping can be performed on an intermittent basis to remove water from the construction excavation, but should be continuous (24 hours a day) to maintain excavation bottom stability. Predrainage dewatering requires the installation of temporary wells and/or wellpoints within or around the excavations, with continuous (24 hours a day) pumping both before excavation and while the excavations are in use to lower the groundwater adequately beneath the entire excavation areas. Cutoff or exclusion involves the installation of sheetpiling completely around the excavations and open pumping from inside the sheeting during excavation. Predrainage dewatering outside the sheeting can be implemented to reduce groundwater pressure on the sheetpiling and potential leakage of the sheeting at joints.

We anticipate preferential horizontal permeability at the contact between clayey soil layers and overlying sandy soils. This may result in seeps in construction excavation grade. If significant seepage occurs at these contacts that potentially destabilizes the construction excavation slope, it may be necessary to intercept and control the seepage with slope drains.

The responsibility for dewatering of construction excavations and preventing excessive settlement of other site features (adjacent utilities or structures) due to dewatering should lie solely with the contractor. This information is



provided only as a service and under no circumstance should S&ME be assumed to be responsible for the effectiveness of the construction dewatering method(s) selected by the contractor.

## **6.2 Pipe Bedding and Initial Trench Backfill**

We understand that a 60-inch diameter steel pipe will be used. Where open-cut is required, we recommend a minimum of 12 inches of washed stone (NCDOT select material class VI – No. 57 or 67) bedding be used to provide a level bottom for bearing of the pipe. The intent of these bedding procedures is to provide firm uniform bearing conditions for the water main. Soft clays and silts were encountered at the assumed invert elevation of 10 feet below the existing ground surface in the following borings: R-2, W-3A/B, W-5A, W-9A/B, C-3, A-4, W-15A, W-17D/H, R-9A/B, R-10B, A-7A/B, W-23A, W-24A and W-25A/B. Additional undercut and replacement with washed No. 57 stone may be required to achieve stable subgrade upon which to install the pipe. The depth of additional undercut should be determined in the field at the time of construction.

The initial trench backfill above the bedding should consist of CFPUA Class II or III soils defined as GW, GP, SW, SP, GM, GC, SM or SC. The initial trench backfill will include the distance from 1 foot above the pipe down to the pipe bedding. The final backfill, extending from 1 foot above the pipe to ground surface should consist of, CFPUA Class II, III or IV soils defined as GW, GP, SW, SP, GM, GC, SM, SC, ML, MH, CH or CL.

Class V soils are excluded from use as trench backfill and are defined as OL and OH materials. The only exception to this is within wetland areas where these materials may be replaced in the order they were removed from within the final backfill zone.

At NCDOT road crossings, the washed stone used for the bedding should be wrapped in a non-woven filter fabric (Mirafi 140N) to prevent the infiltration of soil fines into the granular material which could otherwise result in the creation of voids and corresponding subsidence of these soils.

## **6.3 Trench Backfill**

After proper bedding, and installation of the water main excavated areas may be backfilled to their design subgrade elevations using suitable soils placed and compacted in accordance with the existing project specifications. The contractor is responsible for any subgrade subsidence.

Initial trench backfill should be placed in 6 to 8 inch loose lifts and compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D 698) within 3 percent of optimum moisture content. In pavement areas, the backfill should be compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D 698). This requirement should be increased to 98 percent in the top 12 inches. In non-structural areas, the final backfill zone should be compacted to at least 90 percent of the soil's maximum dry density as determined by ASTM D698. Compactive effort and structural fill must extend the entire width of the trench, contacting the trench sidewalls.

The NCDOT may have specific requirements for compaction levels on their right of way. We suggest that they be contacted regarding any special compaction measures that they may require. We understand that a screenings backfill material is planned to be used where open cuts are performed within NCDOT right-of-ways.



### 6.3.1 *Reuse of On-site Soils*

The excavated soils at this site have Unified Soil Classification (USCS) designations of SP, SM, SC, CL, ML and some OL. The onsite soils are significantly wet of optimum moisture content and will require significant drying prior to reuse as compacted structural fill. If drying of the soils is impractical, off site borrow will be required. The contractor should consider stockpiling suitable cut soils for use in the Initial Backfill zone. Along portions of the alignment, no Class II or III soils are present. No Class II or III soils were encountered in the vicinity of borings R-1A, W-1B, W-2A, W-2B, W-3A, W-6A, W-6B, W-7A through A-6, W-17C, W-17D, W-17G, R-8A through W-18A, R-9A through A-11, W-22B through A-14, A-15, W-24A, W-25A through W-26B, A-17 and A-18. Approximately half of a proposed 10 foot excavation did not encounter class II or III soils in the vicinity of borings W-6A, A-10 through W-9A, W-10A through R-6A, A-6, W-17C, W-17D, W-17G, R-8A through W-18A, R-9A through A-11, R-10A through R-11B and A-17. Excluding near surface topsoil materials, Class V soils were encountered in borings W-9B, W-17B and W-23A.

Within wetland areas, it has been S&ME's experience that as a condition of most Army Corps permits, the final backfill zone should be replaced with materials from the excavation. More specifically, it is often asked that material be replaced in the order it was removed.

Off-site borrow should consist of soils having USCS classifications of SM, SC, SP, SW. The borrow should also have a standard Proctor maximum dry density of at least 110 pounds per cubic foot, a maximum plasticity index of 15, and maximum particle size of 2 inches.

## 6.4 **Jack and Bore Considerations**

We understand that three crossings will require jack and bore installation methods. Appendix IV of this report includes Jack and Bore Difficulty Comments for crossings at North Carolina Highway 11 South, John Riegel Road, and International Paper's railyard. We have also included Jack and Bore Difficulty Comments for the other NCDOT road crossings in case bore and jack is performed in lieu of cut and cover. S&ME recommends that the contractor submit a ground surface settlement monitoring plan for the International Paper railyard. The plan should identify the locations of settlement monitoring points, reference benchmarks, survey frequency and procedures.

## 6.5 **Foundation Recommendations for Pipe Supports**

We understand that an aerial crossing will be required at Livingstone Creek (boring locations W-17A through W-17H). The proposed foundation types are to consist of 12x53 steel H-piles encased in concrete above the mudline. We understand the loads at each support location will consist of 80 kips of vertical loading and 7 kips of horizontal loading.

Based on the subsurface conditions encountered, we recommend the foundations be installed to a minimum depth of 35 feet below the existing ground surface.

### 6.5.1 *Axial Pile Resistance*

A steel H-Pile 12x53 was analyzed at a length of 35 feet. At this length, we estimate the pile will support a maximum of 25 kips of design axial load with an adequate safety factor under static loading conditions.



An efficiency factor accounting for capacity reductions caused by group effects of 1.0 should be used for center-to-center pile spacing of three pile diameters or more. Three pile diameters is the minimum recommended spacing. The structural capacity of the piles has not been considered in our analysis and is the responsibility of the structural engineer.

### 6.5.2 *Lateral Pile Resistance*

The geotechnical response of a laterally loaded 12x53 H-pile was analyzed using LPILE 9.0. An axial load of approximately 25 kips was applied to the 12x53 H-pile.

A summary of maximum shear and moments at 1-inch of deflection for fixed-head and free-head pile conditions are presented in the following table. The values are based on the 12x53 H-pile oriented along its strong axis. Plots of deflection, shear, and moment versus depth at 1-inch allowable deflections are included in the appendix.

Pile Type	Head Condition	Deflection (in.)	Maximum Shear (kips)	Maximum Moment (in.-kips)
12x53 H-Pile	Fixed	1	5	440
	Free	1	1.6	300

### 6.5.3 *Deep Foundation Construction Considerations*

The installation of the piles should be in accordance with the local and state building code requirements. In addition, the installation of all piles should be monitored by the geotechnical engineer. The geotechnical engineer's representative should verify and record the aspects of the installation for general conformance with the project drawings and specifications, including any design information and installation procedures submitted by the foundation subcontractor.

Prior to the start of construction, a wave equation analysis should be performed to verify that the proposed driving system (i.e., hammer type and size) is capable of driving the piles to the desired depth and to establish the driving criteria. It is important for the pile hammer to have enough energy to move the pile at least 30 to 50 blows per foot at the design pile capacity. An impact hammer (air, hydraulic, or diesel) should be used to install the piles and verify that the design compression resistance is achieved. Compression resistance cannot be verified if a vibratory hammer is used. All equipment should be subject to the review of the geotechnical engineer.

Please note that a layer of mostly wood was encountered in W-17D from the ground surface to an approximate depth of 12 feet. Pre-augering may be required in this area in order to install the 12x53 H-pile.



## 6.6 Pavement Thickness Design for NCDOT Roads

We understand that replacement pavement sections will likely be required for NCDOT roadway crossings. The design replacement section will be based on the traffic loading anticipated for that roadway. NCDOT Roadway Standard Drawing 654.01 indicates a typical replacement section consisting of 2 to 3 inches of S-9.5B or S-9.5C asphalt over 11 inches of B-25.0B or B25.0C asphalt. The actual design replacement section will need to be coordinated with the NCDOT District Engineer in Columbus County.

All pavement materials and construction methods should conform to the 2012 edition of the NCDOT "Standard Specifications for Roads and Structures." Aggregate base course (ABC) stone, if required, should consist of stone meeting the requirements under Section 520 and Section 1010. ABC should be compacted to at least 100 percent of the maximum dry density as determined by the modified Proctor compaction test, AASHTO T-180 as modified by NCDOT. To confirm that the base course stone has been uniformly compacted, in-place density tests should be performed by a qualified soils technician and the area should be thoroughly proofrolled under his observation.

Asphaltic concrete should conform to Section 610 in the 2012 edition of the NCDOT "Standard Specifications for Roads and Structures." Sufficient testing and observation should be performed during pavement construction to confirm that the required thickness, density, and quality requirements of the specifications are followed.

## 6.7 Temporary Access Roads

We anticipate that the contractor will be responsible for constructing and maintaining temporary access roads during construction. Subgrade repair will likely be required in order to construct temporary access road due to the soft/loose near-surface soils encountered in a significant number of the borings. Subgrade repair measures may include undercut and replacement, raising site grades using compacted structural fill, ABC stone, or ballast, and/or use of a geosynthetic (i.e. geogrid or geotextile). Actual subgrade repair measures required will be dependent on conditions encountered at time of construction. Even with subgrade repair measures, maintenance of the temporary access roads will be required.

## 7.0 Qualifications of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until



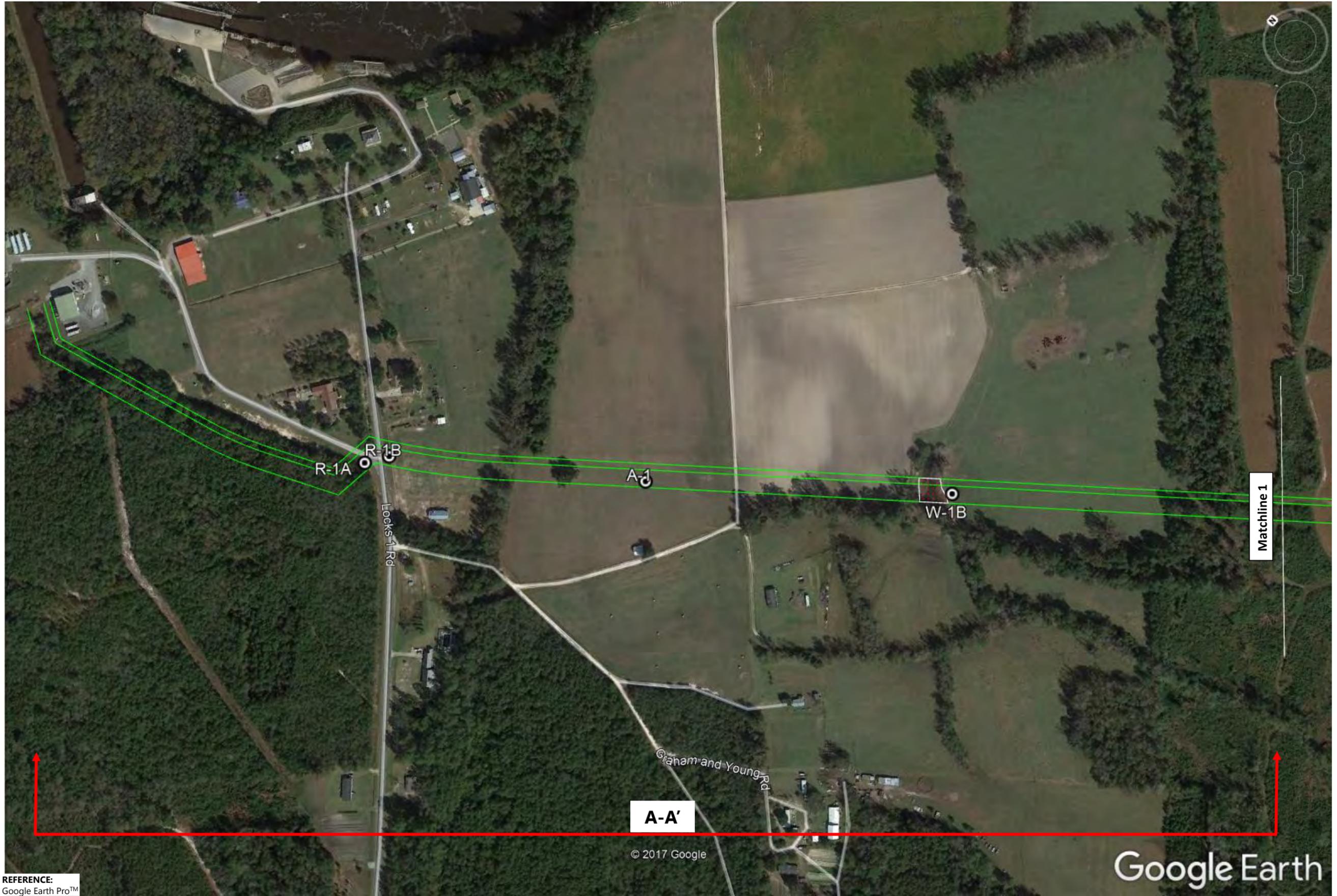
construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

## **Appendices**

## **Appendix I – Figures**



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

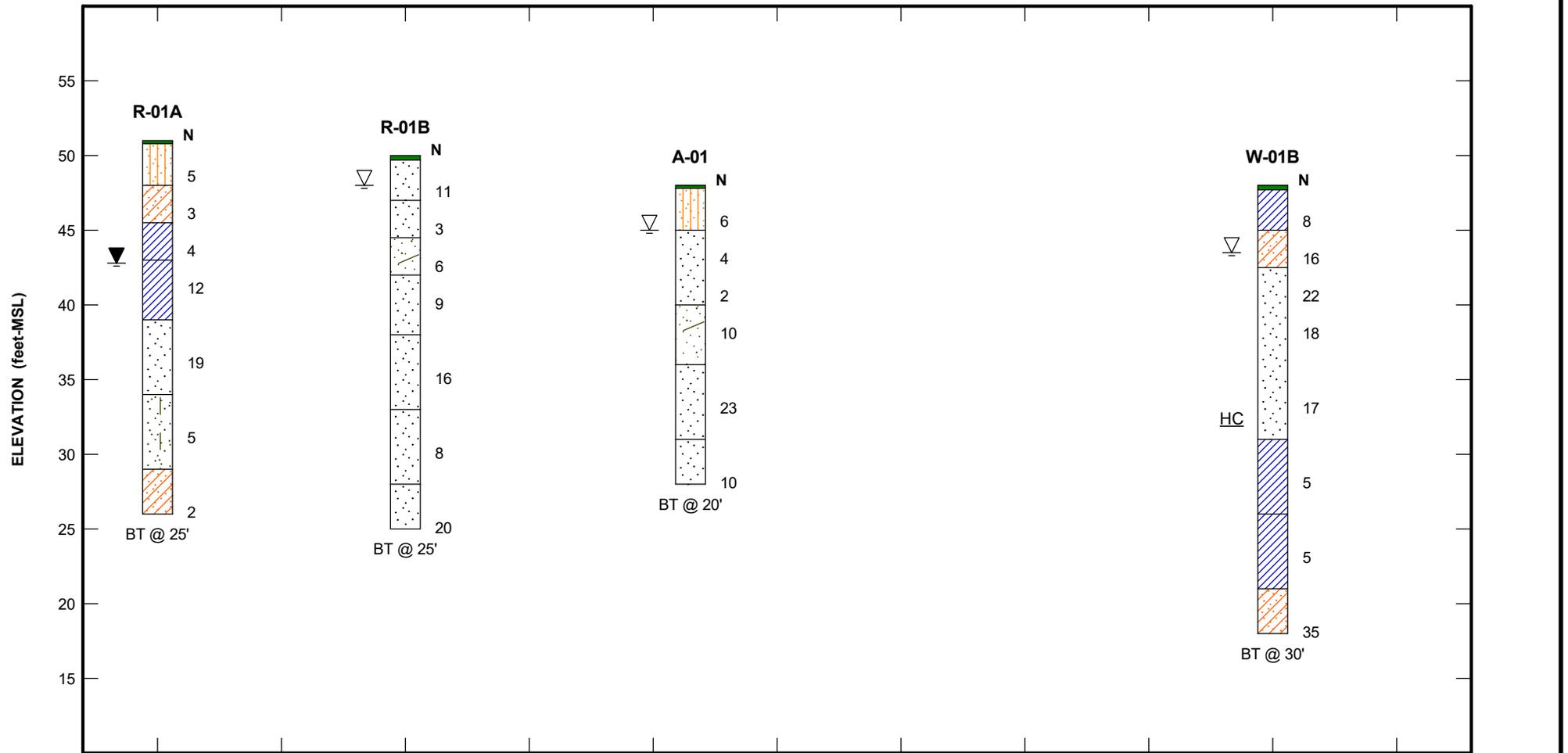
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**1**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

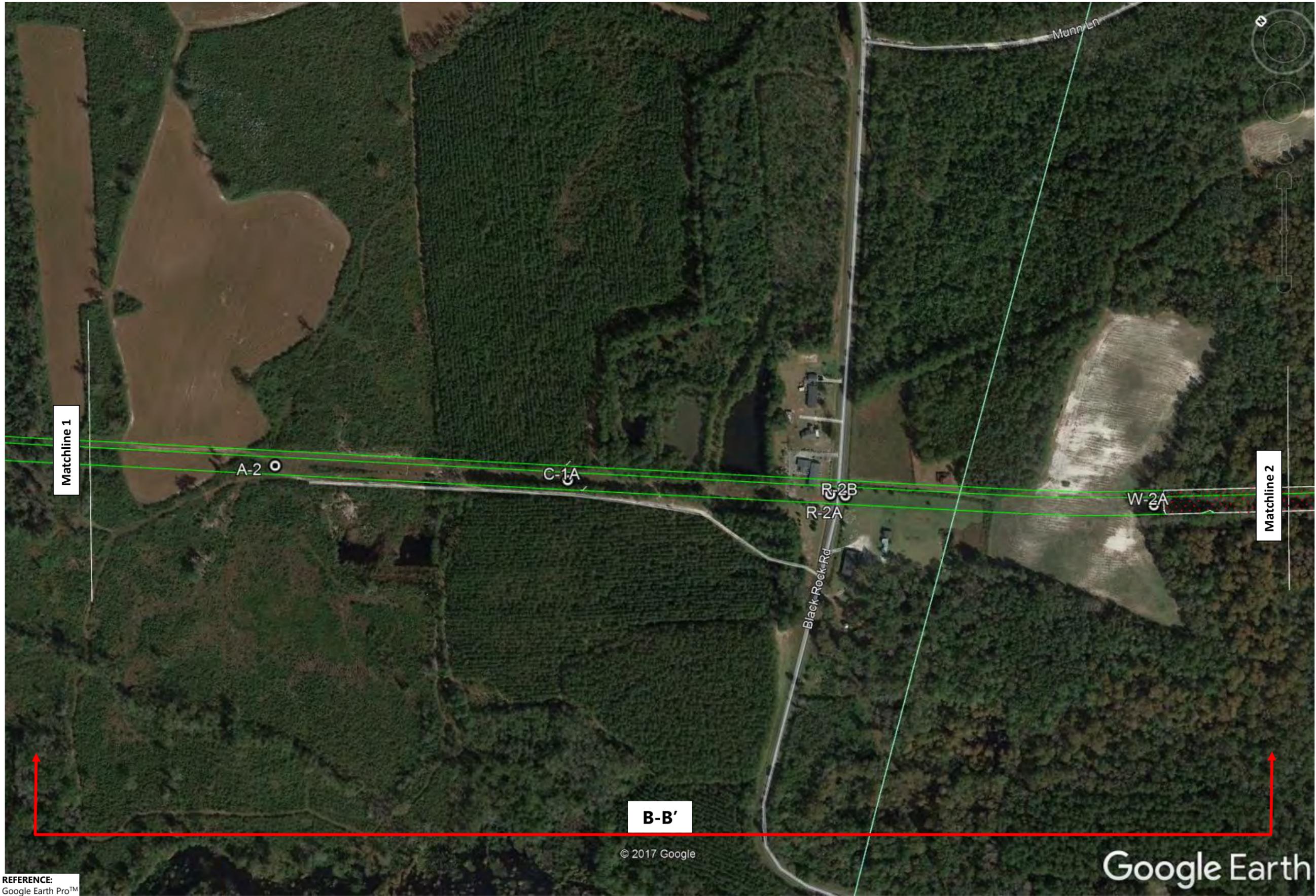


Diagram: A-A'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
2



REFERENCE:  
Google Earth Pro™

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Google Earth



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

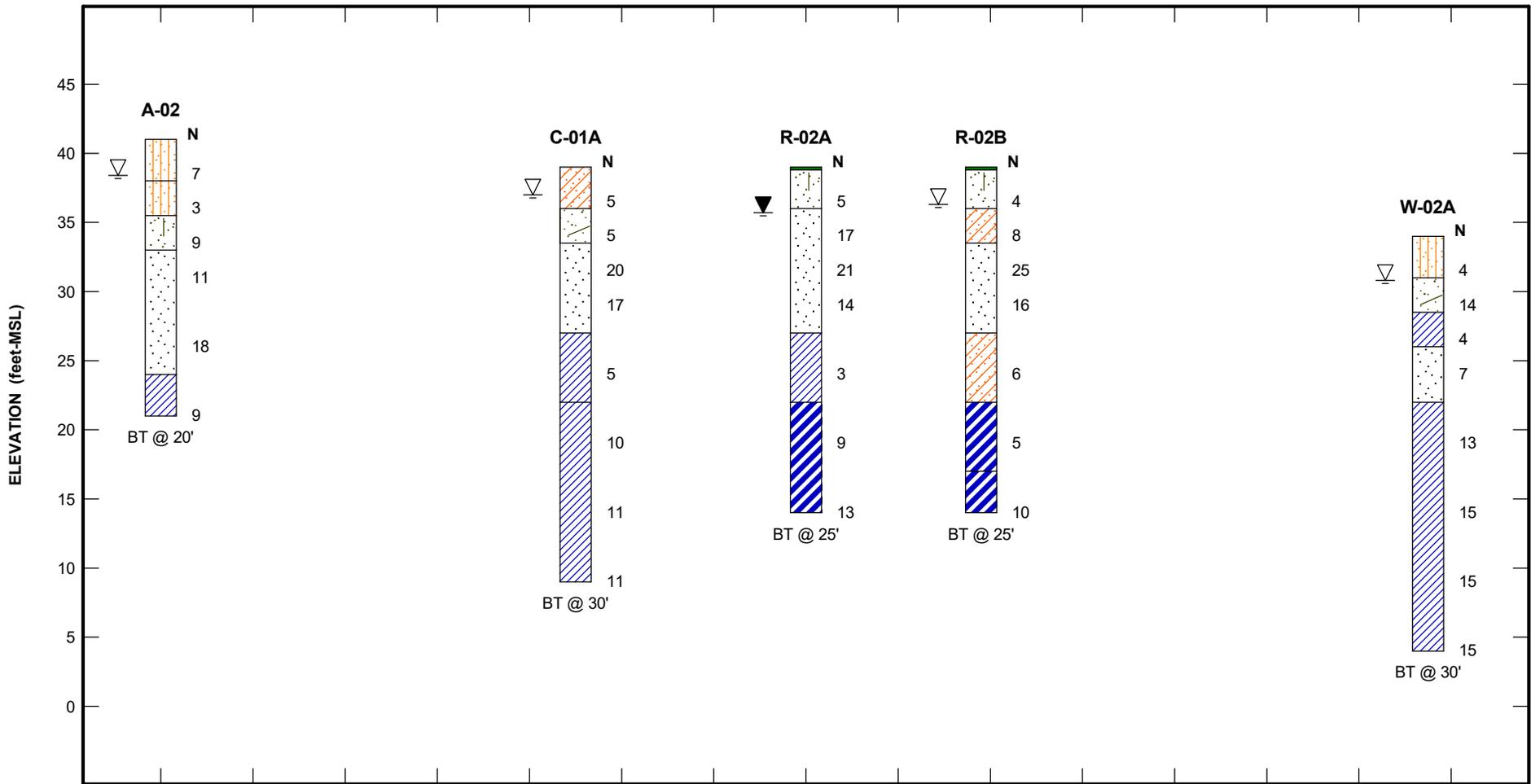
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AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**3**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

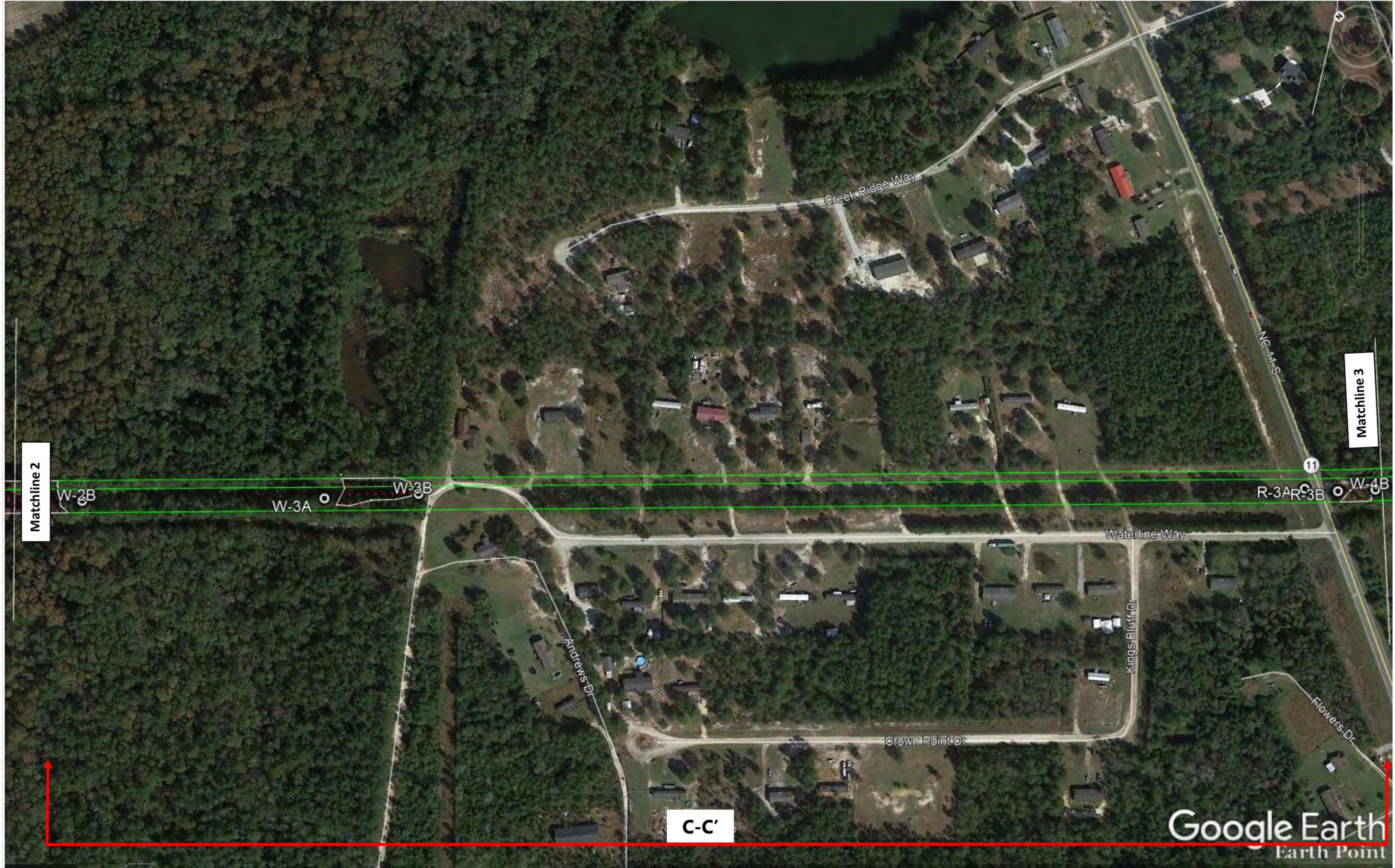


Diagram: B-B'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
4



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

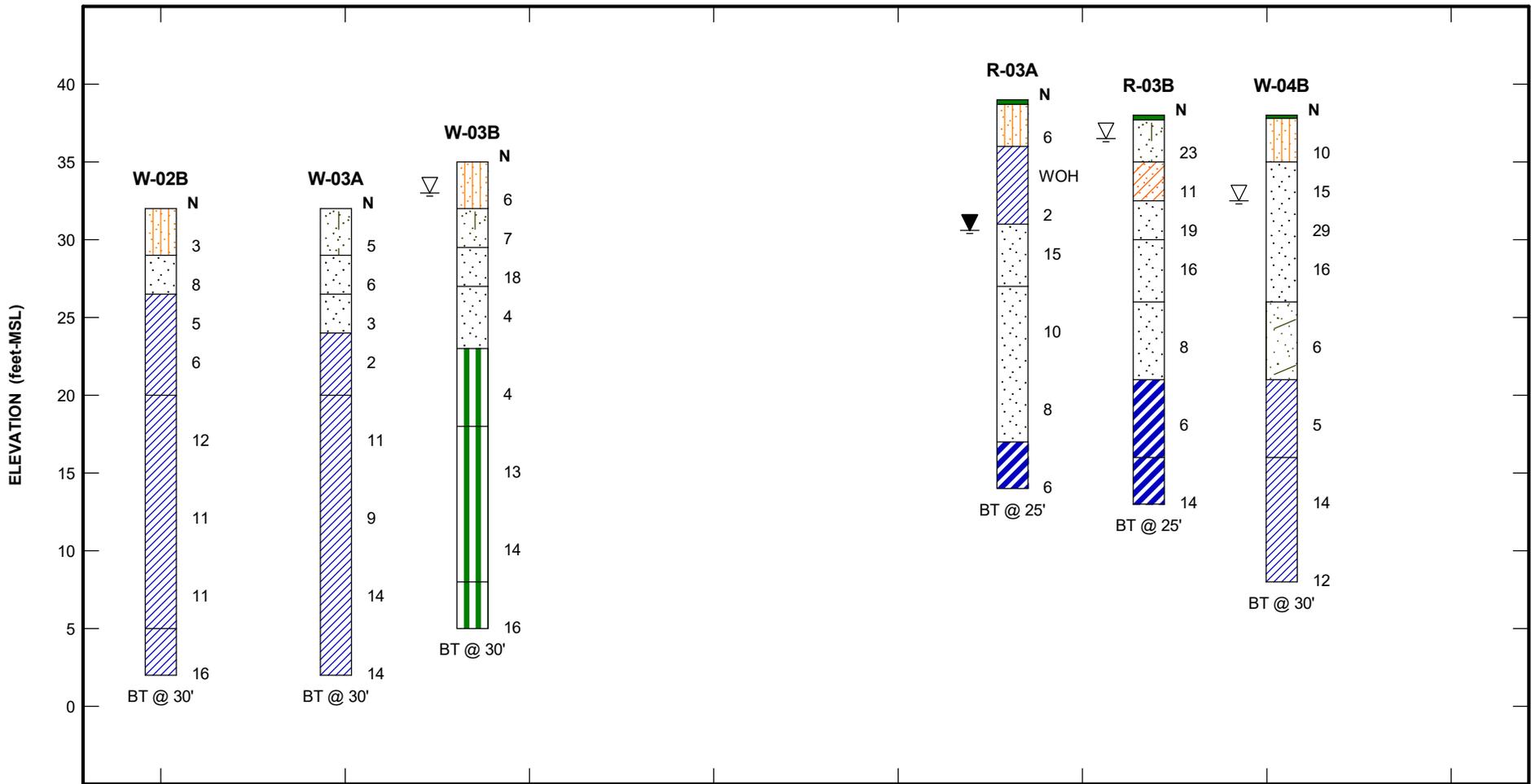
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**5**



- Topsoil
- SM, Silty Sand
- CL, Low Plasticity Clay
- SP, Poorly-graded Sand
- CH, High Plasticity Clay
- SP/SM, Poorly-graded Sand with Silt
- SC, Clayey Sand
- MH, High Plasticity Silt
- SP/SC, Poorly-graded Sand with Clay

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

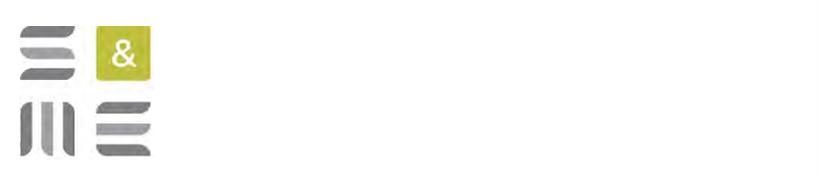
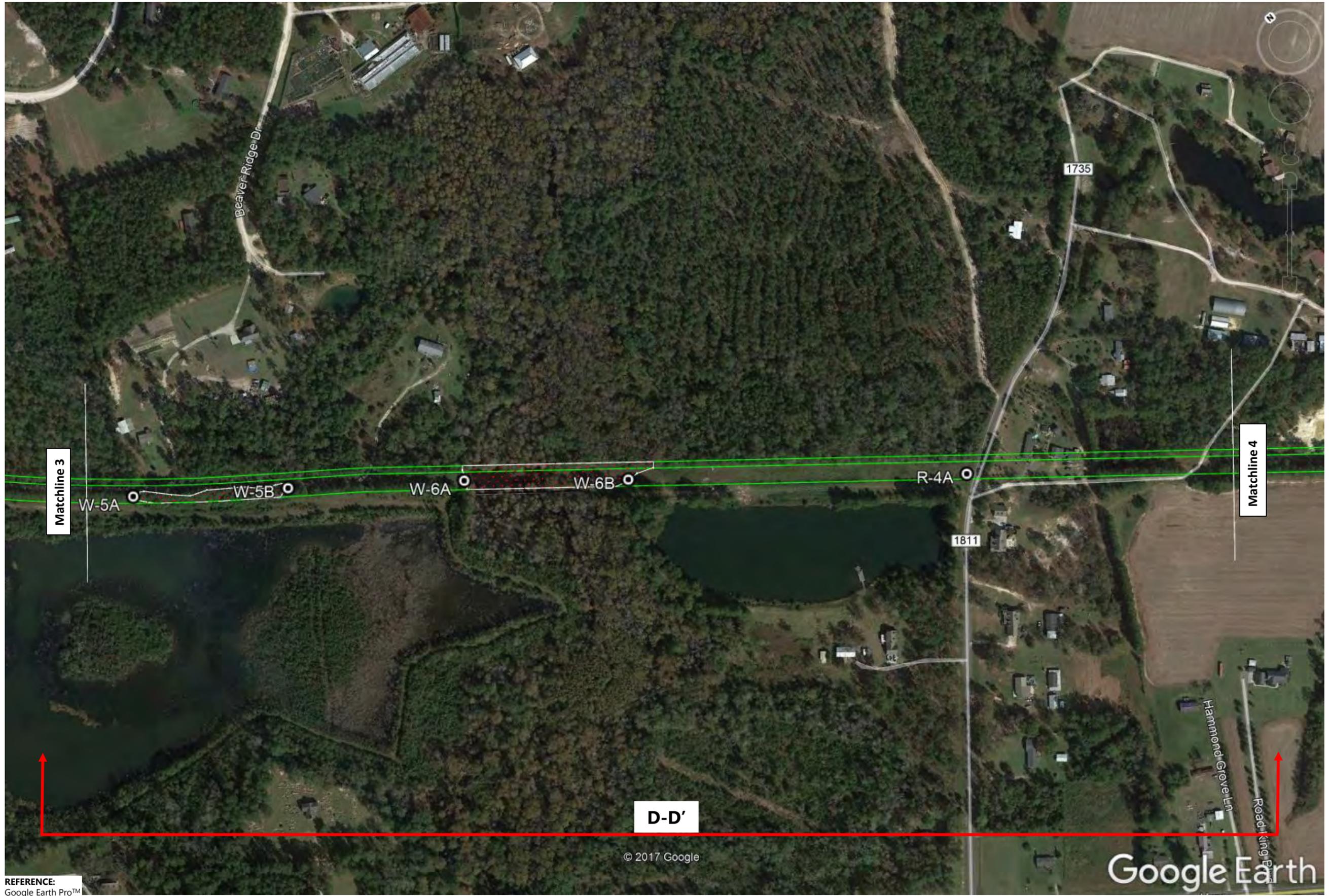


Diagram: C-C'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 6



REFERENCE:  
Google Earth Pro™

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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

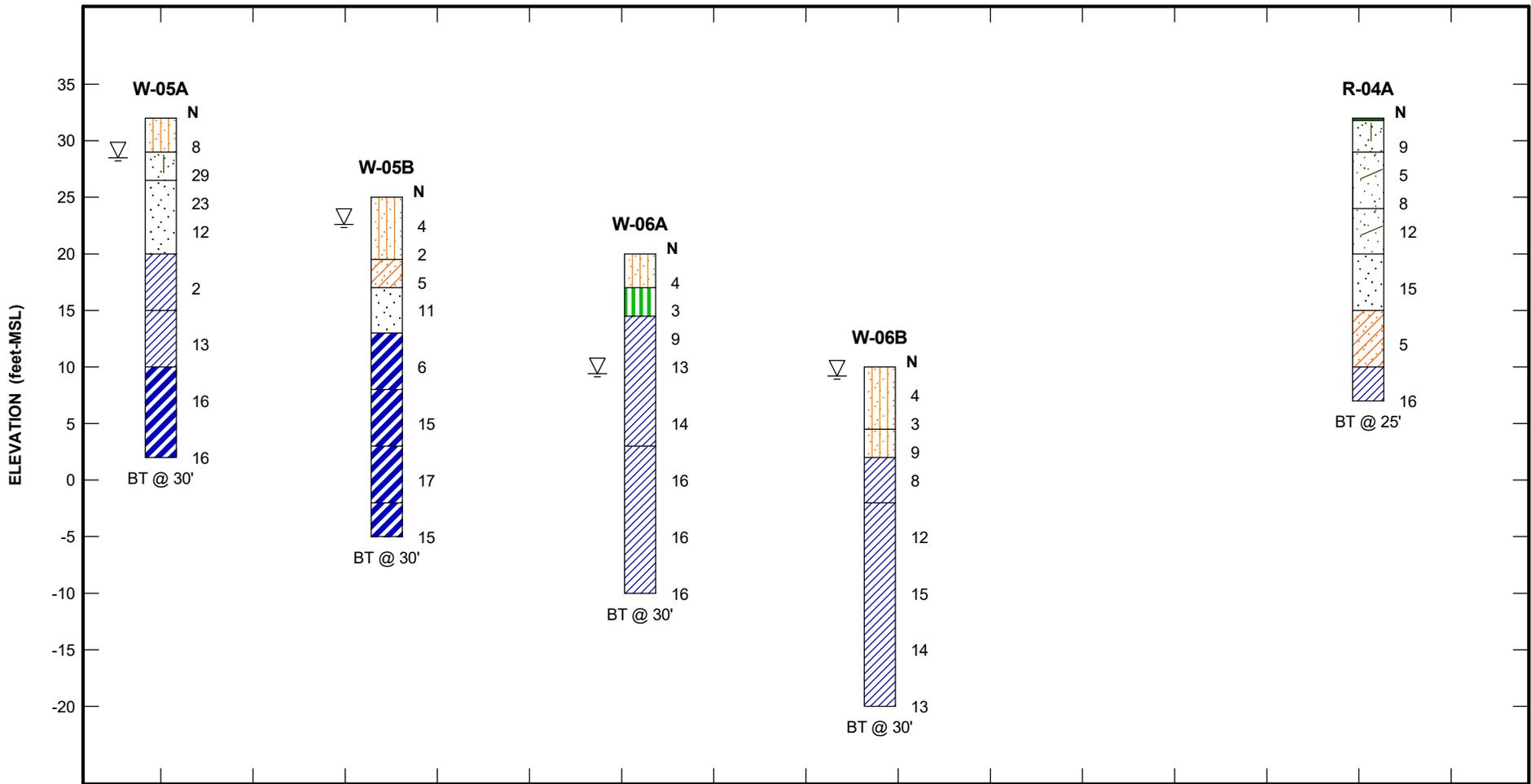
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**7**



- Topsoil
- SP/SM, Poorly-graded Sand with Silt
- SP/SC, Poorly-graded Sand with Clay
- SP, Poorly-graded Sand
- SC, Clayey Sand
- CL, Low Plasticity Clay
- SM, Silty Sand
- CH, High Plasticity Clay
- ML, Low Plasticity Silt

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

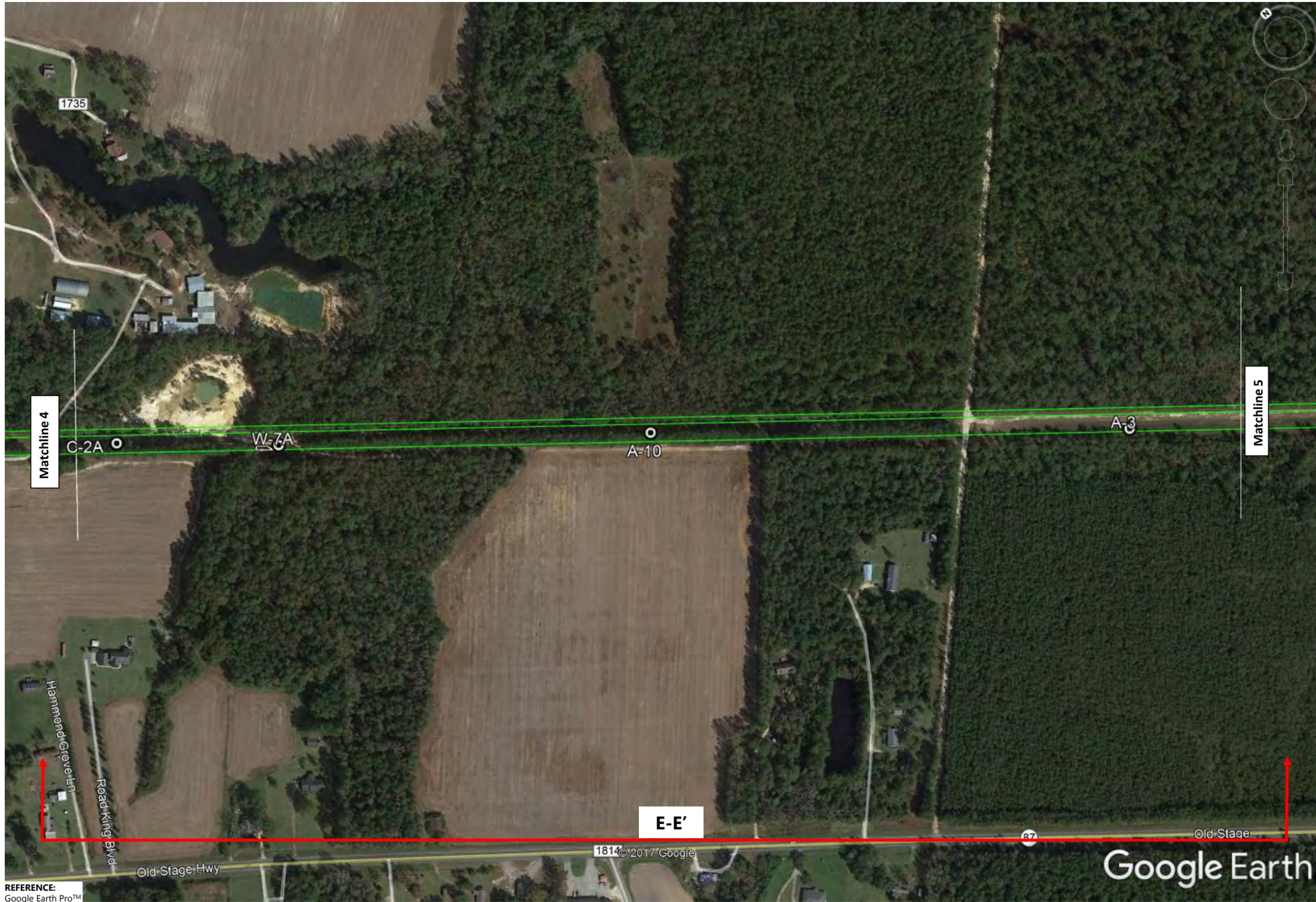
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: D-D'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure  
8



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

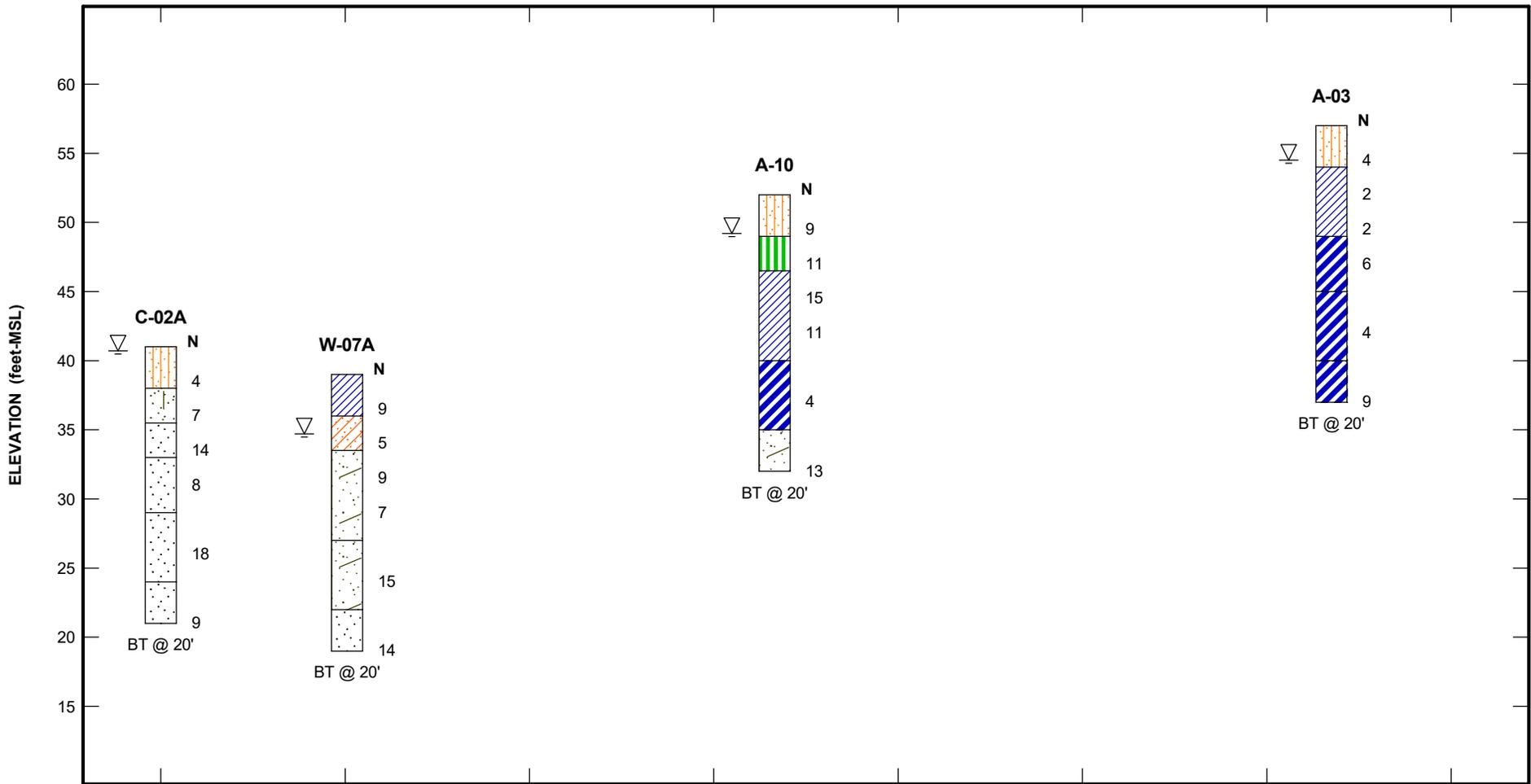
KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.  
**9**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

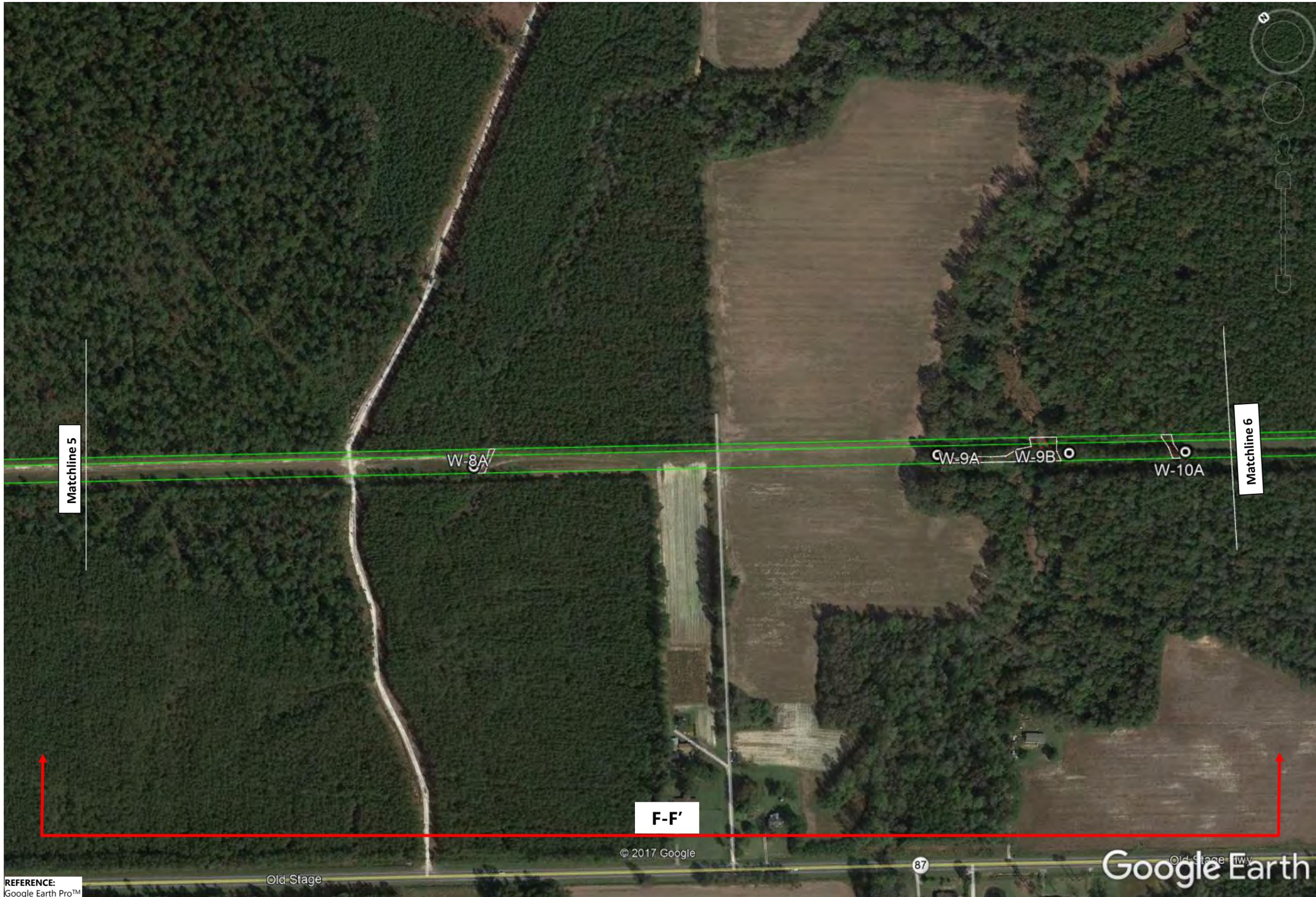
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: E-E'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 10



REFERENCE:  
Google Earth Pro™

Old Stage

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Google Earth



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

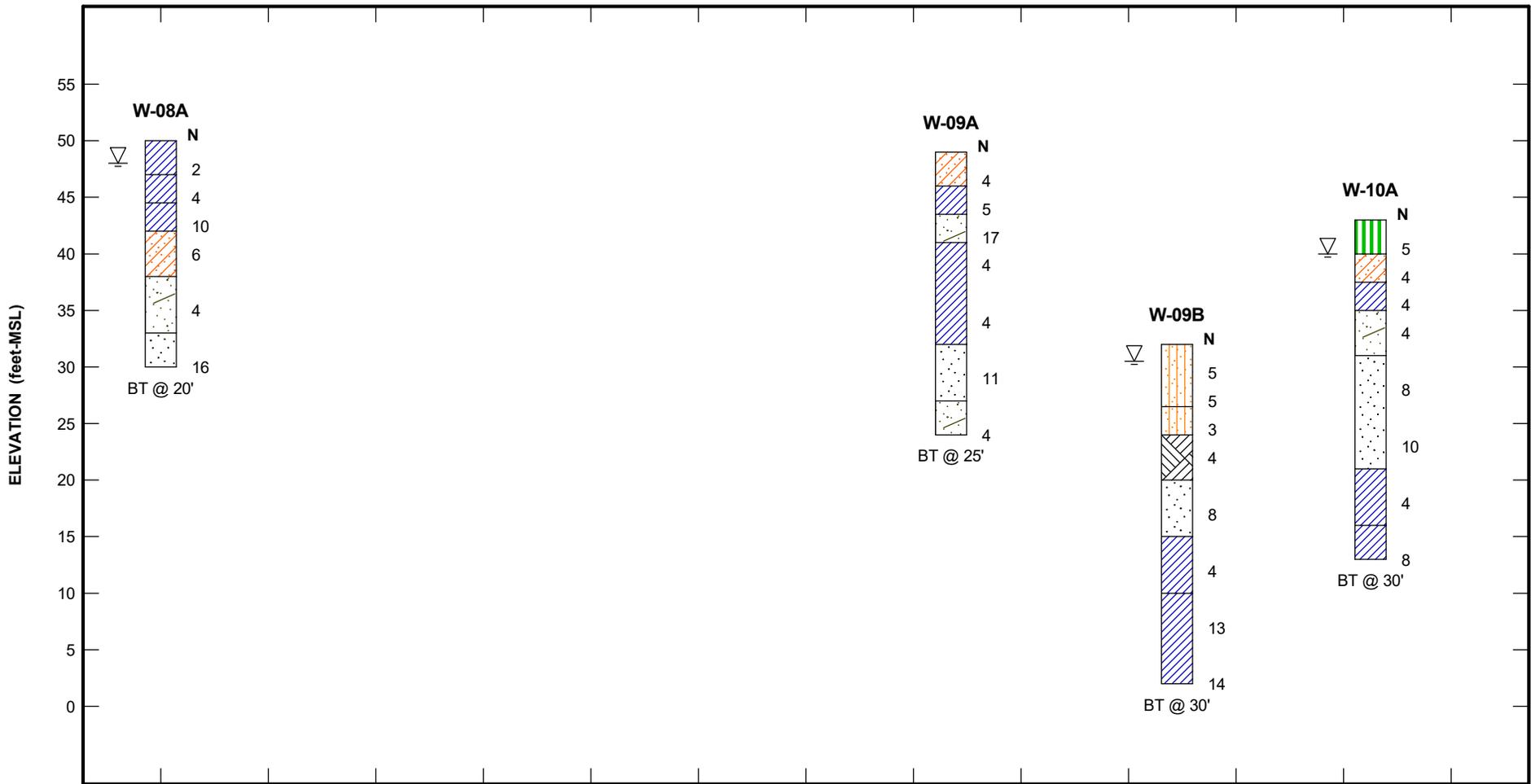
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**11**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

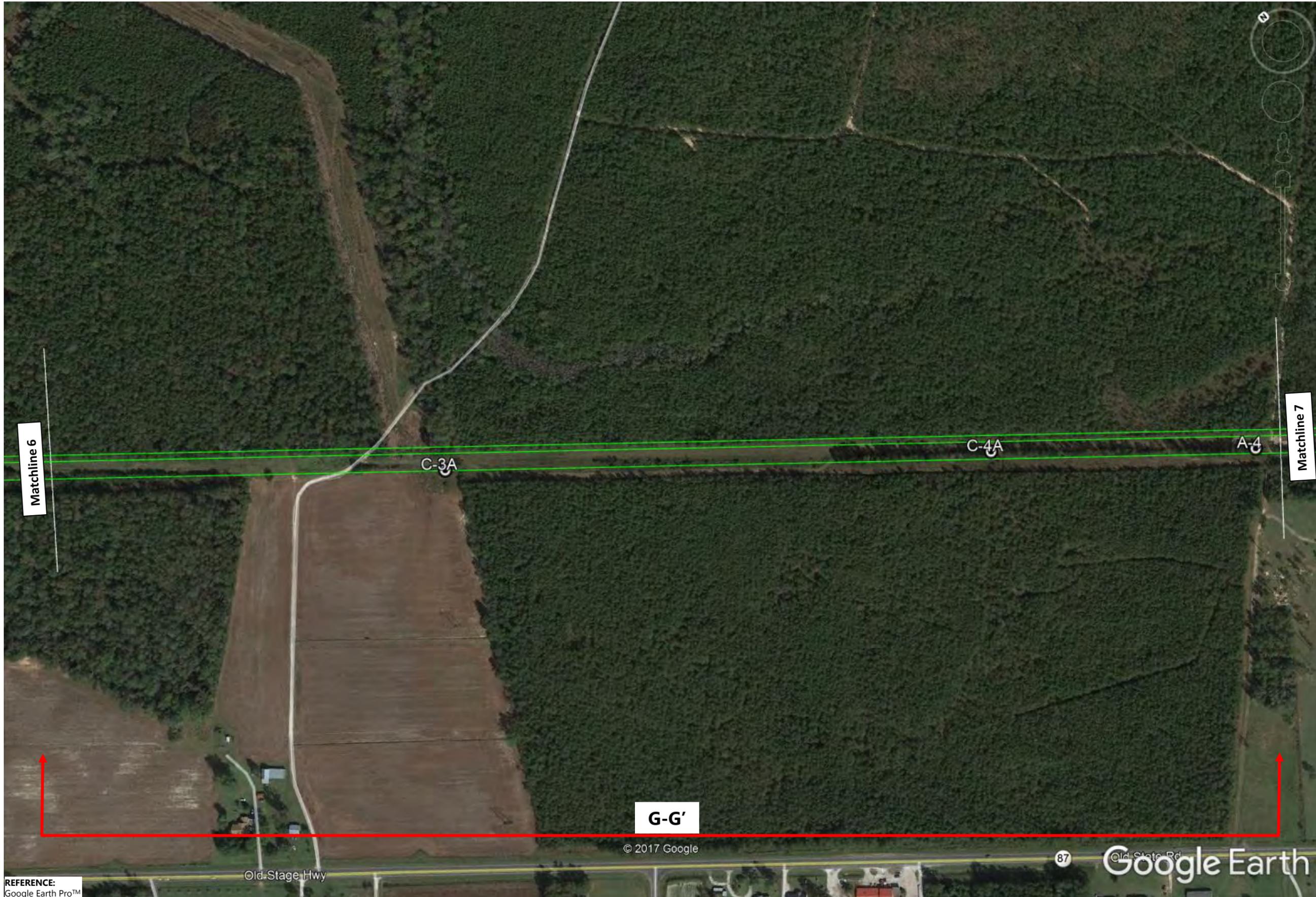
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: F-F'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 12



REFERENCE:  
Google Earth Pro™

Old Stage Hwy

**G-G'**

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Old Stage Rd  
Google Earth



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

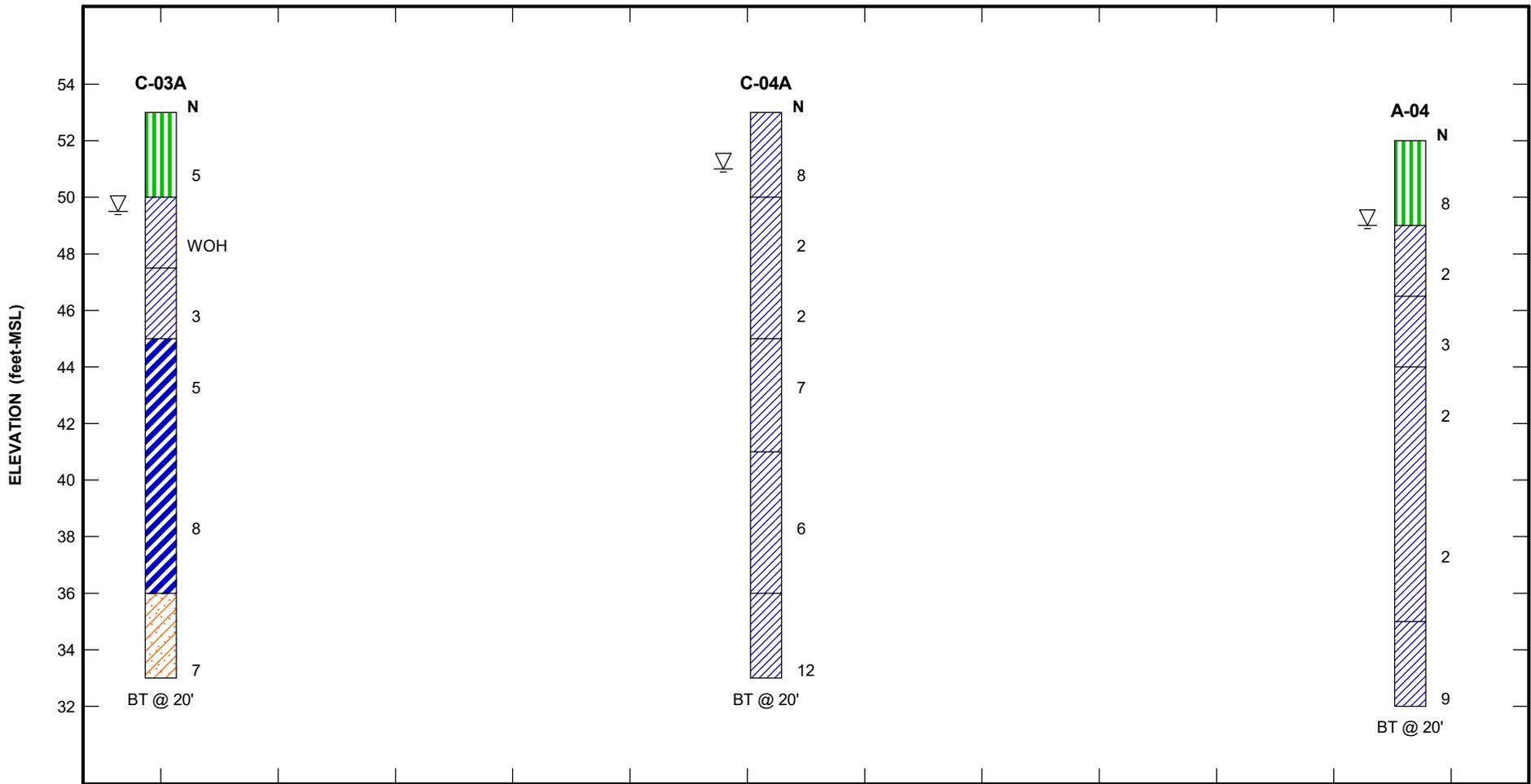
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**13**



 ML, Low Plasticity Silt     
  CL, Low Plasticity Clay     
  CH, High Plasticity Clay     
  SC, Clayey Sand

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

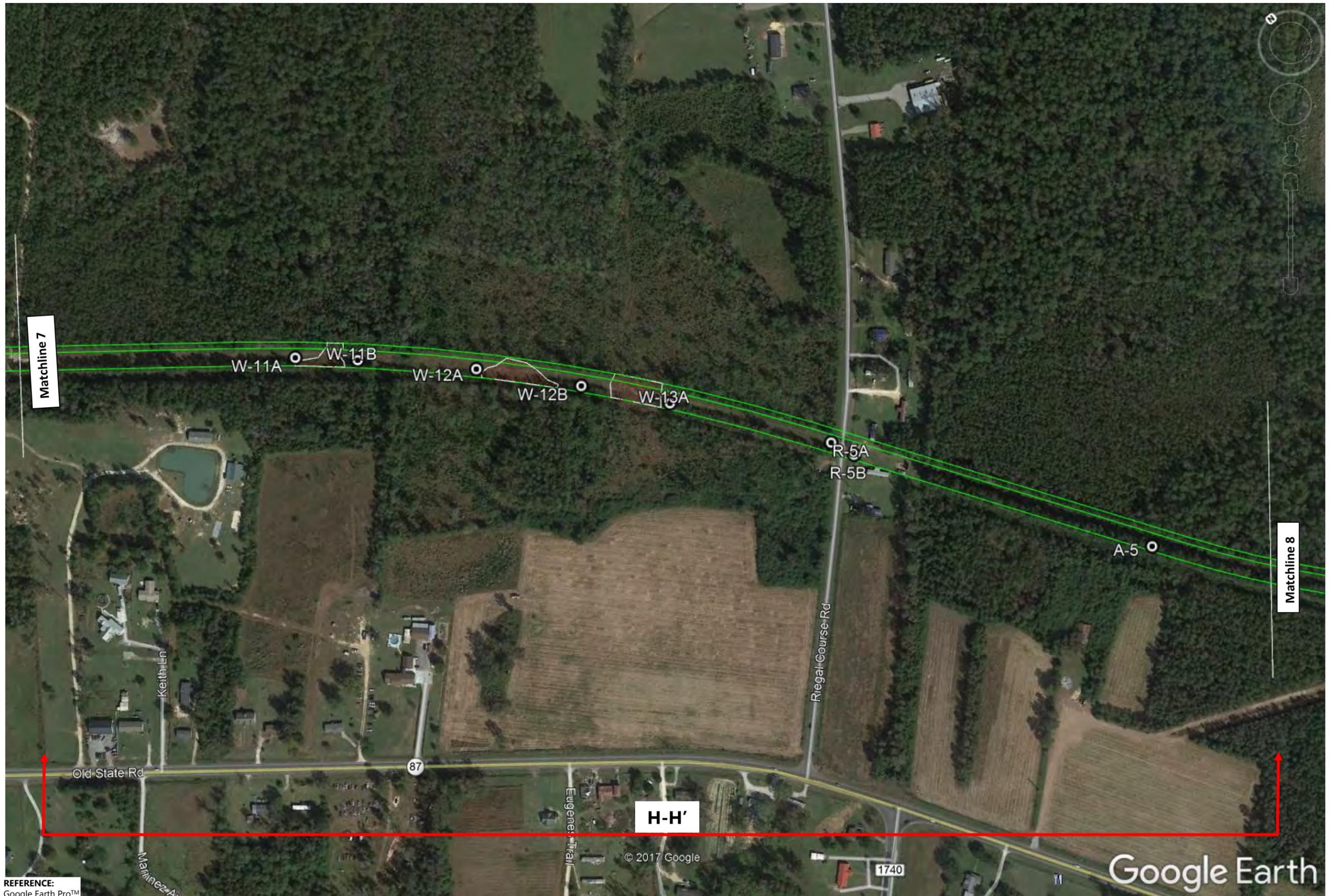


Diagram: G-G'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
14



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

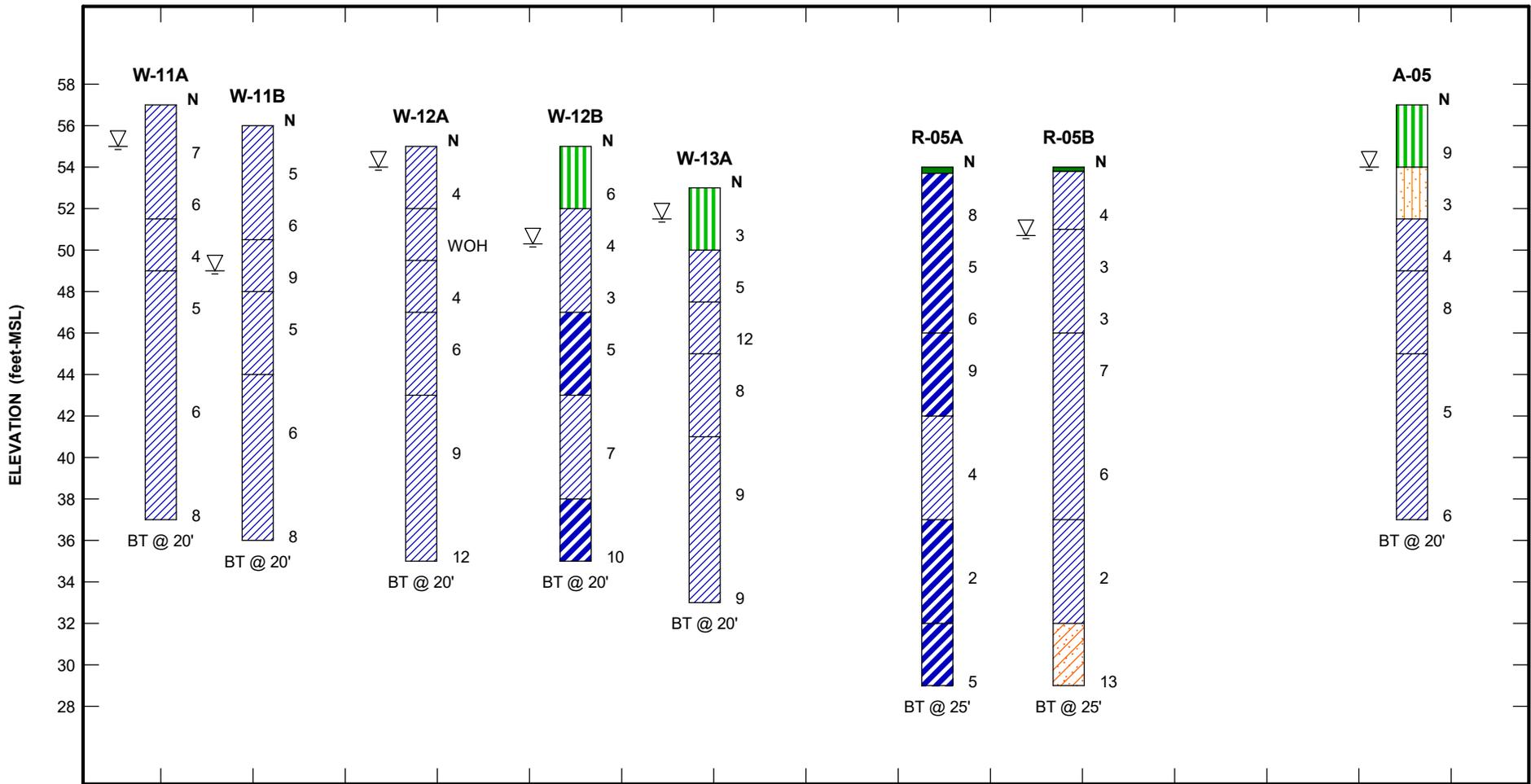
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**15**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

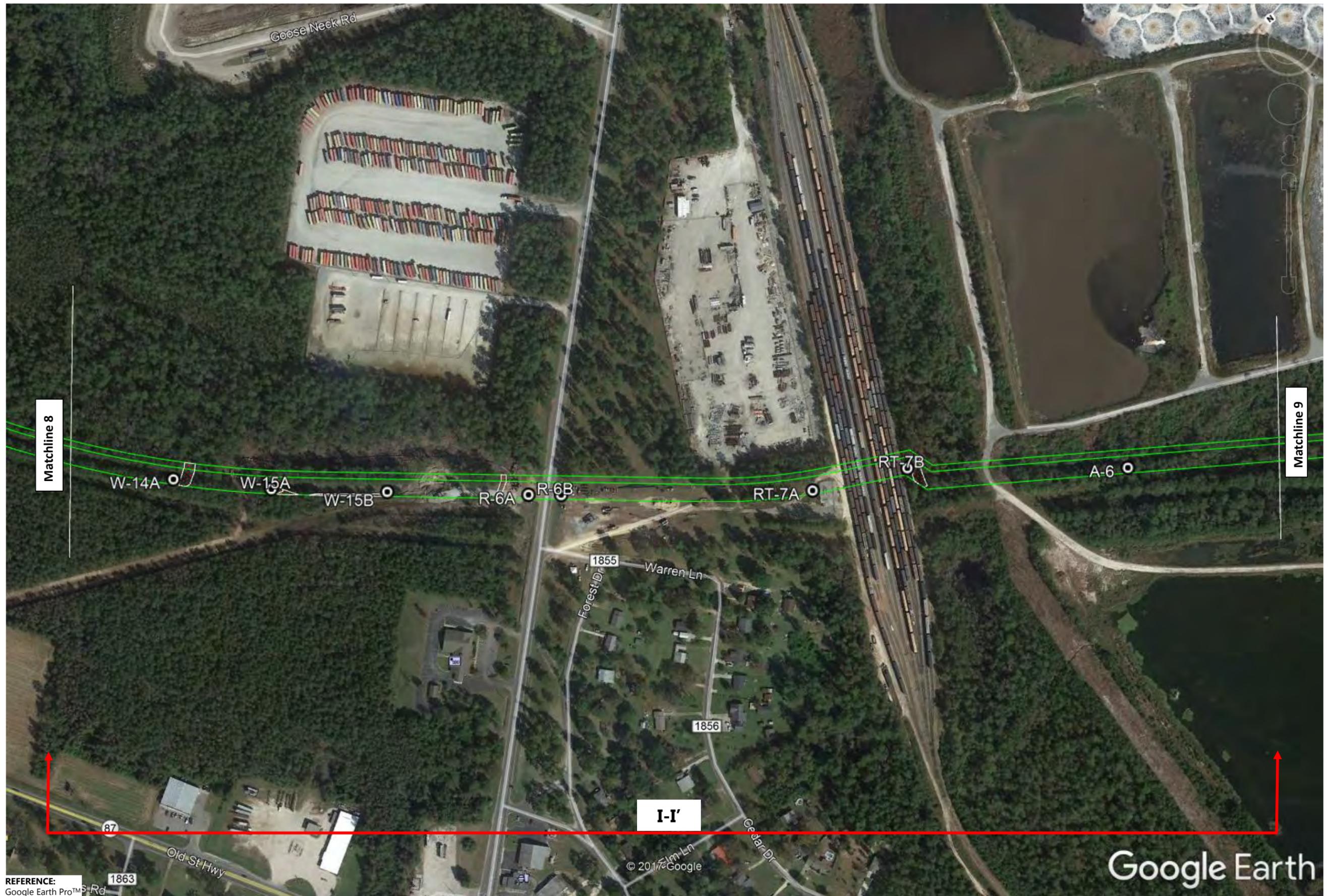
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: H-H'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 16



REFERENCE:  
Google Earth Pro™ S-Rd 1863

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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

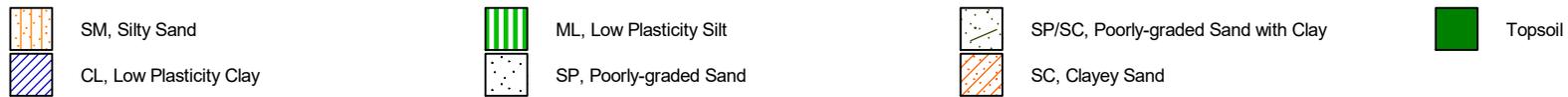
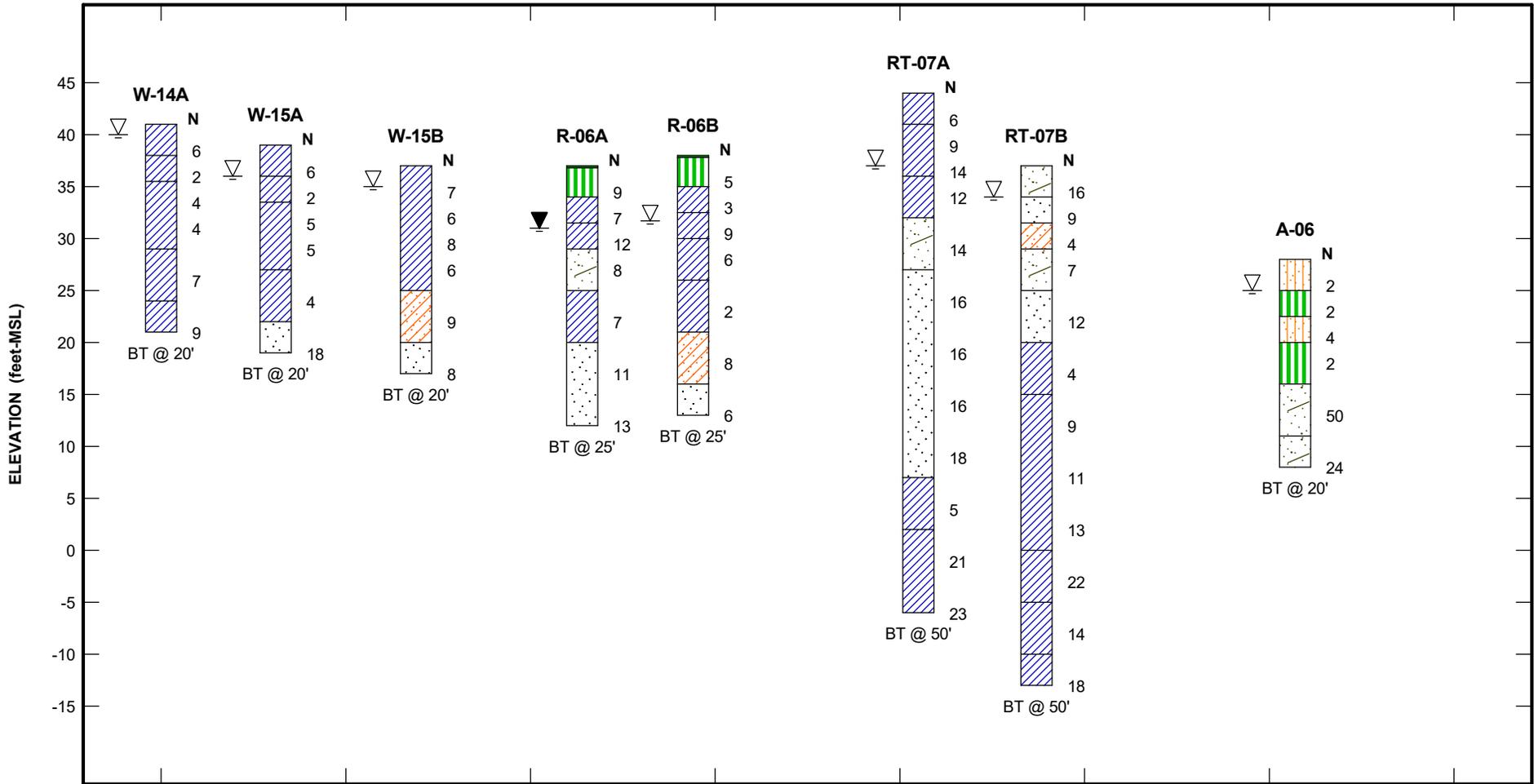
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**17**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: I-I'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 18



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

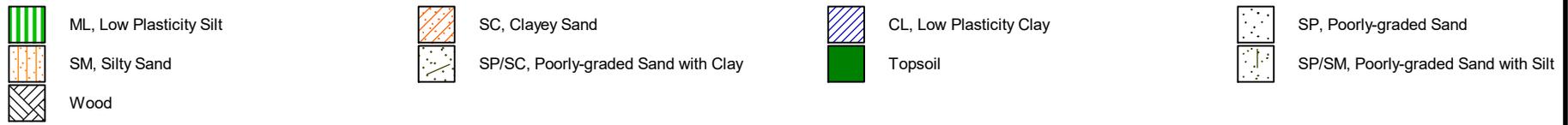
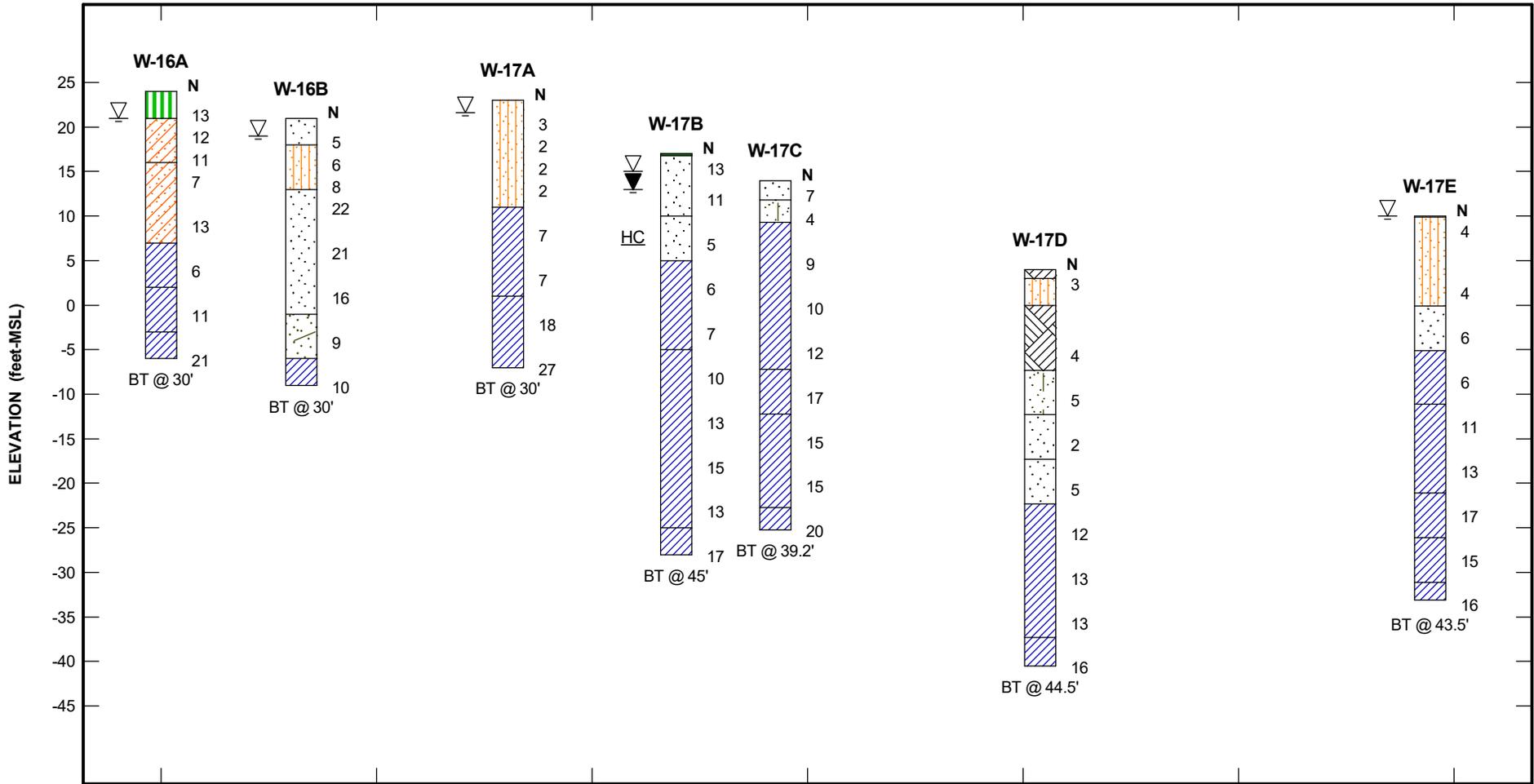
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**19**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

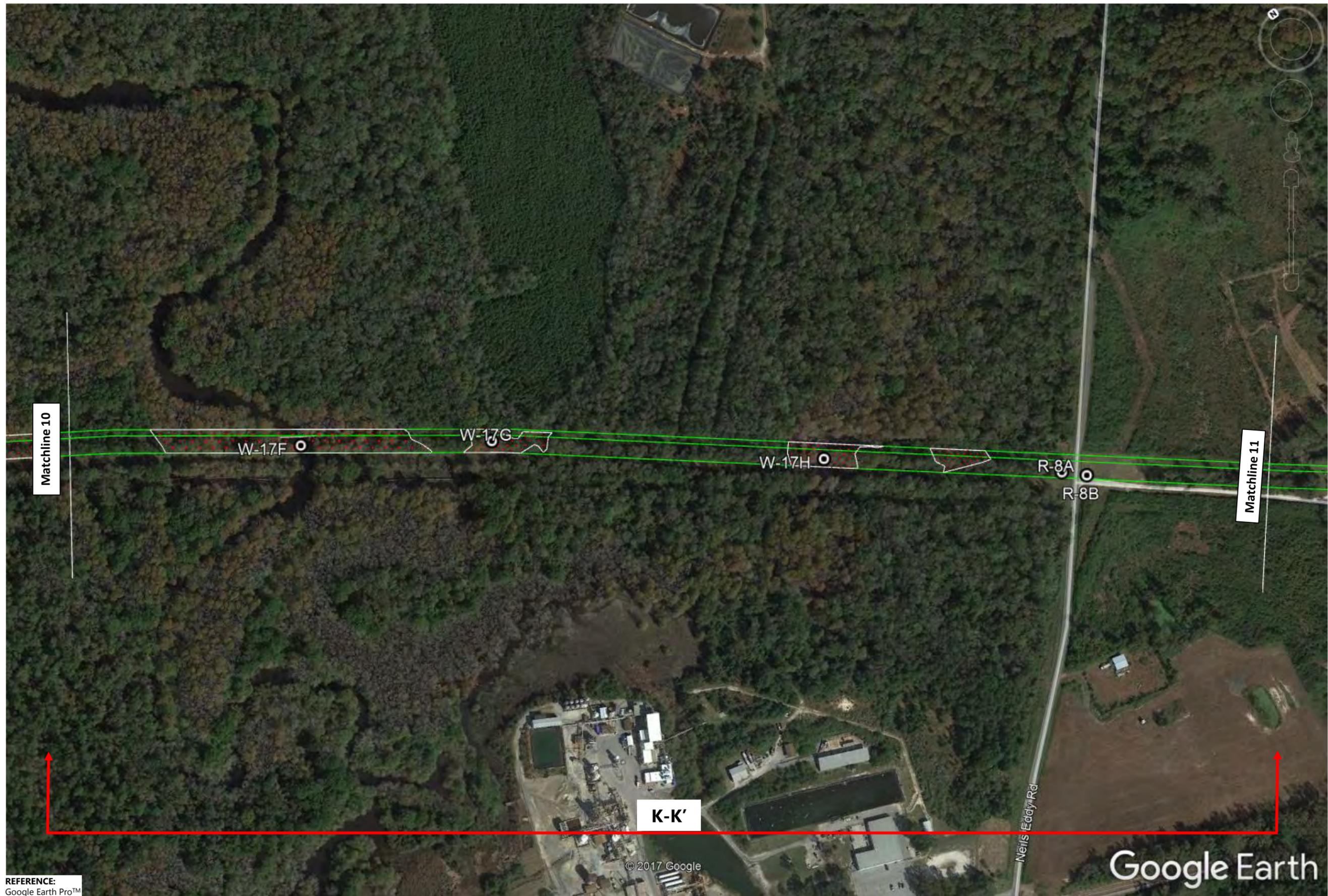
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: J-J'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure  
20



REFERENCE:  
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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

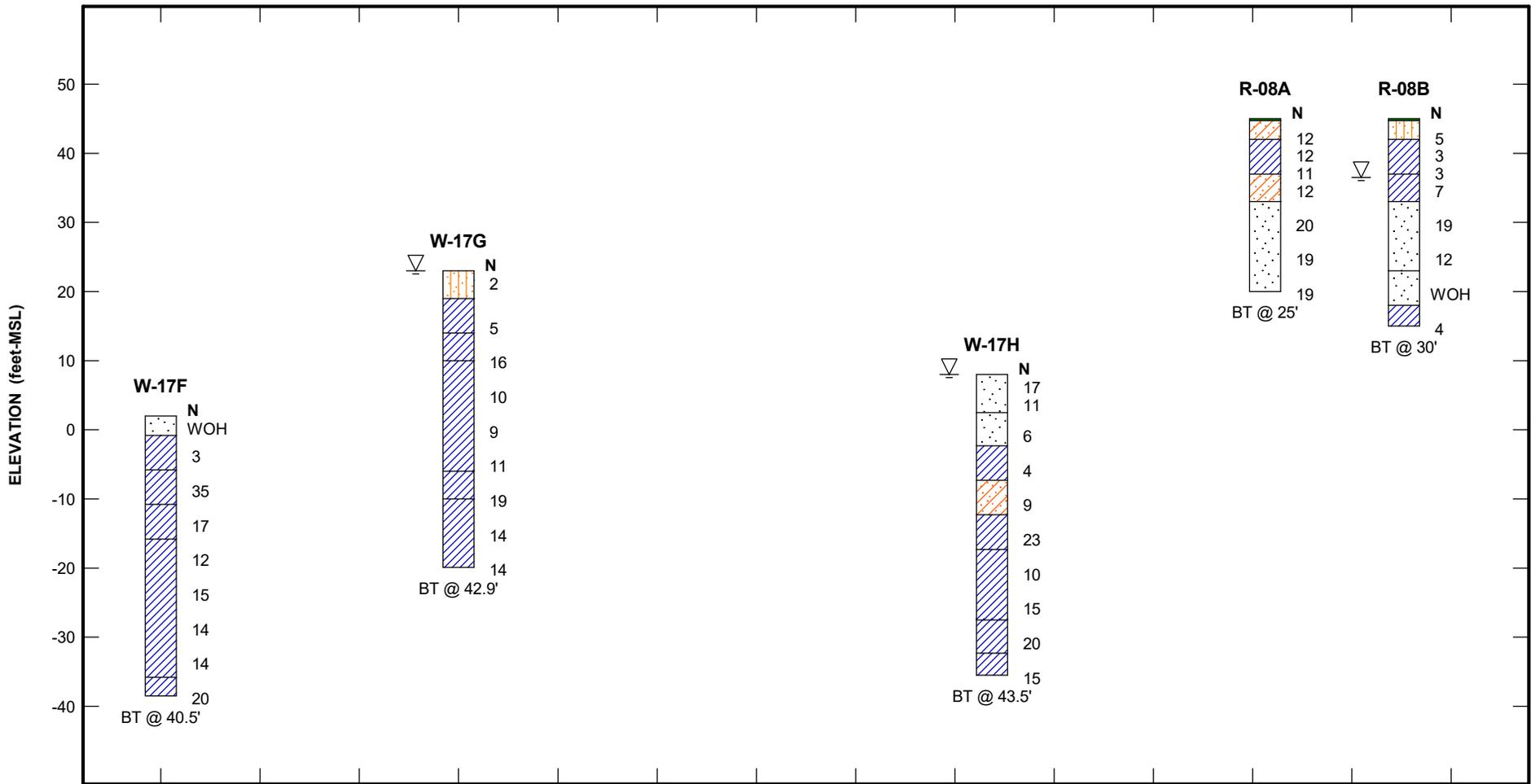
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**21**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

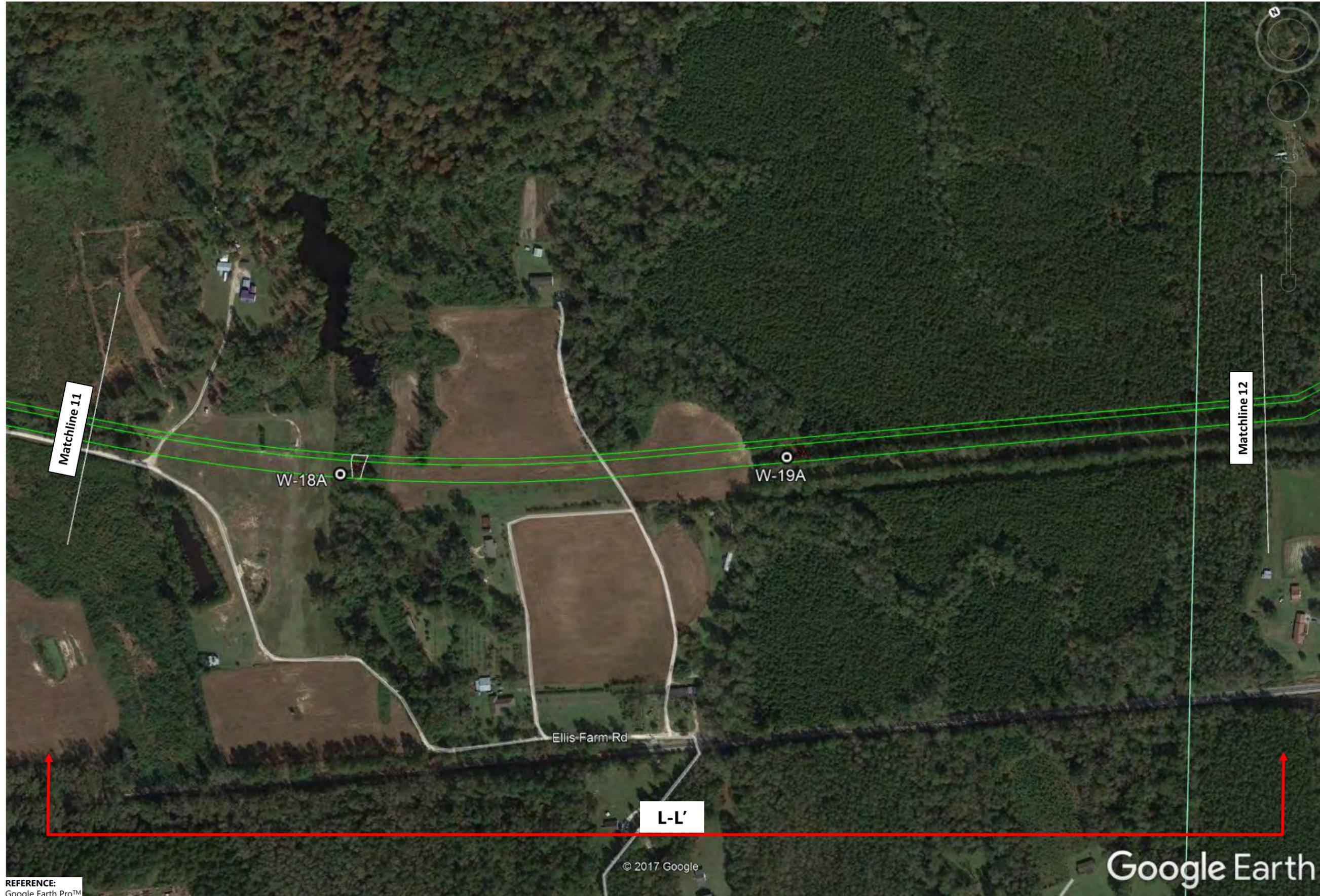
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: K-K'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 22



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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

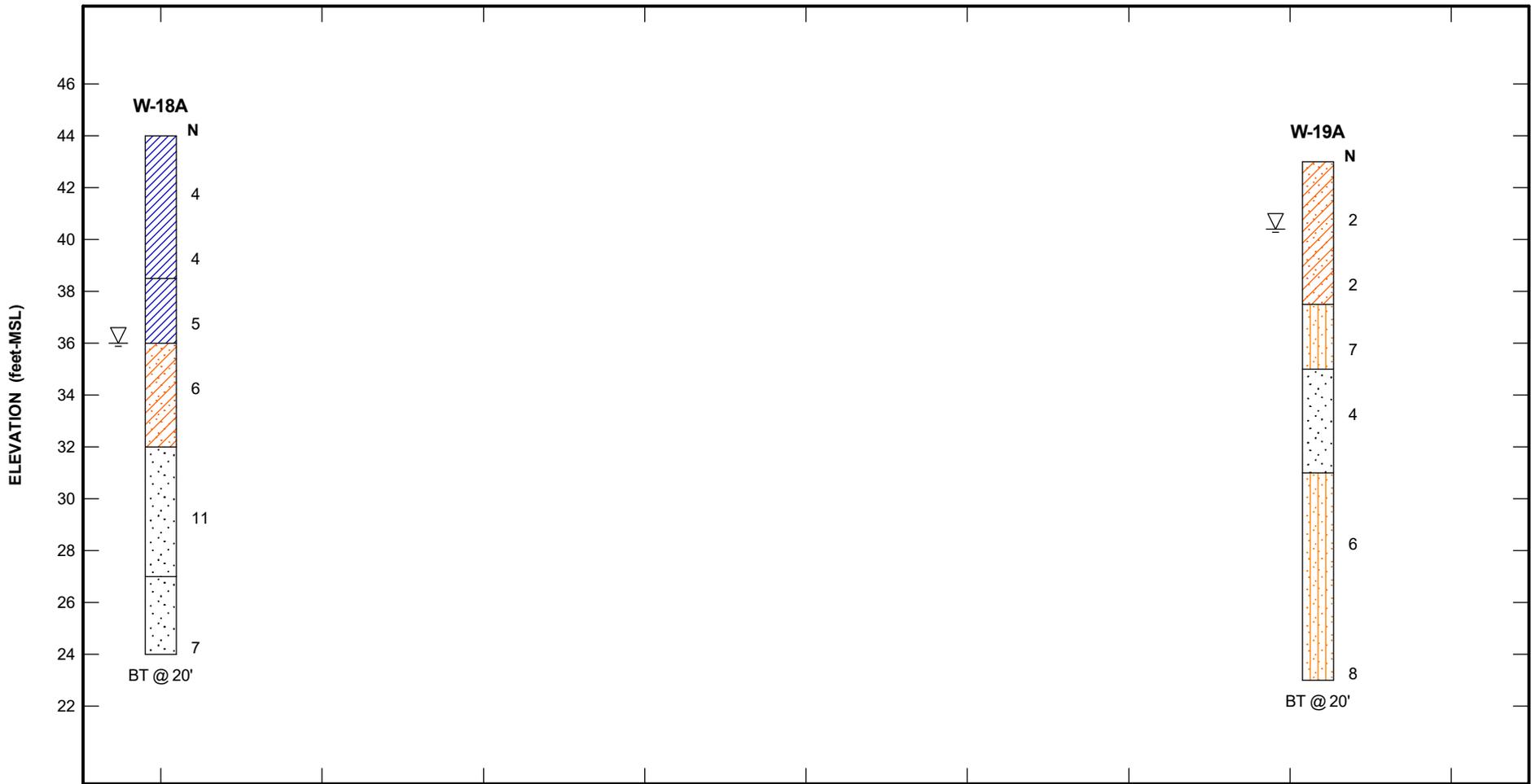
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**23**



 CL, Low Plasticity Clay

 SC, Clayey Sand

 SP, Poorly-graded Sand

 SM, Silty Sand

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

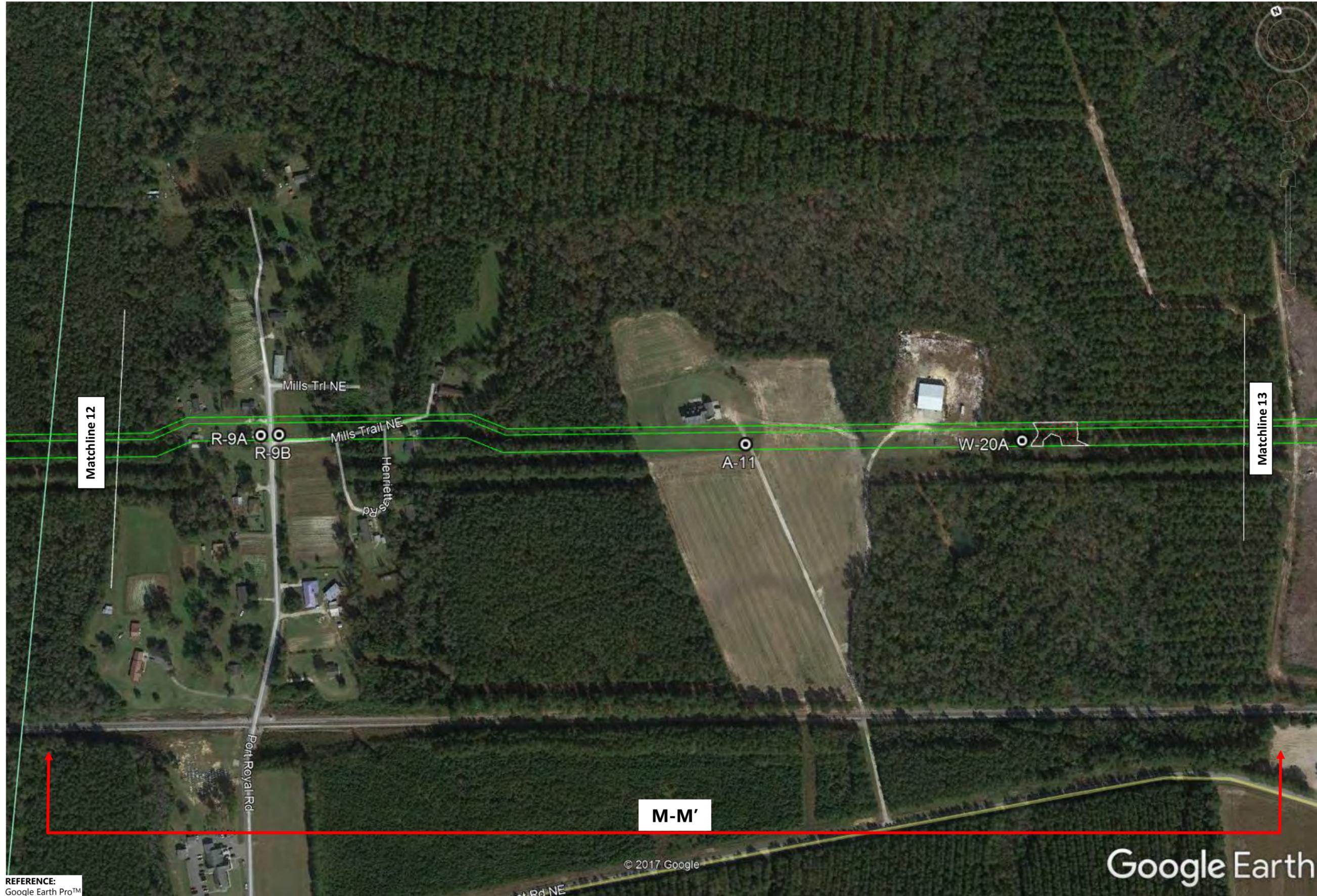


Diagram: L-L'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
24



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

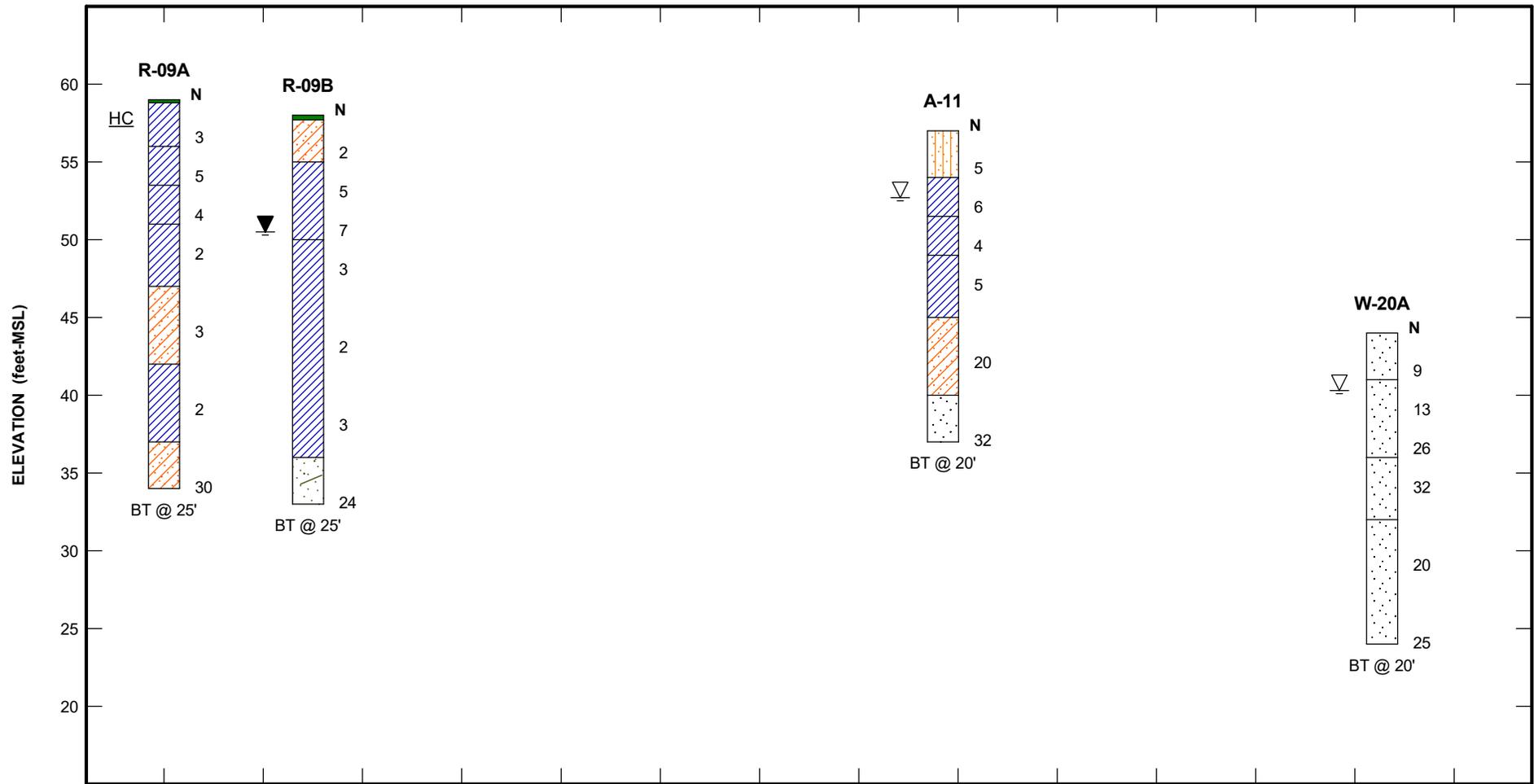
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**25**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

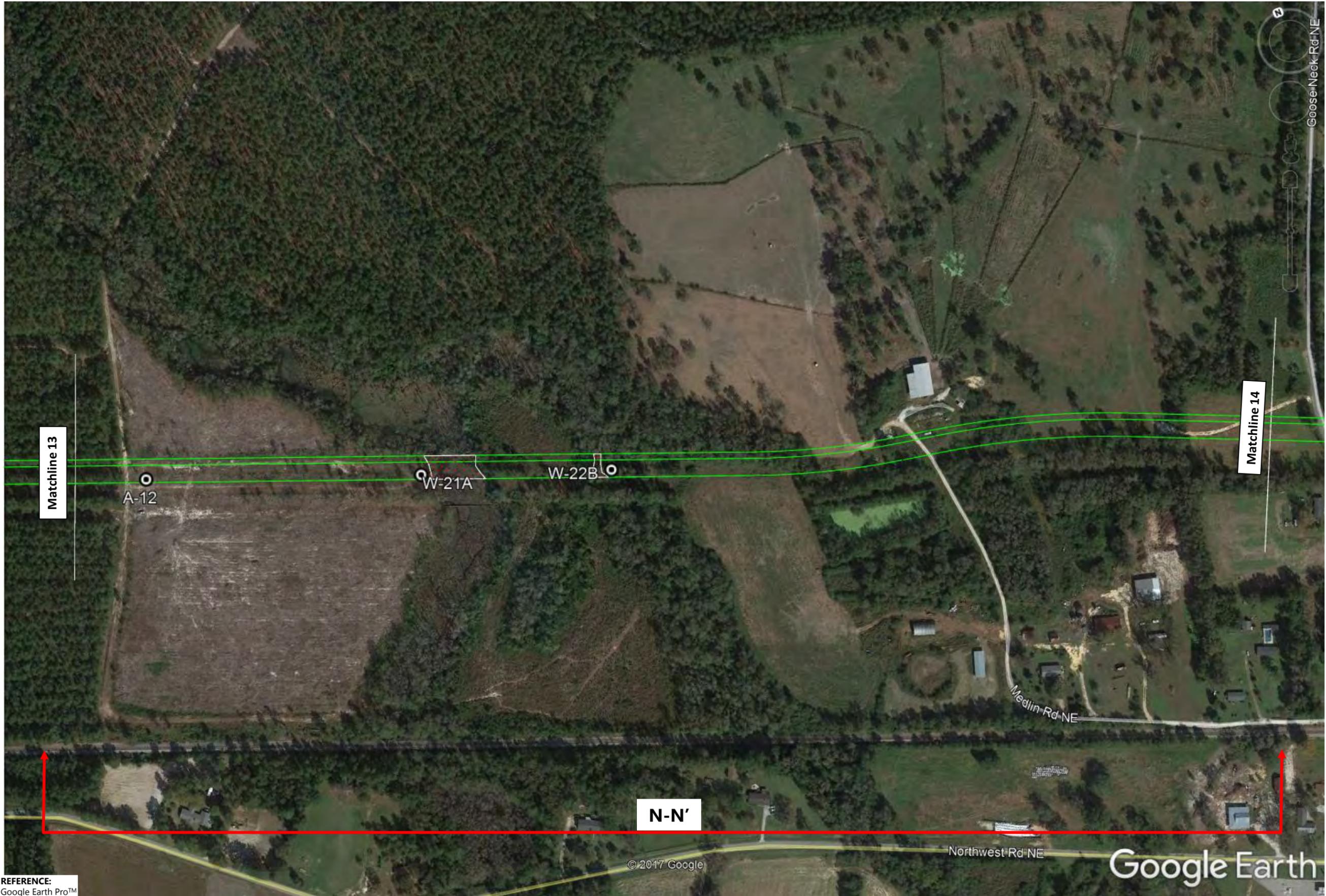


Diagram: M-M'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
26



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

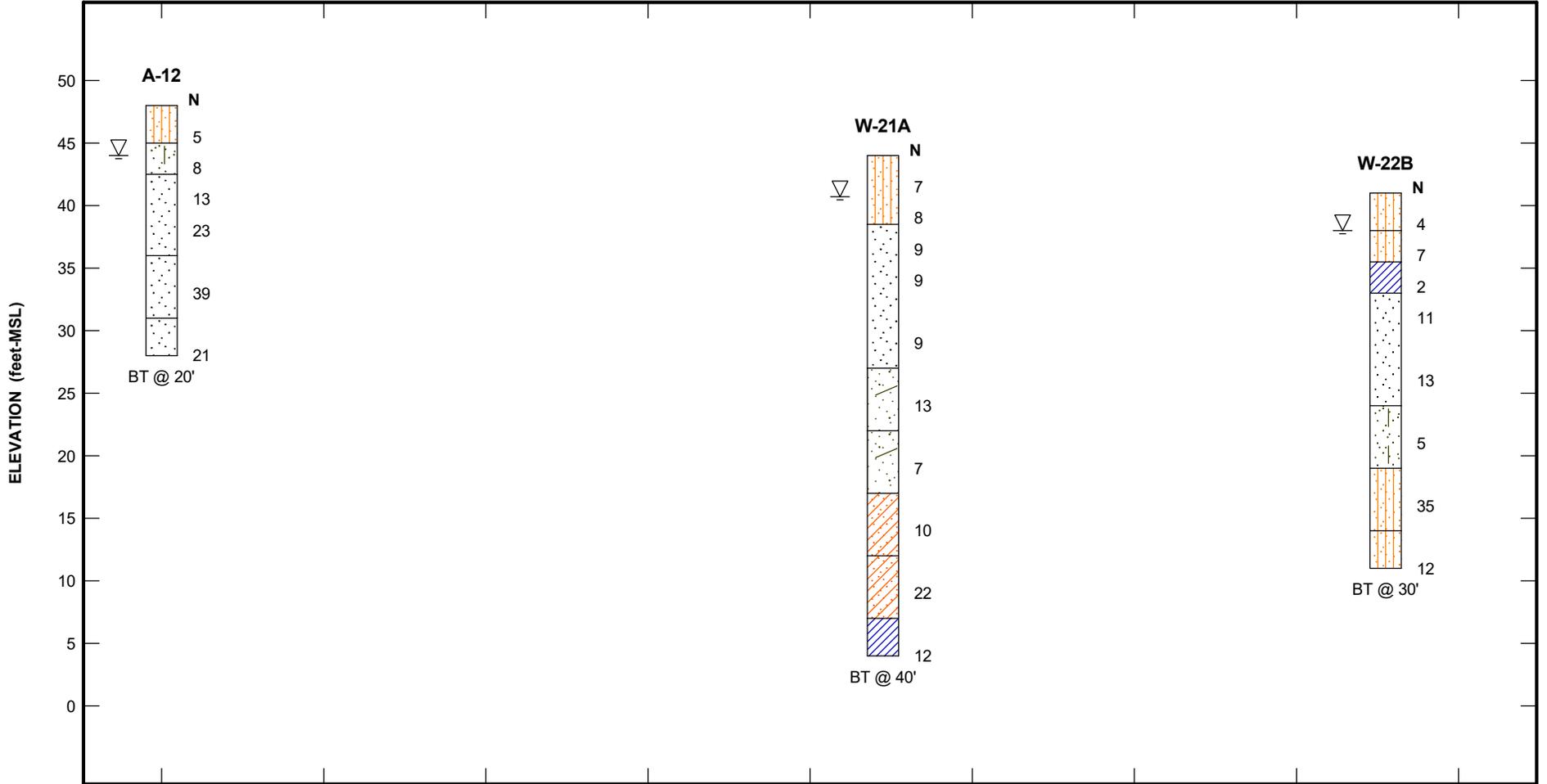
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**27**



-  SM, Silty Sand
-  SP/SM, Poorly-graded Sand with Silt
-  SP, Poorly-graded Sand
-  SP/SC, Poorly-graded Sand with Clay
-  SC, Clayey Sand
-  CL, Low Plasticity Clay

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

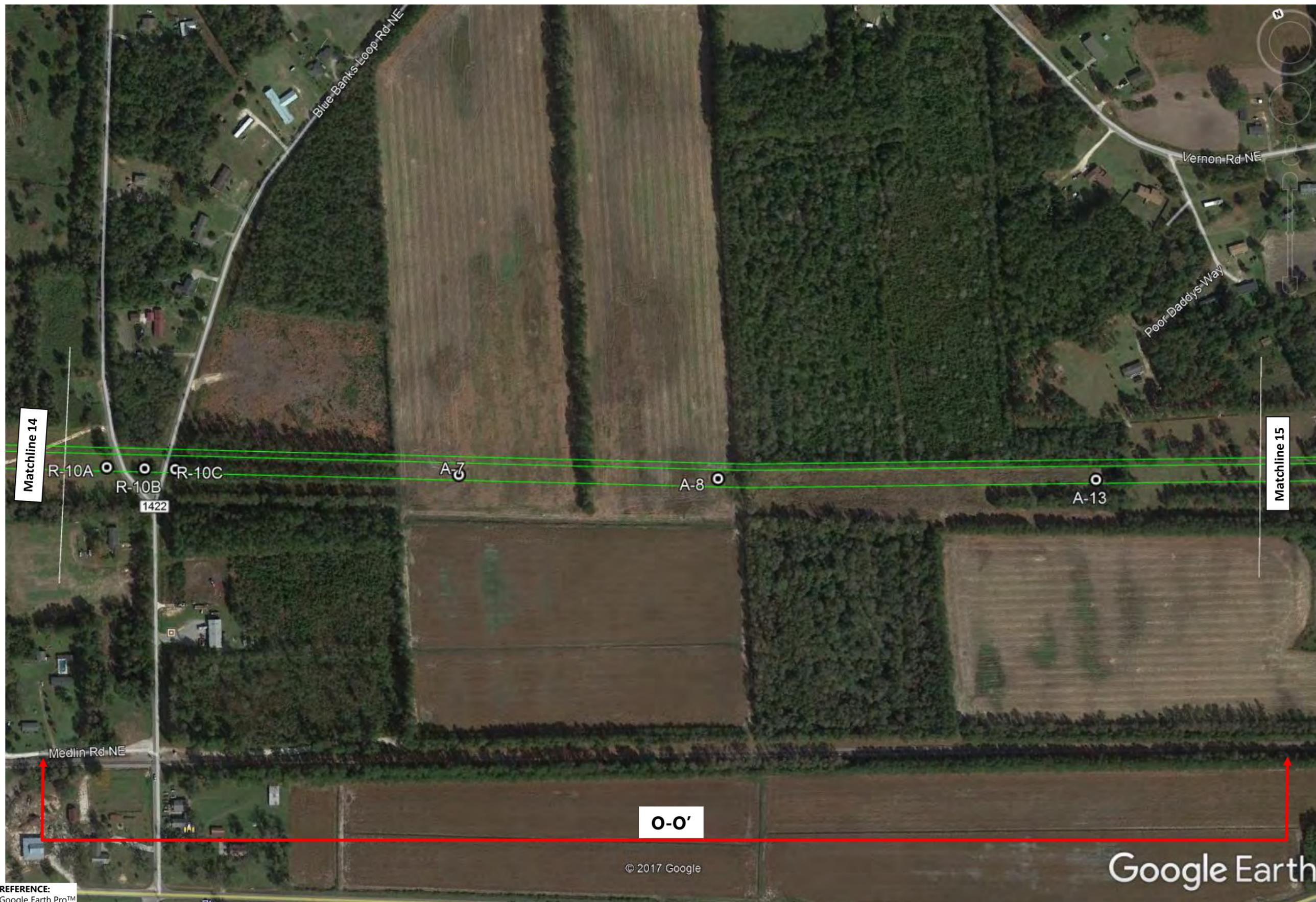
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: N-N'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 28



REFERENCE:  
Google Earth Pro™



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

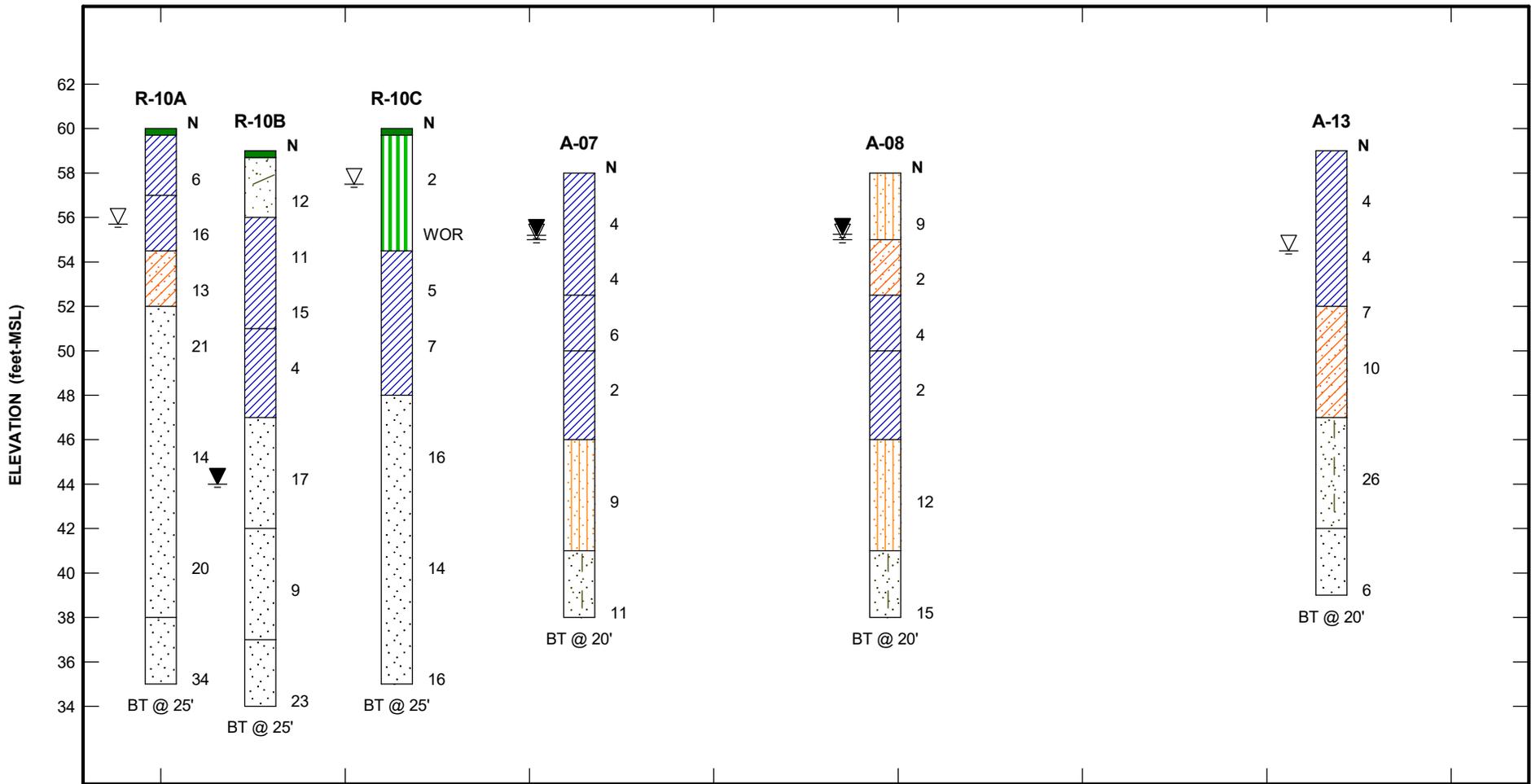
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**29**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

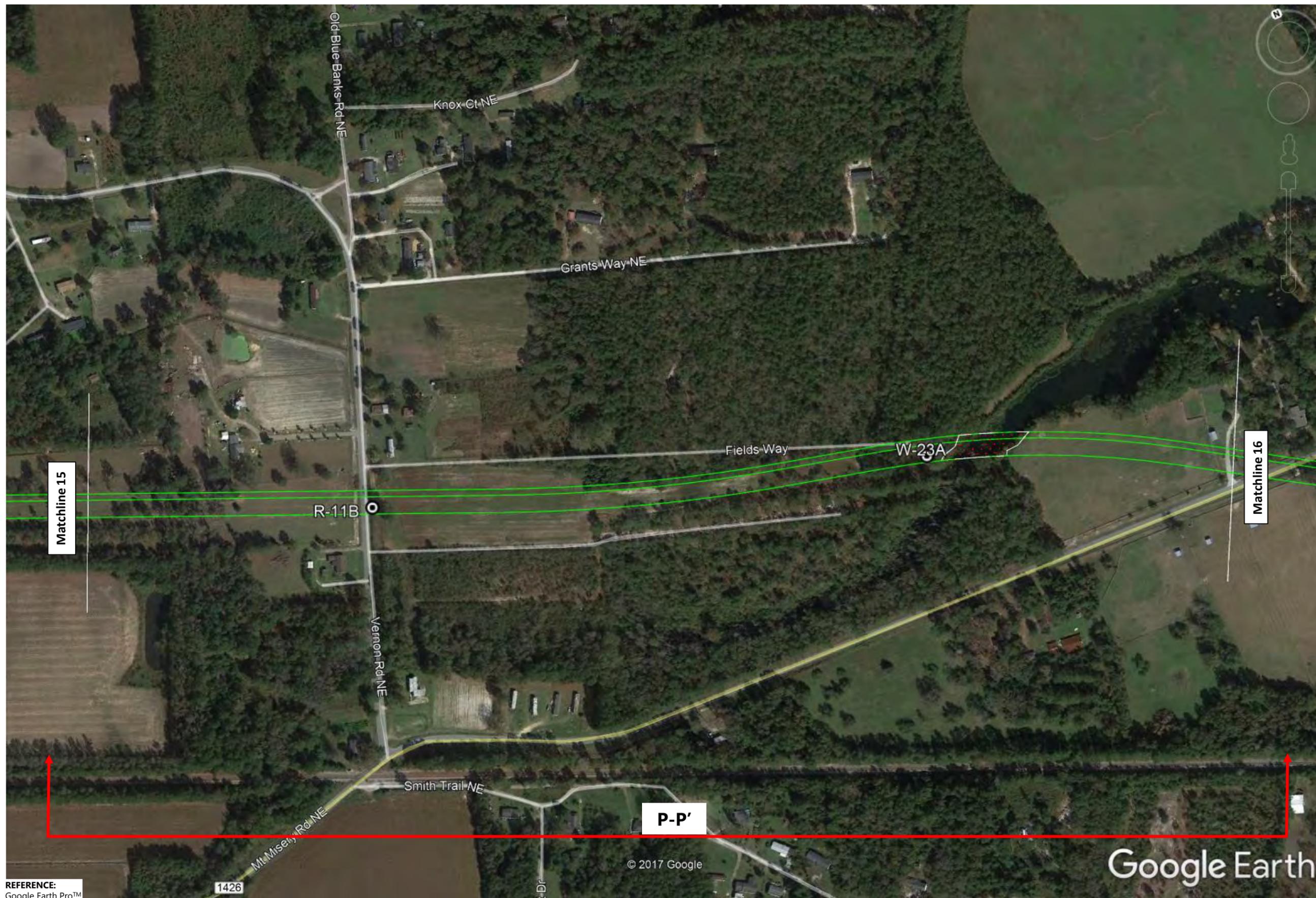
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: O-O'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 30



REFERENCE:  
Google Earth Pro™

1426



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

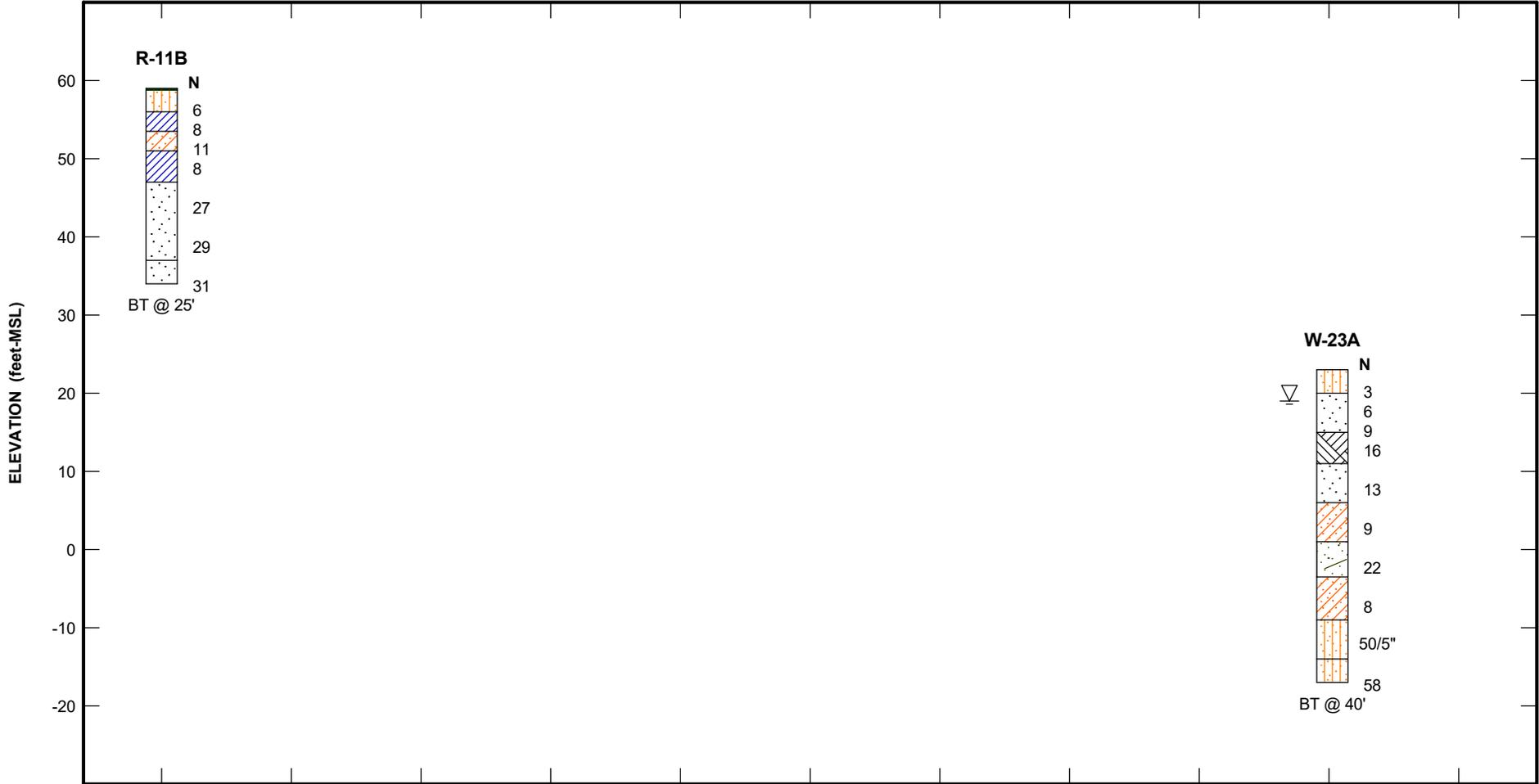
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**31**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

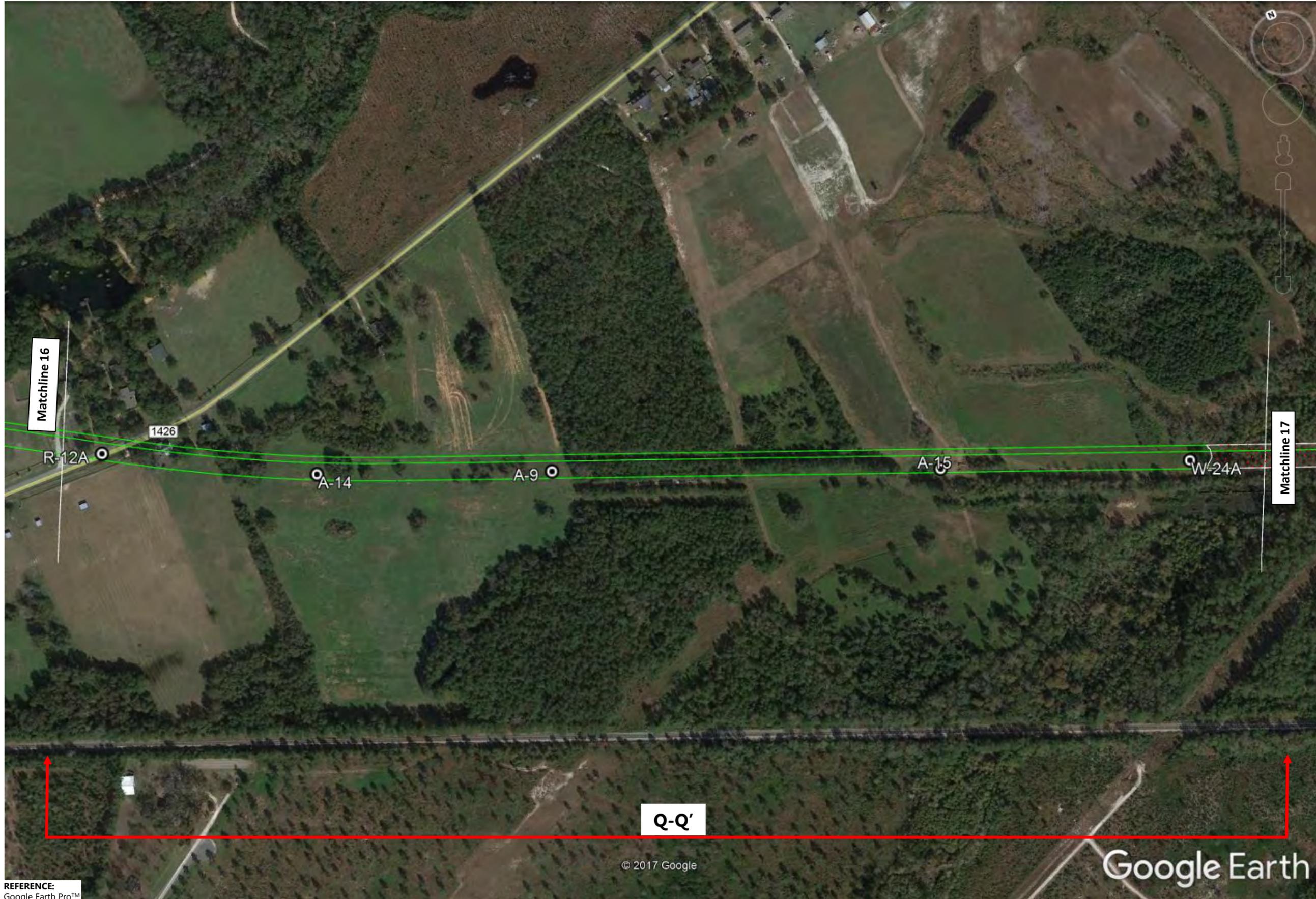
JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: P-P'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure  
32



REFERENCE:  
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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

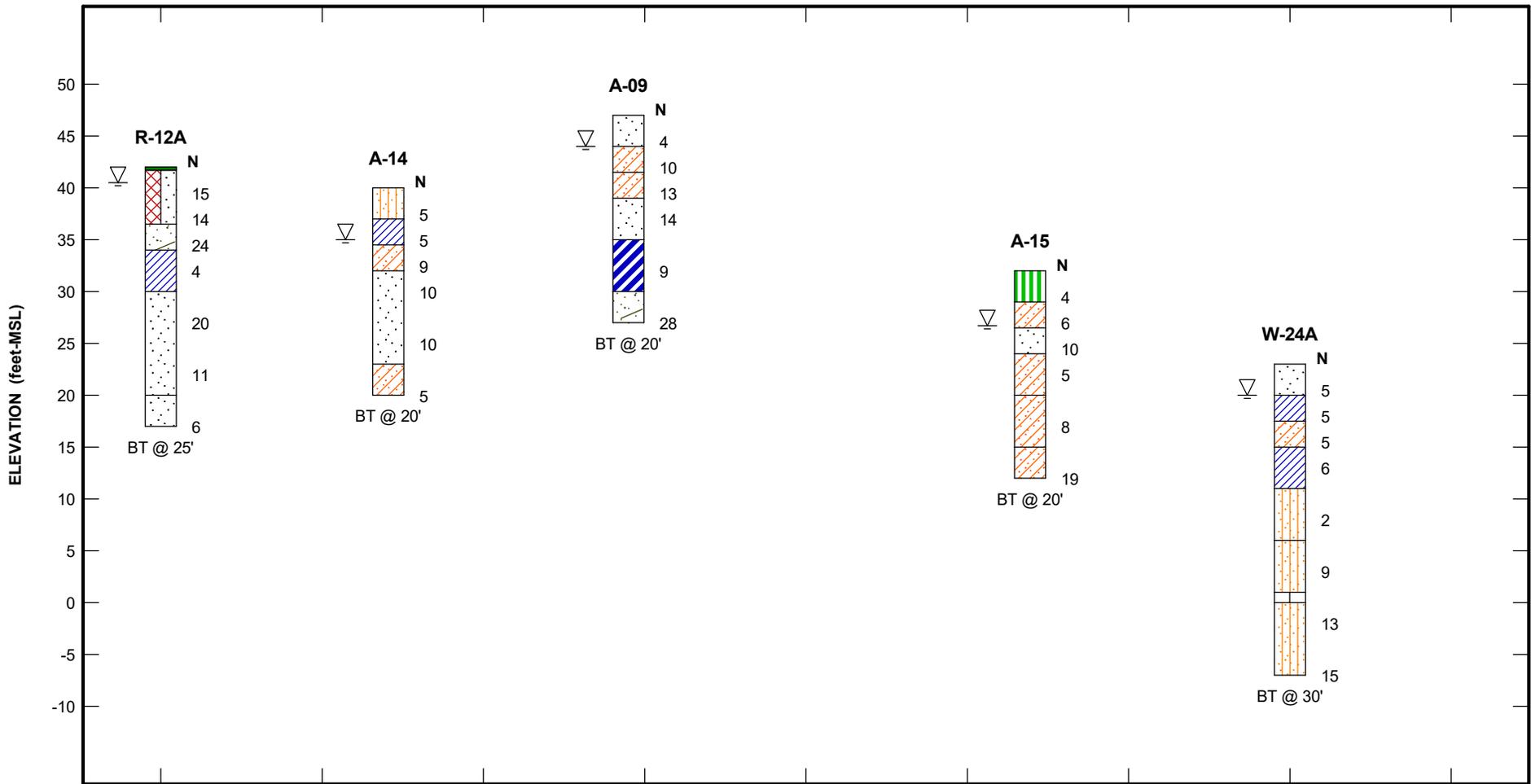
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**33**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

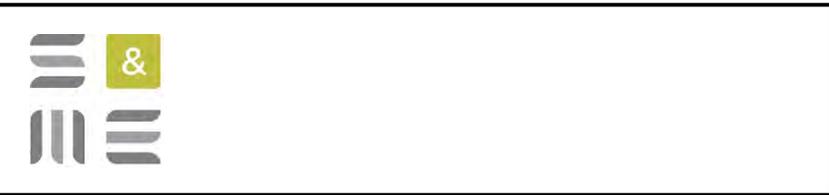
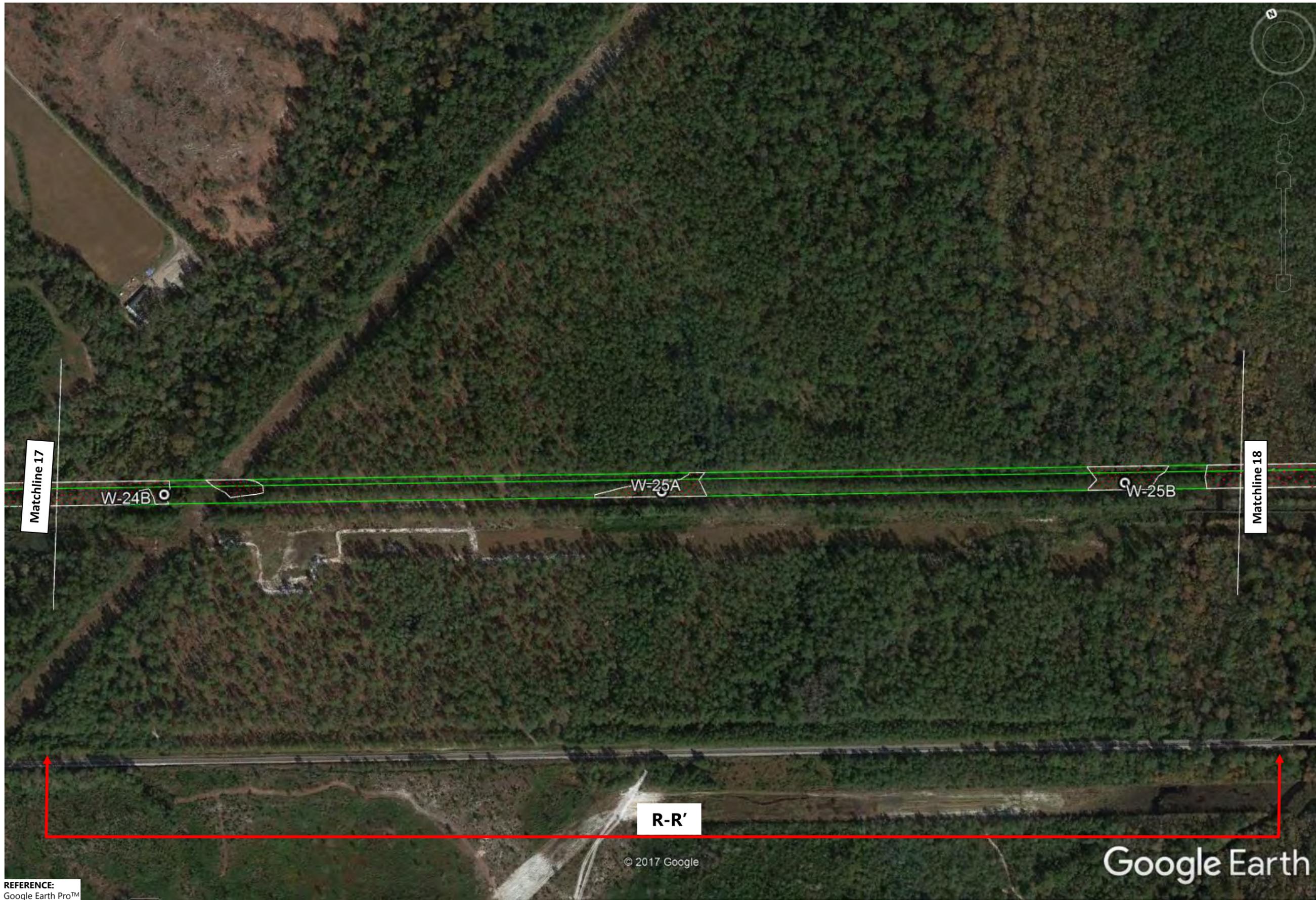


Diagram: Q-Q'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure 34



REFERENCE:  
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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

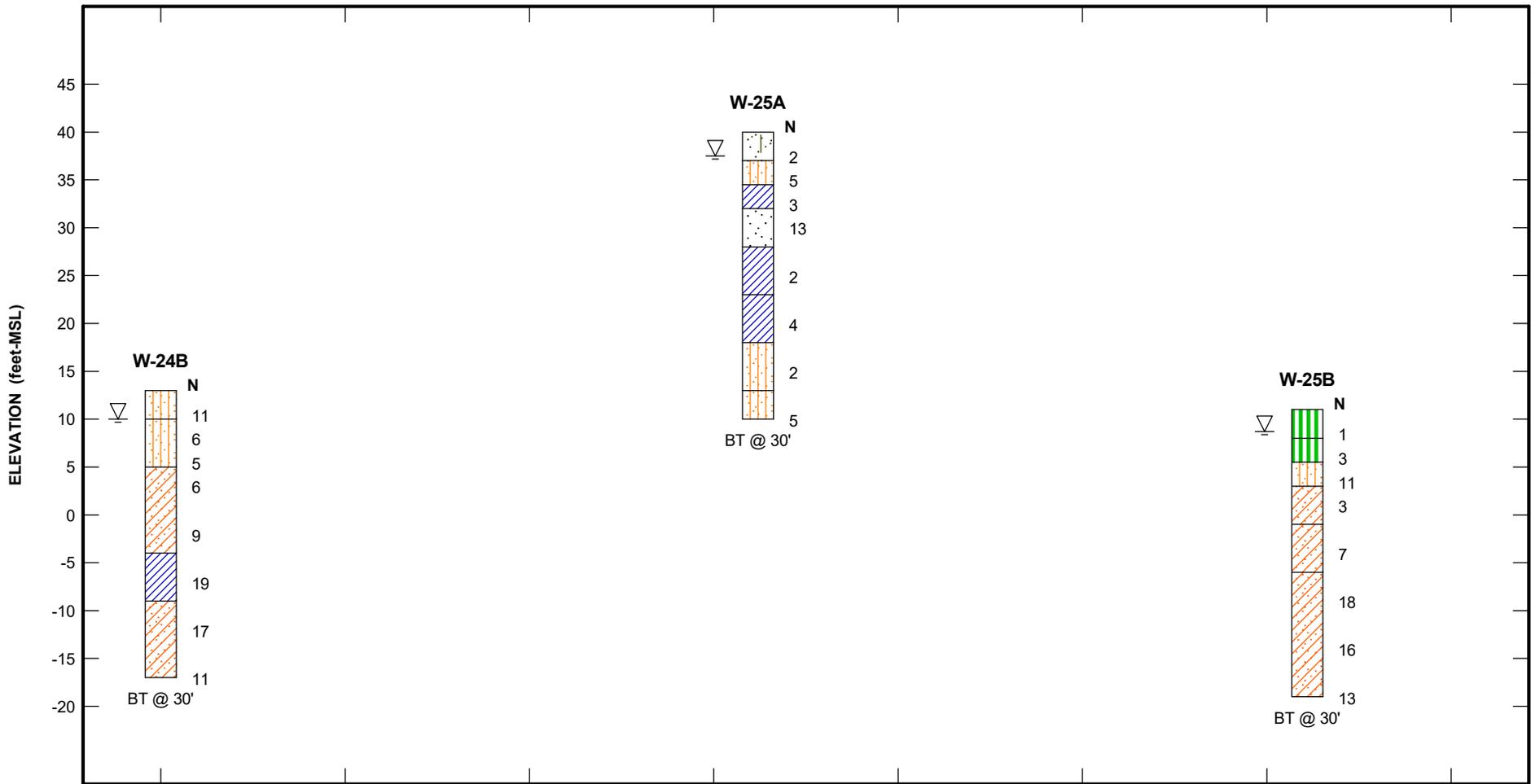
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**35**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: R-R'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure  
 36



**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

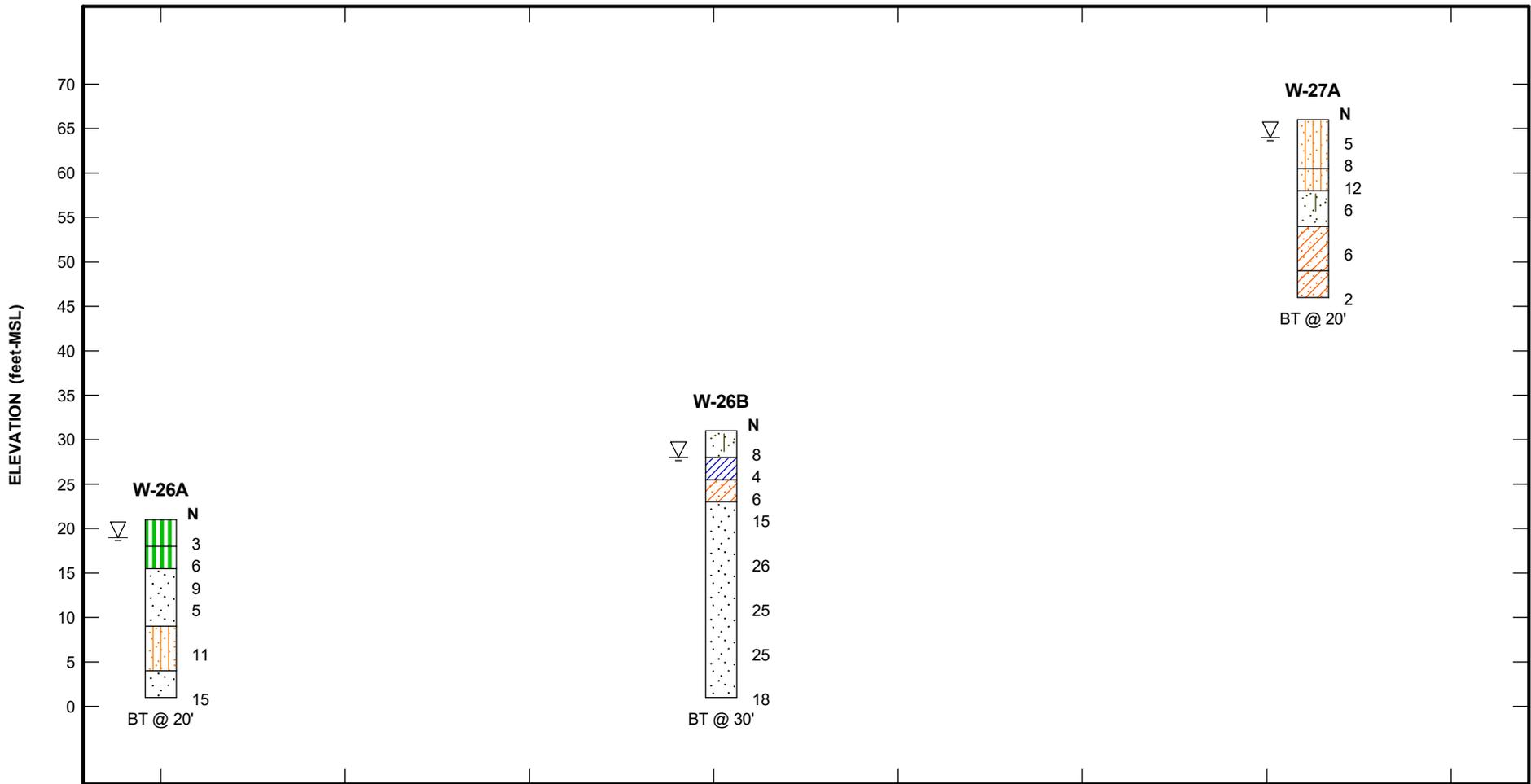
FIGURE NO.

**37**

REFERENCE:  
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N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: S-S'  
 Project: CFPUA - Kings Bluff Water Main  
 Location: Northwest, North Carolina

Figure  
38



REFERENCE:  
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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

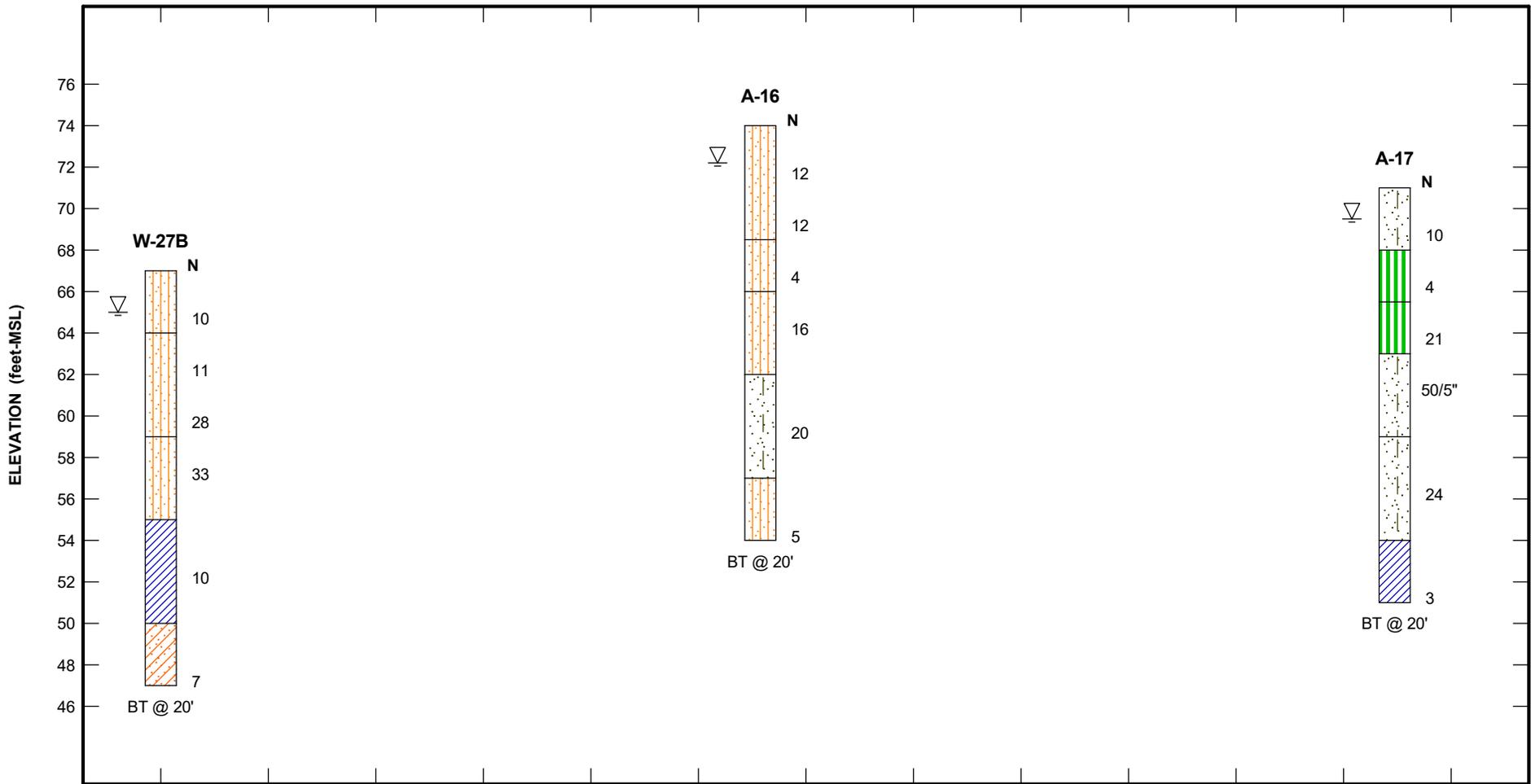
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**39**



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17

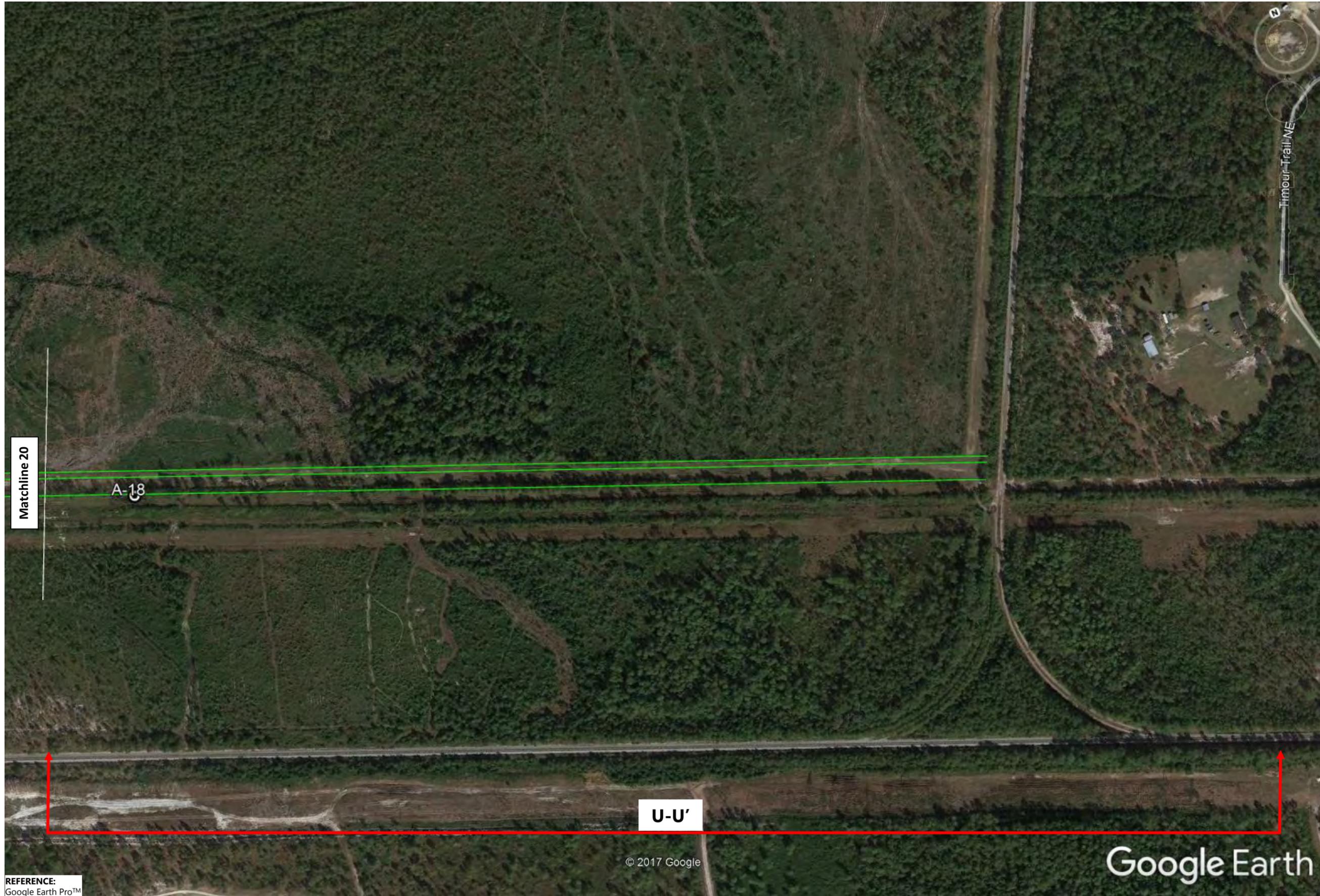


Diagram: T-T'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
40



REFERENCE:  
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**BORING LOCATION PLAN**

KINGS BLUFF WATER MAIN  
BLADEN, COLUMBUS, & BRUNSWICK COUNTIES  
NORTH CAROLINA

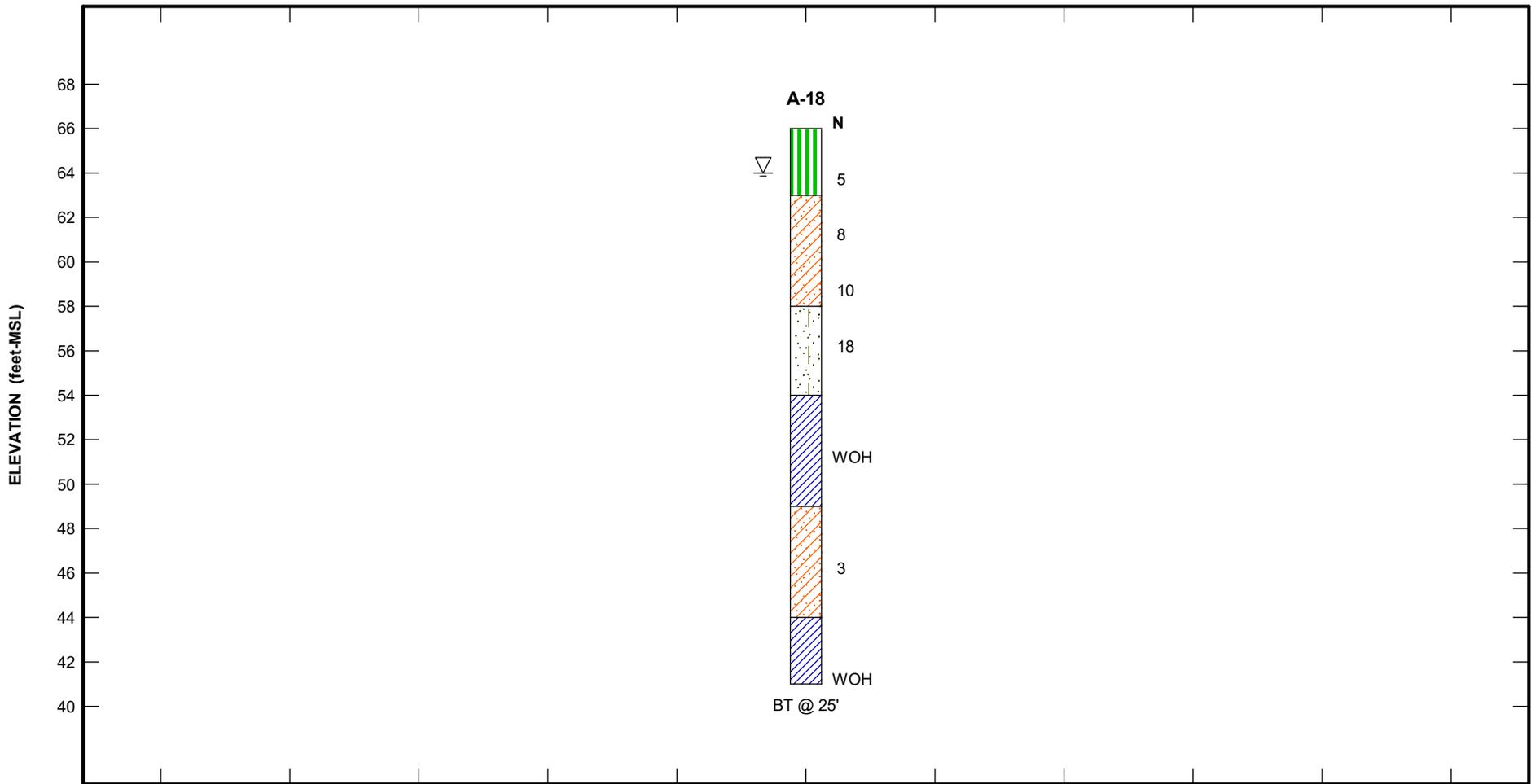
SCALE:  
AS SHOWN

DATE:  
11-1-2017

PROJECT NUMBER  
1306-17-016

FIGURE NO.

**41**



ML, Low Plasticity Silt



SC, Clayey Sand



SP/SM, Poorly-graded Sand with Silt



CL, Low Plasticity Clay

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1306-17-013

DATE: 11/3/17



Diagram: U-U'

Project: CFPUA - Kings Bluff Water Main

Location: Northwest, North Carolina

Figure  
42

## **Appendix II – Boring Logs**

**S&ME BORING LOCATIONS**

CFPUA Kings Bluff Water Main

S&ME Project Number 1306-17-013



Boring	Boring Order Along Alignment	Purpose	Boring Depth (feet)	Water Level at Termination of Drilling (feet)	Water Level After 24 Hours (feet)
A-01	3	General Alignment	20	3	Not Recorded
A-02	5	General Alignment	20	2.6	Not Recorded
A-03	24	General Alignment	20	2.5	Not Recorded
A-04	31	General Alignment	20	3	Not Recorded
A-05	39	General Alignment	20	3	Not Recorded
A-06	47	General Alignment	20	3	Not Recorded
A-07	72	General Alignment	20	3	2.8
A-08	73	General Alignment	20	3	2.8
A-09	79	General Alignment	20	3	Not Recorded
A-10	23	General Alignment	20	2.8	Not Recorded
A-11	64	General Alignment	20	4.3	Not Recorded
A-12	66	General Alignment	20	4	Not Recorded
A-13	74	General Alignment	20	4.5	Not Recorded
A-14	78	General Alignment	20	5	Not Recorded
A-15	80	General Alignment	20	5.3	Not Recorded
A-16	89	General Alignment	20	1.8	Not Recorded
A-17	90	General Alignment	20	1.5	Not Recorded
A-18	91	General Alignment	20	2	Not Recorded
C-01A	6	Creek Crossing	30	2	Not Recorded
C-02A	21	Creek Crossing	20	0.3	Not Recorded
C-03A	29	Creek Crossing	20	3.5	Not Recorded
C-04A	30	Creek Crossing	20	2	Not Recorded
R-01A	1	Road Crossing	25	Not Recorded	8.2
R-01B	2	Road Crossing	25	2	Not Recorded
R-02A	7	Road Crossing	25	Not Recorded	3.3
R-02B	8	Road Crossing	25	2.7	Not Recorded
R-03A	13	Road Crossing	25	Not Recorded	8.4
R-03B	14	Road Crossing	25	1.5	Not Recorded
R-04A	20	Road Crossing	25	3	Not Recorded
R-05A	37	Road Crossing	25	10	Not Recorded
R-05B	38	Road Crossing	25	3.3	Not Recorded
R-06A	43	Road Crossing	25	Not Recorded	6
R-06B	44	Road Crossing	25	6.3	Not Recorded
R-08A	58	Road Crossing	25	7	Not Recorded
R-08B	59	Road Crossing	30	8.5	Not Recorded
R-09A	62	Road Crossing	25	Not Recorded	Not Recorded
R-09B	63	Road Crossing	25	Not Recorded	7.5
R-10A	69	Road Crossing	25	4.3	Not Recorded
R-10B	70	Road Crossing	25	Not Recorded	15
R-10C	71	Road Crossing	25	2.5	Not Recorded
R-11B	75	Road Crossing	25	3	Not Recorded
R-12	77	Road Crossing	25	1.5	Not Recorded

**S&ME BORING LOCATIONS**

CFPUA Kings Bluff Water Main

S&ME Project Number 1306-17-013



Boring	Boring Order Along Alignment	Purpose	Boring Depth (feet)	Water Level at Termination of Drilling (feet)	Water Level After 24 Hours (feet)
RT-07A	45	Railroad Crossing at Int. Paper	50	7	Not Recorded
RT-07B	46	Railroad Crossing at Int. Paper	50	3	Not Recorded
W-01B	4	Wetland Crossing	30	4.5	Not Recorded
W-02A	9	Wetland Crossing	30	3.2	Not Recorded
W-02B	10	Wetland Crossing	30	2	Not Recorded
W-03A	11	Wetland Crossing	30	1	Not Recorded
W-03B	12	Wetland Crossing	30	2	Not Recorded
W-04B	15	Wetland Crossing	30	5.5	Not Recorded
W-05A	16	Wetland Crossing	30	3.5	Not Recorded
W-05B	17	Wetland Crossing	30	2.4	Not Recorded
W-06A	18	Wetland Crossing	30	10.6	Not Recorded
W-06B	19	Wetland Crossing	30	0.8	Not Recorded
W-07A	22	Wetland Crossing	20	4.3	Not Recorded
W-08A	25	Wetland Crossing	20	2	Not Recorded
W-09A	26	Wetland Crossing	25	Not Recorded	Not Recorded
W-09B	27	Wetland Crossing	30	1.5	Not Recorded
W-10A	28	Wetland Crossing	30	3	Not Recorded
W-11A	32	Wetland Crossing	20	2	Not Recorded
W-11B	33	Wetland Crossing	20	7	Not Recorded
W-12A	34	Wetland Crossing	20	1	Not Recorded
W-12B	35	Wetland Crossing	20	4.7	Not Recorded
W-13A	36	Wetland Crossing	20	1.5	Not Recorded
W-14A	40	Wetland Crossing	20	1	Not Recorded
W-15A	41	Wetland Crossing	20	3	Not Recorded
W-15B	42	Wetland Crossing	20	2	Not Recorded
W-16A	48	Wetland Crossing	30	3	Not Recorded
W-16B	49	Wetland Crossing	30	2	Not Recorded
W-17A	50	Wetland Crossing	30	1.4	Not Recorded
W-17B	51	Wetland Crossing	45	2	4
W-17C	52	Wetland Crossing	39.2	3.9 Above Mudline	Not Recorded
W-17D	53	Wetland Crossing	44.5	1.8 Above Mudline	Not Recorded
W-17E	54	Wetland Crossing	43.5	Ground Surface	Not Recorded
W-17F	55	Wetland Crossing	40.5	7.6 Above Mudline	Not Recorded
W-17G	56	Wetland Crossing	42.9	Ground Surface	Not Recorded
W-17H	57	Wetland Crossing	43.5	Ground Surface	Not Recorded
W-18A	60	Wetland Crossing	20	8	Not Recorded
W-19A	61	Wetland Crossing	20	2.6	Not Recorded
W-20A	65	Wetland Crossing	20	3.7	Not Recorded
W-21A	67	Wetland Crossing	40	3.3	Not Recorded
W-22B	68	Wetland Crossing	30	3	Not Recorded
W-23A	76	Wetland Crossing	40	4	Not Recorded
W-24A	81	Wetland Crossing	30	3	Not Recorded

**S&ME BORING LOCATIONS**

CFPUA Kings Bluff Water Main

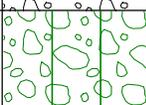
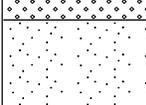
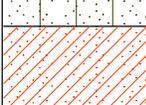
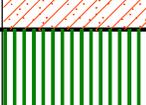
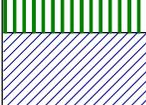
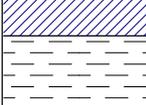
S&ME Project Number 1306-17-013



<b>Boring</b>	<b>Boring Order Along Alignment</b>	<b>Purpose</b>	<b>Boring Depth (feet)</b>	<b>Water Level at Termination of Drilling (feet)</b>	<b>Water Level After 24 Hours (feet)</b>
W-24B	82	Wetland Crossing	30	3	Not Recorded
W-25A	83	Wetland Crossing	30	2.5	Not Recorded
W-25B	84	Wetland Crossing	30	2.3	Not Recorded
W-26A	85	Wetland Crossing	20	2	Not Recorded
W-26B	86	Wetland Crossing	30	3	Not Recorded
W-27A	87	Wetland Crossing	20	2	Not Recorded
W-27B	88	Wetland Crossing	20	2	Not Recorded

# SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
<b>COARSE GRAINED SOILS</b>  MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	<b>GRAVEL AND GRAVELLY SOILS</b>  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	<b>CLEAN GRAVELS</b>  (LITTLE OR NO FINES)		<b>GW</b>	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		<b>GRAVELS WITH FINES</b>  (APPRECIABLE AMOUNT OF FINES)		<b>GP</b>	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		<b>GRAVELS WITH FINES</b>  (APPRECIABLE AMOUNT OF FINES)		<b>GM</b>	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		<b>GRAVELS WITH FINES</b>  (APPRECIABLE AMOUNT OF FINES)		<b>GC</b>	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	<b>SAND AND SANDY SOILS</b>  MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	<b>CLEAN SANDS</b>  (LITTLE OR NO FINES)		<b>SW</b>	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		<b>CLEAN SANDS</b>  (LITTLE OR NO FINES)		<b>SP</b>	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		<b>SANDS WITH FINES</b>  (APPRECIABLE AMOUNT OF FINES)		<b>SM</b>	SILTY SANDS, SAND - SILT MIXTURES
		<b>SANDS WITH FINES</b>  (APPRECIABLE AMOUNT OF FINES)		<b>SC</b>	CLAYEY SANDS, SAND - CLAY MIXTURES
<b>FINE GRAINED SOILS</b>  MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	<b>SILTS AND CLAYS</b>  LIQUID LIMIT LESS THAN 50		<b>ML</b>	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
			<b>CL</b>	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
			<b>OL</b>	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	<b>SILTS AND CLAYS</b>  LIQUID LIMIT GREATER THAN 50		<b>MH</b>	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			<b>CH</b>	INORGANIC CLAYS OF HIGH PLASTICITY	
			<b>OH</b>	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
<b>HIGHLY ORGANIC SOILS</b>				<b>PT</b>	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DATE DRILLED: <b>8/14/17</b>	ELEVATION: <b>51.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>8.2' 24 hr</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>237504</b>	EASTING: <b>2212421</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
	TOPSOIL - 2 inches.														
	COASTAL PLAIN: SILTY SAND (SM) loose, dark brown, trace coarse gravel, fine, moist						2	3	2						5
5	CLAYEY SAND (SC) very loose, light brown, fine to medium, wet			46.0	SS-2		3	1	2						3
	LEAN CLAY (CL) soft, gray brown, trace fine sand, moist to wet						2	2	2						4
10	SANDY CLAY (CL) stiff, gray brown, fine, moist		▼	41.0			2	4	8						12
15	SAND (SP) medium dense, gray, fine to medium, wet			36.0			7	9	10						19
20	SAND (SP-SM) loose, light brown, with silt, fine to medium, wet			31.0	SS-6		4	2	3						5
25	CLAYEY SAND (SC) very loose, gray brown, trace cemented sands, fine, wet			26.0			1	1	1						2
		Boring terminated at 25 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: 8/9/17	ELEVATION: 50.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-C (trailer)	BORING DEPTH: 25.0 ft	
DRILLER: Matt (Mid-Atlantic)	WATER LEVEL: 2' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 237461	EASTING: 2212488
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DRILLING METHOD: Mud Rotary															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	(blows/ft) /REMARKS					
											10	20	30	6080	
	■	<u>TOPSOIL</u> - 2 inches.	▽			▲	5	5	6						11
	●	<u>COASTAL PLAIN: SAND (SP)</u> medium dense, light brown, trace rootlets, fine, moist				▲	1	1	2		●				3
5	●	<u>SAND (SP)</u> very loose, brown, fine to medium, wet		45.0		▲	3	3	3		●				6
	●	<u>SAND (SP-SC)</u> loose, reddish brown, with clay, fine to medium, wet				▲	3	3	6		●				9
10	●	<u>SAND (SP)</u> loose, reddish brown, fine to medium, wet		40.0		▲	5	7	9		●				16
	●	<u>SAND (SP)</u> medium dense, yellowish brown, coarse, wet		35.0		▲	3	4	4		●				8
15	●	<u>SAND (SP)</u> loose, yellowish brown, medium to coarse, wet		30.0		▲	6	10	10		●				20
20	●	<u>SAND (SP)</u> medium dense, yellowish brown, fine to medium, wet		25.0		▲									
25		Boring terminated at 25 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>10/7/17</b>	ELEVATION: <b>48.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>236811</b>	EASTING: <b>2212971</b>
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DRILLING METHOD: <b>Mud Rotary</b>		MATERIAL DESCRIPTION		WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
DEPTH (feet)	GRAPHIC LOG			▽				1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
0		<b>TOPSOIL</b> - 2 inches.		48.0											
5		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, brown, fine, dry		43.0				3	3	3					6
10		<b>SAND (SP-SM)</b> very loose, light gray, with silt, fine to medium, wet		38.0		SS-3	WOH	1	1	1					2
15		<b>CLAYEY SAND (SC)</b> loose, light brown, fine to medium, wet		33.0		SS-4	7	6	4	4					10
20		<b>SAND (SP)</b> medium dense, yellowish brown, fine to medium, wet		28.0			10	11	12	12					23
20		<b>SAND (SP)</b> loose, tan, fine to medium, wet					4	4	6	6					10
20		Boring terminated at 20 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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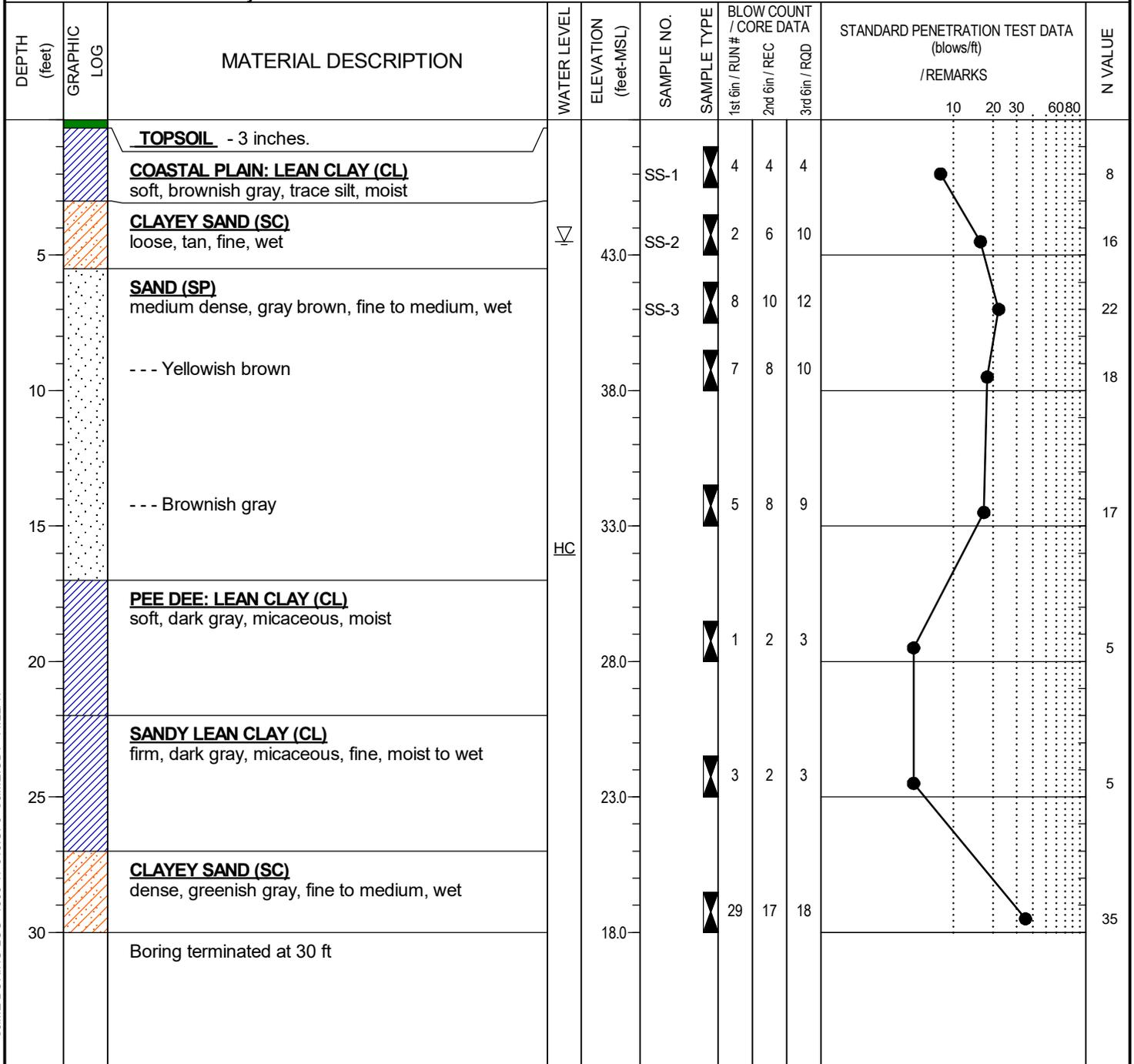
Page 1 of 1



DATE DRILLED: 10/7/17	ELEVATION: 48.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (track)	BORING DEPTH: 30.0 ft	
DRILLER: Matt (Mid-Atlantic)	WATER LEVEL: 4.5' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 236070	EASTING: 2213589
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DRILLING METHOD: Mud Rotary



S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/15/17</b>	ELEVATION: <b>41.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>2.6' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>234809</b>	EASTING: <b>2214614</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, dark brown, fine, moist	▽			3	4	3							7
5		<b>SILTY SAND (SM)</b> very loose, light gray, fine to medium, wet		36.0	SS-2	2	1	2							3
		<b>SAND (SP-SM)</b> loose, brown, with silt, fine, wet				4	4	5							9
10		<b>SAND (SP)</b> medium dense, light brown, fine to medium, wet		31.0	SS-4	3	5	6							11
		--- Medium to coarse				9	9	9							18
15		<b>PEE DEE: LEAN CLAY (CL)</b> stiff, dark gray, with mica, moist				3	4	5							9
20		Boring terminated at 20 ft		21.0											

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>9/15/17</b>	ELEVATION: <b>39.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>234096</b>	EASTING: <b>2215199</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> loose, brownish gray, fine, wet	▽				2	4	1					5
5		<b>SAND (SP-SC)</b> loose, brownish gray, with clay, fine to medium, wet		34.0			1	2	3					5
		<b>SAND (SP)</b> medium dense, brownish gray, trace clay, fine, wet  --- No clay, medium		29.0			7	9	11					20
10							7	10	7					17
		<b>PEE DEE: LEAN CLAY (CL)</b> firm, dark gray, trace mica, moist		24.0			2	2	3					5
15							4	5	5					10
		<b>LEAN CLAY (CL)</b> stiff, dark gray, trace mica, moist		14.0			5	5	6					11
25							5	6	5					11
30		Boring terminated at 30 ft		9.0			5	6	5					11

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-02A</b>												
DATE DRILLED: 8/14/17		ELEVATION: 39.0 ft												
DRILL RIG: CME 45-C (trailer)		BORING DEPTH: 25.0 ft												
DRILLER: Austin (Mid-Atlantic)		WATER LEVEL: 3.3' 24 hr												
HAMMER TYPE: Auto		LOGGED BY: G. Goslin												
SAMPLING METHOD: Split spoon		NORTHING: 233448	EASTING: 2215726											
DRILLING METHOD: Mud Rotary														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>TOPSOIL</b> - 2 inches.												
		<b>COASTAL PLAIN: SAND (SP-SM)</b> loose, brown, with silt, fine, moist					2	3	2					5
5		<b>SAND (SP)</b> medium dense, yellowish brown, fine to medium, wet  --- Light brown, fine to coarse  --- Fine to medium	▼	34.0			6	7	10					17
					SS-3		6	8	13					21
10				29.0			6	7	7					14
		<b>CLAYEY SAND (SC)</b> soft, brown, fine to medium, wet		24.0			1	2	1					3
15					SS-5									
20		<b>FAT CLAY (CH)</b> stiff, gray, moist		19.0			3	4	5					9
25		Boring terminated at 25 ft		14.0			4	5	8					13

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 8/14/17	ELEVATION: 39.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-C (trailer)	BORING DEPTH: 25.0 ft	
DRILLER: Austin (Mid-Atlantic)	WATER LEVEL: 2.7' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 233425	EASTING: 2215749
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
	TOPSOIL	TOPSOIL - 2 inches.												
	COASTAL PLAIN: SAND (SP-SM)	COASTAL PLAIN: SAND (SP-SM) very loose, brown, with silt, fine, moist	▽			2	1	3						4
5	CLAYEY SAND (SC)	CLAYEY SAND (SC) loose, gray brown, fine, wet		34.0		2	3	5						8
	SAND (SP)	SAND (SP) medium dense, yellowish brown, fine to medium, wet  --- Brown, fine				6	11	14						25
10	CLAYEY SAND (SC)	CLAYEY SAND (SC) loose, yellowish brown, medium to coarse, wet		29.0		5	8	8						16
15	FAT CLAY (CH)	FAT CLAY (CH) firm, dark gray, moist		24.0		2	1	5						6
20	FAT CLAY (CH)	FAT CLAY (CH) stiff, brownish gray, moist		19.0		2	2	3						5
25		Boring terminated at 25 ft		14.0		4	4	6						10

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-02A</b>											
DATE DRILLED: <b>9/15/17</b>		ELEVATION: <b>34.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>30.0 ft</b>													
DRILLER: <b>Malcom (Mid-Atlantic)</b>		WATER LEVEL: <b>3.2' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>232676</b>		EASTING: <b>2216380</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, dark brown, fine to medium, wet					2	2	2						4
5		<b>SILTY SAND (SM)</b> medium dense, gray, with clay, fine to medium, moist to wet	▽	29.0	SS-2		3	7	7						14
		<b>LEAN CLAY (CL)</b> soft, tan gray, moist					2	2	2						4
10		<b>SAND (SP)</b> loose, reddish brown, fine to medium, wet		24.0			2	4	3						7
15		<b>PEE DEE: SANDY FAT CLAY (CH)</b> stiff, brownish red, with mica, moist		19.0	SS-5		2	6	7						13
20				14.0			4	7	8						15
25				9.0			5	7	8						15
30				4.0			3	7	8						15
		Boring terminated at 30 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-02B</b>										
DATE DRILLED: <b>9/26/17</b>		ELEVATION: <b>32.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-C (turtle)</b>		BORING DEPTH: <b>30.0 ft</b>												
DRILLER: <b>Ryan (Mid-Atlantic)</b>		WATER LEVEL: <b>2' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>232253</b>		EASTING: <b>2216780</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, tan brown, fine, moist	▽			1	1	2						3
5		<b>SAND (SP)</b> loose, tan white, fine, moist		27.0		2	3	5						8
		<b>LEAN CLAY (CL)</b> firm, reddish brown, trace silt, moist				2	2	3						5
10		--- Brown		22.0		2	2	4						6
15		<b>PEE DEE: LEAN CLAY (CL)</b> stiff, brownish gray, trace silt, trace mica, moist		17.0		4	5	7						12
20				12.0		5	5	6						11
25				7.0		5	6	5						11
30		<b>LEAN CLAY (CL)</b> very stiff, brownish gray, trace mica, moist		2.0		6	8	8						16
		Boring terminated at 30 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/26/17</b>	ELEVATION: <b>32.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>1' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>231843</b>	EASTING: <b>2217174</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
	•••••	<b>COASTAL PLAIN: SAND (SP-SM)</b> loose, brown, with silt, fine to medium, moist	▽			▲▼	3	2	3					5
5	•••••	<b>SAND (SP)</b> loose, tan gray, fine, moist		27.0		▲▼	3	3	3					6
	•••••	<b>SAND (SP)</b> very loose, tan, medium, wet				▲▼	1	1	2					3
10	▨▨▨▨▨	<b>PEE DEE: LEAN CLAY (CL)</b> very soft, dark gray, with mica, trace silt, moist		22.0		▲▼	1	1	1					2
	▨▨▨▨▨	<b>LEAN CLAY (CL)</b> stiff, brownish gray, with mica, trace silt, moist				▲▼	4	5	6					11
20	▨▨▨▨▨			12.0		▲▼	4	5	4					9
25	▨▨▨▨▨			7.0		▲▼	4	6	8					14
30	▨▨▨▨▨	Boring terminated at 30 ft		2.0		▲▼	5	7	7					14

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 8/14/17	ELEVATION: 39.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-C (trailer)	BORING DEPTH: 25.0 ft	
DRILLER: Austin (Mid-Atlantic)	WATER LEVEL: 8.4' 24 hr	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 230183	EASTING: 2218764
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
0-3		<b>TOPSOIL</b> - 3 inches.												
3-5		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, brown, fine, moist				2	3	3						6
5-8		<b>SANDY LEAN CLAY (CL)</b> very soft, light brown, fine, wet  --- Gray brown				WOH	WOH	WOH						WOH
8-10		<b>SAND (SP)</b> medium dense, light brown, fine to medium, wet				1	1	1						2
10-15		<b>SAND (SP)</b> loose, yellowish brown, fine to medium, wet  --- Light brown	▼	29.0	SS-4	6	7	8						15
15-20		<b>SAND (SP)</b> loose, yellowish brown, fine to medium, wet  --- Light brown		24.0		4	5	5						10
20-25		<b>FAT CLAY (CH)</b> firm, dark brown, moist		19.0	SS-6	3	4	4						8
25		Boring terminated at 25 ft		14.0		2	3	3						6

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: 8/9/17	ELEVATION: 38.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-C (trailer)	BORING DEPTH: 25.0 ft	
DRILLER: Austin (Mid-Atlantic)	WATER LEVEL: 1.5' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 230137	EASTING: 2218809
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DRILLING METHOD: Mud Rotary

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>TOPSOIL</b> - 3 inches.	▽											
		<b>COASTAL PLAIN: SAND (SP-SM)</b> medium dense, gray brown, with silt, fine, moist					7	9	14					23
5		<b>CLAYEY SAND (SC)</b> medium dense, light gray, fine, wet		33.0	SS-2		4	4	7					11
		<b>SAND (SP)</b> medium dense, light brown, fine, wet					7	8	11					19
10		<b>SAND (SP)</b> medium dense, light brown, fine, wet		28.0			8	8	8					16
		<b>SAND (SP-SM)</b> loose, brownish orange, with silt, fine to medium, wet					4	4	4					8
15		<b>FAT CLAY (CH)</b> firm, brownish black, moist		23.0	SS-5		4	4	4					6
20		<b>FAT CLAY (CH)</b> stiff, dark brown, moist		18.0			1	3	3					14
25		Boring terminated at 25 ft		13.0			4	5	9					14

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>8/15/17</b>	ELEVATION: <b>38.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>5.5' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>230067</b>	EASTING: <b>2218870</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	blows/ft					
											10	20	30	6080	
	TOPSOIL	<b>TOPSOIL</b> - 2 inches.													
	COASTAL PLAIN: SILTY SAND (SM)	<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, dark brown, fine, moist				3		5	5		10				10
5	SAND (SP)	<b>SAND (SP)</b> medium dense, gray brown, trace clay, fine, moist  --- Tan, medium, wet, no clay.  --- Gray	▽	33.0		3		7	8		15				15
10	SAND (SP-SC)	<b>SAND (SP-SC)</b> loose, yellowish brown, with clay, medium, wet				9		14	15		29				29
15	SAND (SP-SC)	<b>SAND (SP-SC)</b> loose, yellowish brown, with clay, medium, wet				6		7	9		16				16
20	LEAN CLAY (CL)	<b>LEAN CLAY (CL)</b> firm, blackish brown, moist				2		2	4		6				6
25	LEAN CLAY (CL)	<b>LEAN CLAY (CL)</b> stiff, blackish brown, moist				1		2	3		5				5
30	LEAN CLAY (CL)	<b>LEAN CLAY (CL)</b> stiff, blackish brown, moist				5		6	8		14				14
30		Boring terminated at 30 ft				4		4	8		12				12

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-05A</b>											
DATE DRILLED: <b>9/7/17</b>		ELEVATION: <b>32.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>30.0 ft</b>													
DRILLER: <b>Matt (Mid-Atlantic)</b>		WATER LEVEL: <b>3.5' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>229640</b>		EASTING: <b>2219349</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, brown, fine, moist				4	4	4							8
5		<b>SAND (SP-SM)</b> dense, brown, with silt, fine, moist to wet	▽	27.0		11	15	14							29
		<b>SAND (SP)</b> medium dense, brown, fine to medium, wet				8	11	12							23
10		--- Coarse		22.0		4	6	6							12
15		<b>LEAN CLAY (CL)</b> very soft, yellowish brown, trace silt, moist		17.0		2	1	1							2
20		<b>PEE DEE: LEAN CLAY (CL)</b> stiff, dark gray, trace silt, trace mica, moist		12.0		3	6	7							13
25		<b>FAT CLAY (CH)</b> very stiff, dark gray, trace silt, trace mica, moist		7.0		4	7	9							16
30		--- Little silt		2.0		5	7	9							16
		Boring terminated at 30 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 9/7/17	ELEVATION: 25.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (track)	BORING DEPTH: 30.0 ft	
DRILLER: Matt (Mid-Atlantic)	WATER LEVEL: 2.4' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 229359	EASTING: 2219747
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DRILLING METHOD: Mud Rotary

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
	[Orange dotted pattern]	<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, tan brown, fine, moist	▽	25.0		2	2	2							4
5	[Orange diagonal pattern]	<b>CLAYEY SAND (SC)</b> very loose, tan, fine, wet		20.0	SS-2	1	1	1	20	10	20	30	60	80	2
	[Orange diagonal pattern]	<b>CLAYEY SAND (SC)</b> loose, gray tan, fine, moist				2	3	2							5
10	[Orange dotted pattern]	<b>SAND (SP)</b> medium dense, gray tan, fine to medium, wet		15.0		4	6	5	10	20	30	60	80		11
	[Blue diagonal pattern]	<b>LEAN CLAY (CL)</b> firm, gray, with silt, trace mica, moist		10.0	SS-5	1	2	4	10	20	30	60	80		6
20	[Blue diagonal pattern]	<b>PEE DEE: FAT CLAY (CH)</b> stiff, dark gray, trace silt, trace mica, moist		5.0		5	6	9	10	20	30	60	80		15
25	[Blue diagonal pattern]	<b>FAT CLAY (CH)</b> very stiff, dark gray, trace silt, trace mica, moist		0.0		4	7	10	10	20	30	60	80		17
30	[Blue diagonal pattern]	<b>FAT CLAY (CH)</b> stiff, dark gray, trace silt, trace mica, moist		-5.0		5	6	9	10	20	30	60	80		15
		Boring terminated at 30 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

DATE DRILLED: 9/7/17	ELEVATION: 20.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (track)	BORING DEPTH: 30.0 ft	
DRILLER: Matt (Mid-Atlantic)	WATER LEVEL: 10.6' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 229033	EASTING: 2220195
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DRILLING METHOD: Mud Rotary

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
0 - 4.5		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, yellowish brown, fine, moist				2	2	2							4
4.5 - 5.5		<b>SILT (ML)</b> dark gray, moist				1	1	2							3
5.5 - 17		<b>PEE DEE: LEAN CLAY (CL)</b> dark gray, trace silt, trace mica, moist				2	4	5							9
17 - 20		<b>LEAN CLAY (CL)</b> dark gray, trace silt, trace mica, moist				4	6	7							13
20 - 25		<b>LEAN CLAY (CL)</b> dark gray, trace silt, trace mica, moist				5	7	7							14
25 - 30		<b>LEAN CLAY (CL)</b> dark gray, trace silt, trace mica, moist				5	7	9							16
30 - 30		Boring terminated at 30 ft				5	7	9							16

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-06B</b>											
DATE DRILLED: <b>9/13/17</b>		ELEVATION: <b>10.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>30.0 ft</b>													
DRILLER: <b>Matt (Mid-Atlantic)</b>		WATER LEVEL: <b>0.8' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>228715</b>		EASTING: <b>2220601</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
		<b>COASTAL PLAIN: SAND (SP-SM)</b> very loose, dark brown, with silt, fine, moist	▽												
5		--- Fine to medium, wet													
		<b>SILTY SAND (SM)</b> loose, gray tan, fine, wet													
10		<b>PEE DEE: SANDY FAT CLAY (CH)</b> firm, dark gray, trace silt, with mica, fine, moist													
15		<b>FAT CLAY (CH)</b> stiff, dark brown, trace silt, with mica, moist													
20															
25															
30		Boring terminated at 30 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main</b> Northwest, North Carolina S&ME Project No. 1306-17-013				<b>BORING LOG</b>				<b>R-04A</b>						
DATE DRILLED: 8/16/17		ELEVATION: 32.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: CME 45-C (trailer)		BORING DEPTH: 25.0 ft												
DRILLER: Austin (Mid-Atlantic)		WATER LEVEL: 3' ATD												
HAMMER TYPE: Auto		LOGGED BY: G. Goslin												
SAMPLING METHOD: Split spoon				NORTHING: 228057		EASTING: 2221459								
DRILLING METHOD: Mud Rotary														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
		<u>TOPSOIL</u> - 2 inches.												
		<u>COASTAL PLAIN: SAND (SP-SM)</u> loose, brown, with silt, fine, moist	▽				2	3	6					9
5		<u>SAND (SP-SM)</u> loose, light brown, with silt, fine to medium, wet		27.0			2	2	3					5
		<u>SAND (SP-SC)</u> medium dense, yellowish red, with clay, fine to medium, wet			SS-3		2	3	5					8
10		<u>SAND (SP-SC)</u> medium dense, yellowish red, with clay, fine to medium, wet		22.0			4	5	7					12
15		<u>SAND (SP)</u> medium dense, yellowish red, medium, wet		17.0			4	7	8					15
20		<u>CLAYEY SAND (SC)</u> loose, brownish orange, fine to medium, wet		12.0			5	3	2					5
25		<u>LEAN CLAY (CL)</u> very stiff, dark gray, trace fine sand, wet		7.0			4	6	10					16
		Boring terminated at 25 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/13/17</b>	ELEVATION: <b>41.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>0.3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>227482</b>	EASTING: <b>222215</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, yellowish orange, fine, moist	K	41.0		2	2	2	4						4
5		<b>SAND (SP-SM)</b> loose, tan orange, with silt, fine, moist		36.0		4	4	3	7						7
		<b>SAND (SP)</b> medium dense, gray white, fine, moist				4	6	8	14						14
10		<b>SAND (SP)</b> loose, tan white, medium, wet		31.0		3	4	4	8						8
		<b>SAND (SP)</b> medium dense, yellowish tan, fine to medium, wet		26.0		4	8	10	18						18
15		<b>SAND (SP)</b> loose, brown, medium to coarse, wet				5	4	5	9						9
20		Boring terminated at 20 ft		21.0											

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/13/17</b>	ELEVATION: <b>39.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>4.3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>227176</b>	EASTING: <b>2222618</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> stiff, tan, fine, moist					3	4	5						9
5		<b>SILTY SAND (SM)</b> loose, light brown, fine, moist to wet	▽	34.0	SS-2		2	2	3	●					5
		<b>SAND (SP)</b> loose, brownish orange, fine to medium, wet  --- Orange					2	4	5	●					9
10		<b>SAND (SP-SC)</b> medium dense, orange, with clay, fine to medium, wet		29.0	SS-4		4	3	4	●					7
15		<b>SAND (SP-SC)</b> medium dense, orange, with clay, fine to medium, wet		24.0			4	7	8	●					15
20		<b>SAND (SP)</b> medium dense, tan brown, fine to medium, wet		19.0			7	7	7	●					14
		Boring terminated at 20 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>10/23/17</b>	ELEVATION: <b>52.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (trailer)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Brandon (Mid-Atlantic)</b>	WATER LEVEL: <b>2.8' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>226481</b>	EASTING: <b>2223557</b>
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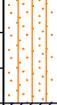
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, tan, fine, moist	▽			8	4	5	9						9
5		<b>SANDY SILT (ML)</b> stiff, yellowish brown, trace clay, fine, moist		47.0		5	5	6	11						11
		<b>SANDY LEAN CLAY (CL)</b> stiff, brownish orange, trace silt, fine, moist				6	7	8	15						15
10		<b>SANDY FAT CLAY (CH)</b> soft, pinkish gray, fine, moist		42.0		5	5	6	11						11
15		<b>SANDY FAT CLAY (CH)</b> soft, pinkish gray, fine, moist		37.0		2	2	2	4						4
20		<b>SAND (SP-SC)</b> medium dense, gray yellow, with clay, fine, wet		32.0		4	5	8	13						13
		Boring terminated at 20 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>A-03</b>										
DATE DRILLED: <b>9/14/17</b>		ELEVATION: <b>57.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>20.0 ft</b>												
DRILLER: <b>Matt (Mid-Atlantic)</b>		WATER LEVEL: <b>2.5' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>225557</b>		EASTING: <b>2224742</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: CLAYEY SAND (SM)</b> very loose, tan, fine, moist	▽		SS-1	▲	1	2	2					4
5		<b>LEAN CLAY (CL)</b> very soft, brown, wet  --- Brownish gray		52.0	SS-2	▲	1	1	1					2
					WOH	▲	1	1						2
10		<b>FAT CLAY (CH)</b> firm, brown, moist		47.0	SS-4	▲	2	2	4					6
15		<b>FAT CLAY (CH)</b> soft, tan gray, moist		42.0		▲	1	2	2					4
20		<b>FAT CLAY (CH)</b> stiff, tan gray, moist		37.0		▲	3	4	5					9
		Boring terminated at 20 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-08A</b>											
DATE DRILLED: <b>9/14/17</b>		ELEVATION: <b>50.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>20.0 ft</b>													
DRILLER: <b>Matt (Mid-Atlantic)</b>		WATER LEVEL: <b>2' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>224615</b>		EASTING: <b>2226004</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: LEAN CLAY (CL)</b> very soft, gray tan, trace fine sand, moist to wet	▽			▲	1	1	1						2
5		<b>LEAN CLAY (CL)</b> soft, gray tan, trace fine sand, moist to wet		45.0		▲	1	1	3						4
		<b>LEAN CLAY (CL)</b> stiff, tan gray, trace fine sand, moist				▲	3	4	6						10
10		<b>CLAYEY SAND (SC)</b> loose, tan brown, fine to medium, wet		40.0		▲	3	4	2						6
15		<b>SAND (SP-SC)</b> very loose, tan orange, with clay, fine to medium, wet		35.0		▲	5	2	2						4
20		<b>SAND (SP)</b> medium dense, tan orange, medium to coarse, wet		30.0		▲	7	8	8						16
		Boring terminated at 20 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/14/17</b>	ELEVATION: <b>49.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Matt (Mid-Atlantic)</b>	WATER LEVEL: <b>Lost mud flow, no water level reading.</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>223735</b>	EASTING: <b>2227173</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	(blows/ft)					
										/REMARKS					
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> very loose, tan brown, fine, moist					2	2	2						4
5		<b>LEAN CLAY (CL)</b> firm, tan, trace fine sand, moist		44.0	SS-2		1	2	3						5
		<b>SAND (SP-SC)</b> medium dense, tan, with clay, fine, moist					4	8	9						17
10		<b>SANDY LEAN CLAY (CL)</b> soft, tan, fine, moist		39.0	SS-4		1	2	2						4
15		--- Brownish tan, no sand		34.0			1	2	2						4
20		<b>SAND (SP)</b> medium dense, yellowish red, fine, wet		29.0			4	5	6						11
25		<b>SAND (SP-SC)</b> very loose, gray brown, with clay, medium to coarse, wet		24.0			2	2	2						4
		Boring terminated at 25 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>9/26/17</b>	ELEVATION: <b>32.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>1.5' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>223482</b>	EASTING: <b>2227502</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, gray, fine to medium, wet	▽			▲▼									
5		<b>SILTY SAND (SM)</b> very loose, tan brown, fine, wet		27.0	SS-2	▲▼	2	2	3						5
		<b>WOOD</b> - No recovery. Mostly wood in spoon.				▲▼	3	2	3						5
						▲▼	1	1	2						3
10				22.0		▲▼	2	2	2						4
		<b>SAND (SP)</b> loose, light gray, fine to medium, wet				▲▼	2	2	2						4
15				17.0	SS-5	▲▼	3	4	4						8
		<b>PEE DEE: LEAN CLAY (CL)</b> soft, dark gray, trace fine sand, trace silt, moist				▲▼	2	1	3						4
20				12.0		▲▼	2	1	3						4
		<b>SANDY LEAN CLAY (CL)</b> stiff, dark gray, trace silt, fine, moist				▲▼	6	6	7						13
25				7.0		▲▼	6	6	7						13
30		Boring terminated at 30 ft		2.0		▲▼	5	6	8						14

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-10A</b>										
DATE DRILLED: <b>9/26/17</b>		ELEVATION: <b>43.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-C (turtle)</b>		BORING DEPTH: <b>30.0 ft</b>												
DRILLER: <b>Ryan (Mid-Atlantic)</b>		WATER LEVEL: <b>3' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>223257</b>		EASTING: <b>222792</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, tan brown, fine, moist				2	2	3						5
5		<b>CLAYEY SAND (SC)</b> very loose, tan, fine, wet	▽	38.0		1	2	2						4
		<b>SANDY LEAN CLAY (CL)</b> soft, tan, fine, wet				2	2	2						4
10		<b>SAND (SP-SC)</b> very loose, tan gray, with clay, fine, wet		33.0		3	2	2						4
15		<b>SAND (SP)</b> loose, tan, medium, wet		28.0		4	4	4						8
20		--- Yellowish red, fine to medium		23.0		4	5	5						10
25		<b>PEE DEE: LEAN CLAY (CL)</b> soft, dark gray, with fine sand, moist		18.0		3	2	2						4
30		<b>LEAN CLAY (CL)</b> firm, dark gray, with fine sand, moist		13.0		3	3	5						8
		Boring terminated at 30 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG C-03A</b>													
DATE DRILLED: <b>9/15/17</b>		ELEVATION: <b>53.0 ft</b>													
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>20.0 ft</b>													
DRILLER: <b>Matt (Mid-Atlantic)</b>		WATER LEVEL: <b>3.5' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>221370</b>	EASTING: <b>2230284</b>												
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, dark brown, fine, moist					3	2	3						5
		<b>SANDY LEAN CLAY (CL)</b> very soft, gray brown, trace silt, fine, moist	▽	48.0		WOH	WOH	WOH							WOH
		<b>LEAN CLAY (CL)</b> soft, tan gray, trace silt, moist				1	1	2							3
		<b>FAT CLAY (CH)</b> firm, tan gray, trace silt, moist		43.0		2	2	3							5
		<b>FAT CLAY (CH)</b> firm, tan gray, trace silt, moist		38.0		2	3	5							8
		<b>CLAYEY SAND (SC)</b> loose, brownish gray, trace silt, fine, wet		33.0		2	4	3							7
		Boring terminated at 20 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: <b>9/20/17</b>	ELEVATION: <b>53.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>221370</b>	EASTING: <b>2230284</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> firm, gray brown, fine, moist	▽			▲	1	4	4					8
5		<b>LEAN CLAY (CL)</b> very soft, brown, some fine sand, moist		48.0	SS-2	▲	1	1	1					2
						▲	1	1	1					2
10		<b>FAT CLAY (CH)</b> firm, brownish gray, trace fine sand, moist		43.0		▲	1	3	4					7
						▲	1	3	3					6
15		<b>PEE DEE: FAT CLAY (CH)</b> firm, gray, trace fine sand, moist		38.0	SS-5	▲	1	3	3					6
						▲	3	5	7					12
20		<b>FAT CLAY (CH)</b> stiff, brownish gray, trace fine sand, moist		33.0		▲	3	5	7					12
		Boring terminated at 20 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/20/17</b>	ELEVATION: <b>52.0 ft</b>	NOTES: <b>Boring location is approximate.</b> <b>Set 15' temporary P.Z.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>220856</b>	EASTING: <b>2230948</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, dark brown, trace rootlets, fine, moist	▽			▲	1	4	4					8
5		<b>SANDY LEAN CLAY (CL)</b> very soft, gray brown, fine, moist		47.0		▲	1	1	1					2
		<b>SANDY LEAN CLAY (CL)</b> soft, reddish brown, fine, wet				▲	1	1	2					3
10		<b>LEAN CLAY (CL)</b> very soft, yellowish gray, trace silt, moist		42.0		▲	1	1	1					2
15		--- Gray brown, wet		37.0		▲	1	1	1					2
20		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> stiff, brownish gray, fine, moist		32.0		▲	2	4	5					9
		Boring terminated at 20 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/19/17</b>	ELEVATION: <b>57.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>220291</b>	EASTING: <b>2231705</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	(blows/ft)				
										/REMARKS				
5		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> firm, brownish red, fine, moist	▽	57.0	SS-1	2	2	5	7					7
		<b>SANDY FAT CLAY (CH)</b> soft, brown, fine, moist		52.0	SS-2	2	2	4	6					6
		<b>SANDY FAT CLAY (CH)</b> firm, light brown, fine, moist		47.0	SS-3	1	1	3	4					4
10		<b>SANDY FAT CLAY (CH)</b> firm, light brown, fine, moist		47.0	SS-4	2	2	3	5					5
15		<b>FAT CLAY (CH)</b> firm, light brown, little fine sand, moist		42.0	SS-5	2	3	3	6					6
20		Boring terminated at 20 ft		37.0		2	3	5	8					8

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG W-11B</b>														
DATE DRILLED: <b>9/18/17</b>		ELEVATION: <b>56.0 ft</b>														
DRILL RIG: <b>CME 45-C (track)</b>		BORING DEPTH: <b>20.0 ft</b>														
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>7' ATD</b>														
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>														
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>220163</b>	EASTING: <b>2231854</b>													
DRILLING METHOD: <b>Mud Rotary</b>																
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE			
						1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80		
5		<b>COASTAL PLAIN: LEAN CLAY (CL)</b> firm, brownish gray, trace fine sand, trace silt, moist	▽			2	2	3							5	
6		<b>LEAN CLAY (CL)</b> stiff, gray red, trace fine sand, trace silt, moist				2	3	3								6
9		<b>SANDY LEAN CLAY (CL)</b> firm, reddish gray, fine, moist to wet				2	4	5								9
10		<b>LEAN CLAY (CL)</b> firm, brownish gray, moist to wet				1	2	3								5
15		<b>LEAN CLAY (CL)</b> firm, brownish gray, moist to wet				1	3	3							6	
20		--- Moist				1	3	5							8	
		Boring terminated at 20 ft														

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG W-12A</b>													
DATE DRILLED: <b>9/18/17</b>		ELEVATION: <b>55.0 ft</b>													
DRILL RIG: <b>CME 45-C (track)</b>		BORING DEPTH: <b>20.0 ft</b>													
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>1' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>219910</b>	EASTING: <b>2232128</b>												
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> soft, brown, fine, moist	▽			2	2	2							
5		<b>SANDY LEAN CLAY (CL)</b> very soft, gray brown, fine, wet		50.0		WOH	WOH	WOH							WOH
		<b>SANDY LEAN CLAY (CL)</b> soft, brownish gray, fine, moist				1	1	3							4
10		<b>LEAN CLAY (CL)</b> firm, gray yellow, trace fine sand, moist		45.0		2	2	4							6
15		<b>LEAN CLAY (CL)</b> stiff, gray brown, trace fine sand, moist		40.0		3	4	5							9
20		--- Trace silt		35.0		3	5	7							12
		Boring terminated at 20 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/18/17</b>	ELEVATION: <b>55.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>4.7' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>219664</b>	EASTING: <b>2232354</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
0		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> firm, tan, fine, moist													
5		<b>LEAN CLAY (CL)</b> soft, gray brown, trace silt, trace fine sand, moist  --- Tan, moist to wet	▽	50.0	SS-2	2	2	2						4	
10		<b>FAT CLAY (CH)</b> firm, brownish gray, moist		45.0	SS-3	1	1	2						3	
15		<b>FAT CLAY (CH)</b> firm, brown, moist		40.0	SS-4	1	2	3						5	
20		<b>FAT CLAY (CH)</b> stiff, brownish gray, trace silt, moist		35.0	SS-5	3	3	4						7	
20		Boring terminated at 20 ft												10	

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: <b>9/18/17</b>	ELEVATION: <b>53.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (track)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>1.5' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>219448</b>	EASTING: <b>2232538</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> soft, dark brown, fine, moist	▽			▲	1	1	2					3
5		<b>LEAN CLAY (CL)</b> firm, tan brown, trace silt, moist		48.0		▲	1	2	3					5
		<b>SANDY LEAN CLAY (CL)</b> stiff, yellowish tan, fine, moist				▲	3	5	7					12
10		<b>LEAN CLAY (CL)</b> firm, yellowish tan, trace fine sand, moist		43.0		▲	1	3	5					8
15		<b>LEAN CLAY (CL)</b> stiff, yellowish tan, trace silt, moist		38.0		▲	1	4	5					9
20		<b>LEAN CLAY (CL)</b> stiff, yellowish tan, trace silt, moist		33.0		▲	3	4	5					9
		Boring terminated at 20 ft												

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-05A</b>												
DATE DRILLED: <b>8/21/17</b>		ELEVATION: <b>54.0 ft</b>												
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>10' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>219048</b>	EASTING: <b>2232848</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>TOPSOIL</b> - 3 inches.												
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> firm, brown, fine, moist --- Reddish brown, moist --- Brownish red, trace fine sand												
5				49.0										
		<b>FAT CLAY (CH)</b> stiff, reddish brown, trace fine sand, moist												
10				44.0										
		<b>SANDY LEAN CLAY (CL)</b> soft, light brown, fine, wet												
15				39.0										
		<b>FAT CLAY (CH)</b> very soft, gray, wet												
20				34.0										
		<b>FAT CLAY (CH)</b> firm, gray, wet												
25		Boring terminated at 25 ft		29.0										

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-05B</b>												
DATE DRILLED: <b>8/15/17</b>		ELEVATION: <b>54.0 ft</b>												
DRILL RIG: <b>CME 45-C (trailer)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>3.3' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>218955</b>	EASTING: <b>2232904</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>TOPSOIL</b> - 2 inches.												
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> soft, gray brown, fine, moist					2	2	2					4
5		<b>SANDY FAT CLAY (CH)</b> soft, brownish red, fine, moist  --- Gray	▽	49.0	SS-2		1	1	2					3
							2	1	2					3
10		<b>LEAN CLAY (CL)</b> firm, gray, trace fine sand, moist  --- Gray brown, no fine sand.		44.0			1	3	4					7
15				39.0			1	2	4					6
20		<b>LEAN CLAY (CL)</b> very soft, gray brown, trace fine sand, moist		34.0			1	1	1					2
25		<b>SILTY SAND (SM)</b> medium dense, light brown, with clay lumps, fine, wet		29.0	SS-7		3	4	9					13
		Boring terminated at 25 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/20/17</b>	ELEVATION: <b>57.0 ft</b>	NOTES: <b>Boring location is approximate.</b> <b>Set 15' temporary P.Z.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>218157</b>	EASTING: <b>2233445</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> stiff, dark brown, fine, dry to moist	▽			▲	3	4	5						9
5		<b>SILTY SAND (SM)</b> very loose, gray brown, fine, wet		52.0		▲	1	1	2						3
		<b>SANDY LEAN CLAY (CL)</b> soft, brownish gray, fine, moist				▲	1	2	2						4
10		<b>LEAN CLAY (CL)</b> firm, tan gray, moist		47.0		▲	2	3	5						8
15		<b>SANDY LEAN CLAY (CL)</b> firm, brownish gray, trace silt, fine, moist		42.0		▲	1	2	3						5
20		--- Brownish gray		37.0		▲	1	3	3						6
		Boring terminated at 20 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/19/17</b>	ELEVATION: <b>41.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>1' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>217601</b>	EASTING: <b>2233902</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> firm, dark brown, trace silt, fine, moist	▽												
5		<b>LEAN CLAY (CL)</b> very soft, yellowish gray, trace fine sand, moist		36.0	SS-1	▲	2	3	3						6
		<b>FAT CLAY (CH)</b> soft, light brown, moist			SS-2	▲	1	1	1						2
		<b>FAT CLAY (CH)</b> soft, light brown, moist			SS-3	▲	1	1	3						4
10		--- Gray		31.0	SS-4	▲	1	1	3						4
		<b>FAT CLAY (CH)</b> firm, brownish gray, moist			SS-5	▲	2	3	4						7
15		<b>FAT CLAY (CH)</b> stiff, brownish gray, moist		26.0		▲									
20		Boring terminated at 20 ft		21.0		▲	3	4	5						9

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

DATE DRILLED: <b>9/20/17</b>	ELEVATION: <b>39.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>217389</b>	EASTING: <b>2234136</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
		<b>COASTAL PLAIN: LEAN CLAY (CL)</b> firm, dark brown, trace silt, trace fine sand, moist	▽			▲	1	3	3					6
5		<b>LEAN CLAY (CL)</b> very soft, yellowish brown, trace silt, moist		34.0		▲	1	1	1					2
		<b>LEAN CLAY (CL)</b> firm, yellowish gray, trace silt, moist				▲	1	2	3					5
10		--- Gray brown		29.0		▲	1	2	3					5
		<b>LEAN CLAY (CL)</b> soft, brownish gray, moist				▲	1	2	2					4
15				24.0		▲	1	2	2					4
		<b>SAND (SP)</b> medium dense, tan gray, fine to medium, wet				▲	6	8	10					18
20		Boring terminated at 20 ft		19.0		▲	6	8	10					18

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: <b>9/19/17</b>	ELEVATION: <b>37.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>217160</b>	EASTING: <b>2234429</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
5		<b>COASTAL PLAIN: LEAN CLAY (CL)</b> firm, brownish gray, moist	▽	32.0	2	2	3	4	7					7
10		--- Trace mica, trace fine sand		27.0	2	2	4	6	6					6
15		<b>CLAYEY SAND (SC)</b> loose, brownish gray, medium, wet		22.0	3	4	5	9	9					9
20		<b>SAND (SP)</b> loose, dark gray, trace silt, medium, wet		17.0	3	4	4	8	8					8
		Boring terminated at 20 ft												

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>8/16/17</b>	ELEVATION: <b>37.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>6' 24 hr</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>216874</b>	EASTING: <b>2234777</b>
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DRILLING METHOD: <b>Mud Rotary</b>		MATERIAL DESCRIPTION		WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
DEPTH (feet)	GRAPHIC LOG							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD						
10      20      30      6080																
0		<b>TOPSOIL</b> - 2 inches.														
5		<b>COASTAL PLAIN: SANDY SILT (ML)</b> stiff, brown, fine, moist			32.0		3	5	4							9
7		<b>LEAN CLAY (CL)</b> firm, brownish gray, trace fine sand, moist					2	3	4							7
12		<b>LEAN CLAY (CL)</b> stiff, gray brown, trace fine sand, moist		▼			4	5	7							12
10		<b>SAND (SP-SM)</b> loose, gray brown, with silt, fine to medium, wet			27.0	SS-4	3	4	4							8
15		<b>LEAN CLAY (CL)</b> firm, light gray, moist to wet			22.0		2	3	4							7
20		<b>SAND (SP)</b> medium dense, light gray, fine to medium, wet			17.0	SS-6	5	5	6							11
25		--- Gray			12.0		5	4	9							13
		Boring terminated at 25 ft														

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

DATE DRILLED: <b>8/15/17</b>	ELEVATION: <b>38.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>6.3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>216790</b>	EASTING: <b>2234890</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>TOPSOIL</b> - 2 inches.													
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, brown, fine, moist					3	3	2						5
5		<b>LEAN CLAY (CL)</b> soft, gray brown, moist		33.0			WOH	1	2						3
		<b>LEAN CLAY (CL)</b> stiff, yellowish brown, trace fine sand, moist					2	4	5						9
10		<b>SANDY LEAN CLAY (CL)</b> firm, light gray, fine, moist		28.0	SS-4		1	2	4						6
15		<b>SANDY LEAN CLAY (CL)</b> very soft, gray, fine, wet		23.0			1	1	1						2
20		<b>SILTY SAND (SM)</b> loose, light gray, with clay, fine to medium, wet		18.0	SS-6		1	4	4						8
25		<b>SAND (SP)</b> loose, gray, fine to medium, wet		13.0			3	3	3						6
		Boring terminated at 25 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>9/20/17</b>	ELEVATION: <b>44.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>50.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>7' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>216351</b>	EASTING: <b>2235527</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80			
		<b>COASTAL PLAIN: LEAN CLAY (CL)</b> firm, brown, with fine sand, moist				▲▼										
5		<b>SANDY LEAN CLAY (CL)</b> stiff, light brown, fine, moist		39.0		▲▼										
		<b>LEAN CLAY (CL)</b> stiff, gray red, trace fine sand, moist	▽	34.0		▲▼										
10		<b>LEAN CLAY (CL)</b> stiff, gray red, trace fine sand, moist		34.0		▲▼										
15		<b>SAND (SP-SM)</b> medium dense, brownish orange, with silt, fine, moist		29.0	SS-5	▲▼										
20		--- Tan, fine to medium, wet		24.0		▲▼										
25		--- Light gray		19.0	SS-7	▲▼										
30		--- Gray tan, medium		14.0		▲▼										
		--- Fine to medium			SS-9	▲▼										

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG RT-07A</b>												
DATE DRILLED: <b>9/20/17</b>		ELEVATION: <b>44.0 ft</b>												
DRILL RIG: <b>CME 45-C (turtle)</b>		BORING DEPTH: <b>50.0 ft</b>												
DRILLER: <b>Ryan (Mid-Atlantic)</b>		WATER LEVEL: <b>7' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>216351</b>	EASTING: <b>2235527</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
40		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> firm, dark gray, fine, moist		4.0		SS-11	1	2	3					5
45		<b>SANDY LEAN CLAY (CL)</b> very stiff, dark gray, trace mica, fine, moist		-1.0			4	6	15					21
50		Boring terminated at 50 ft		-6.0			7	8	15					23

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: 10/13/17	ELEVATION: 37.0 ft	NOTES: Boring location is approximate.
DRILL RIG: <b>Diedrich D-25 (track)</b>	BORING DEPTH: 50.0 ft	
DRILLER: <b>Bobbie (Mid-Atlantic)</b>	WATER LEVEL: 3' ATD	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: **Split spoon**      NORTHING: **216227**      EASTING: **2235814**

DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		<b>COASTAL PLAIN: SAND (SP-SC)</b> medium dense, tan, with clay, fine, moist	▽			▲	4	7	9						
5		<b>SAND (SP)</b> loose, light tan, fine to medium, wet		32.0		▲	3	4	5						9
		<b>CLAYEY SAND (SC)</b> very loose, yellowish brown, fine to medium, wet				▲	3	2	2						4
10		<b>SAND (SP-SC)</b> loose, tan, with clay, fine, wet		27.0	SS-4	▲	4	5	2						7
15		<b>SAND (SP)</b> medium dense, tan, trace clay, medium to coarse, wet		22.0	SS-5	▲	6	5	7						12
20		<b>SILTY SAND (SM)</b> very loose, gray, fine, wet		17.0	SS-6	▲	WOH	2	2						4
25		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> stiff, gray, fine, moist		12.0		▲	3	4	5						9
30		--- With mica		7.0	SS-8	▲	4	4	7						11
						▲	4	6	7						13

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG RT-07B</b>											
DATE DRILLED: 10/13/17		ELEVATION: 37.0 ft											
DRILL RIG: <b>Diedrich D-25 (track)</b>		BORING DEPTH: 50.0 ft											
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: 3' ATD											
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>											
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: 216227	EASTING: 2235814										
DRILLING METHOD: <b>Mud Rotary</b>													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
						1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> stiff, gray, fine, moist ( <i>continued</i> )											
40		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, with mica, fine, moist	-3.0		7	11	11						22
45		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, with mica, fine, moist	-8.0	SS-11	4	6	8						14
50		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, with mica, fine, moist	-13.0		4	7	11						18
		Boring terminated at 50 ft											

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main</b> Northwest, North Carolina S&ME Project No. 1306-17-013				<b>BORING LOG</b>				<b>W-16A</b>						
DATE DRILLED: 9/28/17		ELEVATION: 24.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: CME 45-C (turtle)		BORING DEPTH: 30.0 ft												
DRILLER: Ryan (Mid-Atlantic)		WATER LEVEL: 3' ATD												
HAMMER TYPE: Auto		LOGGED BY: G. Goslin												
SAMPLING METHOD: Split spoon				NORTHING: 215133		EASTING: 2237443								
DRILLING METHOD: Mud Rotary														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, tan brown, trace rootlets, fine, moist					4	5	8					13
5		<b>SILTY SAND (SM)</b> medium dense, tan gray, with clay lumps, fine, moist  --- Light gray, wet	▽	19.0			5	6	6					12
					SS-3		2	6	5					11
10		<b>SILTY SAND (SM)</b> loose, brownish gray, fine, wet		14.0			5	4	3					7
15		<b>SILTY SAND (SM)</b> medium dense, gray, fine to medium, wet		9.0	SS-5		1	7	6					13
20		<b>SANDY LEAN CLAY (CL)</b> firm, gray brown, trace silt, fine, moist		4.0			2	2	4					6
25		<b>SANDY LEAN CLAY (CL)</b> stiff, gray brown, trace silt, fine, moist		-1.0			4	6	5					11
30		<b>SANDY LEAN CLAY (CL)</b> very stiff, gray brown, trace silt, trace mica, fine, moist		-6.0			7	10	11					21
		Boring terminated at 30 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/27/17</b>	ELEVATION: <b>21.0 ft</b>	NOTES: <b>Boring location is approximate.</b> <b>Boring grouted to surface.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>214961</b>	EASTING: <b>2237720</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
	▽	<b>COASTAL PLAIN: SAND (SP)</b> loose, tan, fine, moist	▽			▲▼	1	2	3					5
5		<b>SILTY SAND (SM)</b> loose, tan brown, fine, moist  --- Brown		16.0		▲▼	2	3	3					6
10	.....	<b>SAND (SP)</b> medium dense, tan gray, fine, wet  --- Fine to medium		11.0		▲▼	4	4	4					8
15	.....	<b>SAND (SP)</b> medium dense, tan gray, fine, wet  --- Gray		6.0		▲▼	8	10	12					22
20	.....	<b>SAND (SP-SC)</b> loose, gray brown, with clay, fine, wet		1.0		▲▼	7	10	11					21
25	.....	<b>SAND (SP-SC)</b> loose, gray brown, with clay, fine, wet		-4.0		▲▼	5	10	6					16
30		<b>PEE DEE: LEAN CLAY (CL)</b> dark gray, trace shells, trace mica, moist		-9.0		▲▼	4	4	5					9
		Boring terminated at 30 ft				▲▼	4	5	5					10

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: <b>9/27/17</b>	ELEVATION: <b>23.0 ft</b>	NOTES: <b>Boring location is approximate.</b> <b>Boring grouted to surface.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>1.4' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>214721</b>	EASTING: <b>2238132</b>
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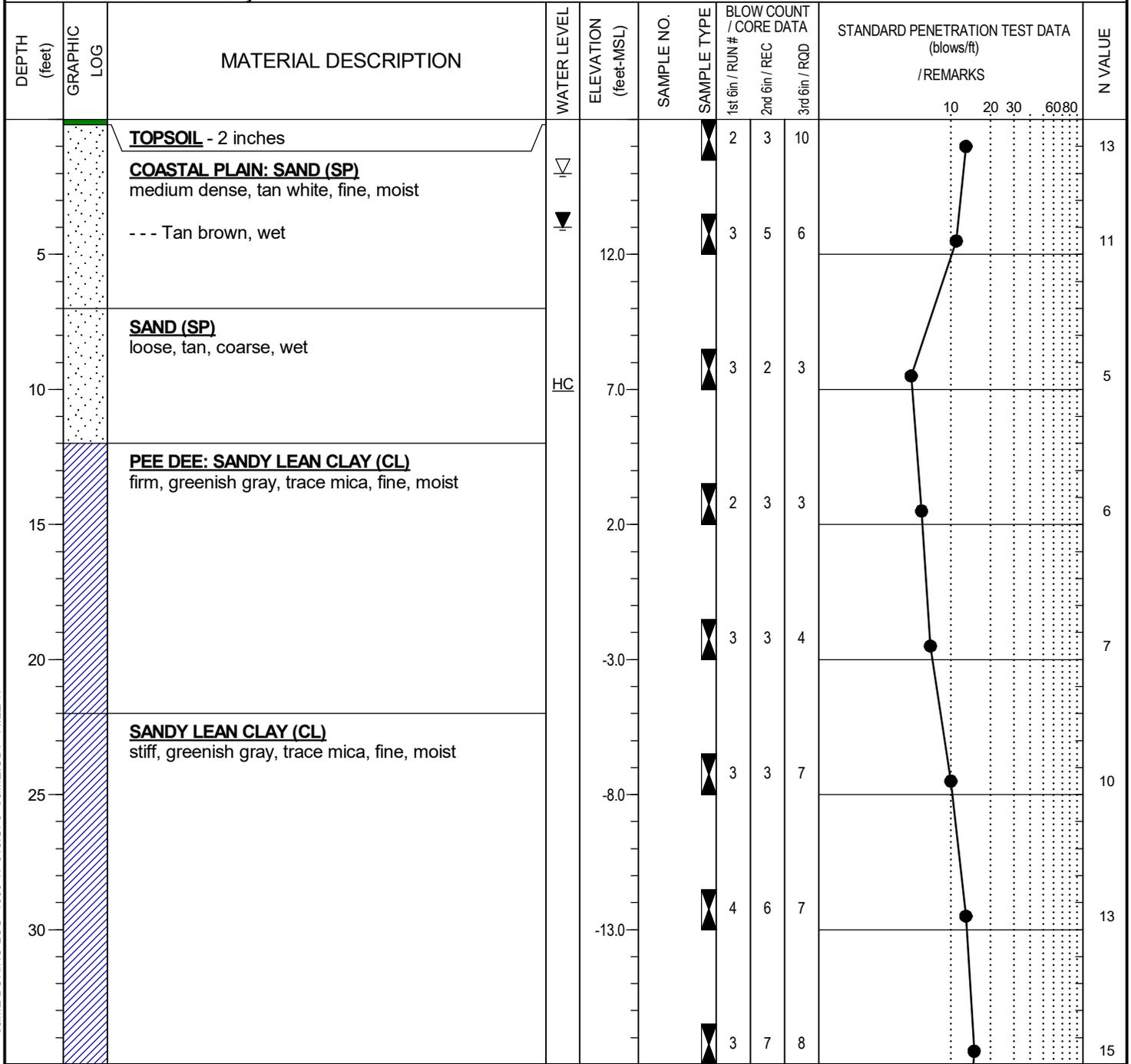
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
	●	<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, gray tan, fine, moist	▽			▲	3	2	1						3
5	■	<b>SANDY SILT (ML)</b> very soft, gray, with wood pieces, fine to medium, wet  --- Dark gray, trace coarse gravel		18.0	SS-2	▲	1	1	1						2
	■					▲	1	1	1						2
10	●	<b>SILTY SAND (SM)</b> very loose, gray brown, with wood pieces, with rock fragments, fine to medium, wet		13.0	SS-4	▲	1	1	1						2
15	■	<b>PEE DEE: SANDY LEAN CLAY (CL)</b> firm, dark brown, trace silt, fine, wet		8.0		▲	1	2	5						7
20	■			3.0		▲	3	3	4						7
25	■	<b>SANDY LEAN CLAY (CL)</b> very stiff, gray brown, trace mica, fine, moist		-2.0		▲	4	7	11						18
30	■	Boring terminated at 30 ft		-7.0		▲	12	12	15						27

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

DATE DRILLED: 10/24/17	ELEVATION: 17.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (marsh buggy)	BORING DEPTH: 45.0 ft	
DRILLER: Sam (S&ME)	WATER LEVEL: 2' ATD, 4' 24 hr	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 214477	EASTING: 2238495
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DRILLING METHOD: Mud Rotary



S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17B</b>											
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>17.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>45.0 ft</b>													
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>2' ATD, 4' 24 hr</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>214477</b>		EASTING: <b>2238495</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
40		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist (continued)		-23.0			5	5	8						13
45		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-28.0			5	7	10						17
		Boring terminated at 45 ft													

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17C</b>											
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>14.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>39.2 ft</b>													
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>Water level 3.9ft above mudline</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>214394</b>		EASTING: <b>2238671</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		<b>COASTAL PLAIN: SAND (SP)</b> loose, brown, little wood, fine, wet				WOH	3	4							7
		<b>SAND (SP-SM)</b> very loose, dark brown, with clay, little wood, fine, wet			SS-2		3	2	2						4
5		<b>PEE DEE: LEAN CLAY (CL)</b> stiff, gray, trace fine sand, trace mica, moist		9.0			4	4	5						9
10				4.0											
15				-1.0	SS-4		5	5	5						10
20				-6.0			3	5	7						12
25		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-11.0			5	8	9						17
30		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist		-16.0			4	6	9						15
							6	6	9						15

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17C</b>										
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>14.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>39.2 ft</b>												
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>Water level 3.9ft above mudline</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>214394</b>		EASTING: <b>2238671</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
	[Hatched Box]	<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist				☒	10	10	10					20
		Boring terminated at 39.2 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 10/24/17	ELEVATION: 4.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (marsh buggy)	BORING DEPTH: 44.5 ft	
DRILLER: Sam (S&ME)	WATER LEVEL: Water level 1.8ft above mudline	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 213918	EASTING: 2239386
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80		
0	WOOD	WOOD - 12 inches														
0	COASTAL PLAIN: SILTY SAND (SM)	COASTAL PLAIN: SILTY SAND (SM) very loose, reddish brown, mostly wood, fine, wet														
5	WOOD	WOOD - brown, trace sand, trace silt, wet		-1.0												
10	SAND (SP-SM)	SAND (SP-SM) loose, brown, with silt, trace wood, fine, wet		-6.0												
15	SAND (SP)	SAND (SP) very loose, gray brown, some wood, fine, wet		-11.0												
20	SAND (SP)	SAND (SP) loose, gray brown, trace silt, fine, wet		-16.0												
25	SAND (SP)	SAND (SP) loose, gray brown, trace silt, fine, wet		-21.0												
30	PEE DEE: SANDY LEAN CLAY (CL)	PEE DEE: SANDY LEAN CLAY (CL) stiff, greenish gray, trace mica, fine, moist		-26.0												
33																
36																
39																
42																
44.5																

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: <b>10/24/17</b>	ELEVATION: <b>4.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (marsh buggy)</b>	BORING DEPTH: <b>44.5 ft</b>	
DRILLER: <b>Sam (S&amp;ME)</b>	WATER LEVEL: <b>Water level 1.8ft above mudline</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>213918</b>	EASTING: <b>2239386</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
40	[Hatched Box]	<b>PEE DEE: SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist <i>(continued)</i>		-36.0		[Sample Icon]	5	6	7					13
	[Hatched Box]	<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist				[Sample Icon]	5	8	8					16
		Boring terminated at 44.5 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

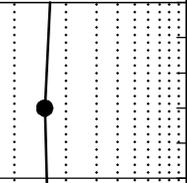
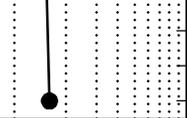
PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17E</b>											
DATE DRILLED: <b>10/25/17</b>		ELEVATION: <b>10.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>43.5 ft</b>													
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>0' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>213435</b>		EASTING: <b>2240177</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS					
										10	20	30	60	80	
0		<b>TOPSOIL</b> - 1 inch					2	2	2						4
5		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> very loose, light brown, fine, wet													
8		--- Some wood			SS-2	WOH	WOH	WOH	4						4
10		<b>SAND (SP)</b> loose, brownish gray, fine to medium, wet					5	3	3						6
15		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> firm, gray, trace mica, fine, moist			SS-4		2	3	3						6
20		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist					4	5	6						11
25		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist					4	5	8						13
30		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist					6	7	10						17

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DEPTH (feet)		GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
								1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
40			<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist		-30.0			5	7	8					15
				<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist					5	7	9				
			Boring terminated at 43.5 ft												

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S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

DATE DRILLED: 10/25/17	ELEVATION: 2.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (marsh buggy)	BORING DEPTH: 40.5 ft	
DRILLER: Sam (S&ME)	WATER LEVEL: Water level 7.6ft above mudline	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 213095	EASTING: 2240676
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	(blows/ft)					
										10	20	30	60	80	
	[Dotted pattern]	<b>COASTAL PLAIN: SAND (SP)</b> very loose, brown, fine, wet				WOH	WOH	WOH							WOH
5	[Diagonal lines]	<b>PEE DEE: SANDY LEAN CLAY (CL)</b> soft, greenish gray, trace mica, fine, moist		-3.0		6	1	2							3
10	[Diagonal lines]	<b>SANDY LEAN CLAY (CL)</b> hard, greenish gray, trace mica, fine, moist		-8.0		6	17	18							35
15	[Diagonal lines]	<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-13.0		6	8	9							17
20	[Diagonal lines]	<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist		-18.0		4	6	6							12
25	[Diagonal lines]			-23.0		4	7	8							15
30	[Diagonal lines]			-28.0		7	7	7							14
	[Diagonal lines]					4	6	8							

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17F</b>										
DATE DRILLED: <b>10/25/17</b>		ELEVATION: <b>2.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>40.5 ft</b>												
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>Water level 7.6ft above mudline</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>213095</b>		EASTING: <b>2240676</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA				STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS	N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD					
		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist <i>(continued)</i>				X								
40		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-38.0		X	6	8	12					20
		Boring terminated at 40.5 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 10/25/17	ELEVATION: 23.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (marsh buggy)	BORING DEPTH: 42.9 ft	
DRILLER: Sam (S&ME)	WATER LEVEL: 0' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 212756	EASTING: 2241183
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DRILLING METHOD: Mud Rotary

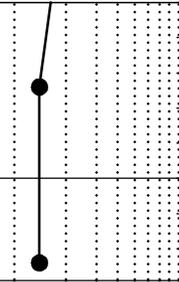
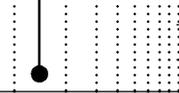
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, brown, medium, wet					1	1	1	●					2
5		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> firm, greenish gray, with mica, fine, moist		18.0			2	2	3	●					5
10		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, with mica, fine, moist		13.0			10	8	8	●					16
15		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, with mica, fine, moist		8.0			4	4	6	●					10
20				3.0			4	4	5	●					9
25				-2.0			4	5	6	●					11
30		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, with mica, fine, moist		-7.0			8	9	10	●					19
		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, with mica, fine, moist								●					

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-17G</b>										
DATE DRILLED: <b>10/25/17</b>		ELEVATION: <b>23.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>42.9 ft</b>												
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>0' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>212756</b>		EASTING: <b>2241183</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
40		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, with mica, fine, moist (continued)		-17.0			10	5	9					14
		Boring terminated at 42.9 ft					5	7	7					14

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>10/26/17</b>	ELEVATION: <b>8.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (marsh buggy)</b>	BORING DEPTH: <b>43.5 ft</b>	
DRILLER: <b>Sam (S&amp;ME)</b>	WATER LEVEL: <b>0' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>211954</b>	EASTING: <b>2242181</b>
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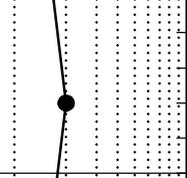
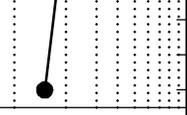
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> medium dense, tan, fine, wet				▲	5	10	7					17
5				3.0	SS-2	▲	6	6	5					11
		<b>SAND (SP)</b> loose, brownish gray, trace silt, little wood, fine, wet				▲	3	3	3					6
10				-2.0		▲	3	3	3					
		<b>PEE DEE: SANDY LEAN CLAY (CL)</b> soft, gray, trace mica, fine, moist			SS-4	▲	2	2	2					4
15				-7.0		▲	4	4	5					9
		<b>CLAYEY SAND (SC)</b> loose, greenish gray, trace mica, fine, moist				▲	4	4	5					
20				-12.0		▲	8	10	13					23
		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist				▲	4	4	6					10
25				-17.0		▲	4	4	6					
		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist				▲	4	4	6					10
30				-22.0		▲	5	7	8					15

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>				<b>BORING LOG</b>				<b>W-17H</b>						
DATE DRILLED: <b>10/26/17</b>		ELEVATION: <b>8.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (marsh buggy)</b>		BORING DEPTH: <b>43.5 ft</b>												
DRILLER: <b>Sam (S&amp;ME)</b>		WATER LEVEL: <b>0' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>						NORTHING: <b>211954</b>		EASTING: <b>2242181</b>						
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
40		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-32.0			7	9	11					20
		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, trace mica, fine, moist					7	8	7					15
		Boring terminated at 43.5 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-08A</b>												
DATE DRILLED: <b>8/21/17</b>		ELEVATION: <b>45.0 ft</b>												
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>7' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>211653</b>	EASTING: <b>2242610</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>TOPSOIL</b> - 3 inches.												
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> medium dense, brown, fine, moist					7	6	6					12
5		<b>LEAN CLAY (CL)</b> stiff, reddish brown, trace fine sand, moist  --- Brownish gray		40.0			3	5	7					12
		<b>SILTY SAND (SM)</b> medium dense, light brown, with clay, fine to medium, wet		35.0	SS-4		8	6	6					12
15		<b>SAND (SP-SM)</b> medium dense, light gray, with silt, fine to medium, wet		30.0	SS-5		8	11	9					20
20		<b>SAND (SP)</b> medium dense, yellowish brown, fine, wet  --- Reddish brown		25.0			6	7	12					19
25		Boring terminated at 25 ft		20.0			8	7	12					19

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-18A</b>											
DATE DRILLED: <b>9/29/17</b>		ELEVATION: <b>44.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-C (turtle)</b>		BORING DEPTH: <b>20.0 ft</b>													
DRILLER: <b>Ryan (Mid-Atlantic)</b>		WATER LEVEL: <b>8' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>210765</b>		EASTING: <b>2243799</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
0 - 5		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> soft, gray tan, fine, moist					3	3	1						4
5 - 8		<b>SANDY LEAN CLAY (CL)</b> firm, gray tan, fine, moist		39.0			1	1	3						4
8 - 10		<b>CLAYEY SAND (SC)</b> loose, gray tan, fine, wet		34.0			1	2	3						5
10 - 15		<b>SAND (SP)</b> medium dense, gray tan, fine, wet					3	3	3						6
15 - 20		<b>SAND (SP)</b> loose, gray tan, fine, wet		29.0			2	4	7						11
20 - 20		Boring terminated at 20 ft		24.0			2	3	4						7

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DATE DRILLED: <b>9/29/17</b>	ELEVATION: <b>43.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2.6' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>210179</b>	EASTING: <b>2245100</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> very loose, tan brown, fine, moist	▽												
5		--- Gray brown, wet		38.0			1	1	1						2
		<b>SILTY SAND (SM)</b> medium dense, brownish gray, with wood pieces, fine to coarse, wet			SS-3		1	1	1						2
10		<b>SAND (SP)</b> very loose, gray, with wood pieces, fine to medium, wet		33.0	SS-4		2	3	4						7
		<b>SAND (SP)</b> very loose, gray, with wood pieces, fine to medium, wet			SS-4		2	3	1						4
15		<b>SILTY SAND (SM)</b> loose, gray brown, fine, moist		28.0			2	3	3						6
20		Boring terminated at 20 ft		23.0			4	4	4						8

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DATE DRILLED: <b>8/16/17</b>	ELEVATION: <b>59.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL:	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>209488</b>	EASTING: <b>2246960</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>TOPSOIL</b> - 2 inches.												
		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> soft, brown, fine, moist	HC			▲▼	2	2	1					3
5		<b>SANDY LEAN CLAY (CL)</b> firm, yellowish brown, fine to medium, moist		54.0		▲▼	1	2	3					5
		<b>SANDY LEAN CLAY (CL)</b> soft, light gray, fine, moist			SS-3	▲▼	2	2	2					4
10		<b>SANDY LEAN CLAY (CL)</b> very soft, yellowish gray, fine, wet		49.0		▲▼	1	1	1					2
		<b>SILTY SAND (SM)</b> very loose, gray, fine to medium, wet				▲▼	WOH	1	2					3
15		<b>LEAN CLAY (CL)</b> very soft, gray, little fine sand, wet		44.0		▲▼	1	1	1					2
20		<b>CLAYEY SAND (SC)</b> medium dense, brownish gray, fine to medium, wet		39.0		▲▼	7	11	19					30
25		Boring terminated at 25 ft		34.0		▲▼								

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DATE DRILLED: <b>8/25/17</b>	ELEVATION: <b>58.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Ron (Mid-Atlantic)</b>	WATER LEVEL: <b>7.5' 24 hr</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>209473</b>	EASTING: <b>2247052</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		<b>TOPSOIL</b> - 3 inches.												
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> very loose, brown, trace rootlets, fine, moist					1	1	1	●				2
5		<b>SANDY LEAN CLAY (CL)</b> firm, reddish brown, fine, moist		53.0			1	2	3	●				5
			▼				3	2	5	●				7
10		<b>SANDY LEAN CLAY (CL)</b> soft, yellowish brown, fine, wet		48.0			2	1	2	●				3
15		--- Gray		43.0			WOH	WOH	2	●				2
20		--- Light gray		38.0			1	2	1	●				3
25		<b>SAND (SP-SC)</b> medium dense, brownish gray, with clay, fine to medium, wet		33.0			6	12	12	●				24
		Boring terminated at 25 ft												

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DATE DRILLED: <b>10/23/17</b>	ELEVATION: <b>57.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (trailer)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Brandon (Mid-Atlantic)</b>	WATER LEVEL: <b>4.3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>208882</b>	EASTING: <b>2248397</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: CLAYEY SAND (SC)</b> loose, tan, fine to medium, moist			SS-1	▲	3	2	3						5
5		<b>FAT CLAY (CH)</b> firm, yellowish brown, with fine sand, moist	▽	52.0		▲	2	3	3						6
		<b>FAT CLAY (CH)</b> soft, brown, trace fine sand, moist			SS-3	▲	3	2	2						4
10		<b>SANDY FAT CLAY (CH)</b> firm, reddish gray, fine, moist		47.0		▲	2	2	3						5
15		<b>CLAYEY SAND (SC)</b> medium dense, brownish red, fine to medium, wet		42.0		▲	5	9	11						20
20		<b>SAND (SP)</b> dense, yellowish brown, medium, wet		37.0		▲	11	16	16						32
		Boring terminated at 20 ft													

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DATE DRILLED: 10/13/17	ELEVATION: 44.0 ft	NOTES: Boring location is approximate.
DRILL RIG: <b>Diedrich D-25 (track)</b>	BORING DEPTH: 20.0 ft	
DRILLER: <b>Bobbie (Mid-Atlantic)</b>	WATER LEVEL: 3.7' ATD	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>208559</b>	EASTING: <b>2249221</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
	•••••	<b>COASTAL PLAIN: SAND (SP)</b> loose, tan brown, trace clay, fine, moist				▲	3	4	5					9
5	•••••	<b>SAND (SP)</b> medium dense, brown, fine to medium, wet  --- Fine	▽	39.0		▲	3	4	9					13
10	•••••	<b>SAND (SP)</b> dense, yellowish red, fine, wet		34.0		▲	2	12	14					26
15	•••••	<b>SAND (SP)</b> medium dense, yellowish brown, fine, wet  --- Dark gray, trace shell fragments		29.0		▲	29	18	14					32
20	•••••	<b>SAND (SP)</b> medium dense, yellowish brown, fine, wet  --- Dark gray, trace shell fragments		24.0		▲	13	5	15					20
20		Boring terminated at 20 ft				▲	18	5	20					25

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>A-12</b>										
DATE DRILLED: 10/23/17		ELEVATION: 48.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: CME 45-B (trailer)		BORING DEPTH: 20.0 ft												
DRILLER: Brandon (Mid-Atlantic)		WATER LEVEL: 4' ATD												
HAMMER TYPE: Auto		LOGGED BY: G. Goslin												
SAMPLING METHOD: Split spoon				NORTHING: 208208		EASTING: 2250092								
DRILLING METHOD: Mud Rotary														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, tan brown, fine, moist					3	3	2					5
5		<b>SAND (SP-SC)</b> loose, tan, with clay, fine to medium, moist to wet	▽	43.0	SS-2		2	3	5					8
		<b>SAND (SP)</b> medium dense, tan, fine to medium, wet					2	6	7					13
10		<b>SAND (SP)</b> dense, gray brown, trace clay, fine to medium, wet		38.0	SS-4		6	11	12					23
15		<b>SAND (SP)</b> medium dense, brownish gray, fine to medium, wet		33.0			11	17	22					39
20		Boring terminated at 20 ft		28.0			10	10	11					21

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: 10/13/17	ELEVATION: 44.0 ft	NOTES: Boring location is approximate.
DRILL RIG: <b>Diedrich D-25 (track)</b>	BORING DEPTH: 40.0 ft	
DRILLER: <b>Bobbie (Mid-Atlantic)</b>	WATER LEVEL: 3.3' ATD	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>207888</b>	EASTING: <b>2250916</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, brown, trace wood, fine, moist	▽			▲▼								
5		--- No wood		39.0		▲▼	1	2	5	●				7
		<b>SAND (SP)</b> loose, yellowish brown, trace silt, fine to medium, wet				▲▼	2	4	4	●				8
		--- Reddish brown, fine				▲▼	2	4	5	●				9
10				34.0		▲▼	5	4	5	●				9
		<b>PEE DEE: SAND (SP-SC)</b> medium dense, greenish gray, with clay, little shell fragments, medium to coarse, wet				▲▼	1	4	5	●				9
15				29.0		▲▼	6	7	6	●				13
		<b>SAND (SP-SC)</b> loose, greenish gray, with clay, little shell fragments, medium to coarse, wet				▲▼	3	2	5	●				7
25				19.0		▲▼	3	3	7	●				10
		<b>CLAYEY SAND (SC)</b> loose, greenish gray, fine, moist				▲▼	6	12	10	●				22
30				14.0		▲▼	3	3	7	●				10
		<b>CLAYEY SAND (SC)</b> medium dense, greenish gray, fine, moist				▲▼	6	12	10	●				22

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>				<b>BORING LOG W-21A</b>								
DATE DRILLED: <b>10/13/17</b>		ELEVATION: <b>44.0 ft</b>		NOTES: <b>Boring location is approximate.</b>								
DRILL RIG: <b>Diedrich D-25 (track)</b>		BORING DEPTH: <b>40.0 ft</b>										
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: <b>3.3' ATD</b>										
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>										
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>207888</b>		EASTING: <b>2250916</b>						
DRILLING METHOD: <b>Mud Rotary</b>												
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA	STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS		
		<b>CLAYEY SAND (SC)</b> medium dense, greenish gray, fine, moist <i>(continued)</i>										
		<b>SANDY LEAN CLAY (CL)</b> stiff, greenish gray, fine, moist					5	5	7			
40		Boring terminated at 40 ft		4.0								12

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main</b> Northwest, North Carolina S&ME Project No. 1306-17-013				<b>BORING LOG</b>				<b>W-22B</b>						
DATE DRILLED: 10/12/17		ELEVATION: 41.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: <b>Diedrich D-25 (track)</b>		BORING DEPTH: 30.0 ft												
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: 3' ATD												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>						NORTHING: 207673		EASTING: 2251488				
SAMPLING METHOD: <b>Split spoon</b>														
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, blackish brown, some wood, fine, moist	▽			1	2	2						4
5		<b>SILTY SAND (SM)</b> loose, dark brown, trace wood, fine, wet		36.0	SS-2	2	4	3						7
		<b>SANDY LEAN CLAY (CL)</b> very soft, tan gray, fine, wet				WOH	WOH	2						2
10		<b>SAND (SP)</b> medium dense, tan, fine to medium, wet		31.0	SS-4	4	5	6						11
15		--- Yellowish brown		26.0		6	7	6						13
20		<b>SAND (SP-SM)</b> loose, dark gray, with clay, little shell fragments, medium, wet		21.0		WOH	WOH	5						5
25		<b>PEE DEE: SILTY SAND (SM)</b> dense, greenish gray, trace shell fragments, fine, moist		16.0		20	18	17						35
30		<b>SILTY SAND (SM)</b> medium dense, greenish gray, fine, moist		11.0		5	6	6						12
		Boring terminated at 30 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>8/21/17</b>	ELEVATION: <b>60.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (track)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>4.3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>206916</b>	EASTING: <b>2253607</b>
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DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	(blows/ft) /REMARKS				
										10	20	30	6080	
	[Green]	<b>TOPSOIL</b> - 3 inches.												
	[Blue Hatched]	<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> firm, yellowish brown, fine, moist				4	3	3						6
5		<b>SANDY LEAN CLAY (CL)</b> very stiff, yellowish brown, fine, wet	▽	55.0		4	6	10						16
	[Orange Hatched]	<b>CLAYEY SAND (SC)</b> medium dense, brownish orange, fine to medium, wet			SS-3	5	7	6						13
10		<b>SAND (SP)</b> medium dense, yellowish brown, fine to medium, wet		50.0		6	9	12						21
15		---		45.0		5	6	8						14
20		---		40.0	SS-6	7	8	12						20
		<b>SAND (SP)</b> dense, light brown, fine, wet				12	15	19						34
25		Boring terminated at 25 ft		35.0										

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>				<b>BORING LOG R-10B</b>										
DATE DRILLED: <b>8/21/17</b>		ELEVATION: <b>59.0 ft</b>		NOTES: <b>Boring location is approximate.</b>										
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>15' 24 hr</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>206877</b>		EASTING: <b>2253725</b>								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>TOPSOIL</b> - 3 inches.												
		<b>COASTAL PLAIN: SAND (SP-SC)</b> medium dense, brown, with clay, fine, moist					4	5	7					12
5		<b>SANDY LEAN CLAY (CL)</b> stiff, reddish brown, fine to medium, moist		54.0			3	4	7					11
		--- Fine					5	7	8					15
10		<b>SANDY LEAN CLAY (CL)</b> soft, light brown, fine, wet		49.0	SS-4		3	2	2					4
15		<b>SAND (SP)</b> medium dense, yellowish brown, fine to medium, wet	▼	44.0			7	8	9					17
20		<b>SAND (SP)</b> loose, gray, fine to medium, wet		39.0	SS-6		6	4	5					9
25		<b>SAND (SP)</b> medium dense, light brown, fine to medium, wet		34.0			12	12	11					23
		Boring terminated at 25 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-10C</b>												
DATE DRILLED: <b>8/21/17</b>		ELEVATION: <b>60.0 ft</b>												
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Austin (Mid-Atlantic)</b>		WATER LEVEL: <b>2.5' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>206835</b>	EASTING: <b>2253820</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
						1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS					
									10	20	30	60	80	
		<b>TOPSOIL</b> - 3 inches.												
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> very soft, brown, trace rootlets, fine, moist  --- No recovery.	▽			2	1	1						2
5		<b>SANDY LEAN CLAY (CL)</b> firm, gray brown, fine, wet				WOR	WOR	WOR						WOR
10		<b>SAND (SP)</b> medium dense, gray, fine to medium, wet  --- Brown, wet				1	2	3						5
15						1	2	5						7
20						5	9	7						16
25						8	6	8						14
		Boring terminated at 25 ft				11	9	7						16

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>9/29/17</b>	ELEVATION: <b>58.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD, 2.8' 24 hr</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>206472</b>	EASTING: <b>2254645</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS					
											10	20	30	6080	
5		<u><b>COASTAL PLAIN: LEAN CLAY (CL)</b></u> soft, tan, trace fine sand, moist  - - - Yellowish brown	▼	53.0	SS-2	2	2	2	●					4	
		<u><b>SANDY LEAN CLAY (CL)</b></u> firm, light gray, fine, moist				2	2	2	●					4	
		<u><b>SANDY LEAN CLAY (CL)</b></u> very soft, light gray, fine, wet		48.0		3	3	3	●					6	
10		<u><b>SANDY LEAN CLAY (CL)</b></u> very soft, light gray, fine, wet				2	1	1	●					2	
		<u><b>SILTY SAND (SM)</b></u> loose, dark brown, fine to medium, wet		43.0		4	4	5	●					9	
		<u><b>SAND (SP-SM)</b></u> medium dense, dark brown, with silt, fine to medium, wet		38.0		4	5	6	●					11	
20		Boring terminated at 20 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

DATE DRILLED: <b>9/29/17</b>	ELEVATION: <b>58.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD, 2.75' 24 hr</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>206148</b>	EASTING: <b>2255409</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	
	[Dotted pattern]	<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, gray brown, fine, moist	▼			▲	3	5	4					9
5	[Diagonal lines]	<b>CLAYEY SAND (SC)</b> very loose, gray, fine, wet		53.0	SS-2	▲	1	1	1					2
	[Blue diagonal lines]	<b>SANDY LEAN CLAY (CL)</b> soft, gray, fine, moist				▲	2	2	2					4
10	[Dotted pattern]	<b>CLAYEY SAND (SC)</b> very soft, gray, fine, wet		48.0	SS-4	▲	2	1	1					2
15	[Dotted pattern]	<b>SILTY SAND (SM)</b> medium dense, dark brown, fine to medium, moist		43.0		▲	2	5	7					12
20	[Dotted pattern]	<b>SAND (SP-SM)</b> medium dense, dark brown, with silt, fine to medium, wet		38.0		▲	7	7	8					15
		Boring terminated at 20 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>10/23/17</b>	ELEVATION: <b>59.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (trailer)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Brandon (Mid-Atlantic)</b>	WATER LEVEL: <b>4.5' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>205689</b>	EASTING: <b>2256527</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080			
5		<b>COASTAL PLAIN: SANDY LEAN CLAY (CL)</b> soft, gray brown, trace silt, fine, moist to wet  --- Brownish gray, wet	▽	54.0	1	▲	1	2	2					4		
10		<b>CLAYEY SAND (SC)</b> loose, gray brown, fine to medium, wet --- Gray, fine		49.0	2	▲	2	2	4					6	10	7
15		<b>SAND (SP-SM)</b> medium dense, dark brown, with silt, fine to medium, wet		44.0	3	▲	3	4	6					18	26	6
20		<b>SAND (SP)</b> loose, brown, trace silt, fine to medium, wet		39.0	6	▲	6	8	18					26	6	6
		Boring terminated at 20 ft			5	▲	5	3	3					3	6	6

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG R-11B</b>												
DATE DRILLED: <b>8/25/17</b>		ELEVATION: <b>59.0 ft</b>												
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>25.0 ft</b>												
DRILLER: <b>Ron (Mid-Atlantic)</b>		WATER LEVEL: <b>3' ATD</b>												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>		NORTHING: <b>205161</b>	EASTING: <b>2257874</b>											
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>TOPSOIL</b> - 2 inches.												
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, brown, fine, moist	▽				3	3	3					6
5		<b>LEAN CLAY (CL)</b> firm, tan, trace fine sand, moist		54.0	SS-2	2	3	5						8
		<b>CLAYEY SAND (SC)</b> medium dense, yellowish brown, fine, moist			SS-3	3	5	6						11
10		<b>LEAN CLAY (CL)</b> firm, brown, trace fine sand, moist		49.0	SS-4	3	3	5						8
15		<b>SAND (SP)</b> medium dense, brown, fine, wet		44.0		8	13	14						27
20		--- Gray brown		39.0		13	18	11						29
25		<b>SAND (SP)</b> dense, light brown, fine, wet		34.0		13	14	17						31
		Boring terminated at 25 ft												

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: <b>CFPUA - Kings Bluff Water Main</b> Northwest, North Carolina S&ME Project No. 1306-17-013				<b>BORING LOG</b>				<b>W-23A</b>						
DATE DRILLED: 10/2/17		ELEVATION: 23.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: CME 45-B (track)		BORING DEPTH: 40.0 ft												
DRILLER: Bobbie (Mid-Atlantic)		WATER LEVEL: 4' ATD												
HAMMER TYPE: Auto		LOGGED BY: G. Goslin												
SAMPLING METHOD: Split spoon				NORTHING: 204651		EASTING: 2259585								
DRILLING METHOD: Mud Rotary														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> very loose, dark brown, fine, moist				1	1	2						3
5		<b>SAND (SP)</b> loose, tan, fine, wet  --- Tan brown	▽	18.0		2	3	3						6
		<b>SILTY SAND (SM)</b> medium dense, dark brown, mostly wood, fine, wet		13.0		2	4	5						9
10		<b>SAND (SP)</b> medium dense, tan, fine to medium, wet		8.0		6	7	9						16
15		<b>CLAYEY SAND (SC)</b> loose, yellowish brown, fine, wet		3.0		6	4	5						13
20		<b>SAND (SP-SC)</b> medium dense, gray, with clay, with shell fragments, fine to medium, wet		-2.0		6	11	11						9
25		<b>CLAYEY SAND (SC)</b> loose, light gray, some cemented sands, some shell fragments, medium to coarse, wet, driller noted limestone cuttings and hard drilling at 26.5'		-7.0		6	4	4						22
30		<b>SILTY SAND (SM)</b> dense, dark gray, fine, wet				12	50/5"							8

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-23A</b>											
DATE DRILLED: <b>10/2/17</b>		ELEVATION: <b>23.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>40.0 ft</b>													
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: <b>4' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>204651</b>		EASTING: <b>2259585</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80
		<b>SILTY SAND (SM)</b> dense, dark gray, fine, wet ( <i>continued</i> )													
		<b>SILTY SAND (SM)</b> very dense, dark gray, fine, wet													
40		Boring terminated at 40 ft		-17.0			9	10	48						58

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>8/22/17</b>	ELEVATION: <b>42.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (trailer)</b>	BORING DEPTH: <b>25.0 ft</b>	
DRILLER: <b>Austin (Mid-Atlantic)</b>	WATER LEVEL: <b>1.5' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>204185</b>	EASTING: <b>2260599</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	blows/ft					
											10	20	30	6080	
		<b>ASPHALT</b> - 4 inches.	▽												
5		<b>FILL: SAND (SP)</b> medium dense, brown, fine, moist		37.0			14	9	6						15
		<b>COASTAL PLAIN: SAND (SP-SC)</b> medium dense, gray brown, with clay, fine, moist					4	7	7						14
		<b>COASTAL PLAIN: SAND (SP-SC)</b> medium dense, gray brown, with clay, fine, moist					7	12	12						24
10		<b>SANDY LEAN CLAY (CL)</b> soft, light gray, fine, wet		32.0	SS-4		2	2	2						4
		<b>SAND (SP-SM)</b> medium dense, yellowish brown, with silt, medium, wet					9	9	11						20
20		--- Gray, with shell fragments		22.0	SS-6		5	5	6						11
		<b>SAND (SP)</b> loose, yellowish brown, fine, wet					4	4	2						6
25		Boring terminated at 25 ft		17.0			4	4	2						

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>A-14</b>												
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>40.0 ft</b>		NOTES: <b>Boring location is approximate.</b>												
DRILL RIG: <b>CME 45-B (trailer)</b>		BORING DEPTH: <b>20.0 ft</b>														
DRILLER: <b>Brandon (Mid-Atlantic)</b>		WATER LEVEL: <b>5' ATD</b>														
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>														
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>203861</b>		EASTING: <b>2261208</b>										
DRILLING METHOD: <b>Mud Rotary</b>																
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE		
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS						
										10	20	30	6080			
0-5		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, gray brown, fine, moist	▽	35.0		2	3	2						5		
5-7		<b>LEAN CLAY (CL)</b> firm, brownish gray, with fine sand, moist					1	2	3							5
7-10		<b>CLAYEY SAND (SC)</b> loose, yellowish gray, fine to medium, wet					3	4	5							9
10-15		<b>SAND (SP)</b> loose, gray, fine to medium, wet  --- Yellowish gray					3	4	6							10
15-20		<b>CLAYEY SAND (SC)</b> loose, dark gray, little shell fragments, fine to medium, wet					5	5	5							10
20-20		Boring terminated at 20 ft					5	3	2							5

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 10/12/17	ELEVATION: 47.0 ft	NOTES: Boring location is approximate. <b>Set 14' temporary piezometer.</b>
DRILL RIG: <b>Diedrich D-25 (track)</b>	BORING DEPTH: 20.0 ft	
DRILLER: <b>Bobbie (Mid-Atlantic)</b>	WATER LEVEL: 3' ATD	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>203583</b>	EASTING: <b>2261911</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
	•••••	<b>COASTAL PLAIN: SAND (SP)</b> very loose, tan, fine, moist	▽			▲	2	2	2					4
5	// // //	<b>CLAYEY SAND (SC)</b> loose, tan, fine to medium, moist		42.0	SS-2	▲	2	4	6					10
	// // //	<b>CLAYEY SAND (SC)</b> medium dense, gray tan, fine, moist				▲	3	6	7					13
10	•••••	<b>SAND (SP-SC)</b> medium dense, tan, with clay, fine to medium, wet		37.0	SS-4	▲	4	6	8					14
15	// // //	<b>FAT CLAY (CH)</b> stiff, gray, trace fine sand, moist		32.0		▲	1	4	5					9
20	•••••	<b>SAND (SP-SC)</b> medium dense, yellowish gray, with clay, medium, wet		27.0		▲	10	10	18					28
		Boring terminated at 20 ft												

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>A-15</b>														
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>32.0 ft</b>		NOTES: <b>Boring location is approximate.</b>														
DRILL RIG: <b>CME 45-B (trailer)</b>		BORING DEPTH: <b>20.0 ft</b>																
DRILLER: <b>Brandon (Mid-Atlantic)</b>		WATER LEVEL: <b>5.3' ATD</b>																
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>																
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>203117</b>		EASTING: <b>2263070</b>												
DRILLING METHOD: <b>Mud Rotary</b>																		
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE				
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60		80			
0-5		<b>COASTAL PLAIN: SANDY SILT (ML)</b> soft, yellowish brown, fine, moist	▽	27.0			2	2	2	●				4				
5-7		<b>CLAYEY SAND (SC)</b> loose, tan, fine to medium, wet					22.0				4	3	3	●				6
7-9		<b>SAND (SP)</b> loose, tan gray, fine to medium, wet									17.0				2	4	6	●
9-11		<b>CLAYEY SAND (SC)</b> loose, tan gray, fine, wet					12.0								2	2	3	●
11-15		<b>CLAYEY SAND (SC)</b> loose, gray, mostly shell fragments, medium, wet													3	4	4	●
15-20		<b>CLAYEY SAND (SC)</b> medium dense, light gray, mostly shell fragments, medium to coarse, wet					Boring terminated at 20 ft									6	7	12

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>				<b>BORING LOG W-24A</b>											
DATE DRILLED: <b>10/2/17</b>		ELEVATION: <b>23.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (track)</b>		BORING DEPTH: <b>30.0 ft</b>													
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: <b>3' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>202839</b>		EASTING: <b>2263822</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SAND (SP)</b> loose, tan, fine, moist					3	3	2						5
5		<b>SANDY LEAN CLAY (CL)</b> firm, brownish gray, fine, moist	▽	18.0	SS-2		1	2	3						5
		<b>CLAYEY SAND (SC)</b> loose, brownish gray, fine to medium, wet			SS-3		4	3	2						5
10		<b>SANDY LEAN CLAY (CL)</b> firm, yellowish gray, fine, wet		13.0			2	3	3						6
15		<b>SILTY SAND (SM)</b> very loose, dark gray, fine, wet		8.0	SS-5	WOH		1	1						2
20		<b>SILTY SAND (SM)</b> loose, dark gray, fine, wet		3.0			3	3	6						9
25		<b>CEMENTED SAND</b> - Layer observed by driller from 22' to 23'. <b>SILTY SAND (SM)</b> medium dense, dark gray, fine, wet		-2.0			4	6	7						13
30		Boring terminated at 30 ft		-7.0			5	6	9						15

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>W-24B</b>										
DATE DRILLED: 10/18/17		ELEVATION: 13.0 ft		NOTES: Boring location is approximate.										
DRILL RIG: <b>Diedrich D-25 (track)</b>		BORING DEPTH: 30.0 ft												
DRILLER: <b>Bobbie (Mid-Atlantic)</b>		WATER LEVEL: 3' ATD												
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>												
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: 202628		EASTING: 2264370								
DRILLING METHOD: <b>Mud Rotary</b>														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
										10	20	30	6080	
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> medium dense, gray brown, trace wood, fine, moist	▽			1	4	7						11
5		<b>SILTY SAND (SM)</b> loose, dark brown, fine, wet  --- Tan		8.0		1	4	2						6
						3	3	2						5
10		<b>PEE DEE: CLAYEY SAND (SC)</b> loose, greenish gray, trace mica, fine, wet		3.0		WOH	2	4						6
15				-2.0		3	3	6						9
20		<b>SANDY LEAN CLAY (CL)</b> very stiff, greenish gray, trace mica, fine, moist		-7.0		3	3	16						19
25		<b>CLAYEY SAND (SC)</b> medium dense, greenish gray, trace mica, fine, wet		-12.0		5	7	10						17
30		Boring terminated at 30 ft		-17.0		5	5	6						11

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 10/18/17	ELEVATION: 40.0 ft	NOTES: Boring location is approximate.
DRILL RIG: <b>Diedrich D-25 (track)</b>	BORING DEPTH: 30.0 ft	
DRILLER: <b>Bobbie (Mid-Atlantic)</b>	WATER LEVEL: 2.5' ATD	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>202129</b>	EASTING: <b>2265587</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		<b>COASTAL PLAIN: SAND (SP-SM)</b> very loose, dark brown, with silt, little wood, fine to medium, moist	▽			▲	1	1	1						2
5		<b>SILTY SAND (SM)</b> loose, gray brown, fine, wet		35.0		▲	3	2	3						5
		<b>SANDY LEAN CLAY (CL)</b> soft, gray brown, fine, wet				▲	2	1	2						3
10		<b>SAND (SP)</b> medium dense, light gray, fine, wet		30.0		▲	5	6	7						13
		<b>LEAN CLAY (CL)</b> very soft, gray brown, with sand, fine, moist				▲	WOH	1	1						2
20		<b>SANDY LEAN CLAY (CL)</b> soft, brownish gray, fine, wet		20.0		▲	2	2	2						4
		<b>SILTY SAND (SM)</b> very loose, gray brown, trace shell fragments, fine, wet				▲	WOH	1	1						2
30		<b>SILTY SAND (SM)</b> loose, gray brown, little shell fragments, fine to medium, wet		10.0		▲	7	3	2						5
		Boring terminated at 30 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: 10/18/17	ELEVATION: 11.0 ft	NOTES: Boring location is approximate.
DRILL RIG: Diedrich D-25 (track)	BORING DEPTH: 30.0 ft	
DRILLER: Bobbie (Mid-Atlantic)	WATER LEVEL: 2.3' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 201970	EASTING: 2266036
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DRILLING METHOD: Mud Rotary

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS					
											10	20	30	6080	
0		<b>COASTAL PLAIN: SANDY SILT (ML)</b> very soft, dark brown, fine, wet	▽	11.0		WOH	WOH	1							1
5		<b>CLAYEY SAND (SC)</b> very loose, dark brown, fine, wet		6.0	SS-2	1	1	2							3
8		<b>CLAYEY SAND (SC)</b> medium dense, brown, fine, wet				1	3	8							11
10		<b>PEE DEE: CLAYEY SAND (SC)</b> very loose, gray, trace mica, fine, wet		1.0	SS-4	1	1	2							3
15		<b>CLAYEY SAND (SC)</b> loose, greenish gray, trace mica, fine, wet		-4.0		3	3	4							7
20		<b>CLAYEY SAND (SC)</b> medium dense, greenish gray, trace mica, fine, wet		-9.0		3	5	13							18
25				-14.0		6	6	10							16
30		Boring terminated at 30 ft		-19.0		6	6	7							13

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

**NOTES:**

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2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.





DATE DRILLED: <b>9/27/17</b>	ELEVATION: <b>31.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>30.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>3' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>200713</b>	EASTING: <b>2269317</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		<b>COASTAL PLAIN: SAND (SP-SM)</b> loose, tan brown, with silt, fine, moist	▽			▲	2	3	5					8
5		<b>SANDY LEAN CLAY (CL)</b> soft, tan brown, fine, moist		26.0		▲	3	2	2					4
		<b>CLAYEY SAND (SC)</b> loose, tan gray, fine, moist				▲	3	3	3					6
10		<b>SAND (SP)</b> medium dense, tan gray, fine, wet		21.0		▲	4	8	7					15
		--- Tan, fine to medium				▲	6	12	14					26
15				16.0		▲	12	12	13					25
		--- Brownish gray				▲	9	13	12					25
20				11.0		▲	7	9	9					18
		--- Gray		6.0		▲	7	9	9					18
25				1.0		▲	7	9	9					18
30		Boring terminated at 30 ft				▲	7	9	9					18

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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DATE DRILLED: <b>9/27/17</b>	ELEVATION: <b>66.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>200123</b>	EASTING: <b>2270812</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
5		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, reddish brown, fine, wet	▽	61.0	2	2	3	2	3	5				
		<b>SILTY SAND (SM)</b> medium dense, brown, fine, wet			3	4	4	4	4	8				
		<b>SAND (SP-SM)</b> loose, brown, with silt, fine, wet			4	5	7	7	12	12				
10		<b>SAND (SP-SM)</b> loose, brown, with silt, fine, wet		56.0	3	3	3	3	6	6				
		<b>CLAYEY SAND (SC)</b> loose, greenish tan, fine to medium, wet			3	3	3	3	6	6				
15		<b>CLAYEY SAND (SC)</b> very loose, greenish gray, fine, wet		51.0	1	1	1	1	2	2				
20		Boring terminated at 20 ft		46.0										

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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Page 1 of 1



DATE DRILLED: <b>9/27/17</b>	ELEVATION: <b>67.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-C (turtle)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Ryan (Mid-Atlantic)</b>	WATER LEVEL: <b>2' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>199898</b>	EASTING: <b>2271387</b>
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DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		<b>COASTAL PLAIN: SILTY SAND (SM)</b> loose, tan brown, fine, moist	▽			▲	3	5	5						
5		<b>SILTY SAND (SM)</b> medium dense, gray brown, fine, moist  --- Reddish brown		62.0	SS-2	▲	4	5	6						11
						▲	12	14	14						28
10		<b>SAND (SP)</b> dense, brown, fine, wet		57.0	SS-4	▲	12	16	17						33
15		<b>SANDY LEAN CLAY (CL)</b> stiff, tan gray, fine, moist		52.0		▲	4	4	6						10
20		<b>CLAYEY SAND (SC)</b> loose, gray tan, fine, wet				▲	1	2	5						7
		Boring terminated at 20 ft		47.0											

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: <b>10/24/17</b>	ELEVATION: <b>74.0 ft</b>	NOTES: <b>Boring location is approximate.</b>
DRILL RIG: <b>CME 45-B (trailer)</b>	BORING DEPTH: <b>20.0 ft</b>	
DRILLER: <b>Brandon (Mid-Atlantic)</b>	WATER LEVEL: <b>1.8' ATD</b>	
HAMMER TYPE: <b>Auto</b>	LOGGED BY: <b>G. Goslin</b>	

SAMPLING METHOD: <b>Split spoon</b>	NORTHING: <b>199473</b>	EASTING: <b>2272413</b>
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
														10    20    30    60    80	
	[Orange dotted pattern]	<b>COASTAL PLAIN: SILTY SAND (SM)</b> medium dense, dark red, fine, moist	▽			▲	5	5	7						12
5		--- Gray brown, wet		69.0		▲	4	5	7						12
	[Orange dotted pattern]	<b>SILTY SAND (SM)</b> very loose, dark brown, fine, wet				▲	4	3	1						4
10		<b>SILTY SAND (SM)</b> medium dense, dark brown, fine, wet		64.0		▲	4	6	10						16
	[Orange dotted pattern]	<b>SAND (SP-SM)</b> medium dense, brown, with silt, fine, wet				▲	8	8	12						20
15		<b>SILTY SAND (SM)</b> loose, brownish gray, fine, wet		59.0		▲	3	3	2						5
20		Boring terminated at 20 ft		54.0		▲									

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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Page 1 of 1



PROJECT: <b>CFPUA - Kings Bluff Water Main Northwest, North Carolina S&amp;ME Project No. 1306-17-013</b>		<b>BORING LOG</b>		<b>A-17</b>											
DATE DRILLED: <b>10/24/17</b>		ELEVATION: <b>71.0 ft</b>		NOTES: <b>Boring location is approximate.</b>											
DRILL RIG: <b>CME 45-B (trailer)</b>		BORING DEPTH: <b>20.0 ft</b>													
DRILLER: <b>Brandon (Mid-Atlantic)</b>		WATER LEVEL: <b>1.5' ATD</b>													
HAMMER TYPE: <b>Auto</b>		LOGGED BY: <b>G. Goslin</b>													
SAMPLING METHOD: <b>Split spoon</b>				NORTHING: <b>199052</b>		EASTING: <b>2273520</b>									
DRILLING METHOD: <b>Mud Rotary</b>															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		<b>COASTAL PLAIN: SAND (SP-SM)</b> loose, dark gray, with silt, fine, moist	▽			3	5	5							
5		<b>SANDY SILT (ML)</b> soft, dark brown, fine, wet		66.0		3	2	2							10
		<b>SANDY SILT (ML)</b> very stiff, dark brown, fine, wet				2	5	16							4
10		<b>SAND (SP-SM)</b> very dense, dark brown, with silt, fine, moist		61.0		22	37	50/5"							21
		<b>SAND (SP-SM)</b> medium dense, brown, with silt, fine, moist				7	11	13							50/5"
15				56.0											24
		<b>LEAN CLAY (CL)</b> soft, gray, trace fine sand, wet				1	1	2							3
20		Boring terminated at 20 ft		51.0											

S&ME BORING LOG 1306-17-013.GPJ S&ME.GDT 11/22/17

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DATE DRILLED: 10/19/17	ELEVATION: 66.0 ft	NOTES: Boring location is approximate.
DRILL RIG: CME 45-B (trailer)	BORING DEPTH: 25.0 ft	
DRILLER: Brandon (Mid-Atlantic)	WATER LEVEL: 2' ATD	
HAMMER TYPE: Auto	LOGGED BY: G. Goslin	

SAMPLING METHOD: Split spoon	NORTHING: 198450	EASTING: 2275042
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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS					
										10	20	30	60	80	
		<b>COASTAL PLAIN: SANDY SILT (ML)</b> firm, dark brown, fine, moist	▽			2	3	2						5	
5		<b>SILTY SAND (SM)</b> loose, light brown, some wood, fine to medium, wet  --- No wood		61.0	SS-2	2	3	5						8	
10		<b>SAND (SP)</b> medium dense, dark brown, fine, wet		56.0	SS-4	2	4	6						10	
15		<b>LEAN CLAY (CL)</b> very soft, gray, wet		51.0		WOH	WOH	WOH						18	
20		<b>CLAYEY SAND (SC)</b> very loose, greenish gray, fine to medium, wet		46.0		1	1	2						3	
25		<b>LEAN CLAY (CL)</b> very soft, brownish gray, moist		41.0		WOH	WOH	WOH						WOH	
		Boring terminated at 25 ft													

S&amp;ME BORING LOG 1306-17-013.GPJ S&amp;ME.GDT 11/22/17

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## **Appendix III – Laboratory Testing**

**S&ME LABORATORY TESTING SUMMARY**

CFPUA Kings Bluff Water Main

S&ME Project Number 1306-17-013



NP = Non-Plastic; "-" = Test Not Performed

Boring	Depth	Natural Moisture Content	% Gravel	% Sand	% Silt/Clay	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
A-01	6-7.5	21.5	0.0	91.5	8.5	-	-	-	SP-SM
A-01	8.5-10	16.0	0.0	73.0	27.0	-	-	-	SC
A-02	3.5-5	14.3	0.0	78.3	21.7	-	-	-	SM
A-02	8.5-10	20.4	0.0	96.8	3.2	-	-	-	SP
A-03	1-2.5	16.2	0.0	57.1	43.0	-	-	-	SM
A-03	3.5-5	26.1	-	-	-	29	15	14	CL
A-03	8.5-10	32.6	-	-	-	61	22	39	CH
A-06	3.5-5	26.2	-	-	-	NP	NP	NP	SM
A-06	13.5-15	17.2	0.9	90.4	8.7	-	-	-	SP-SC
A-07	3.5-5	25.7	-	-	-	35	12	23	CL
A-08	3.5-5	19.9	0.0	64.1	35.9	-	-	-	SC
A-08	8.5-10	39.1	-	-	-	28	18	10	SC
A-09	3.5-5	16.9	0.0	84.1	15.9	-	-	-	SC
A-09	8.5-10	16.6	0.0	93.0	7.1	-	-	-	SP-SC
A-11	1-2.5	14.3	0.0	58.4	41.6	-	-	-	SC
A-11	6-7.5	26.1	-	-	-	51	14	37	CH
A-12	3.5-5	13.6	0.1	92.1	7.8	-	-	-	SP-SC
A-12	8.5-10	19.0	0.0	96.1	3.9	-	-	-	SP
A-18	3.5-5	15.8	0.4	65.1	34.5	-	-	-	SM w/ Some Wood
A-18	8.5-10	24.5	0.0	96.7	3.3	-	-	-	SP
C-04A	3.5-5	27.9	0.0	44.3	55.7	39	17	22	CL
C-04A	13.5-15	33.1	0.0	2.2	97.8	56	23	33	CH
R-01A	3.5-5	17.3	0.1	68.7	31.2	-	-	-	SC
R-01A	18.5-20	19.8	0.0	91.5	8.5	-	-	-	SP-SM
R-02A	6-7.5	16.2	0.5	95.4	4.1	-	-	-	SP
R-02A	13.5-15	37.2	3.8	48.7	47.5	-	-	-	SC
R-03A	8.5-10	19.4	0.0	95.4	4.6	-	-	-	SP
R-03A	18.5-20	22.3	0.0	95.7	4.3	-	-	-	SP
R-03B	3.5-5	14.4	0.0	64.0	36.0	-	-	-	SC
R-03B	13.5-15	21.7	0.1	93.7	6.2	-	-	-	SP-SM
R-04A	6-7.5	16.5	0.3	93.8	5.9	-	-	-	SP-SM
R-04A	18.5-20	26.6	0.2	71.3	28.5	-	-	-	SC
R-05A	6-7.5	22.7	-	-	-	45	17	28	CL
R-05A	13.5-15	36.0	0.0	15.6	84.4	-	-	-	CL
R-05B	3.5-5	30.5	-	-	-	51	21	30	CH
R-05B	23.5-25	27.6	0.0	79.5	20.5	-	-	-	SM
R-06A	8.5-10	22.3	0.0	91.4	8.6	-	-	-	SP-SM
R-06A	18.5-20	17.9	0.0	97.1	2.9	-	-	-	SP
R-06B	8.5-10	27.0	0.0	12.2	87.8	-	-	-	CL
R-06B	18.5-20	25.7	0.0	71.5	28.5	-	-	-	SM
R-08A	8.5-10	20.7	0.0	66.1	33.9	-	-	-	SM
R-08A	13.5-15	24.7	0.0	93.5	6.5	-	-	-	SP-SM
R-08B	23.5-25	24.8	0.1	93.6	6.3	-	-	-	SP-SM
R-09A	6-7.5	24.3	0.0	39.1	60.9	-	-	-	CL
R-09A	13.5-15	32.5	0.0	75.4	24.6	-	-	-	SM
R-10A	6-7.5	20.4	0.0	76.0	24.0	-	-	-	SC
R-10A	18.5-20	20.9	0.0	96.6	3.4	-	-	-	SP
R-10B	8.5-10	27.7	0.0	49.8	50.2	-	-	-	CL
R-10B	18.5-20	21.1	0.0	97.8	2.2	-	-	-	SP
R-11B	3.5-5	17.4	-	-	-	25	14	11	CL

**S&ME LABORATORY TESTING SUMMARY**

CFPUA Kings Bluff Water Main

S&ME Project Number 1306-17-013



NP = Non-Plastic; "-" = Test Not Performed

Boring	Depth	Natural Moisture Content	% Gravel	% Sand	% Silt/Clay	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
R-11B	6-7.5	17.1	-	-	-	-	-	-	SC
R-11B	8.5-10	19.6	-	-	-	31	15	16	CL
R-12	8.5-10	26.4	0.0	39.8	60.2	-	-	-	CL
R-12	18.5-20	20.5	1.8	90.9	7.3	-	-	-	SP-SM w/ Shells
RT-07A	6-7.5	22.6	-	-	-	46	22	24	CL
RT-07A	13.5-15	24.6	0.0	90.8	9.2	-	-	-	SP-SM
RT-07A	23.5-25	23.0	0.5	94.3	5.2	-	-	-	SP-SM
RT-07A	33.5-35	19.4	3.7	91.4	4.9	-	-	-	SP
RT-07A	43.5-45	24.4	0.0	46.3	53.7	-	-	-	CL
RT-07B	8.5-10	20.2	0.0	93.8	6.2	-	-	-	SP-SC
RT-07B	13.5-15	16.6	5.8	89.8	4.3	-	-	-	SP
RT-07B	18.5-20	31.2	0.0	58.5	41.5	NP	NP	NP	SM
RT-07B	28.5-30	27.4	0.0	47.1	52.9	28	18	10	CL
RT-07B	43.5-45	26.3	0.0	37.2	62.8	39	19	14	CL
W-01B	1-2.5	15.9	-	-	-	-	-	-	CL
W-01B	3.5-5	15.7	0.0	77.8	22.2	-	-	-	SC
W-01B	6-7.5	17.7	-	-	-	-	-	-	SP
W-02A	3.5-5	15.2	0.0	86.3	13.7	-	-	-	SM
W-02A	13.5-15	30.5	-	-	-	56	18	38	CH
W-03B	6-7.5	16.6	0.0	93.6	6.4	-	-	-	SP-SC
W-03B	13.5-15	44.4	-	-	-	45	19	26	CL
W-05B	3.5-5	23.6	3.1	63.2	33.7	-	-	-	SC
W-05B	13.5-15	42.1	0.0	26.2	73.8	-	-	-	CL
W-06B	3.5-5	22.3	1.2	87.0	11.8	-	-	-	SP-SM
W-06B	8.5-10	33.1	-	-	-	55	17	38	CH
W-07A	3.5-5	18.8	0.0	81.7	18.3	-	-	-	SM
W-07A	8.5-10	17.4	0.0	95.9	4.1	-	-	-	SP
W-09A	3.5-5	22.1	-	-	-	37	14	23	CL
W-09A	8.5-10	32.4	-	-	-	41	18	23	CL
W-09B	3.5-5	17.4	1.2	86.0	12.8	-	-	-	SM
W-09B	13.5-15	21.6	0.0	98.4	1.6	-	-	-	SP
W-11A	1-2.5	19.6	0.0	45.5	54.5	40	17	23	CL
W-11A	3.5-5	26.3	0.0	39.3	60.7	43	18	25	CL
W-11A	6-7.5	30.8	0.0	40.6	59.4	60	21	39	CH
W-11A	8.5-10	33.6	0.0	30.9	69.1	64	21	43	CH
W-11A	13.5-15	25.1	0.0	14.0	86.0	55	19	36	CH
W-12B	1-2.5	19.6	-	-	-	NP	NP	NP	SC
W-12B	3.5-5	22.9	-	-	-	-	-	-	CL
W-12B	6-7.5	24.5	-	-	-	28	15	13	CL
W-12B	8.5-10	30.3	-	-	-	-	-	-	CH
W-12B	13.5-15	36.4	-	-	-	74	28	46	CH
W-14A	1-2.5	19.4	-	-	-	-	-	-	CL
W-14A	3.5-5	35.4	-	-	-	-	-	-	CL
W-14A	6-7.5	35.8	-	-	-	76	24	52	CH
W-14A	8.5-10	36.4	-	-	-	-	-	-	CH
W-14A	13.5-15	29.3	-	-	-	-	-	-	CH
W-16A	6-7.5	21.2	0.0	69.0	31.0	-	-	-	SM
W-16A	13.5-15	20.3	0.3	70.7	29.0	-	-	-	SM
W-17A	3.5-5	38.2	2.3	46.7	51.0	-	-	-	ML w/ Wood Pieces

**S&ME LABORATORY TESTING SUMMARY**

CFPUA Kings Bluff Water Main

S&amp;ME Project Number 1306-17-013

*NP = Non-Plastic; "-" = Test Not Performed*

Boring	Depth	Natural Moisture Content	% Gravel	% Sand	% Silt/Clay	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
W-17A	8.5-10	46.9	23.2	49.8	27.0	-	-	-	SM w/ Wood Pieces & Rock Fragments
W-17C	2.5-4	56.1	0.4	89.6	10.0	-	-	-	SP-SM w/ Little Wood
W-17C	12.5-14	27.1	-	-	-	38	17	21	CL
W-17E	7-8.5	37.3	0.0	58.8	41.2	-	-	-	SC w/ Some Wood
W-17E	17-18.5	27.0	0.0	35.5	64.5	-	-	-	CL
W-17H	2.5-4	27.4	0.0	84.6	15.4	-	-	-	SC
W-17H	12-13.5	27.1	0.0	46.7	53.3	-	-	-	CL
W-19A	6-7.5	56.8	1.9	75.3	22.8	-	-	-	SM w/ Wood Pieces
W-19A	8.5-10	27.3	0.7	96.0	3.3	-	-	-	SP w/ Wood Pieces
W-22B	3.5-5	18.8	0.2	87.4	12.4	-	-	-	SM
W-22B	8.5-10	21.9	0.0	98.0	2.0	-	-	-	SP
W-24A	3.5-5	14.6	-	-	-	-	-	-	CL
W-24A	6-7.5	19.6	0.0	76.0	24.0	-	-	-	SC
W-24A	13.5-15	32.0	0.0	77.2	22.8	-	-	-	SM
W-25B	3.5-5	35.0	-	-	-	NP	NP	NP	SC
W-25B	8.5-10	28.0	0.0	81.0	19.0	-	-	-	SC
W-26A	8.5-10	22.5	0.0	95.9	4.1	-	-	-	SP w/ Trace Wood
W-27B	3.5-5	13.7	0.0	78.0	22.0	-	-	-	SM
W-27B	8.5-10	28.7	0.0	96.3	3.7	-	-	-	SP

## LABORATORY DETERMINATION OF WATER CONTENT



ASTM D 2216  AASHTO T 265

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	9/14/17
Project Name:	Kings Bluff Water Main	Test Date(s):	9/5-9/14/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample by:	Mid Atlantic Drilling/G. Goslin (S&ME)	Sample Date(s):	Various
Sampling Method:	Split Spoon	Drill Rig :	N/A

<b>Method:</b>	A (1%) <input type="checkbox"/>	B (0.1%) <input checked="" type="checkbox"/>	Balance ID. 14862	Calibration Date: 7/1/17
			Oven ID. 14603	Calibration Date: 1/26/17

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt. + Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft. or m.		grams	grams	grams	grams	%
R-1A	S2	3.5'-5.0'	51	151.43	364.47	333.04	31.43	17.3%
R-1A	S6	18.5'-20.0'	520	152.62	370.49	334.46	36.03	19.8%
R-2A	S3	6.5'-7.0'	BK	146.97	372.34	340.85	31.49	16.2%
R-2A	S5	13.5'-15.0'	1520	149.19	362.53	304.66	57.87	37.2%
R-3A	S4	8.5'-10.0'	52	155.74	371.90	336.78	35.12	19.4%
R-3A	S6	18.5'-20.0'	HC	149.39	364.62	325.43	39.19	22.3%
R-3B	S2	3.5'-5.0'	GTH	147.68	366.77	339.19	27.58	14.4%
R-3B	S5	13.5'-15.0'	BD	281.89	497.51	459.11	38.40	21.7%
R-4A	S3	6.5'-7.0'	GP	280.01	491.91	461.97	29.94	16.5%
R-4A	S6	18.5'-20.0'	SSDD	281.85	497.25	451.95	45.30	26.6%
R-5A	S3	6.5'-7.0'	R	235.42	472.30	428.42	43.88	22.7%
R-5A	S5	13.5'-15.0'	52B	246.53	451.02	396.93	54.09	36.0%
R-5B	S2	3.5'-5.0'	158	192.06	400.87	352.08	48.79	30.5%
R-5B	S7	23.5'-25.0'	HC	149.30	360.06	314.45	45.61	27.6%
R-6A	S4	8.5'-10.0'	52	155.72	367.47	328.79	38.68	22.3%
R-6A	S6	18.5'-20.0'	BK	146.93	358.52	326.39	32.13	17.9%

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/20/2017  
Date

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## LABORATORY DETERMINATION OF WATER CONTENT



ASTM D 2216  AASHTO T 265

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/9/17
Project Name:	Kings Bluff Water Main	Test Date(s):	10/19-11/9/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample by:	Mid Atlantic Drilling/G. Goslin (S&ME)	Sample Date(s):	Various
Sampling Method:	Split Spoon	Drill Rig :	N/A

Method:	A (1%) <input type="checkbox"/>	B (0.1%) <input checked="" type="checkbox"/>	Balance ID.	14862	Calibration Date:	7/1/17	Oven ID.	14603	Calibration Date:	1/26/17
Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt. + Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture		
		ft. or m.		grams	grams	grams	grams	%		
A-1	S3	6.0'-7.5'	H	0.00	201.09	165.51	35.58	21.5%		
A-1	S4	8.5'-10.0'	A	0.00	206.90	178.32	28.58	16.0%		
A-2	S2	3.5'-5.0'	S	0.00	206.29	180.49	25.80	14.3%		
A-2	S4	8.5'-10.0'	T	0.00	208.31	173.03	35.28	20.4%		
W-2A	S2	3.5'-5.0'	E	0.00	204.43	177.46	26.97	15.2%		
W-2A	S5	13.5'-15.0'	HN	157.58	374.87	324.04	50.83	30.5%		
W-6B	S2	3.5'-5.0'	E	156.43	369.66	330.71	38.95	22.3%		
W-6B	S4	8.5'-10.0'	T	157.46	356.92	307.28	49.64	33.1%		
W-7A	S2	3.5'-5.0'	S	157.92	369.13	335.69	33.44	18.8%		
W-7A	S4	8.5'-10.0'	A	157.88	369.19	337.87	31.32	17.4%		
W-9B	S2	3.5'-5.0'	H	157.11	366.56	335.48	31.08	17.4%		
W-9B	S5	13.5'-15.0'	HN	157.53	366.22	329.19	37.03	21.6%		
C-4A	S2	3.5'-5.0'	BK	146.83	354.80	309.47	45.33	27.9%		
C-4A	S5	13.5'-15.0'	520	152.50	358.32	307.08	51.24	33.1%		
W-11A	S1	1.0'-2.5'	GTH	147.33	348.18	315.27	32.91	19.6%		
W-11A	S2	3.5'-5.0'	H	157.11	364.02	320.89	43.13	26.3%		

Notes / Deviations / References

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Gunnar Goslin

Staff Professional

11/20/2017



## LABORATORY DETERMINATION OF WATER CONTENT



ASTM D 2216  AASHTO T 265

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/9/17
Project Name:	Kings Bluff Water Main	Test Date(s):	10/19-11/9/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample by:	Mid Atlantic Drilling/G. Goslin (S&ME)	Sample Date(s):	Various
Sampling Method:	Split Spoon	Drill Rig :	N/A

<b>Method:</b>	A (1%) <input type="checkbox"/>	B (0.1%) <input checked="" type="checkbox"/>	Balance ID. 14862	Calibration Date: 7/1/17
			Oven ID. 14603	Calibration Date: 1/26/17

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt. + Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft. or m.		grams	grams	grams	grams	%
A-8	S2	3.5'-5.0'	H	157.04	363.70	329.38	34.32	19.9%
A-8	S4	8.5'-10.0'	GTH	147.29	254.81	224.58	30.23	39.1%
W-24A	S2	3.5'-5.0'	S	157.84	360.17	334.39	25.78	14.6%
W-24A	S3	6.0'-7.5'	E	156.37	367.95	333.28	34.67	19.6%
W-24A	S5	13.5'-15.0'	T	157.54	367.93	316.87	51.06	32.0%
W-27B	S2	3.5'-5.0'	52	155.69	378.76	351.80	26.96	13.7%
W-27B	S4	8.5'-10.0'	HC	149.10	366.91	318.34	48.57	28.7%

Notes / Deviations / References

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AASHTO T 265: Laboratory Determination of Moisture Content of Soils  
 ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Gunnar Goslin

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Staff Professional
11/20/2017

## MOISTURE CONTENT

ASTM D 2216-10

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R2017-861-001

Lab ID:	001	002	003	004	005
Boring No.:	W-1B	W-1B	W-1B	W-3B	W-3B
Depth (ft):	1-2.5	3.5-5	6-7.5	6-7.5	13.5-15
Sample No.:	SS-1	SS-2	SS-3	SS-3	SS-5
Tare Number	18	55	15	29	1506
Wt. of Tare & Wet Sample (g)	699.34	714.93	607.36	748.78	703.20
Wt. of Tare & Dry Sample (g)	615.44	645.44	529.30	671.46	531.76
Weight of Tare (g)	87.05	203.67	87.74	204.33	145.66
Weight of Water (g)	83.90	69.49	78.06	77.32	171.44
Weight of Dry Sample (g)	528.39	441.77	441.56	467.13	386.10
<b>Water Content (%)</b>	<b>15.9</b>	<b>15.7</b>	<b>17.7</b>	<b>16.6</b>	<b>44.4</b>

Lab ID	006	007	008	009	010
Boring No.	W-5B	W-5B	A-3	A-3	A-3
Depth (ft)	3.5-5	13.5-15	1-2.5	3.5-5	8.5-10
Sample No.	SS-2	SS-5	SS-1	SS-2	SS-4
Tare Number	48	27	31	1416	1537
Wt. of Tare & Wet Sample (g)	752.25	995.44	679.96	701.12	555.20
Wt. of Tare & Dry Sample (g)	647.39	760.95	613.43	586.21	454.12
Weight of Tare (g)	202.80	204.32	203.12	145.63	143.95
Weight of Water (g)	104.86	234.49	66.53	114.91	101.08
Weight of Dry Sample (g)	444.59	556.63	410.31	440.58	310.17
<b>Water Content (%)</b>	<b>23.6</b>	<b>42.1</b>	<b>16.2</b>	<b>26.1</b>	<b>32.6</b>

Notes :

Tested By RT Date 11/10/17 Checked By NC Date 11/13/17

## MOISTURE CONTENT

ASTM D 2216-10

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R2017-861-001

Lab ID:	011	012	013	014	015
Boring No.:	W-9A	W-9A	W-12B	W-12B	W-12B
Depth (ft):	3.5-5	8.5-10	1-2.5	3.5-5	6-7.5
Sample No.:	SS-2	SS-4	SS-1	SS-2	SS-3
Tare Number	1482	1470	1545	10	1556
Wt. of Tare & Wet Sample (g)	582.79	613.16	526.87	729.34	926.64
Wt. of Tare & Dry Sample (g)	503.92	498.98	464.71	609.87	772.91
Weight of Tare (g)	147.77	146.53	147.49	87.15	146.71
Weight of Water (g)	78.87	114.18	62.16	119.47	153.73
Weight of Dry Sample (g)	356.15	352.45	317.22	522.72	626.20
<b>Water Content (%)</b>	<b>22.1</b>	<b>32.4</b>	<b>19.6</b>	<b>22.9</b>	<b>24.5</b>

Lab ID	016	017	018	019	020
Boring No.	W-12B	W-12B	RT-7B	RT-7B	RT-7B
Depth (ft)	8.5-10	13.5-15	8.5-10	13.5-15	18.5-20
Sample No.	SS-4	SS-5	SS-4	SS-5	SS-6
Tare Number	4	1461	26	582	1522
Wt. of Tare & Wet Sample (g)	545.54	782.86	596.08	725.76	867.35
Wt. of Tare & Dry Sample (g)	439.34	612.94	529.56	666.15	696.29
Weight of Tare (g)	88.29	146.10	200.59	307.49	148.59
Weight of Water (g)	106.20	169.92	66.52	59.61	171.06
Weight of Dry Sample (g)	351.05	466.84	328.97	358.66	547.70
<b>Water Content (%)</b>	<b>30.3</b>	<b>36.4</b>	<b>20.2</b>	<b>16.6</b>	<b>31.2</b>

Notes :

Tested By RT Date 11/10/17 Checked By NC Date 11/13/17

## MOISTURE CONTENT

ASTM D 2216-10

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R2017-861-001

Lab ID:	021	022	023	024	025
Boring No.:	RT-7B	RT-7B	A-6	A-6	W-17C
Depth (ft):	28.5-30	43.5-45	3.5-5	13.5-15	3.5-5
Sample No.:	SS-8	SS-11	SS-2	SS-5	SS-2
Tare Number	1490	1519	1535	1562	1558
Wt. of Tare & Wet Sample (g)	836.85	935.71	568.61	990.39	479.41
Wt. of Tare & Dry Sample (g)	688.02	771.52	481.28	890.74	417.92
Weight of Tare (g)	144.63	147.68	148.11	310.71	308.22
Weight of Water (g)	148.83	164.19	87.33	99.65	61.49
Weight of Dry Sample (g)	543.39	623.84	333.17	580.03	109.70
<b>Water Content (%)</b>	<b>27.4</b>	<b>26.3</b>	<b>26.2</b>	<b>17.2</b>	<b>56.1</b>

Lab ID	026	027	028	029	030
Boring No.	W-17C	W-17E	W-17E	W-17H	W-17H
Depth (ft)	8.5-10	3.5-5	8.5-10	3.5-5	8.5-10
Sample No.	SS-4	SS-2	SS-4	SS-2	SS-4
Tare Number	579	581	587	1560	589
Wt. of Tare & Wet Sample (g)	572.31	415.31	575.33	538.01	554.15
Wt. of Tare & Dry Sample (g)	516.04	386.38	518.63	487.97	501.85
Weight of Tare (g)	308.51	308.91	308.85	305.42	308.58
Weight of Water (g)	56.27	28.93	56.70	50.04	52.30
Weight of Dry Sample (g)	207.53	77.47	209.78	182.55	193.27
<b>Water Content (%)</b>	<b>27.1</b>	<b>37.3</b>	<b>27.0</b>	<b>27.4</b>	<b>27.1</b>

Notes :

Tested By RT Date 11/10/17 Checked By NC Date 11/13/17

## MOISTURE CONTENT

ASTM D 2216-10

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R2017-861-001

Lab ID:	031	032	033	034	035
Boring No.:	A-11	A-11	A-12	A-12	W-22B
Depth (ft):	1-2.5	6-7.5	3.5-5	8.5-10	3.5-5
Sample No.:	SS-1	SS-3	SS-2	SS-4	SS-2
Tare Number	577	1571	1569	588	1564
Wt. of Tare & Wet Sample (g)	887.63	788.95	884.55	881.55	865.06
Wt. of Tare & Dry Sample (g)	815.15	689.89	815.62	790.22	776.81
Weight of Tare (g)	309.31	309.65	307.41	308.79	307.93
Weight of Water (g)	72.48	99.06	68.93	91.33	88.25
Weight of Dry Sample (g)	505.84	380.24	508.21	481.43	468.88
<b>Water Content (%)</b>	<b>14.3</b>	<b>26.1</b>	<b>13.6</b>	<b>19.0</b>	<b>18.8</b>

Lab ID	036	037	038	039	040
Boring No.	W-22B	A-7	R-11B	R-11B	R-11B
Depth (ft)	8.5-10	3.5-5	3.5-5	6-7.5	8.5-10
Sample No.	SS-4	SS-2	SS-2	SS-3	SS-4
Tare Number	576	584	1572	2	1570
Wt. of Tare & Wet Sample (g)	611.83	652.24	805.50	726.95	1129.75
Wt. of Tare & Dry Sample (g)	557.38	582.08	731.63	633.31	994.72
Weight of Tare (g)	308.36	308.86	308.23	87.13	306.47
Weight of Water (g)	54.45	70.16	73.87	93.64	135.03
Weight of Dry Sample (g)	249.02	273.22	423.40	546.18	688.25
<b>Water Content (%)</b>	<b>21.9</b>	<b>25.7</b>	<b>17.4</b>	<b>17.1</b>	<b>19.6</b>

Notes :

Tested By RT Date 11/10/17 Checked By NC Date 11/13/17

## MOISTURE CONTENT

ASTM D 2216-10

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R2017-861-001

Lab ID:	041	042	043	044	045
Boring No.:	A-9	A-9	W-25B	W-25B	W-26A
Depth (ft):	3.5-5	8.5-10	3.5-5	8.5-10	8.5-10
Sample No.:	SS-2	SS-4	SS-2	SS-4	SS-4
Tare Number	583	574	1565	1563	585
Wt. of Tare & Wet Sample (g)	827.92	812.86	950.72	976.39	830.72
Wt. of Tare & Dry Sample (g)	752.82	740.85	784.35	829.27	734.93
Weight of Tare (g)	309.75	308.26	308.85	304.64	308.89
Weight of Water (g)	75.10	72.01	166.37	147.12	95.79
Weight of Dry Sample (g)	443.07	432.59	475.50	524.63	426.04
<b>Water Content (%)</b>	<b>16.9</b>	<b>16.6</b>	<b>35.0</b>	<b>28.0</b>	<b>22.5</b>

Lab ID	046	047
Boring No.	A-18	A-18
Depth (ft)	3.5-5	8.5-10
Sample No.	SS-2	SS-4
Tare Number	1566	578
Wt. of Tare & Wet Sample (g)	681.15	784.38
Wt. of Tare & Dry Sample (g)	630.43	691.17
Weight of Tare (g)	309.58	310.86
Weight of Water (g)	50.72	93.21
Weight of Dry Sample (g)	320.85	380.31
<b>Water Content (%)</b>	<b>15.8</b>	<b>24.5</b>

Notes :

Tested By RT Date 11/10/17 Checked By NC Date 11/13/17

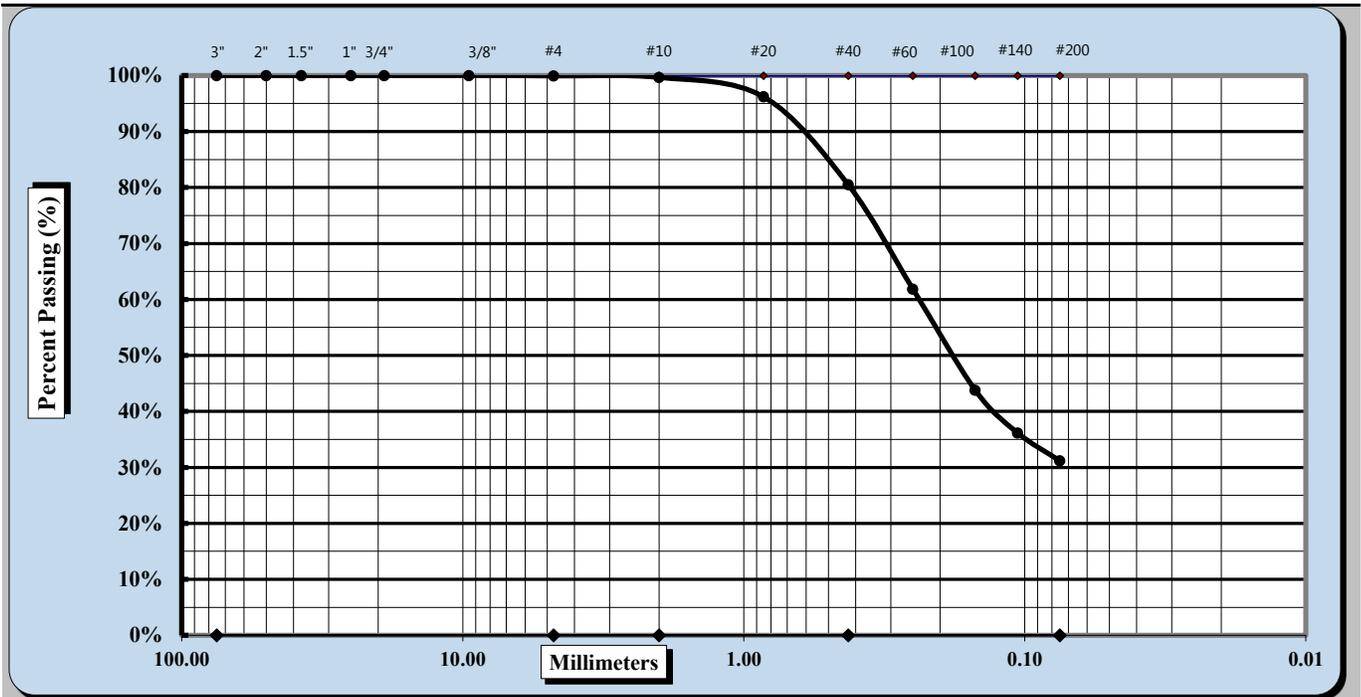
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 1 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-1A/S2)	Elev/Depth: 3.5'-5.0'
Sample Description: Light Brown Clayey SAND (SC)	



## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	1 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-1A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Light Brown Clayey SAND (SC)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates:		9/5-9/14/17	
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 24 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>51</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>213.0</b>		Pan No.	<b>51</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>181.6</b>		Dry Mass of Specimen after Wash +Tare			<b>127.1</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>181.6</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>127.1</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>213.0</b>		Dry Mass passing #200			<b>54.5</b>
F=(E-D)/D Water Content of Specimen		<b>17.3%</b>		% Passing #200			<b>30.0%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.1	325	<b>0.1</b>	0.1%	99.9%
#10	2.000	0.2	0.4	180	<b>0.6</b>	0.3%	99.7%
#20	0.850	3.1	3.8	115	<b>6.9</b>	3.8%	96.2%
#40	0.425	18.4	17.0	75	<b>35.4</b>	19.5%	80.5%
#60	0.250	36.6	32.7	60	<b>69.3</b>	38.2%	61.8%
#100	0.150	52.1	50.0	40	<b>102.1</b>	56.2%	43.8%
#140	0.106	58.6	57.3	30	<b>115.9</b>	63.8%	36.2%
#200	0.075	62.9	62.1	20	<b>125.0</b>	68.8%	31.2%
Pan	<0.075	63.9	63.3	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	2 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-1A/S6)	Type:	Split Spoon	Elev/Depth:	18.5'-20.0'
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Sample Description: Light Brown Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing):	<b>#4</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>520</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>217.9</b>	Pan No. <b>520</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>181.8</b>	Dry Mass of Specimen after Wash +Tare <b>166.6</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>181.8</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>166.6</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>217.9</b>	Dry Mass passing #200 <b>15.2</b>	
F=(E-D)/D Water Content of Specimen	<b>19.9%</b>	% Passing #200 <b>8.4%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	6.4	5.3	180	<b>11.7</b>	6.4%	93.6%
#20	0.850	45.2	44.1	115	<b>89.3</b>	49.1%	50.9%
#40	0.425	66.6	66.0	75	<b>132.6</b>	72.9%	27.1%
#60	0.250	77.6	77.2	60	<b>154.8</b>	85.1%	14.9%
#100	0.150	81.9	81.9	40	<b>163.8</b>	90.1%	9.9%
#140	0.106	82.9	82.7	30	<b>165.6</b>	91.1%	8.9%
#200	0.075	83.3	83.0	20	<b>166.3</b>	91.5%	8.5%
Pan	<0.075	83.4	83.1	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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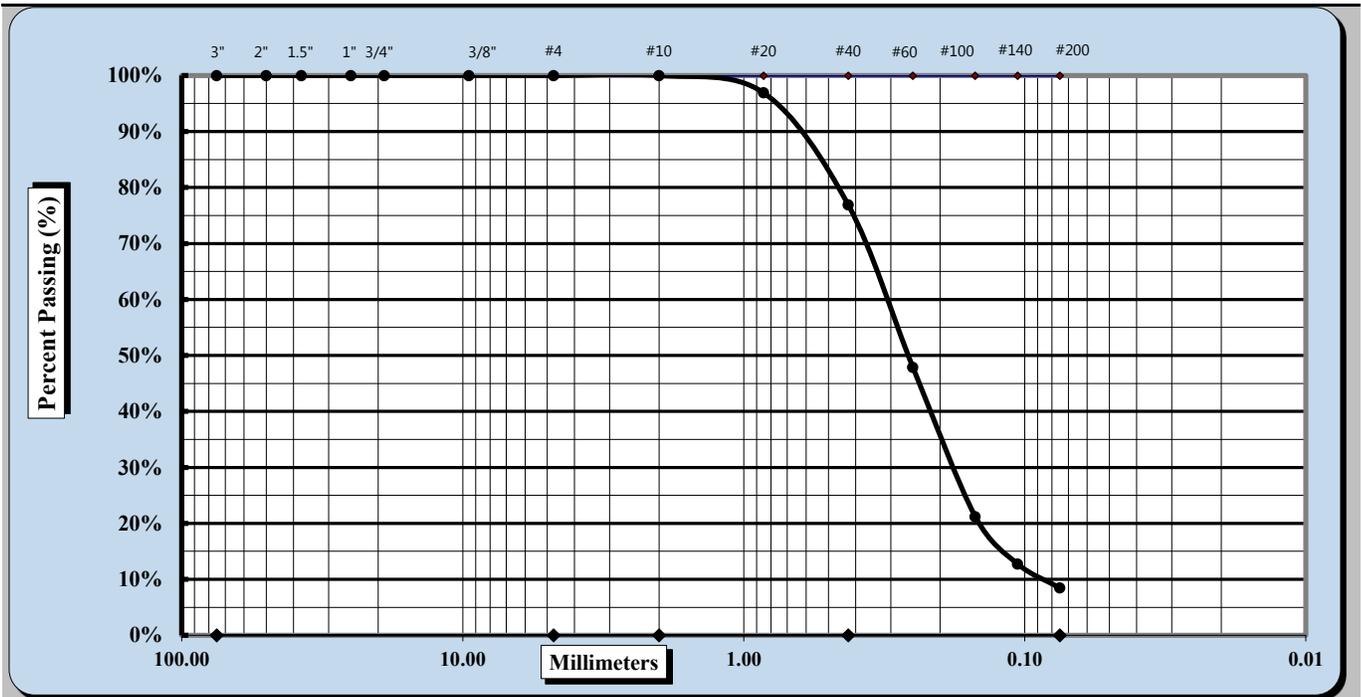
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/22/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	1 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-1/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'
Sample Description:	Light Gray Poorly Graded SAND with Silt (SP-SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	68.5%	
Gravel	0.0%	Medium Sand	23.1%	Silt & Clay	8.5%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	21.5%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/22/17
Project Name:	Kings Bluff Water Main	Lab Report #:	1 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-1/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'

Sample Description: Light Gray Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/19-10/22/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g		Soak Time:	2.0 hours
				Shaking Apparatus?
<b>Specimen:</b>	Pan No.	<b>H</b>	B) Tare Wt.	<b>0.0</b>
				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>201.1</b>		Pan No.	<b>H</b>
			B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>165.5</b>		Dry Mass of Specimen after Wash +Tare	
			<b>152.9</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>165.5</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
			<b>152.9</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>201.1</b>		Dry Mass passing #200	
			<b>12.6</b>	
F=(E-D)/D) Water Content of Specimen	<b>21.5%</b>		% Passing #200	
			<b>7.6%</b>	

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		Retained (Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	2.3	2.8	115	<b>5.1</b>	3.1%	96.9%
#40	0.425	18.2	20.0	75	<b>38.2</b>	23.1%	76.9%
#60	0.250	41.0	45.3	60	<b>86.3</b>	52.1%	47.9%
#100	0.150	63.4	67.0	40	<b>130.4</b>	78.8%	21.2%
#140	0.106	71.4	73.0	30	<b>144.4</b>	87.3%	12.7%
#200	0.075	75.7	75.8	20	<b>151.5</b>	91.5%	8.5%
Pan	<0.075	76.6	76.3	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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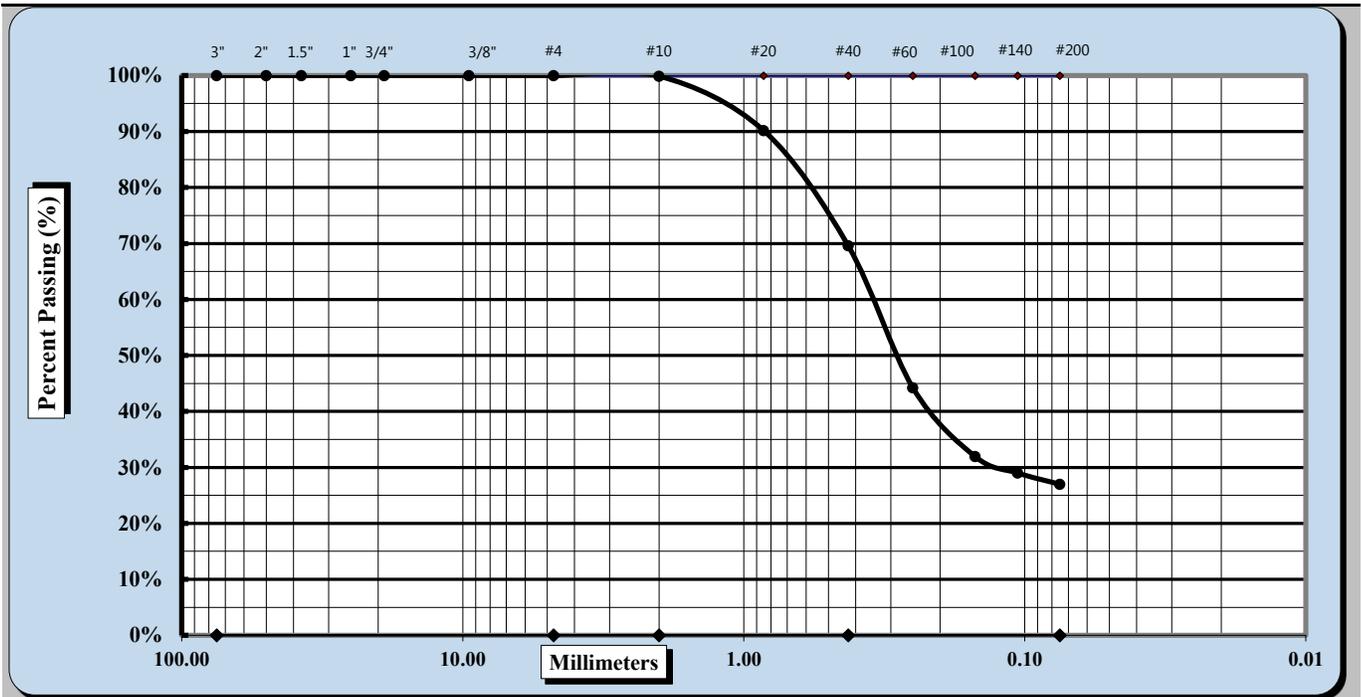
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 10/22/2017
Project Name: Kings Bluff Water Main	Lab Report #: 2 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Date Sampled: Various	
Location: Various/Water Main/R-O-W	
Log/Sample Id. 155 (A-1/S4)	Elev/Depth: 8.5'-10.0'
Type: Split Spoon	
Sample Description: Light Brown Clayey SAND (SC)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size #10	Coarse Sand 0.1%	Fine Sand 42.6%
Gravel 0.0%	Medium Sand 30.3%	Silt & Clay 27.0%
Liquid Limit N/A	Plastic Limit N/A	Plastic Index N/A
Maximum Dry Density N/A	Assumed SG(D854) 2.650	% Absorption N/A
Optimum Moisture N/A	Natural Moisture 16.0%	CBR N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/22/17
Project Name:	Kings Bluff Water Main	Lab Report #:	2 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-1/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Light Brown Clayey SAND (SC)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/19-10/22/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:		Moist	x	Air-Dried
				Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	2.0 hours	Shaking Apparatus?
<b>Specimen:</b>	Pan No. <b>A</b>	B) Tare Wt.	<b>0.0</b>	
			<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>	
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>206.9</b>	Pan No.	<b>A</b>	B) Tare Wt.
				<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>178.3</b>	Dry Mass of Specimen after Wash +Tare		<b>131.0</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>178.3</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>131.0</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>206.9</b>	Dry Mass passing #200		<b>47.3</b>
F=(E-D)/D) Water Content of Specimen	<b>16.0%</b>	% Passing #200		<b>26.5%</b>

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.1	0.1	180	<b>0.2</b>	0.1%	99.9%
#20	0.850	10.4	7.1	115	<b>17.5</b>	9.8%	90.2%
#40	0.425	30.4	23.8	75	<b>54.2</b>	30.4%	69.6%
#60	0.250	52.1	47.4	60	<b>99.5</b>	55.8%	44.2%
#100	0.150	61.3	60.1	40	<b>121.4</b>	68.1%	31.9%
#140	0.106	63.3	63.3	30	<b>126.6</b>	71.0%	29.0%
#200	0.075	64.6	65.6	20	<b>130.2</b>	73.0%	27.0%
Pan	<0.075	65.0	66.0	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

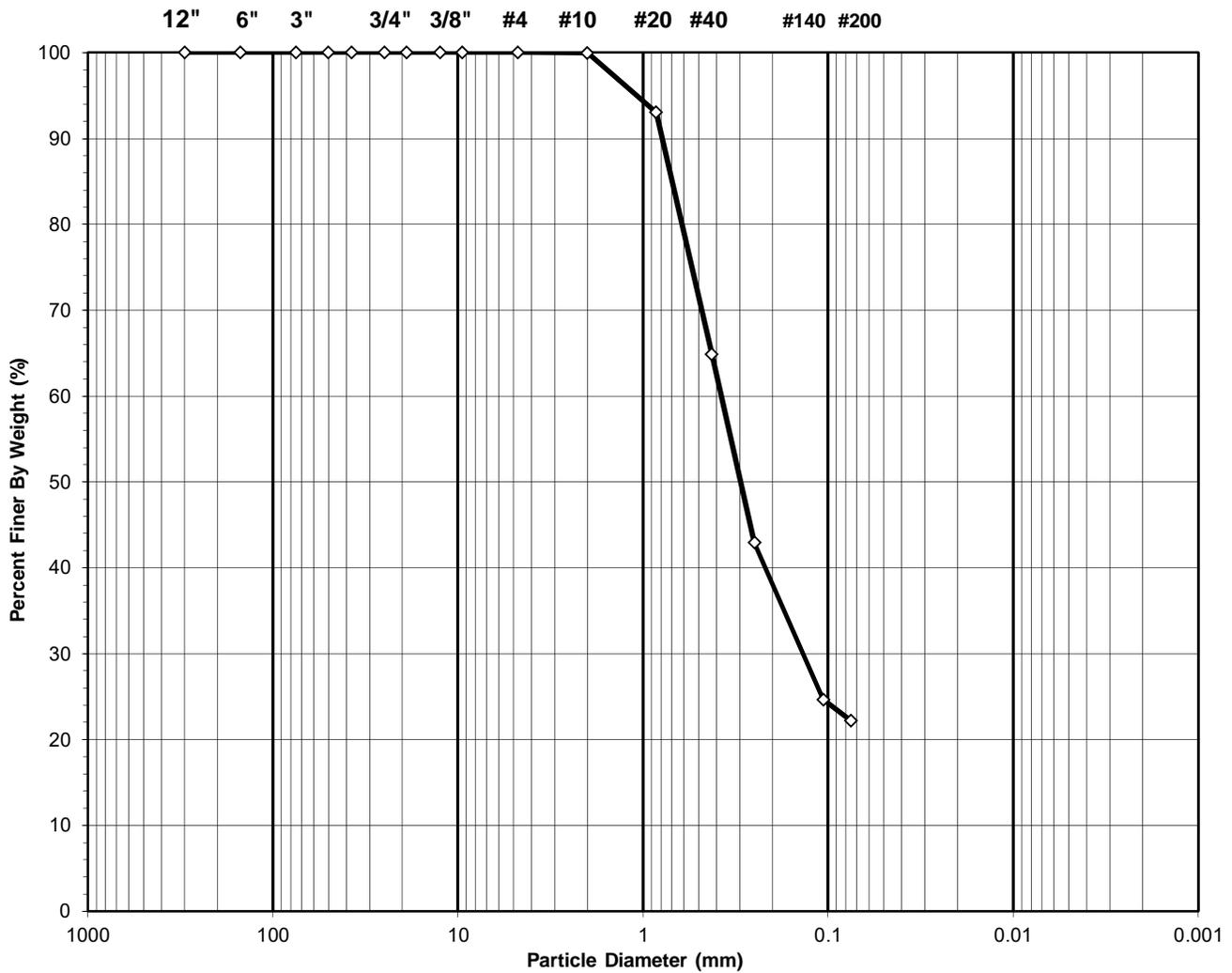
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-1B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-002	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-1B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-002	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	55	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	714.93	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	645.44	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	203.67	Weight of Tare (g):	NA
Weight of Water (g):	69.49	Weight of Water (g):	NA
Weight of Dry Sample (g):	441.77	Weight of Dry Sample (g):	NA
*Moisture Content (%):	15.7	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	441.77
Dry Weight of - 3/4" Sample (g):	441.8	Weight of - #200 Material (g):	97.96
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	343.81
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.15	0.03	0.03	99.97	99.97
#20	0.850	30.60	6.93	6.96	93.04	93.04
#40	0.425	124.39	28.16	35.12	64.88	64.88
#60	0.250	96.98	21.95	57.07	42.93	42.93
#140	0.106	80.75	18.28	75.35	24.65	24.65
#200	0.075	10.94	2.48	77.83	22.17	22.17
Pan	-	97.96	22.17	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

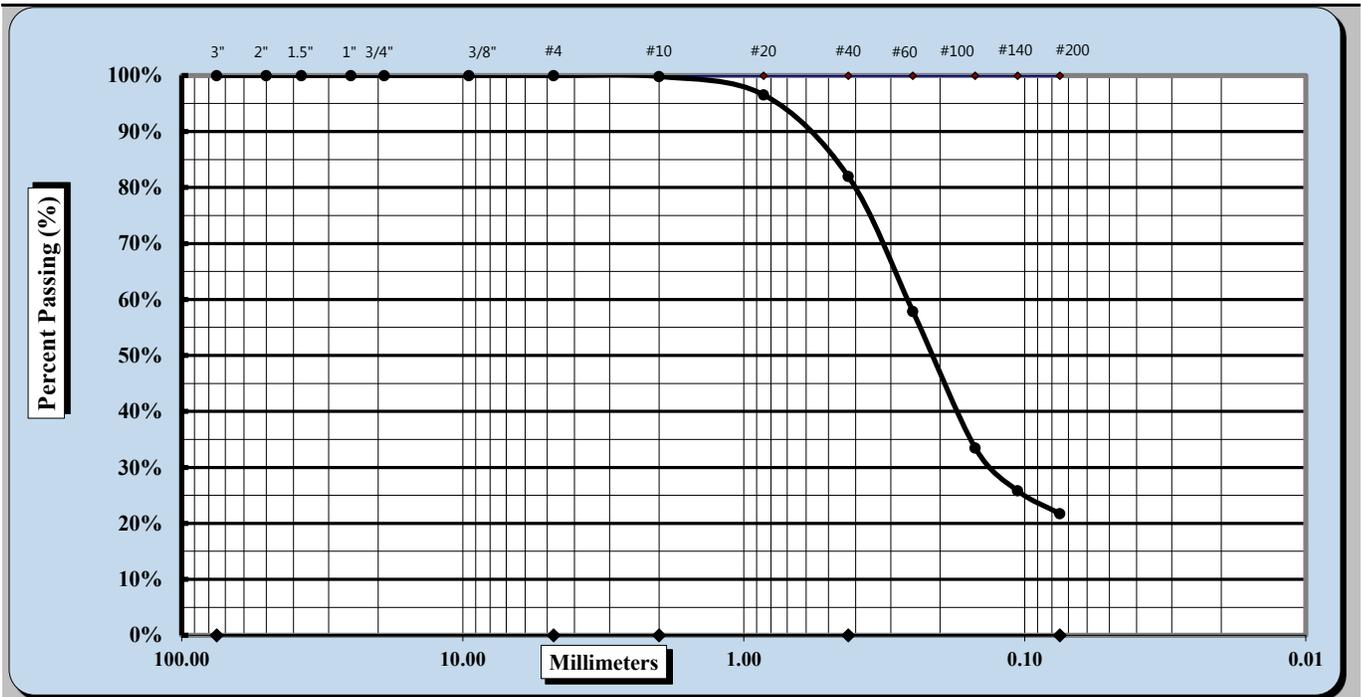
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/22/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	3 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-2/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Light Gray Silty SAND (SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.2%	Fine Sand	60.3%
Gravel	0.0%	Medium Sand	17.8%	Silt & Clay	21.7%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	14.3%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/22/17
Project Name:	Kings Bluff Water Main	Lab Report #:	3 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-2/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Light Gray Silty SAND (SM)

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates:		10/19-10/22/17		
Method A (1%)		Method B (0.1%)	x	Material Excluded?	None		
Procedure used to Obtain Specimen:		Moist	x	Air-Dried		Oven-Dried	
Sampling Method:	Stockpile:		Mechanically Split:		Quartered:	x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant	x	Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time:	2.0 hours		
				Shaking Apparatus?			
<b>Specimen:</b>	Pan No.	<b>S</b>	B) Tare Wt.	<b>0.0</b>			<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>206.3</b>		Pan No.	<b>S</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>180.5</b>		Dry Mass of Specimen after Wash +Tare			<b>142.5</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>180.5</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>142.5</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>206.3</b>		Dry Mass passing #200			<b>38.0</b>
F=(E-D)/D) Water Content of Specimen		<b>14.3%</b>		% Passing #200			<b>21.1%</b>

Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.1	0.2	180	<b>0.3</b>	0.2%	99.8%
#20	0.850	3.1	3.1	115	<b>6.2</b>	3.4%	96.6%
#40	0.425	16.6	15.9	75	<b>32.5</b>	18.0%	82.0%
#60	0.250	37.9	38.2	60	<b>76.1</b>	42.2%	57.8%
#100	0.150	59.8	60.3	40	<b>120.1</b>	66.5%	33.5%
#140	0.106	66.9	67.0	30	<b>133.9</b>	74.2%	25.8%
#200	0.075	70.8	70.5	20	<b>141.3</b>	78.3%	21.7%
Pan	<0.075	71.4	71.1	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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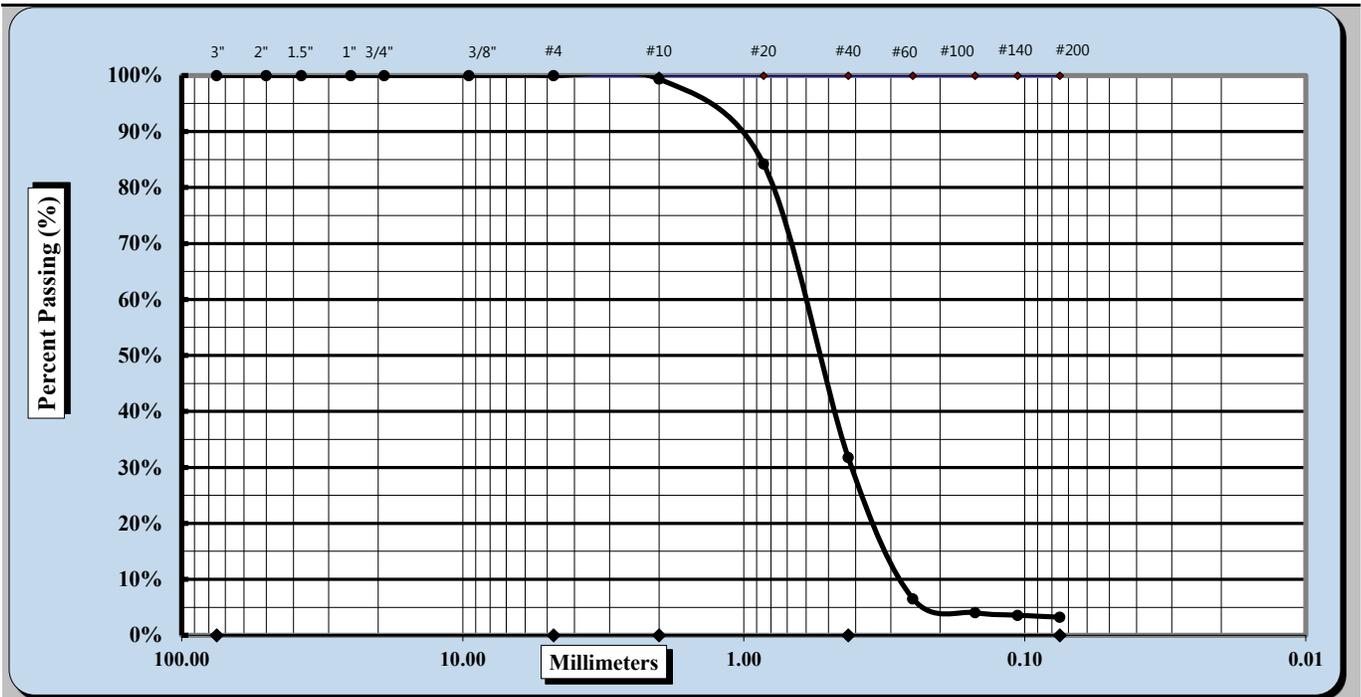
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 10/22/2017
Project Name: Kings Bluff Water Main	Lab Report #: 4 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (A-2/S4)	Elev/Depth: 8.5'-10.0'
Sample Description: Light Brown Poorly Graded SAND (SP)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#10	Coarse Sand 0.6%
Gravel	0.0%	Medium Sand 67.6%
Liquid Limit	N/A	Plastic Limit N/A
Maximum Dry Density	N/A	Assumed SG(D854) 2.650
Optimum Moisture	N/A	Natural Moisture 20.4%
		Fine Sand 28.6%
		Silt & Clay 3.2%
		Plastic Index N/A
		% Absorption N/A
		CBR N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/22/17
Project Name:	Kings Bluff Water Main	Lab Report #:	4 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (A-2/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Light Brown Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/19-10/22/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g		Soak Time:	2.0 hours
				Shaking Apparatus?
<b>Specimen:</b>	Pan No.	<b>T</b>	B) Tare Wt.	<b>0.0</b>
				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>208.3</b>		Pan No.	<b>T</b>
			B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>173.0</b>		Dry Mass of Specimen after Wash +Tare	
			<b>167.5</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>173.0</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
			<b>167.5</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>208.3</b>		Dry Mass passing #200	
			<b>5.5</b>	
F=(E-D)/D) Water Content of Specimen	<b>20.4%</b>		% Passing #200	
			<b>3.2%</b>	

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		Retained (Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.6	0.5	180	<b>1.1</b>	0.6%	99.4%
#20	0.850	12.0	15.3	115	<b>27.3</b>	15.8%	84.2%
#40	0.425	57.6	60.4	75	<b>118.0</b>	68.2%	31.8%
#60	0.250	80.9	80.8	60	<b>161.7</b>	93.5%	6.5%
#100	0.150	83.1	82.9	40	<b>166.0</b>	96.0%	4.0%
#140	0.106	83.5	83.3	30	<b>166.8</b>	96.4%	3.6%
#200	0.075	83.8	83.6	20	<b>167.4</b>	96.8%	3.2%
Pan	<0.075	83.9	83.6	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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# SIEVE ANALYSIS OF SOIL

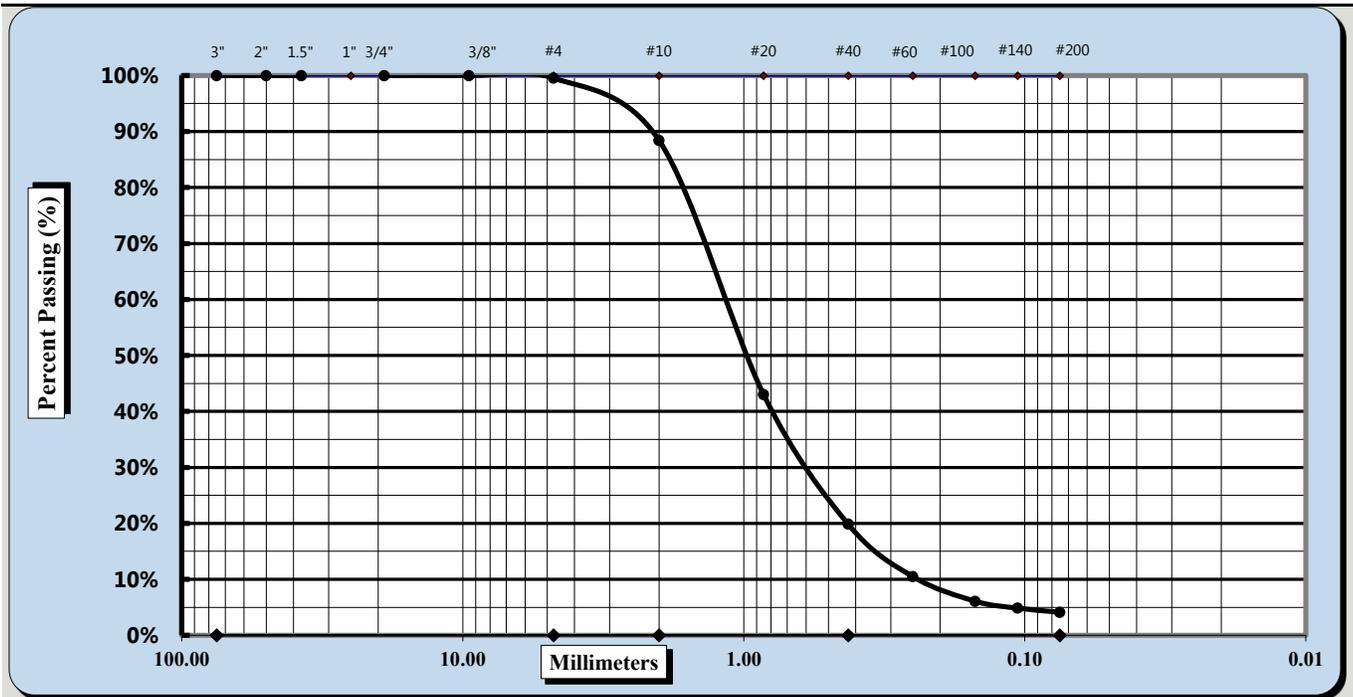


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	3 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-2A/S3)	Type:	Split Spoon
		Elev/Depth:	6.5'-7.0'
Sample Description:	Light Brown Poorly Graded SAND (SP)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	11.1%	Fine Sand	15.7%	
Gravel	0.5%	Medium Sand	68.5%	Silt & Clay	4.1%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	16.2%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 9/14/17
Project Name: Kings Bluff Water Main	Lab Report #: 3 of 27
Client Name: McKim & Creed	Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-2A/S3)	Type: Split Spoon
	Elev/Depth: 6.5'-7.0'

Sample Description: Light Brown Poorly Graded SAND (SP)						
Estimate Max. Particle Size (99% Passing):			<b>#4</b>	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?			Soaked without Dispersant		x	Ultrasonic Bath
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 5 hours	
					Shaking Apparatus	
<b>Specimen:</b>	Pan No.	<b>BK</b>	B) Tare Wt.		Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>225.4</b>		Pan No.	<b>BK</b>
					Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>193.9</b>		Dry Mass of Washed Sample + Tare Wt.	
					<b>186.4</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>193.9</b>		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
					<b>186.4</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>225.4</b>		Dry Mass passing #200	
					<b>7.5</b>	
F=(E-D)/D) Water Content of Specimen			<b>16.2%</b>		% Passing #200	
					<b>3.9%</b>	
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.9	0.90	325	0.5%	99.5%
#10	2.000	22.5	21.60	180	11.6%	88.4%
#20	0.850	110.5	88.00	115	57.0%	43.0%
#40	0.425	155.4	44.90	75	80.1%	19.9%
#60	0.250	173.6	18.20	60	89.5%	10.5%
#100	0.150	182.1	8.50	40	93.9%	6.1%
#140	0.106	184.5	2.40	30	95.2%	4.8%
#200	0.075	185.9	1.40	20	95.9%	4.1%
Pan	<0.075	186.2	0.3	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	4 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-2A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Brown Clayey SAND (SC)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#4	Coarse Sand 4.0%
Gravel	3.8%	Fine Sand 27.6%
Liquid Limit	N/A	Medium Sand 17.2%
Maximum Dry Density	N/A	Silt & Clay 47.5%
Optimum Moisture	N/A	Plastic Limit N/A
		Plastic Index N/A
		% Absorption N/A
		Natural Moisture 37.2%
		CBR N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

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 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 9/14/17
Project Name: Kings Bluff Water Main		Lab Report #: 4 of 27
Client Name: McKim & Creed		Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various (NC)		
Log/Sample Id. 128 (R-2A/S5)	Type: Split Spoon	Elev/Depth: 13.5'-15.0'

Sample Description: Brown Clayey SAND (SC)						
Estimate Max. Particle Size (99% Passing):			#4	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x
Estimated Wet Mass of specimen required:		200 g.		Soak Time: 24 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No. 1520	B) Tare Wt. 0.0		Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)		213.3		Pan No. 1520	Tare Wt. 0.0	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		155.5		Dry Mass of Washed Sample + Tare Wt.		86.9
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		155.5		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		86.9
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		213.3		Dry Mass passing #200		68.6
F=(E-D)/D) Water Content of Specimen		37.2%		% Passing #200		44.1%
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	5.9	5.90	325	3.8%	96.2%
#10	2.000	12.1	6.20	180	7.8%	92.2%
#20	0.850	28.3	16.20	115	18.2%	81.8%
#40	0.425	38.8	10.50	75	25.0%	75.0%
#60	0.250	44.4	5.60	60	28.6%	71.4%
#100	0.150	53.7	9.30	40	34.5%	65.5%
#140	0.106	64.2	10.50	30	41.3%	58.7%
#200	0.075	81.7	17.50	20	52.5%	47.5%
Pan	<0.075	86.9	5.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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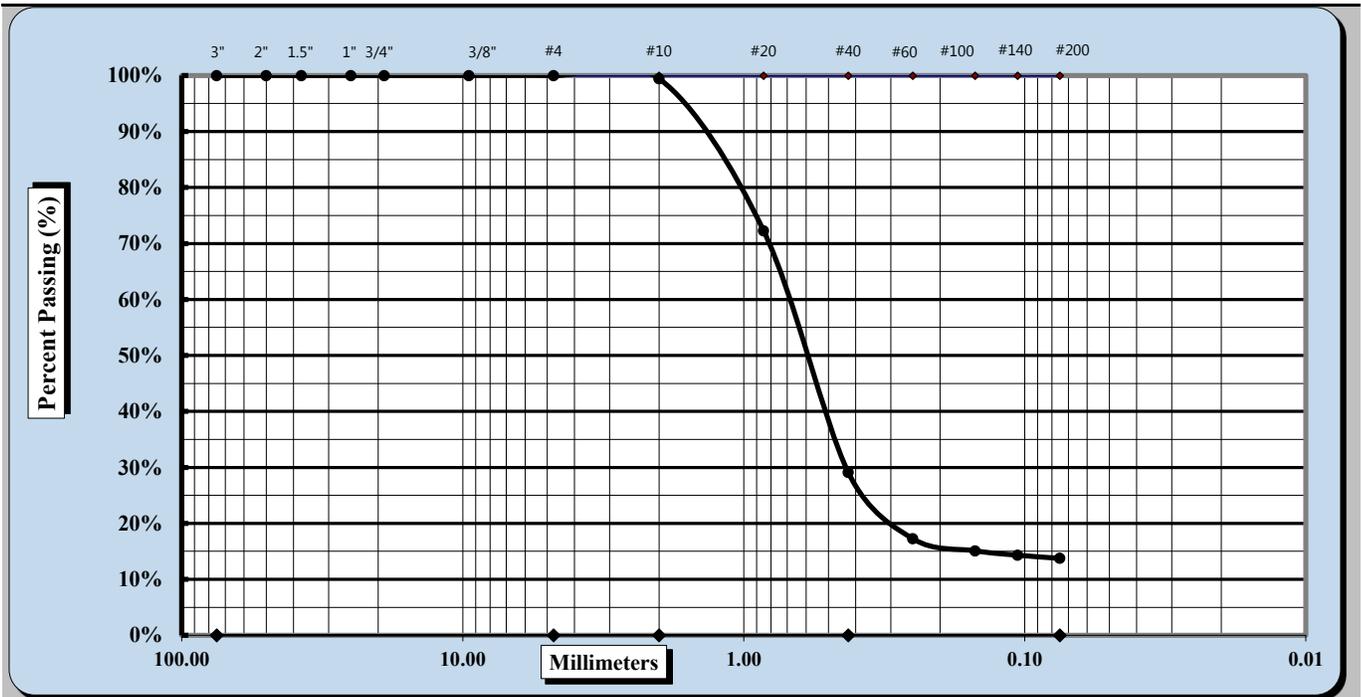
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/22/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	5 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-2A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Gray Silty SAND (SM) with Clay		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.6%	Fine Sand	15.4%	
Gravel	0.0%	Medium Sand	70.3%	Silt & Clay	13.7%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	15.2%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/22/17
Project Name:	Kings Bluff Water Main	Lab Report #:	5 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-2A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Gray Silty SAND (SM) with Clay							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates: 10/19-10/22/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 2.0 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>204.4</b>		Pan No.		<b>E</b>	
						B) Tare Wt. <b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>177.5</b>		Dry Mass of Specimen after Wash +Tare <b>153.4</b>			
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>177.5</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>153.4</b>			
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>204.4</b>		Dry Mass passing #200 <b>24.1</b>			
F=(E-D)/D) Water Content of Specimen		<b>15.2%</b>		% Passing #200 <b>13.6%</b>			
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.6	0.4	180		0.6%	99.4%
#20	0.850	29.8	19.4	115		27.7%	72.3%
#40	0.425	66.9	58.9	75		70.9%	29.1%
#60	0.250	74.6	72.3	60		82.8%	17.2%
#100	0.150	75.8	74.9	40		84.9%	15.1%
#140	0.106	76.3	75.8	30		85.7%	14.3%
#200	0.075	76.7	76.4	20		86.3%	13.7%
Pan	<0.075	76.8	76.5	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



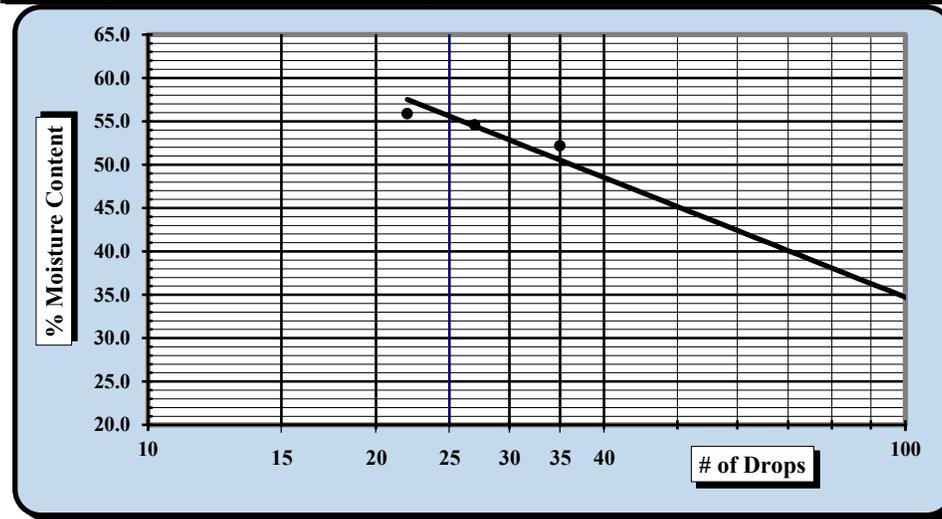
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	10/22/17
Project Name:	Kings Bluff Water Main	Test Date(s)	10/19-10/22/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-2A/S5	Depth(ft): 13.5'-15.0'

Sample Description: Brown-Red Sandy CLAY					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3			4	5		
A	Tare Weight	11.08	10.64	11.63				11.35	10.72	
B	Wet Soil Weight + A	20.26	19.76	20.39				20.01	19.77	
C	Dry Soil Weight + A	17.11	16.54	17.25				18.68	18.38	
D	Water Weight (B-C)	3.15	3.22	3.14				1.33	1.39	
E	Dry Soil Weight (C-A)	6.03	5.90	5.62				7.33	7.66	
F	% Moisture (D/E)*100	52.2%	54.6%	55.9%				18.1%	18.1%	
N	# OF DROPS	35	27	22				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>18.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>56</b>
Plastic Limit	<b>18</b>
Plastic Index	<b>38</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

**MC = 30.5%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

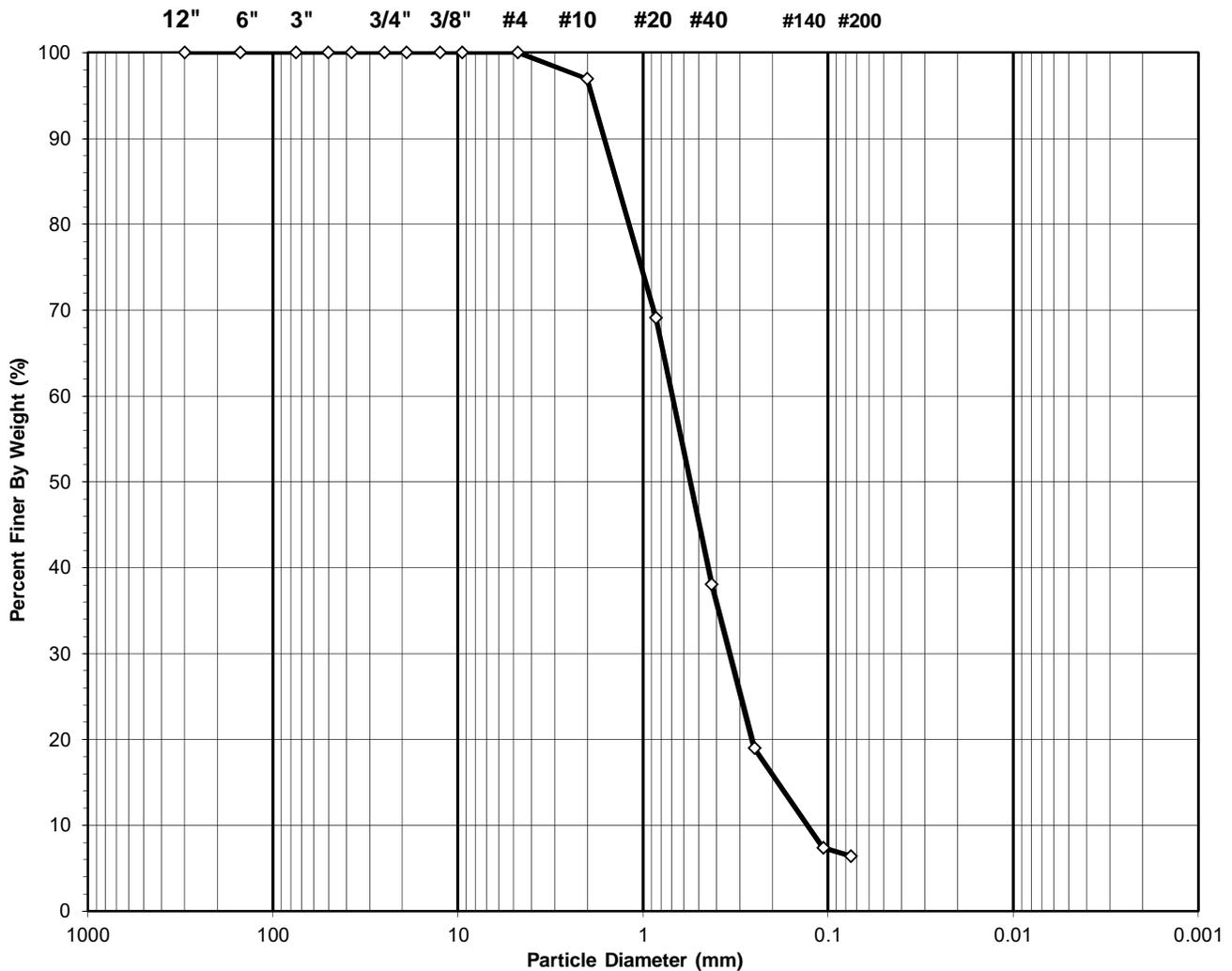
11/20/2017  
 Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-3B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	6-7.5
Project No.:	R-2017-861-001	Sample No.:	SS-3
Lab ID:	R-2017-861-001-004	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp-sc, ASSUMED**

**D60 = 0.69      CC = 1.29**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.34      CU = 5.39**

**D10 = 0.13**

Tested By RT      Date 11/14/17      Checked By NC      Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-3B
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 6-7.5
Project No.: R-2017-861-001	Sample No.: SS-3
Lab ID: R-2017-861-001-004	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	29	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	748.78	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	671.46	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	204.33	Weight of Tare (g):	NA
Weight of Water (g):	77.32	Weight of Water (g):	NA
Weight of Dry Sample (g):	467.13	Weight of Dry Sample (g):	NA
*Moisture Content (%):	16.6	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	467.13
Dry Weight of - 3/4" Sample (g):	467.1	Weight of - #200 Material (g):	29.92
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	437.21
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.00	0.00	0.00	100.00	<b>100.00</b>
#10	2.00	14.28	3.06	3.06	96.94	<b>96.94</b>
#20	0.850	130.02	27.83	30.89	69.11	<b>69.11</b>
#40	0.425	144.97	31.03	61.92	38.08	<b>38.08</b>
#60	0.250	89.22	19.10	81.02	18.98	<b>18.98</b>
#140	0.106	54.20	11.60	92.63	7.37	<b>7.37</b>
#200	0.075	4.52	0.97	93.59	6.41	<b>6.41</b>
Pan	-	29.92	6.41	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	W-3B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	13.5-15
Project No.:	R-2017-861-001	Sample No.:	SS-5
Lab ID:	R-2017-861-001-005	Soil Description:	GRAY LEAN CLAY

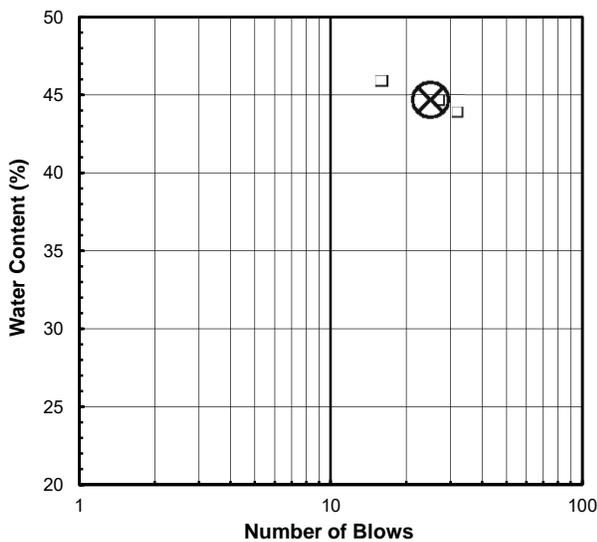
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried)**  
**seive material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1506	32	36	26	U
Wt. of Tare & Wet Sample (g):	703.20	40.92	39.49	44.66	L
Wt. of Tare & Dry Sample (g):	531.76	34.54	33.08	36.80	T
Weight of Tare (g):	145.66	20.00	18.71	19.67	I
Weight of Water (g):	171.4	6.4	6.4	7.9	P
Weight of Dry Sample (g):	386.1	14.5	14.4	17.1	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>44.4</b>	<b>43.9</b>	<b>44.6</b>	<b>45.9</b>	<b>N</b>
<b>Number of Blows:</b>		<b>32</b>	<b>27</b>	<b>16</b>	<b>T</b>

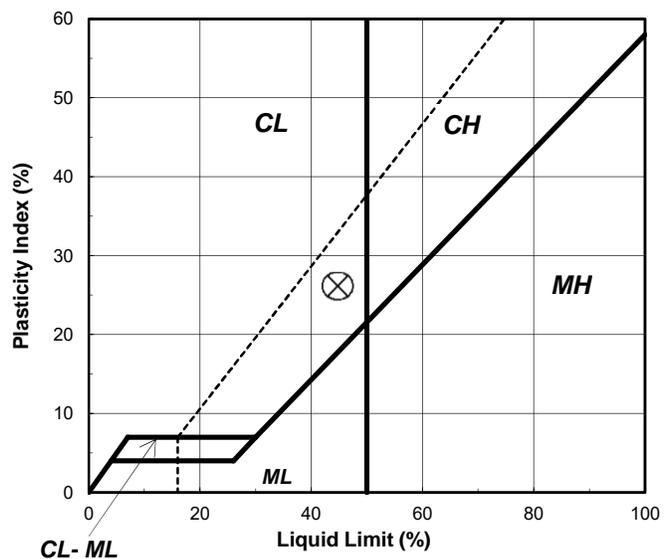
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	3	47		<b>Liquid Limit (%):</b> 45
Wt. of Tare & Wet Sample (g):	25.18	24.32		<b>Plastic Limit (%):</b> 19
Wt. of Tare & Dry Sample (g):	24.13	23.33		<b>Plasticity Index (%):</b> 26
Weight of Tare (g):	18.70	18.29		<b>USCS Symbol:</b> CL
Weight of Water (g):	1.1	1.0		
Weight of Dry Sample (g):	5.4	5.0		
<b>Moisture Content (%):</b>	<b>19.3</b>	<b>19.6</b>	<b>-0.3</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/17/17 Checked By NC Date 11/18/17

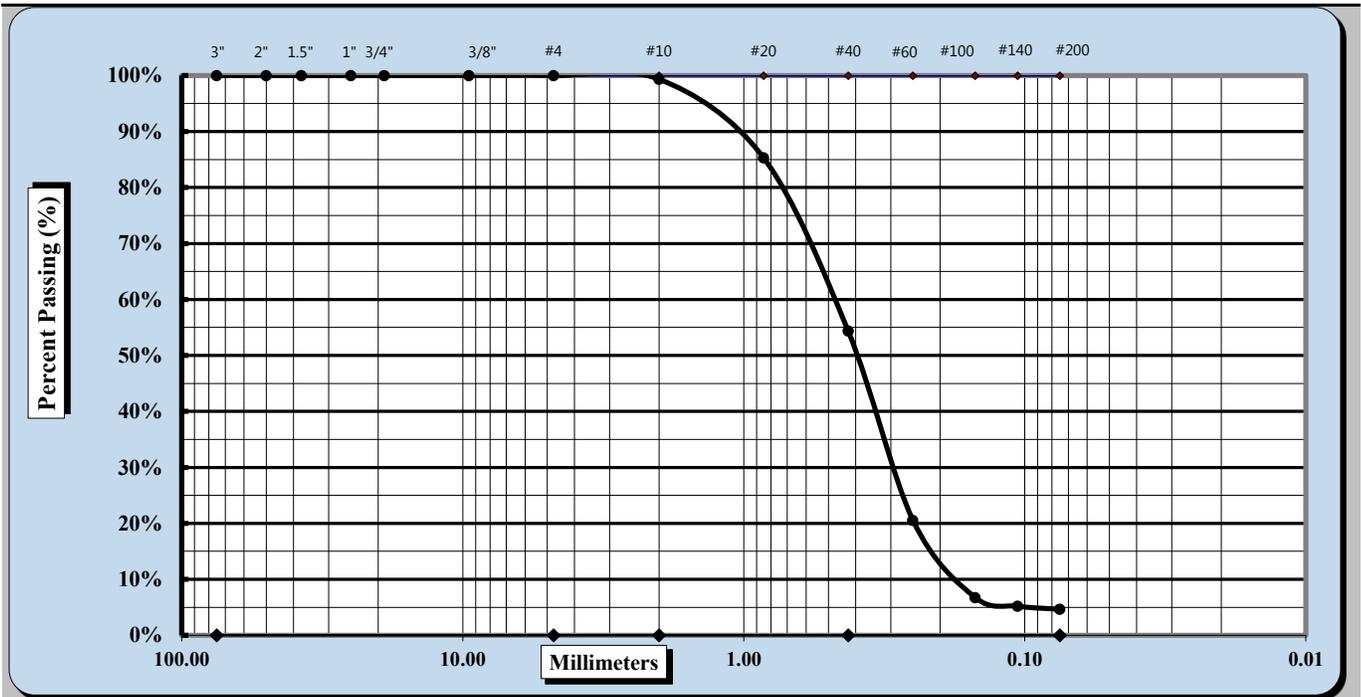
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 5 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-3A/S4)	Type: Split Spoon
Sample Description: Light Brown Poorly Graded SAND (SP)	Elev/Depth: 8.5'-10.0'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#10 Coarse Sand	0.7% Fine Sand
Gravel	0.0%	45.0% Silt & Clay
Liquid Limit	N/A	N/A Plastic Index
Maximum Dry Density	N/A Assumed SG(D854)	2.650 % Absorption
Optimum Moisture	N/A Natural Moisture	19.4% CBR

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	5 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-3A/S4)	Type:	Split Spoon	Elev/Depth:	8.5'-10.0'
----------------	---------------	-------	-------------	-------------	------------

Sample Description: Light Brown Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>52</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>216.2</b>	Pan No. <b>52</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>181.0</b>	Dry Mass of Specimen after Wash +Tare <b>173.0</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>181.0</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>173.0</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>216.2</b>	Dry Mass passing #200 <b>8.0</b>	
F=(E-D)/D) Water Content of Specimen	<b>19.4%</b>	% Passing #200 <b>4.4%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.5	0.7	180	<b>1.2</b>	0.7%	99.3%
#20	0.850	12.2	14.4	115	<b>26.6</b>	14.7%	85.3%
#40	0.425	39.1	43.5	75	<b>82.6</b>	45.6%	54.4%
#60	0.250	70.8	73.0	60	<b>143.8</b>	79.4%	20.6%
#100	0.150	84.2	84.6	40	<b>168.8</b>	93.3%	6.7%
#140	0.106	85.7	85.9	30	<b>171.6</b>	94.8%	5.2%
#200	0.075	86.3	86.3	20	<b>172.6</b>	95.4%	4.6%
Pan	<0.075	86.4	86.4	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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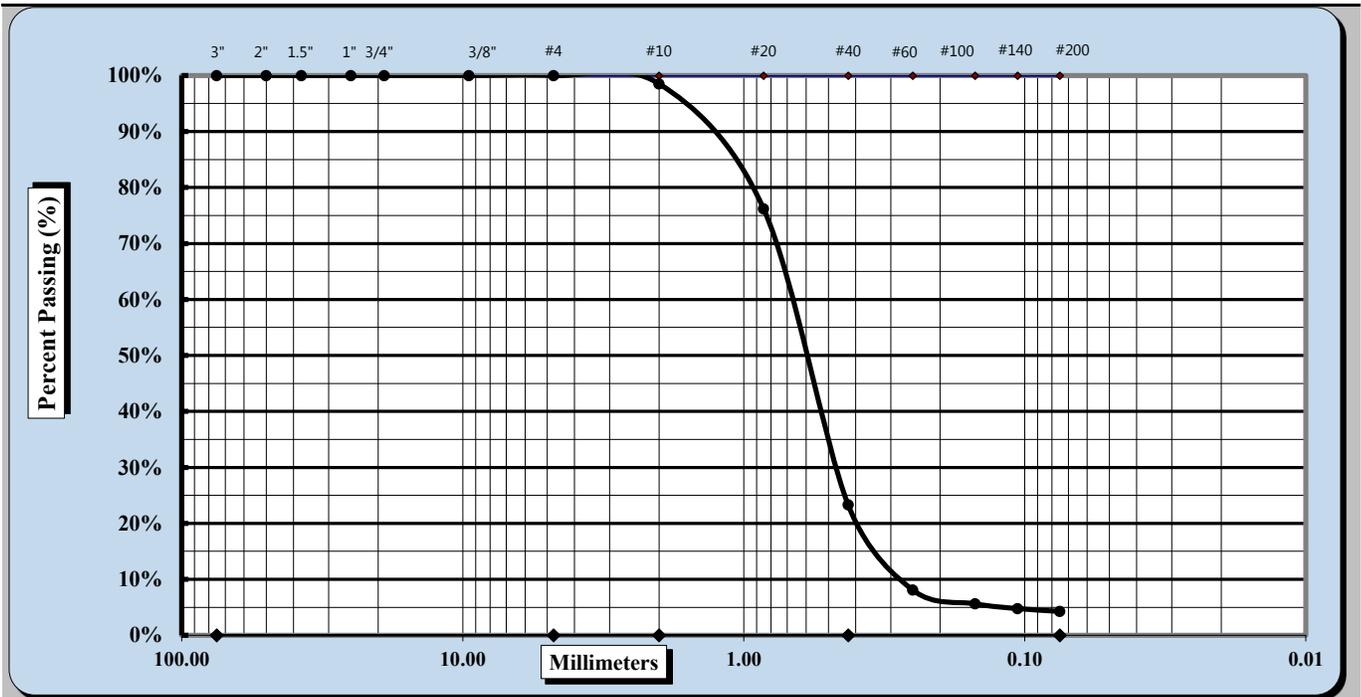
# SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	6 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-3A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'
Sample Description:	Light Brown Poorly Graded SAND (SP)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	1.5%	Fine Sand	19.0%	
Gravel	0.0%	Medium Sand	75.2%	Silt & Clay	4.3%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	22.3%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	6 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-3A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Light Brown Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#4</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>HC</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>215.2</b>	Pan No. <b>HC</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>176.0</b>	Dry Mass of Specimen after Wash +Tare <b>168.7</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>m</sub></b> )	<b>176.0</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub></b> ) <b>168.7</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub></b> )	<b>215.2</b>	Dry Mass passing #200 <b>7.3</b>	
F=(E-D)/D Water Content of Specimen	<b>22.3%</b>	% Passing #200 <b>4.1%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	1.2	1.4	180	<b>2.6</b>	1.5%	98.5%
#20	0.850	21.0	20.9	115	<b>41.9</b>	23.8%	76.2%
#40	0.425	68.8	66.2	75	<b>135.0</b>	76.7%	23.3%
#60	0.250	82.0	79.8	60	<b>161.8</b>	91.9%	8.1%
#100	0.150	83.6	82.5	40	<b>166.1</b>	94.4%	5.6%
#140	0.106	84.1	83.5	30	<b>167.6</b>	95.2%	4.8%
#200	0.075	84.4	84.1	20	<b>168.5</b>	95.7%	4.3%
Pan	<0.075	84.4	84.2	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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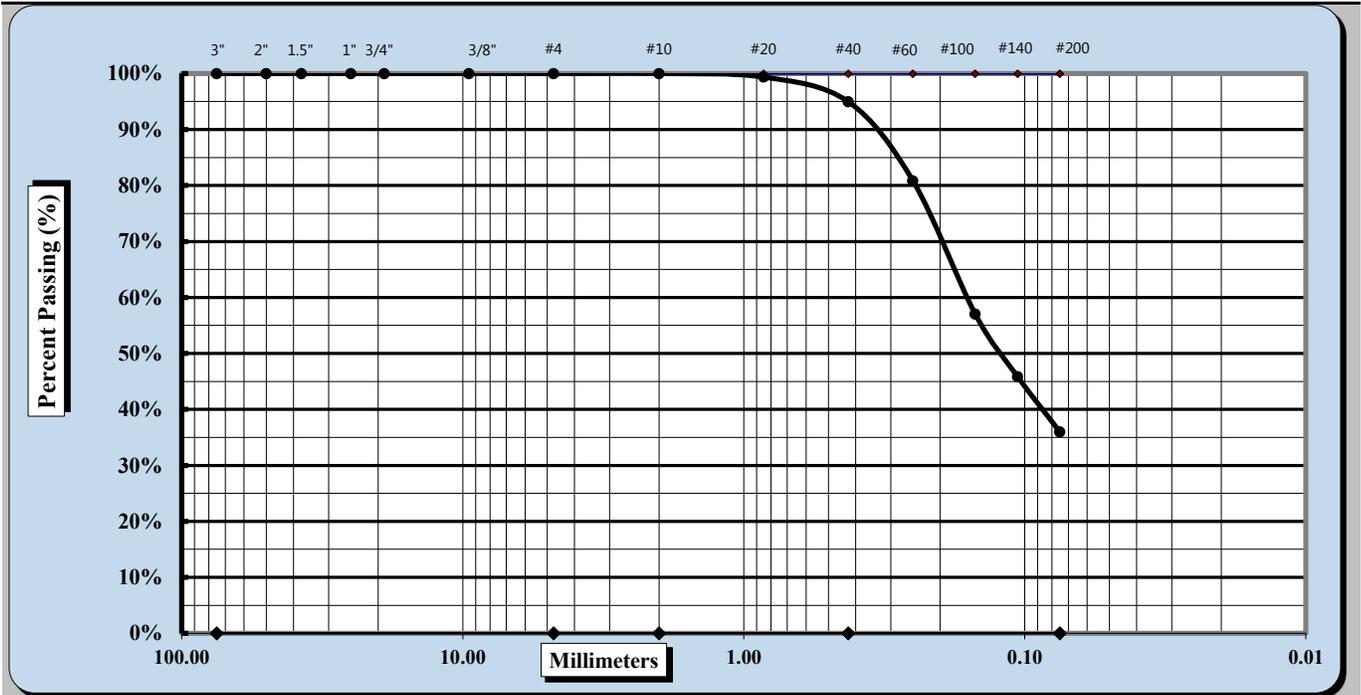
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	7 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-3B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Light Gray Clayey SAND (SC)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	59.0%	
Gravel	0.0%	Medium Sand	5.0%	Silt & Clay	36.0%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	14.4%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	7 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-3B/S2)	Type:	Split Spoon	Elev/Depth:	3.5'-5.0'
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Sample Description: Light Gray Clayey SAND (SC)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	24 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>GTH</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>219.1</b>	Pan No. <b>GTH</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>191.5</b>	Dry Mass of Specimen after Wash +Tare <b>126.6</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>191.5</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>126.6</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>219.1</b>	Dry Mass passing #200 <b>64.9</b>	
F=(E-D)/D) Water Content of Specimen	<b>14.4%</b>	% Passing #200 <b>33.9%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.7	0.5	115	<b>1.2</b>	0.6%	99.4%
#40	0.425	5.1	4.5	75	<b>9.6</b>	5.0%	95.0%
#60	0.250	19.0	17.7	60	<b>36.7</b>	19.2%	80.8%
#100	0.150	41.5	40.8	40	<b>82.3</b>	43.0%	57.0%
#140	0.106	52.1	51.6	30	<b>103.7</b>	54.2%	45.8%
#200	0.075	61.8	60.8	20	<b>122.6</b>	64.0%	36.0%
Pan	<0.075	64.0	62.7	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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### SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	8 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-3B/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Brown-Orange Poorly Graded SAND with Silt (SP-SM)		



# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 9/14/17
Project Name: Kings Bluff Water Main	Lab Report #: 8 of 27
Client Name: McKim & Creed	Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-3B/S5)	Type: Split Spoon
	Elev/Depth: 13.5'-15.0'

Sample Description: Brown-Orange Poorly Graded SAND with Silt (SP-SM)						
Estimate Max. Particle Size (99% Passing):			#4	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?			Soaked without Dispersant		Soaked with Dispersant x	
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 5 hours	
Shaking Apparatus						
<b>Specimen:</b>	Pan No.	<b>BD</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>215.6</b>	Pan No.	<b>BD</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>177.2</b>	Dry Mass of Washed Sample + Tare Wt. <b>166.6</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>177.2</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>166.6</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>215.6</b>	Dry Mass passing #200 <b>10.6</b>		
F=(E-D)/D) Water Content of Specimen			<b>21.7%</b>	% Passing #200 <b>6.0%</b>		
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.2	0.20	325	0.1%	99.9%
#10	2.000	3.9	3.70	180	2.2%	97.8%
#20	0.850	40.9	37.00	115	23.1%	76.9%
#40	0.425	111.7	70.80	75	63.0%	37.0%
#60	0.250	150.7	39.00	60	85.0%	15.0%
#100	0.150	160.3	9.60	40	90.5%	9.5%
#140	0.106	164.6	4.30	30	92.9%	7.1%
#200	0.075	166.3	1.70	20	93.8%	6.2%
Pan	<0.075	166.5	0.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

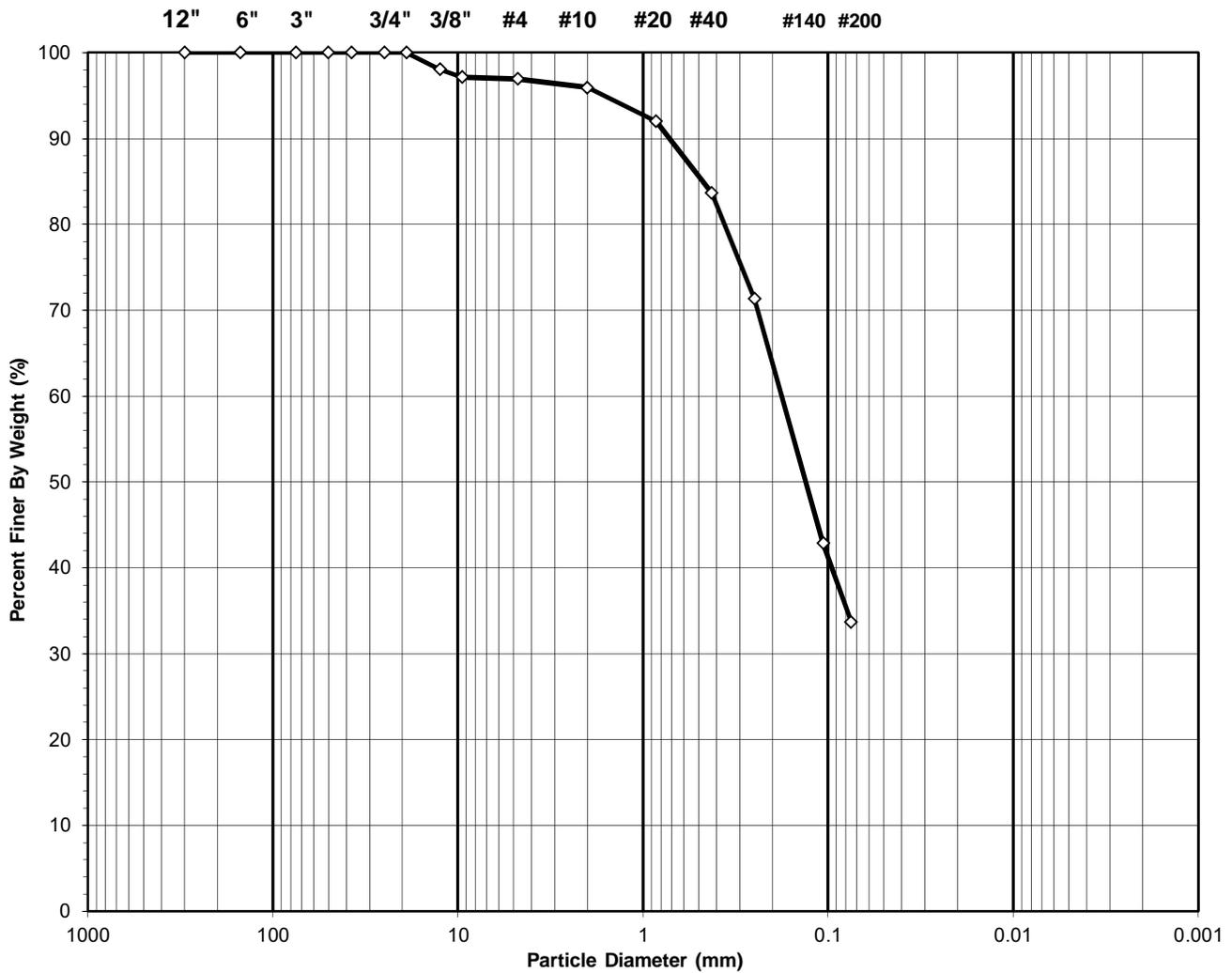
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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-5B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-006	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-5B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-006	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	48	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	752.25	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	647.39	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	202.80	Weight of Tare (g):	NA
Weight of Water (g):	104.86	Weight of Water (g):	NA
Weight of Dry Sample (g):	444.59	Weight of Dry Sample (g):	NA
*Moisture Content (%):	23.6	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	444.59
Dry Weight of - 3/4" Sample (g):	444.6	Weight of - #200 Material (g):	149.85
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	294.74
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	8.66	1.95	1.95	98.05	<b>98.05</b>
3/8"	9.50	4.04	0.91	2.86	97.14	<b>97.14</b>
#4	4.75	0.84	0.19	3.05	96.95	<b>96.95</b>
#10	2.00	4.50	1.01	4.06	95.94	<b>95.94</b>
#20	0.850	17.46	3.93	7.98	92.02	<b>92.02</b>
#40	0.425	37.26	8.38	16.37	83.63	<b>83.63</b>
#60	0.250	54.48	12.25	28.62	71.38	<b>71.38</b>
#140	0.106	126.61	28.48	57.10	42.90	<b>42.90</b>
#200	0.075	40.89	9.20	66.29	33.71	<b>33.71</b>
Pan	-	149.85	33.71	100.00	-	-

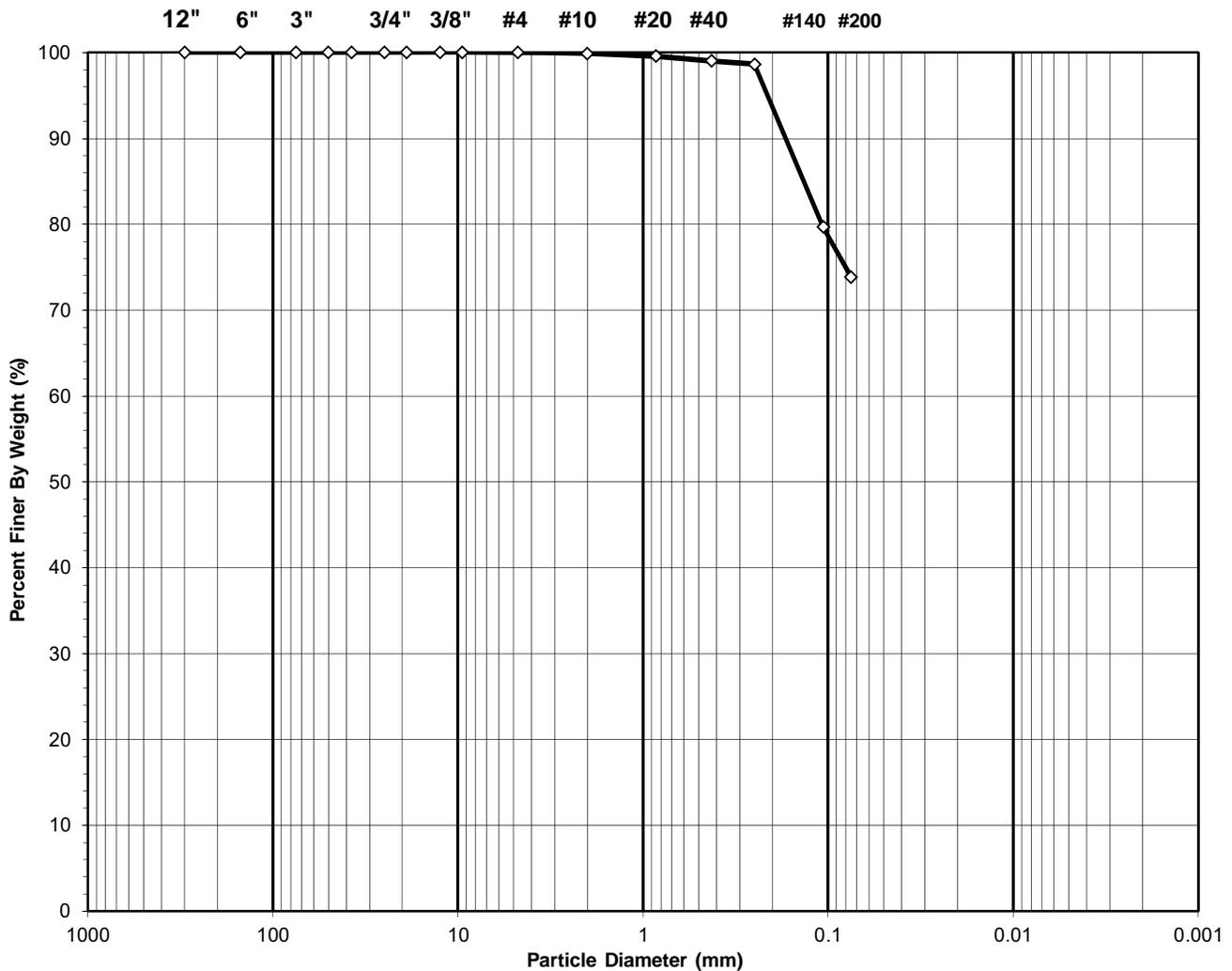
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By    RT                      Date    11/14/17                      Checked By    NC                      Date    11/14/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-5B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	13.5-15
Project No.:	R-2017-861-001	Sample No.:	SS-5
Lab ID:	R-2017-861-001-007	Soil Color:	Gray

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**cl, ASSUMED**

**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-5B
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 13.5-15
Project No.: R-2017-861-001	Sample No.: SS-5
Lab ID: R-2017-861-001-007	Soil Color: Gray

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	27	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	995.44	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	760.95	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	204.32	Weight of Tare (g):	NA
Weight of Water (g):	234.49	Weight of Water (g):	NA
Weight of Dry Sample (g):	556.63	Weight of Dry Sample (g):	NA
*Moisture Content (%):	42.1	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	556.63
Dry Weight of - 3/4" Sample (g):	556.6	Weight of - #200 Material (g):	410.94
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	145.69
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.55	0.10	0.10	99.90	99.90
#20	0.850	1.79	0.32	0.42	99.58	99.58
#40	0.425	3.07	0.55	0.97	99.03	99.03
#60	0.250	2.08	0.37	1.35	98.65	98.65
#140	0.106	105.53	18.96	20.30	79.70	79.70
#200	0.075	32.67	5.87	26.17	73.83	73.83
Pan	-	410.94	73.83	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

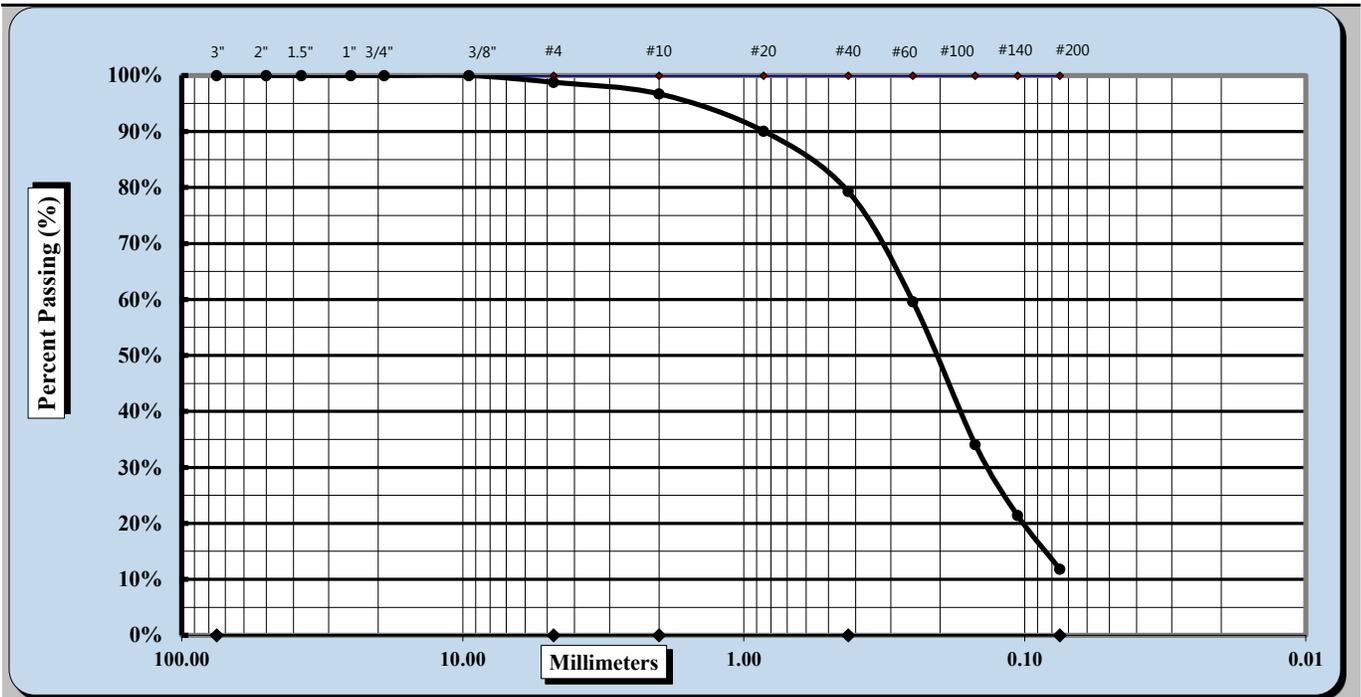
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/23/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	6 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-6B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Dark Brown Poorly Graded SAND with Silt (SP-SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	2.1%	Fine Sand	67.5%	
Gravel	1.2%	Medium Sand	17.4%	Silt & Clay	11.8%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	22.3%	CBR	N/A	

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/23/17
Project Name:	Kings Bluff Water Main	Lab Report #:	6 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-6B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Dark Brown Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing):	<b>#4</b>	Testing Dates:	10/20-10/23/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g		Soak Time:	4.0 hours
				Shaking Apparatus?
<b>Specimen:</b>	Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>
				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>213.2</b>		Pan No.	<b>E</b>
			B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>174.3</b>		Dry Mass of Specimen after Wash +Tare	
			<b>156.5</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>174.3</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
			<b>156.5</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>213.2</b>		Dry Mass passing #200	
			<b>17.8</b>	
F=(E-D)/D) Water Content of Specimen	<b>22.3%</b>		% Passing #200	
			<b>10.2%</b>	

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		Retained (Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	2.1	325	<b>2.1</b>	1.2%	98.8%
#10	2.000	0.8	4.9	180	<b>5.7</b>	3.3%	96.7%
#20	0.850	5.7	11.6	115	<b>17.3</b>	9.9%	90.1%
#40	0.425	15.3	20.8	75	<b>36.1</b>	20.7%	79.3%
#60	0.250	33.5	36.9	60	<b>70.4</b>	40.4%	59.6%
#100	0.150	57.2	57.7	40	<b>114.9</b>	65.9%	34.1%
#140	0.106	68.6	68.4	30	<b>137.0</b>	78.6%	21.4%
#200	0.075	77.0	76.7	20	<b>153.7</b>	88.2%	11.8%
Pan	<0.075	78.4	78.1	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



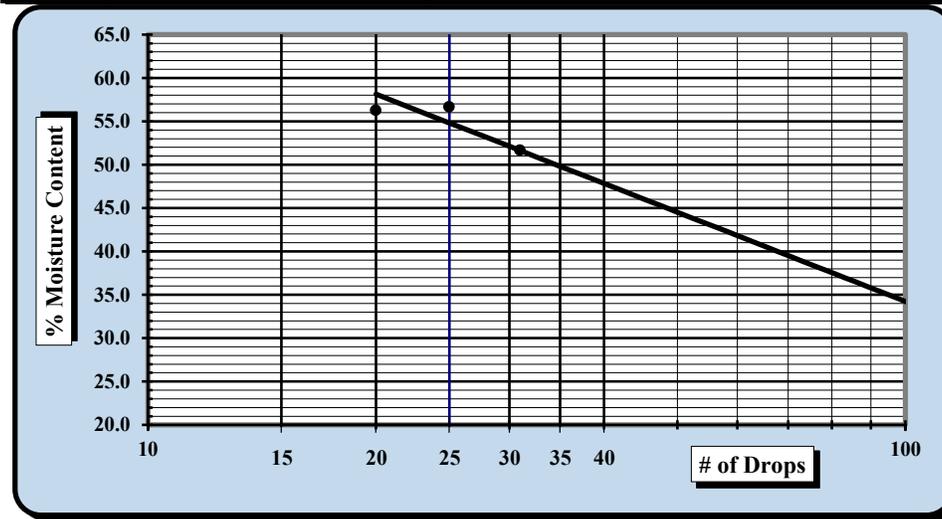
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	10/23/17
Project Name:	Kings Bluff Water Main	Test Date(s)	10/20-10/23/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-6B/S4	Depth(ft): 8.5'-10.0'

Sample Description: Dark Gray Sandy CLAY					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3			4	5		
A	Tare Weight	11.07	10.65	11.61				11.34	10.73	
B	Wet Soil Weight + A	19.76	18.97	20.97				19.18	19.12	
C	Dry Soil Weight + A	16.80	15.96	17.60				18.03	17.90	
D	Water Weight (B-C)	2.96	3.01	3.37				1.15	1.22	
E	Dry Soil Weight (C-A)	5.73	5.31	5.99				6.69	7.17	
F	% Moisture (D/E)*100	51.7%	56.7%	56.3%				17.2%	17.0%	
N	# OF DROPS	31	25	20				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>17.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>55</b>
Plastic Limit	<b>17</b>
Plastic Index	<b>38</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

**MC = 33.1%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/20/2017</u> Date
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# SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	9 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-4A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'
Sample Description:	Light Brown Poorly Graded SAND with Silt (SP-SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#4	Coarse Sand	2.0%	Fine Sand	28.5%
Gravel	0.3%	Medium Sand	63.3%	Silt & Clay	5.9%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	16.4%	CBR	N/A

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 9/14/17
Project Name: Kings Bluff Water Main	Lab Report #: 9 of 27
Client Name: McKim & Creed	Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-4A/S3)	Type: Split Spoon
	Elev/Depth: 6.0'-7.5'

Sample Description: Light Brown Poorly Graded SAND with Silt (SP-SM)						
Estimate Max. Particle Size (99% Passing):			<b>#4</b>	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x
Estimated Wet Mass of specimen required:			200 g.	Soak Time: 5 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No.	<b>GP</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>211.9</b>	Pan No.	<b>GP</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>182.0</b>	Dry Mass of Washed Sample + Tare Wt. <b>171.9</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>182.0</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>171.9</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>211.9</b>	Dry Mass passing #200 <b>10.1</b>		
F=(E-D)/D) Water Content of Specimen			<b>16.4%</b>	% Passing #200 <b>5.5%</b>		
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.6	0.60	325	0.3%	99.7%
#10	2.000	4.2	3.60	180	2.3%	97.7%
#20	0.850	34.2	30.00	115	18.8%	81.2%
#40	0.425	119.4	85.20	75	65.6%	34.4%
#60	0.250	160.9	41.50	60	88.4%	11.6%
#100	0.150	169.7	8.80	40	93.2%	6.8%
#140	0.106	170.9	1.20	30	93.9%	6.1%
#200	0.075	171.3	0.40	20	94.1%	5.9%
Pan	<0.075	171.7	0.4	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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**SIEVE ANALYSIS OF SOIL**



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	10 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-4A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'
Sample Description:	Brown-Orange Clayey SAND (SC)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.7%	Fine Sand	44.2%
Gravel	0.2%	Medium Sand	26.5%	Silt & Clay	28.5%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	26.6%	CBR	N/A

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	10 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-4A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Brown-Orange Clayey SAND (SC)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	24 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>SSDD</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>215.4</b>	Pan No. <b>SSDD</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>170.1</b>	Dry Mass of Specimen after Wash +Tare <b>122.3</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>170.1</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>122.3</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>215.4</b>	Dry Mass passing #200 <b>47.8</b>	
F=(E-D)/D Water Content of Specimen	<b>26.6%</b>	% Passing #200 <b>28.1%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.4	0.0	325	<b>0.4</b>	0.2%	99.8%
#10	2.000	1.1	0.5	180	<b>1.6</b>	0.9%	99.1%
#20	0.850	7.3	7.3	115	<b>14.6</b>	8.6%	91.4%
#40	0.425	23.4	23.2	75	<b>46.6</b>	27.4%	72.6%
#60	0.250	37.1	36.4	60	<b>73.5</b>	43.2%	56.8%
#100	0.150	54.7	54.0	40	<b>108.7</b>	63.9%	36.1%
#140	0.106	59.3	58.6	30	<b>117.9</b>	69.3%	30.7%
#200	0.075	61.2	60.5	20	<b>121.7</b>	71.5%	28.5%
Pan	<0.075	61.4	60.8	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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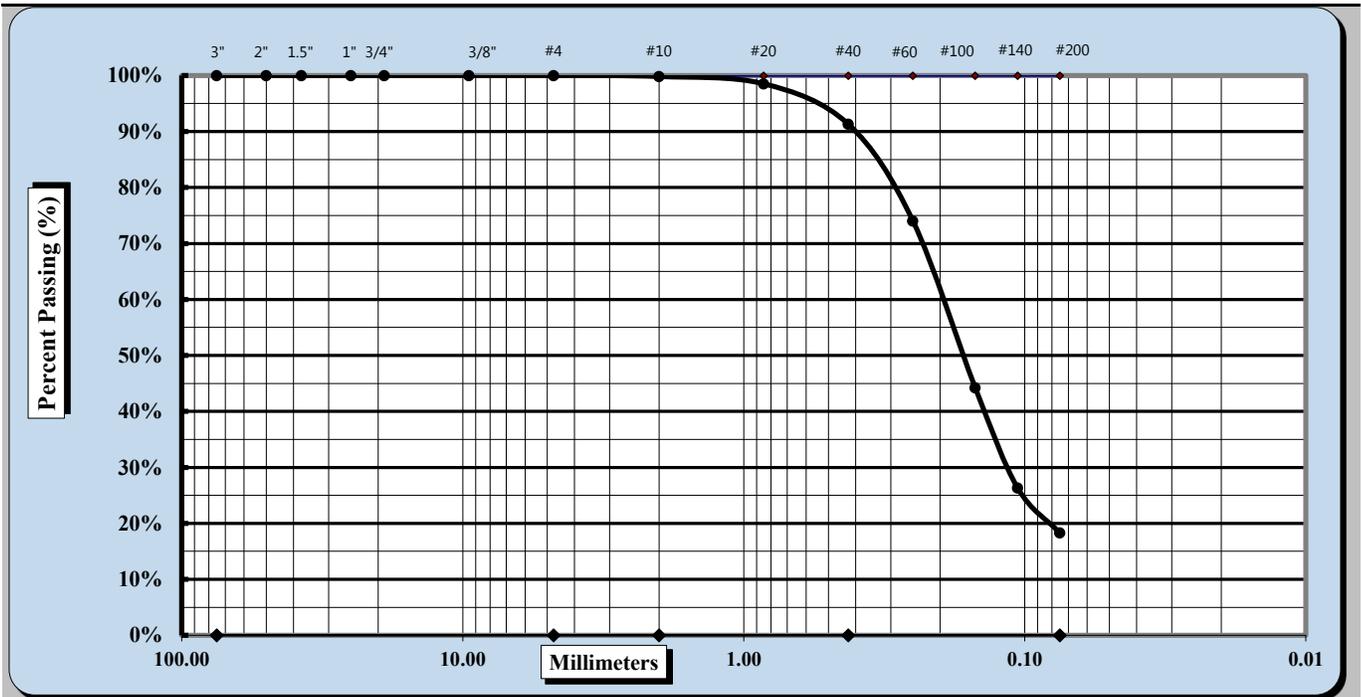
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 10/23/2017
Project Name: Kings Bluff Water Main	Lab Report #: 7 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
	Date Sampled: Various
Location: Various/Water Main/R-O-W	
Log/Sample Id. 155 (W-7A/S2)	Elev/Depth: 3.5'-5.0'
Sample Description: Light Brown Silty SAND (SM)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.2%
Gravel	0.0%	Medium Sand	8.5%
Liquid Limit	N/A	Plastic Limit	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650
Optimum Moisture	N/A	Natural Moisture	18.8%
		Fine Sand	73.1%
		Silt & Clay	18.3%
		Plastic Index	N/A
		% Absorption	N/A
		CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/23/17
Project Name:	Kings Bluff Water Main	Lab Report #:	7 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-7A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Light Brown Silty SAND (SM)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/20-10/23/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:		Moist	x	Air-Dried
				Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	4.0 hours	Shaking Apparatus?
<b>Specimen:</b>	Pan No. <b>S</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>	
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>211.2</b>	Pan No. <b>S</b>	B) Tare Wt. <b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>177.8</b>	Dry Mass of Specimen after Wash +Tare		<b>147.3</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>177.8</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>147.3</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )	<b>211.2</b>	Dry Mass passing #200		<b>30.5</b>
F=(E-D)/D) Water Content of Specimen	<b>18.8%</b>	% Passing #200		<b>17.2%</b>

Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.3	180	<b>0.3</b>	0.2%	99.8%
#20	0.850	0.6	2.0	115	<b>2.6</b>	1.5%	98.5%
#40	0.425	5.2	10.2	75	<b>15.4</b>	8.7%	91.3%
#60	0.250	18.1	28.1	60	<b>46.2</b>	26.0%	74.0%
#100	0.150	45.4	53.8	40	<b>99.2</b>	55.8%	44.2%
#140	0.106	63.6	67.4	30	<b>131.0</b>	73.7%	26.3%
#200	0.075	72.3	73.0	20	<b>145.3</b>	81.7%	18.3%
Pan	<0.075	73.5	73.7	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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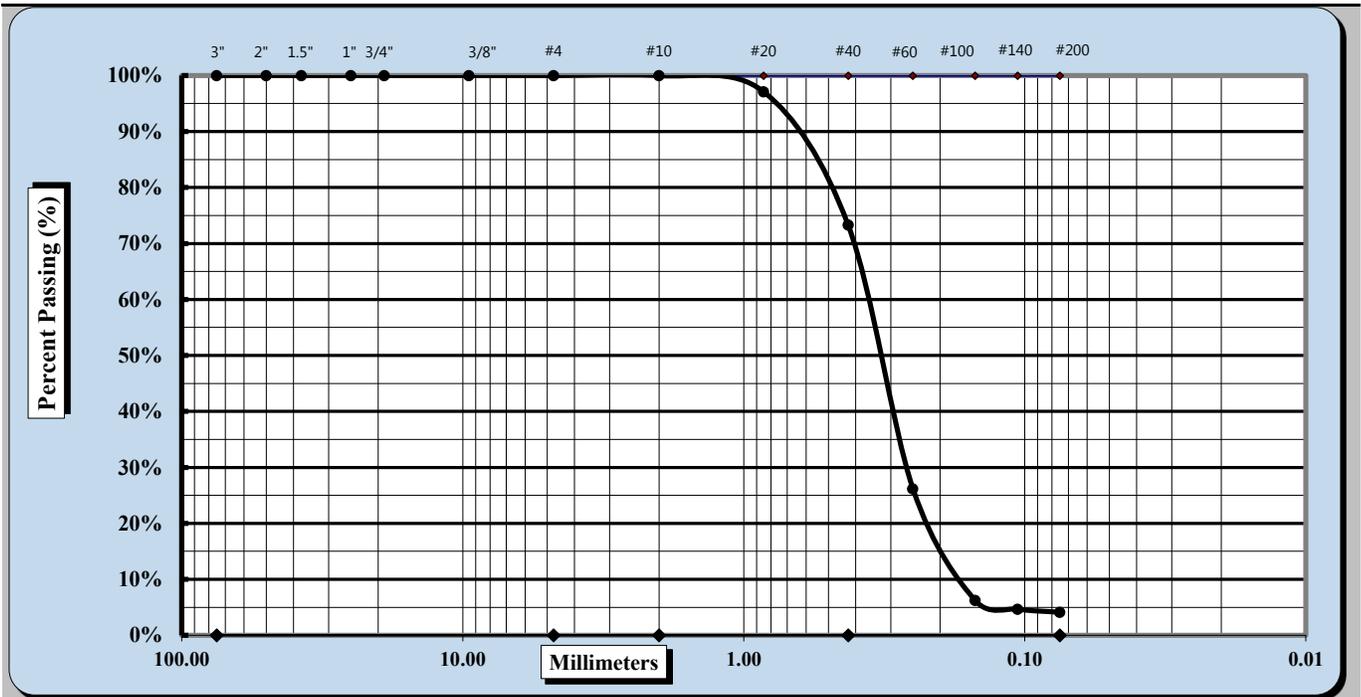
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/23/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	8 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-7A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Brown-Orange Poorly Graded SAND (SP)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	69.2%
Gravel	0.0%	Medium Sand	26.7%	Silt & Clay	4.1%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	17.4%	CBR	N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

*[Signature]*  
 Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/23/17
Project Name:	Kings Bluff Water Main	Lab Report #:	8 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-7A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Brown-Orange Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/20-10/23/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?
				None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:	Quartered:
				x
Dispersion Process:	Soaked without Dispersant		Soaked with Dispersant	x
				Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g		Soak Time:	4.0 hours
				Shaking Apparatus?
<b>Specimen:</b>	Pan No.	<b>A</b>	B) Tare Wt.	<b>0.0</b>
				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>211.3</b>		Pan No.	<b>A</b>
			B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>180.0</b>		Dry Mass of Specimen after Wash +Tare	
			<b>172.9</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>180.0</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
			<b>172.9</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>211.3</b>		Dry Mass passing #200	
			<b>7.1</b>	
F=(E-D)/D) Water Content of Specimen	<b>17.4%</b>		% Passing #200	
			<b>3.9%</b>	

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		Retained (Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	2.4	2.8	115	<b>5.2</b>	2.9%	97.1%
#40	0.425	22.2	25.9	75	<b>48.1</b>	26.7%	73.3%
#60	0.250	64.3	68.6	60	<b>132.9</b>	73.8%	26.2%
#100	0.150	84.1	84.7	40	<b>168.8</b>	93.8%	6.2%
#140	0.106	85.9	85.7	30	<b>171.6</b>	95.3%	4.7%
#200	0.075	86.5	86.1	20	<b>172.6</b>	95.9%	4.1%
Pan	<0.075	86.6	86.1	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-3
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	1-2.5
Project No.:	R-2017-861-001	Sample No.:	SS-1
Lab ID:	R-2017-861-001-008	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: A-3
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 1-2.5
Project No.: R-2017-861-001	Sample No.: SS-1
Lab ID: R-2017-861-001-008	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	31	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	679.96	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	613.43	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	203.12	Weight of Tare (g):	NA
Weight of Water (g):	66.53	Weight of Water (g):	NA
Weight of Dry Sample (g):	410.31	Weight of Dry Sample (g):	NA
*Moisture Content (%):	16.2	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	410.31
Dry Weight of - 3/4" Sample (g):	410.3	Weight of - #200 Material (g):	176.24
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	234.07
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	1.09	0.27	0.27	99.73	99.73
#20	0.850	2.70	0.66	0.92	99.08	99.08
#40	0.425	20.11	4.90	5.82	94.18	94.18
#60	0.250	29.81	7.27	13.09	86.91	86.91
#140	0.106	142.69	34.78	47.87	52.13	52.13
#200	0.075	37.67	9.18	57.05	42.95	42.95
Pan	-	176.24	42.95	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	A-3
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-009	Soil Description:	BROWN LEAN CLAY

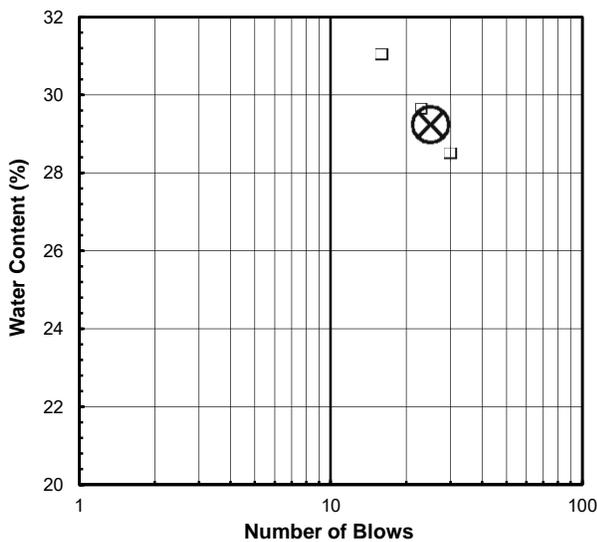
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried)**  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test			
	1	2	3	M
Tare Number:	1416	15	40	23
Wt. of Tare & Wet Sample (g):	701.12	41.90	39.19	40.83
Wt. of Tare & Dry Sample (g):	586.21	36.89	34.37	35.67
Weight of Tare (g):	145.63	19.30	18.09	19.03
Weight of Water (g):	114.9	5.0	4.8	5.2
Weight of Dry Sample (g):	440.6	17.6	16.3	16.6
Was As Received MC Preserved:	<b>Yes</b>			
<b>Moisture Content (%):</b>	<b>26.1</b>	<b>28.5</b>	<b>29.6</b>	<b>31.0</b>
<b>Number of Blows:</b>	<b>30</b>	<b>23</b>	<b>16</b>	<b>T</b>

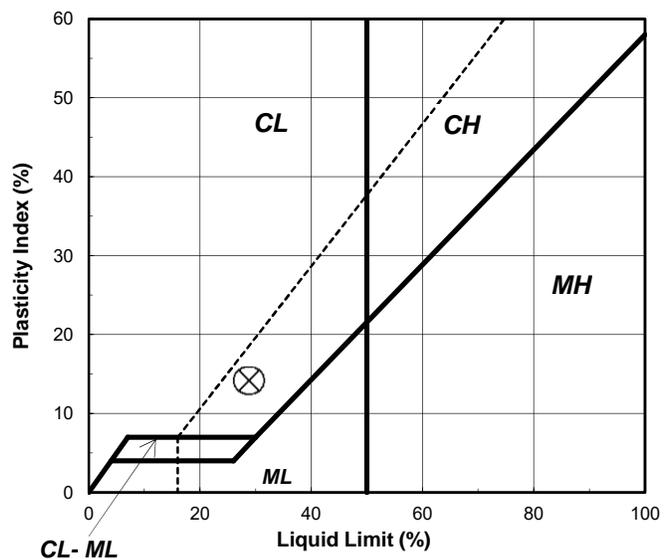
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	10	12		<b>Liquid Limit (%):</b> <b>29</b>
Wt. of Tare & Wet Sample (g):	25.40	26.34		<b>Plastic Limit (%):</b> <b>15</b>
Wt. of Tare & Dry Sample (g):	24.44	25.31		<b>Plasticity Index (%):</b> <b>14</b>
Weight of Tare (g):	18.26	18.60		<b>USCS Symbol:</b> <b>CL</b>
Weight of Water (g):	1.0	1.0		
Weight of Dry Sample (g):	6.2	6.7		
<b>Moisture Content (%):</b>	<b>15.5</b>	<b>15.4</b>	<b>0.2</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/17/17 Checked By NC Date 11/18/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	A-3
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-010	Soil Description:	BROWN FAT CLAY

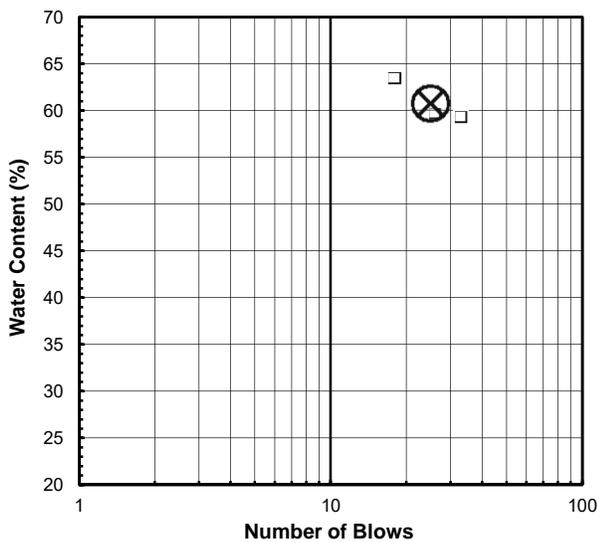
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1537	19	33	20	U
Wt. of Tare & Wet Sample (g):	555.20	38.72	39.42	42.38	L
Wt. of Tare & Dry Sample (g):	454.12	31.19	31.55	33.01	T
Weight of Tare (g):	143.95	18.47	18.34	18.22	I
Weight of Water (g):	101.1	7.5	7.9	9.4	P
Weight of Dry Sample (g):	310.2	12.7	13.2	14.8	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>32.6</b>	<b>59.2</b>	<b>59.6</b>	<b>63.4</b>	<b>N</b>
<b>Number of Blows:</b>		<b>33</b>	<b>26</b>	<b>18</b>	<b>T</b>

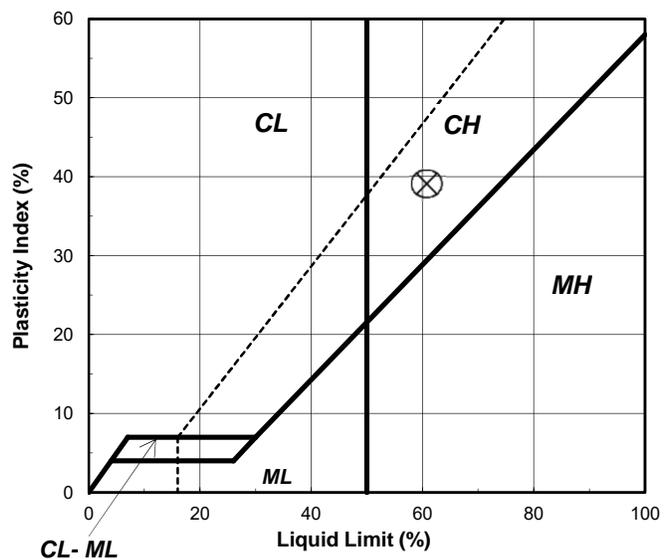
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	42	37		<b>Liquid Limit (%):</b> <b>61</b>
Wt. of Tare & Wet Sample (g):	24.83	24.31		<b>Plastic Limit (%):</b> <b>22</b>
Wt. of Tare & Dry Sample (g):	23.60	23.11		<b>Plasticity Index (%):</b> <b>39</b>
Weight of Tare (g):	18.12	17.70		<b>USCS Symbol:</b> <b>CH</b>
Weight of Water (g):	1.2	1.2		
Weight of Dry Sample (g):	5.5	5.4		
<b>Moisture Content (%):</b>	<b>22.4</b>	<b>22.2</b>	<b>0.3</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By PF Date 11/16/17 Checked By NC Date 11/18/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	W-9A
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-011	Soil Description:	TAN LEAN CLAY

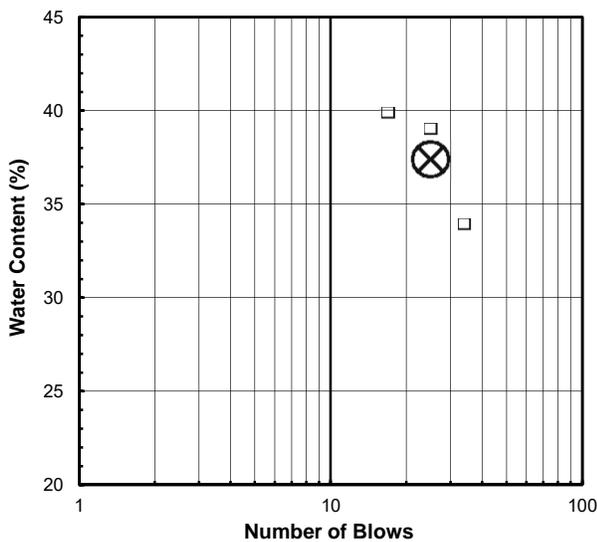
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1482	31	29	35	U
Wt. of Tare & Wet Sample (g):	582.79	41.62	39.92	42.16	L
Wt. of Tare & Dry Sample (g):	503.92	35.71	33.86	35.45	T
Weight of Tare (g):	147.77	18.27	18.32	18.61	I
Weight of Water (g):	78.9	5.9	6.1	6.7	P
Weight of Dry Sample (g):	356.2	17.4	15.5	16.8	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>22.1</b>	<b>33.9</b>	<b>39.0</b>	<b>39.8</b>	<b>N</b>
<b>Number of Blows:</b>		<b>34</b>	<b>25</b>	<b>17</b>	<b>T</b>

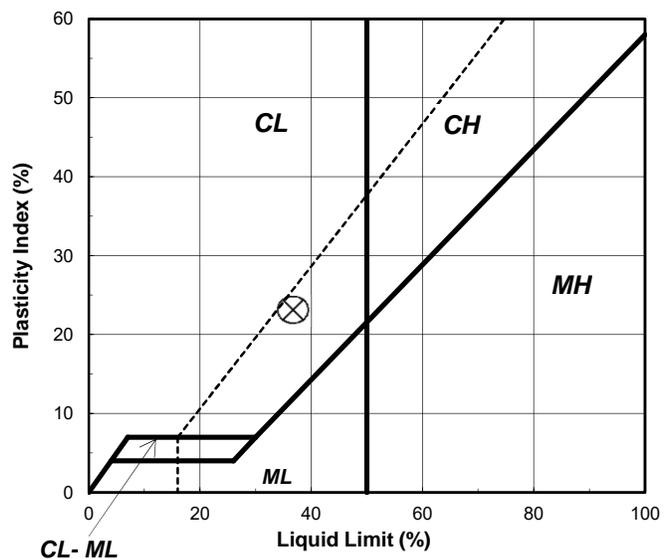
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	43	39		<b>Liquid Limit (%):</b>	<b>37</b>
Wt. of Tare & Wet Sample (g):	25.24	25.13		<b>Plastic Limit (%):</b>	<b>14</b>
Wt. of Tare & Dry Sample (g):	24.48	24.39		<b>Plasticity Index (%):</b>	<b>23</b>
Weight of Tare (g):	18.89	18.92		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	0.8	0.7			
Weight of Dry Sample (g):	5.6	5.5			
<b>Moisture Content (%):</b>	<b>13.6</b>	<b>13.5</b>	<b>0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By PF Date 11/16/17 Checked By NC Date 11/18/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client: S&ME, Inc.	Boring No.: W-9A	
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10	
Project No.: R-2017-861-001	Sample No.: SS-4	
Lab ID: R-2017-861-001-012	Soil Description: TAN LEAN CLAY	

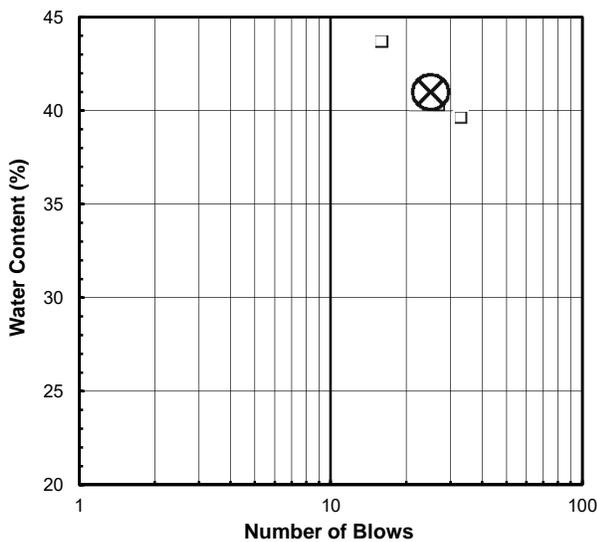
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test			
	1	2	3	M
Tare Number:	24	17	16	U
Wt. of Tare & Wet Sample (g):	39.79	40.20	41.19	L
Wt. of Tare & Dry Sample (g):	33.81	33.97	34.31	T
Weight of Tare (g):	18.69	18.49	18.55	I
Weight of Water (g):	6.0	6.2	6.9	P
Weight of Dry Sample (g):	15.1	15.5	15.8	O
Was As Received MC Preserved:	Yes			I
<b>Moisture Content (%):</b>	<b>39.6</b>	<b>40.2</b>	<b>43.7</b>	<b>N</b>
<b>Number of Blows:</b>	<b>33</b>	<b>27</b>	<b>16</b>	<b>T</b>

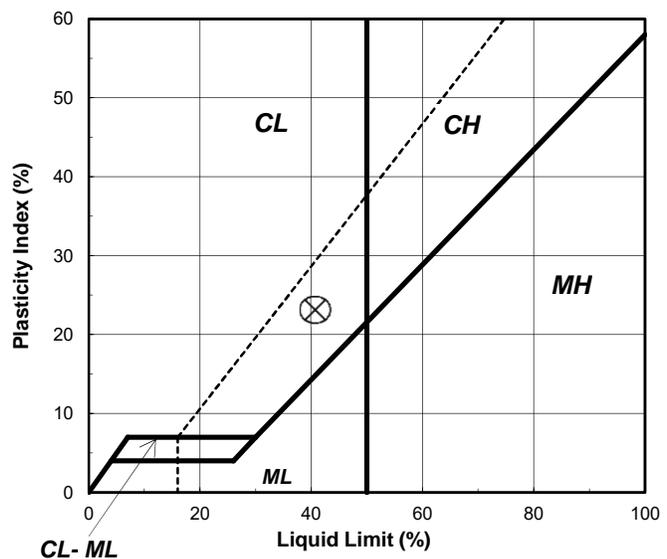
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	28	44		<b>Liquid Limit (%):</b> 41
Wt. of Tare & Wet Sample (g):	26.73	25.18		<b>Plastic Limit (%):</b> 18
Wt. of Tare & Dry Sample (g):	25.59	24.11		<b>Plasticity Index (%):</b> 23
Weight of Tare (g):	19.39	18.19		<b>USCS Symbol:</b> CL
Weight of Water (g):	1.1	1.1		
Weight of Dry Sample (g):	6.2	5.9		
<b>Moisture Content (%):</b>	<b>18.4</b>	<b>18.1</b>	<b>0.3</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/16/17 Checked By NC Date 11/18/17

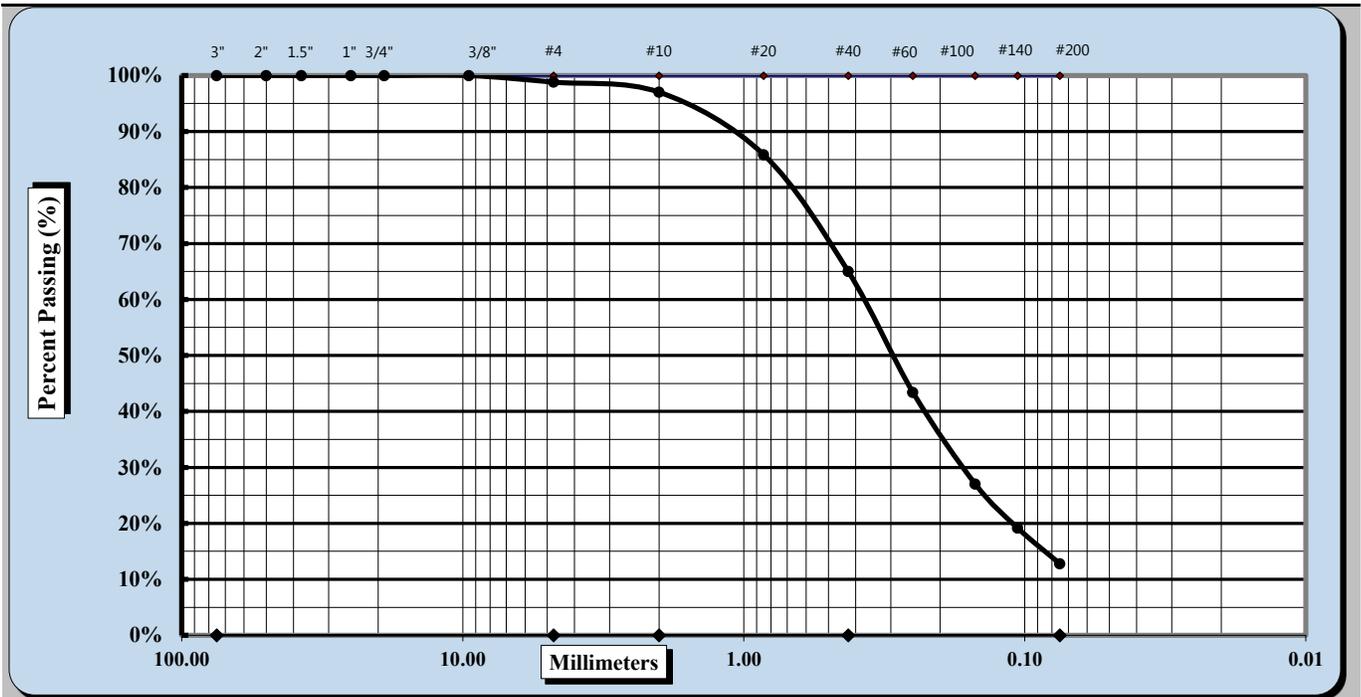
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/23/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	9 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-9B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Gray Silty SAND (SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#4	Coarse Sand	1.8%	Fine Sand	52.2%
Gravel	1.2%	Medium Sand	32.0%	Silt & Clay	12.8%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	17.4%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/23/17
Project Name:	Kings Bluff Water Main	Lab Report #:	9 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-9B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Gray Silty SAND (SM)							
Estimate Max. Particle Size (99% Passing):		<b>#4</b>		Testing Dates: 10/20-10/23/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.0 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>H</b>	B) Tare Wt.	<b>0.0</b>			
				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>			
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>209.5</b>		Pan No.	<b>H</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>178.4</b>		Dry Mass of Specimen after Wash +Tare			<b>157.1</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>178.4</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>157.1</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>209.5</b>		Dry Mass passing #200			<b>21.3</b>
F=(E-D)/D) Water Content of Specimen		<b>17.4%</b>		% Passing #200			<b>11.9%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)			PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	2.1	325		1.2%	98.8%
#10	2.000	1.0	4.3	180		3.0%	97.0%
#20	0.850	9.2	16.0	115		14.1%	85.9%
#40	0.425	27.0	35.4	75		35.0%	65.0%
#60	0.250	47.5	53.5	60		56.6%	43.4%
#100	0.150	63.8	66.4	40		73.0%	27.0%
#140	0.106	71.6	72.6	30		80.8%	19.2%
#200	0.075	77.9	77.7	20		87.2%	12.8%
Pan	<0.075	78.7	78.3	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	10/23/17
Project Name:	Kings Bluff Water Main	Lab Report #:	10 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-9B/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Light Gray Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing): **#10** Testing Dates: 10/20-10/23/17

Method A (1%)  Method B (0.1%)  x Material Excluded?  None

Procedure used to Obtain Specimen: Moist  x Air-Dried  Oven-Dried

Sampling Method: Stockpile  Mechanically Split  Quartered

Dispersion Process: Soaked without Dispersant  Soaked with Dispersant  x Ultrasonic Bath

Estimated Wet Mass of specimen required: 200 g Soak Time: 4.0 hours Shaking Apparatus?

**Specimen:** Pan No. **HN** B) Tare Wt. **0.0** Method B of ASTM D1140 or D6913 sec. 11.4.3

A) Total Specimen Wet Wt. + Tare Wt. (g.) **208.7** Pan No. **HN** B) Tare Wt. **0.0**

C) Total Specimen Dry Wt. + Tare Wt. (g.) **171.7** Dry Mass of Specimen after Wash +Tare **169.2**

D = (C-B) Total Specimen Dry Weight (**S<sub>w</sub>M<sub>d</sub>**) **171.7** Dry Mass of Specimen after Wash (**S<sub>w</sub>M<sub>d</sub>**) **169.2**

E = (A-B) Moist Specimen Mass (**S<sub>m</sub>M<sub>m</sub>**) **208.7** Dry Mass passing #200 **2.5**

F=(E-D)/D Water Content of Specimen **21.5%** % Passing #200 **1.5%**

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.1	0.1	180	<b>0.2</b>	0.1%	99.9%
#20	0.850	5.7	5.2	115	<b>10.9</b>	6.3%	93.7%
#40	0.425	56.4	55.3	75	<b>111.7</b>	65.1%	34.9%
#60	0.250	79.5	79.2	60	<b>158.7</b>	92.4%	7.6%
#100	0.150	83.3	83.0	40	<b>166.3</b>	96.9%	3.1%
#140	0.106	84.2	83.9	30	<b>168.1</b>	97.9%	2.1%
#200	0.075	84.7	84.3	20	<b>169.0</b>	98.4%	1.6%
Pan	<0.075	84.8	84.4	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	10/23/17
Project Name:	Kings Bluff Water Main	Test Date(s)	10/20-10/23/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: C-4A/S2	Depth(ft): 3.5'-5.0'

Sample Description: Brown Sandy Lean CLAY (CL)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		6	7	8			9	10		
A	Tare Weight	11.24	11.69	10.88				11.98	11.72	
B	Wet Soil Weight + A	22.31	21.27	20.75				21.04	21.29	
C	Dry Soil Weight + A	19.36	18.60	17.87				19.74	19.84	
D	Water Weight (B-C)	2.95	2.67	2.88				1.30	1.45	
E	Dry Soil Weight (C-A)	8.12	6.91	6.99				7.76	8.12	
F	% Moisture (D/E)*100	36.3%	38.6%	41.2%				16.8%	17.9%	
N	# OF DROPS	34	25	19				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>17.4%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>39</b>
Plastic Limit	<b>17</b>
Plastic Index	<b>22</b>
Group Symbol	<b>CL</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 1%

Notes / Deviations / References:

**MC = 27.9%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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# SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/23/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	11 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (C-4A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Brown Sandy Lean CLAY (CL)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	43.0%
Gravel	0.0%	Medium Sand	1.3%	Silt & Clay	55.7%
Liquid Limit	39	Plastic Limit	17	Plastic Index	22
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	27.9%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 10/23/17
Project Name: Kings Bluff Water Main		Lab Report #: 11 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (C-4A/S2)	Type: Split Spoon	Elev/Depth: 3.5'-5.0'

Sample Description: Brown Sandy Lean CLAY (CL)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	10/20-10/23/17		
Method A (1%)		Method B (0.1%)	x	Material Excluded?	None
Procedure for obtaining Specimen:	Moist	x	Air-Dried		Oven-Dried
Sampling Method	Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x	Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g.	Soak Time:	4.0 hours	Shaking Apparatus	
<b>Specimen:</b>	Pan No. <b>BK</b>	B) Tare Wt. <b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>208.0</b>	Pan No. <b>BK</b>	Tare Wt. <b>0.0</b>		
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>162.6</b>	Dry Mass of Washed Sample + Tare Wt.	<b>73.8</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>162.6</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>73.8</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )	<b>208.0</b>	Dry Mass passing #200	<b>88.8</b>		
F=(E-D)/D) Water Content of Specimen	<b>27.9%</b>	% Passing #200	<b>54.6%</b>		

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.1	0.10	115	0.1%	99.9%
#40	0.425	2.1	2.00	75	1.3%	98.7%
#60	0.250	8.9	6.80	60	5.5%	94.5%
#100	0.150	24.4	15.50	40	15.0%	85.0%
#140	0.106	49.4	25.00	30	30.4%	69.6%
#200	0.075	72.0	22.60	20	44.3%	55.7%
Pan	<0.075	73.9	1.9	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



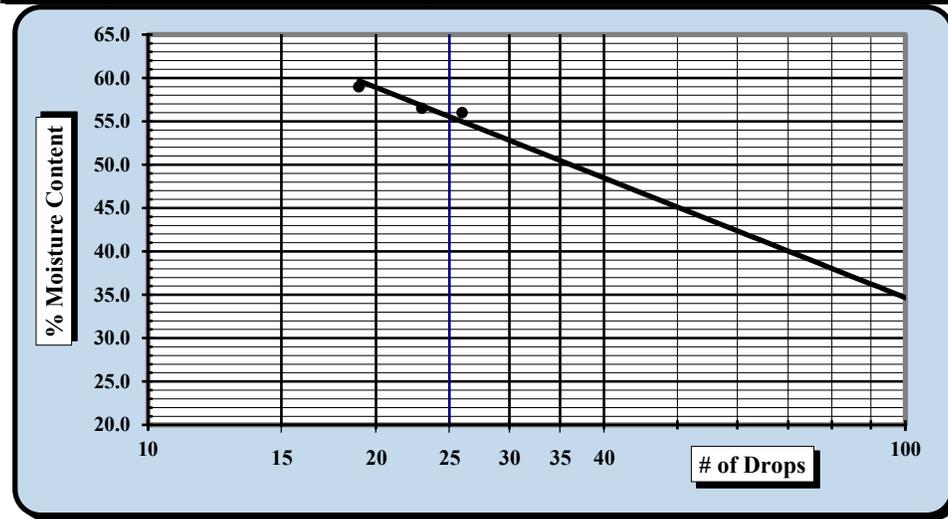
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	10/23/17
Project Name:	Kings Bluff Water Main	Test Date(s)	10/20-10/23/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: C-4A/S5	Depth(ft): 13.5'-15.0'

Sample Description: Gray Fat CLAY (CH)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		11	12	13			14	15		
A	Tare Weight	11.05	10.75	12.06				11.79	11.80	
B	Wet Soil Weight + A	20.66	19.20	22.17				20.23	20.76	
C	Dry Soil Weight + A	17.21	16.15	18.42				18.69	19.11	
D	Water Weight (B-C)	3.45	3.05	3.75				1.54	1.65	
E	Dry Soil Weight (C-A)	6.16	5.40	6.36				6.90	7.31	
F	% Moisture (D/E)*100	56.0%	56.5%	59.0%				22.3%	22.6%	
N	# OF DROPS	26	23	19				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>22.5%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>56</b>
Plastic Limit	<b>23</b>
Plastic Index	<b>33</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: <1%

Notes / Deviations / References:

**MC = 33.1%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/20/2017</u> Date
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# SIEVE ANALYSIS OF SOIL

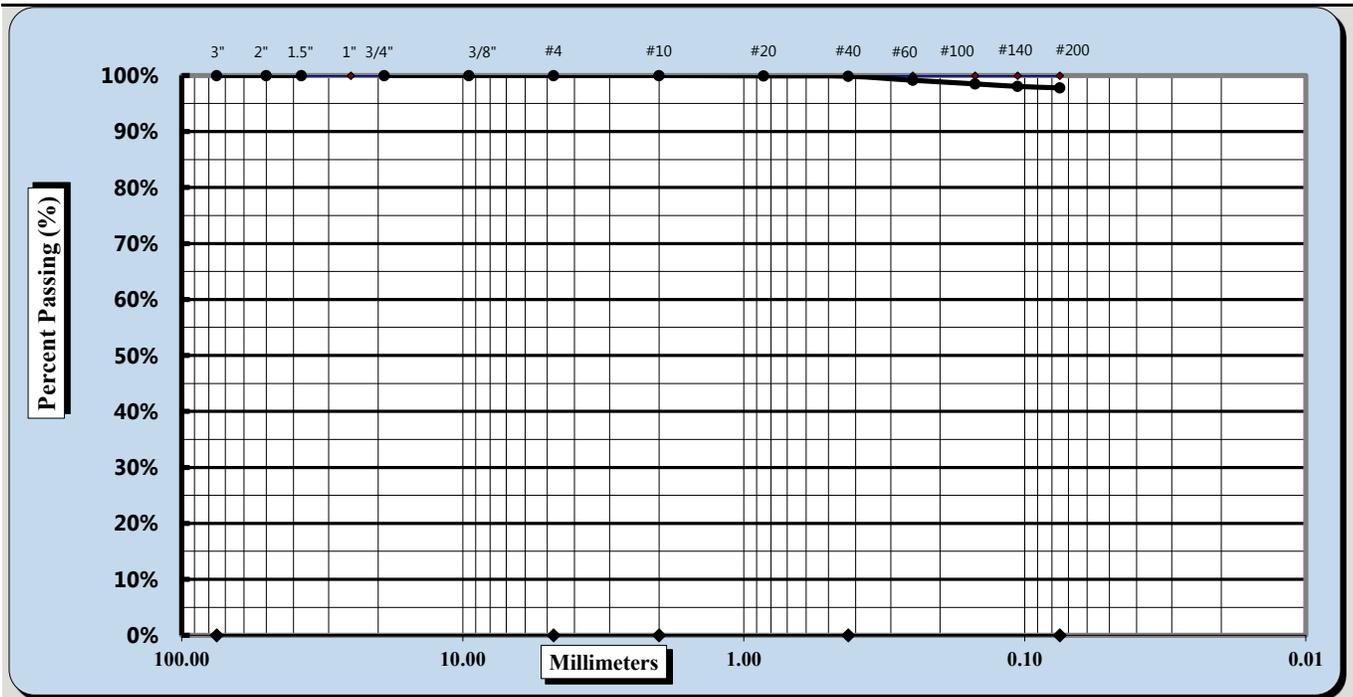


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	10/23/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	12 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (C-4A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Gray Fat CLAY (CH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	2.1%	
Gravel	0.0%	Medium Sand	0.1%	Silt & Clay	97.8%	
Liquid Limit	56	Plastic Limit	23	Plastic Index	33	
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	33.1%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 10/23/17
Project Name: Kings Bluff Water Main		Lab Report #: 12 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (C-4A/S5)	Type: Split Spoon	Elev/Depth: 13.5'-15.0'

Sample Description: Gray Fat CLAY (CH)						
Estimate Max. Particle Size (99% Passing):			#10	Testing Dates: 10/20-10/23/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath
Estimated Wet Mass of specimen required:			200 g.	Soak Time: 4.0 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No. 520	B) Tare Wt. 0.0		Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)			205.8	Pan No. 520	Tare Wt. 0.0	
C) Total Specimen Dry Wt. + Tare Wt. (g.)			154.6	Dry Mass of Washed Sample + Tare Wt. 3.4		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			154.6	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) 3.4		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			205.8	Dry Mass passing #200 151.2		
F=(E-D)/D) Water Content of Specimen			33.1%	% Passing #200 97.8%		
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.1	0.10	115	0.1%	99.9%
#40	0.425	0.2	0.10	75	0.1%	99.9%
#60	0.250	1.3	1.10	60	0.8%	99.2%
#100	0.150	2.3	1.00	40	1.5%	98.5%
#140	0.106	3.0	0.70	30	1.9%	98.1%
#200	0.075	3.4	0.40	20	2.2%	97.8%
Pan	<0.075	3.4	0.0	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		

Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-11A/S1	Depth(ft): 1.0'-2.5'

Sample Description: **Brown-Red Sandy Lean CLAY (CL)**

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3			4	5		
A	Tare Weight	11.09	10.65	11.63				11.35	10.74	
B	Wet Soil Weight + A	20.98	19.40	20.88				20.54	19.99	
C	Dry Soil Weight + A	18.28	16.90	18.15				19.22	18.66	
D	Water Weight (B-C)	2.70	2.50	2.73				1.32	1.33	
E	Dry Soil Weight (C-A)	7.19	6.25	6.52				7.87	7.92	
F	% Moisture (D/E)*100	37.6%	40.0%	41.9%				16.8%	16.8%	
N	# OF DROPS	30	26	22				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>16.8%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic

Liquid Limit **40**

Plastic Limit **17**

Plastic Index **23**

Group Symbol **CL**

Multipoint Method

One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 2%

Notes / Deviations / References:

**MC = 19.7%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

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Date

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# SIEVE ANALYSIS OF SOIL

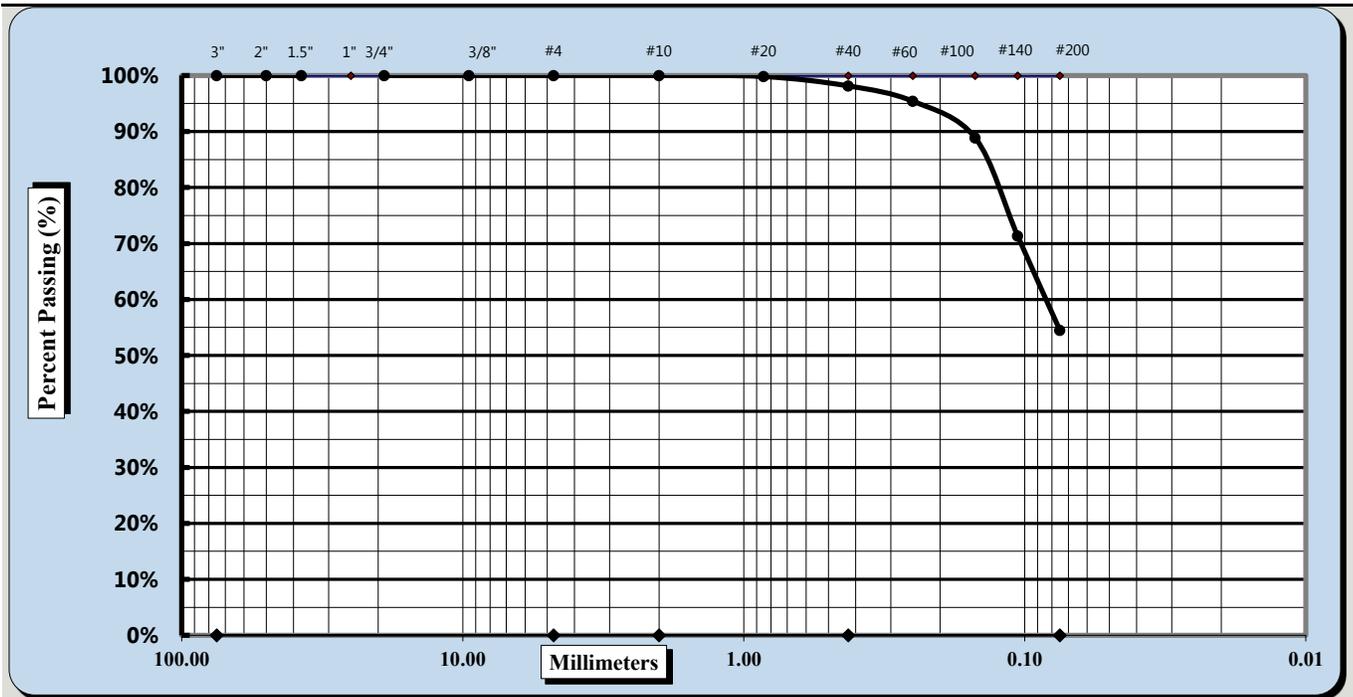


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/7/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	13 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-11A/S1)	Type:	Split Spoon
		Elev/Depth:	1.0'-2.5'
Sample Description:	Brown-Red Sandy Lean CLAY (CL)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	43.7%
Gravel	0.0%	Medium Sand	1.8%	Silt & Clay	54.5%
Liquid Limit	40	Plastic Limit	17	Plastic Index	23
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	19.7%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/7/17
Project Name: Kings Bluff Water Main		Lab Report #: 13 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-11A/S1)	Type: Split Spoon	Elev/Depth: 1.0'-2.5'

Sample Description: Brown-Red Sandy Lean CLAY (CL)						
Estimate Max. Particle Size (99% Passing):			#10	Testing Dates: 11/3-11/7/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?			Soaked without Dispersant		Soaked with Dispersant x	
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 7.0 hours	
Shaking Apparatus						
<b>Specimen:</b>	Pan No.	GTH	B) Tare Wt.	0.0		
Method B of ASTM D1140 or D6913 Sec. 11.4.3						
A) Total Specimen Wet Wt. + Tare Wt. (g.)			200.9		Pan No. GTH Tare Wt. 0.0	
C) Total Specimen Dry Wt. + Tare Wt. (g.)			167.9		Dry Mass of Washed Sample + Tare Wt. 79.1	
D = (C-B) Total Specimen Dry Weight (S <sub>w</sub> M <sub>d</sub> )			167.9		Dry Mass of Washed Sample (S <sub>w</sub> M <sub>d</sub> ) 79.1	
E = (A-B) Moist Specimen Mass (S <sub>w</sub> M <sub>m</sub> )			200.9		Dry Mass passing #200 88.8	
F=(E-D)/D) Water Content of Specimen			19.7%		% Passing #200 52.9%	
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.3	0.30	115	0.2%	99.8%
#40	0.425	3.1	2.80	75	1.8%	98.2%
#60	0.250	7.7	4.60	60	4.6%	95.4%
#100	0.150	18.7	11.00	40	11.1%	88.9%
#140	0.106	48.1	29.40	30	28.6%	71.4%
#200	0.075	76.4	28.30	20	45.5%	54.5%
Pan	<0.075	79.1	2.7	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

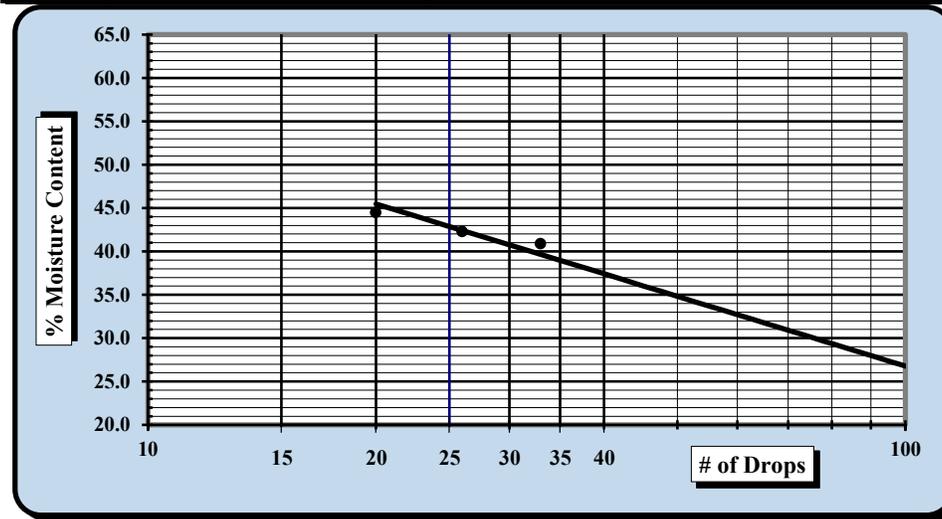
Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		

Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-11A/S2	Depth(ft): 3.5'-5.0'

Sample Description: **Brown-Red Sandy Lean CLAY (CL)**

Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		6	7	8			9	10		
A	Tare Weight	11.25	11.70	10.89				11.96	11.73	
B	Wet Soil Weight + A	21.89	22.29	21.38				21.15	20.91	
C	Dry Soil Weight + A	18.80	19.14	18.15				19.77	19.53	
D	Water Weight (B-C)	3.09	3.15	3.23				1.38	1.38	
E	Dry Soil Weight (C-A)	7.55	7.44	7.26				7.81	7.80	
F	% Moisture (D/E)*100	40.9%	42.3%	44.5%				17.7%	17.7%	
N	# OF DROPS	33	26	20				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>17.7%</b>		



NP, Non-Plastic		<input type="checkbox"/>
Liquid Limit	<b>43</b>	
Plastic Limit	<b>18</b>	
Plastic Index	<b>25</b>	
Group Symbol	<b>CL</b>	
Multipoint Method	<input checked="" type="checkbox"/>	
One-point Method	<input type="checkbox"/>	

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 1%

Notes / Deviations / References:

**MC = 26.3%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

<u>Gunnar Goslin</u> Technical Responsibility	 Signature	Staff Professional Position	11/20/2017 Date
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## SIEVE ANALYSIS OF SOIL

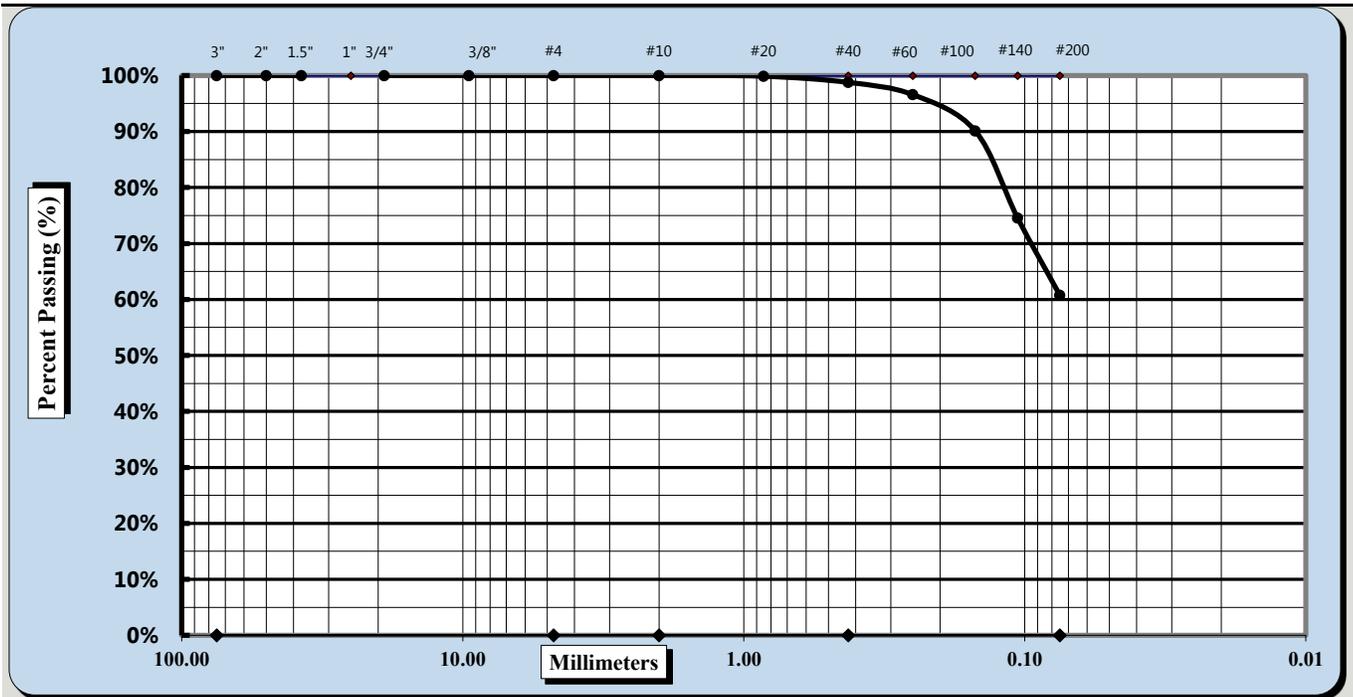


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/7/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	14 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-11A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Brown-Red Sandy Lean CLAY (CL)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	38.0%
Gravel	0.0%	Medium Sand	1.2%	Silt & Clay	60.7%
Liquid Limit	43	Plastic Limit	18	Plastic Index	25
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	26.3%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/7/17
Project Name: Kings Bluff Water Main		Lab Report #: 14 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-11A/S2)	Type: Split Spoon	Elev/Depth: 3.5'-5.0'

Sample Description: Brown-Red Sandy Lean CLAY (CL)						
Estimate Max. Particle Size (99% Passing):			#10	Testing Dates: 11/3-11/7/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x
Estimated Wet Mass of specimen required:		200 g.		Soak Time: 7.0 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No.	<b>H</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>206.9</b>		Pan No.	<b>H</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>163.8</b>		Dry Mass of Washed Sample + Tare Wt.		<b>66.4</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>163.8</b>		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>66.4</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>206.9</b>		Dry Mass passing #200		<b>97.4</b>
F=(E-D)/D) Water Content of Specimen		<b>26.3%</b>		% Passing #200		<b>59.5%</b>
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.2	0.20	115	0.1%	99.9%
#40	0.425	2.0	1.80	75	1.2%	98.8%
#60	0.250	5.6	3.60	60	3.4%	96.6%
#100	0.150	16.2	10.60	40	9.9%	90.1%
#140	0.106	41.7	25.50	30	25.5%	74.5%
#200	0.075	64.3	22.60	20	39.3%	60.7%
Pan	<0.075	66.4	2.1	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-11A/S3	Depth(ft): 6.0'-7.5'

Sample Description: Brown Sandy Fat CLAY (CH)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		11	12	13			14	15		
A	Tare Weight	11.04	10.76	12.05				11.79	11.83	
B	Wet Soil Weight + A	20.56	19.75	22.45				20.23	20.51	
C	Dry Soil Weight + A	17.15	16.42	18.52				18.76	19.00	
D	Water Weight (B-C)	3.41	3.33	3.93				1.47	1.51	
E	Dry Soil Weight (C-A)	6.11	5.66	6.47				6.97	7.17	
F	% Moisture (D/E)*100	55.8%	58.8%	60.7%				21.1%	21.1%	
N	# OF DROPS	35	26	22				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>21.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>60</b>
Plastic Limit	<b>21</b>
Plastic Index	<b>39</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 1%

Notes / Deviations / References:

**MC = 30.8%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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### SIEVE ANALYSIS OF SOIL

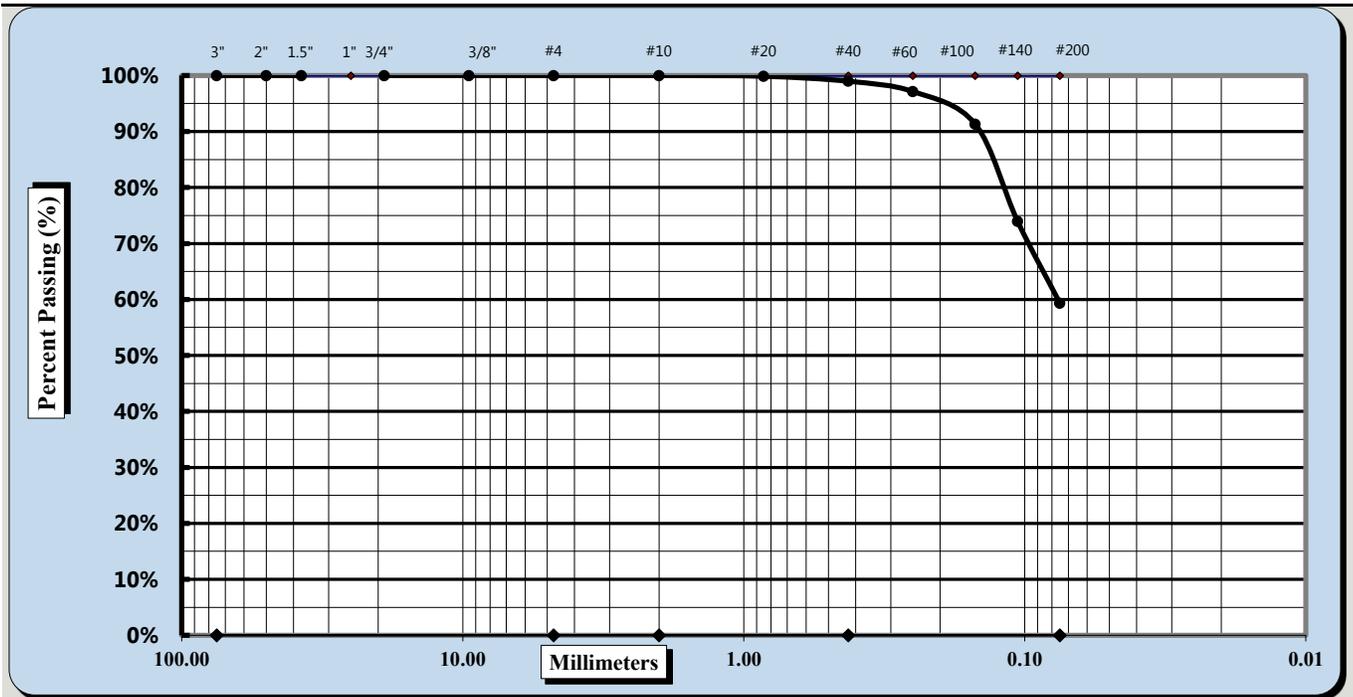


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/7/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	15 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-11A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'
Sample Description:	Brown Sandy Fat CLAY (CH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	39.6%
Gravel	0.0%	Medium Sand	1.0%	Silt & Clay	59.4%
Liquid Limit	60	Plastic Limit	21	Plastic Index	39
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	30.8%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/7/17
Project Name: Kings Bluff Water Main		Lab Report #: 15 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-11A/S3)	Type: Split Spoon	Elev/Depth: 6.0'-7.5'

Sample Description: Brown Sandy Fat CLAY (CH)

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates: 11/3-11/7/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded? None
Procedure for obtaining Specimen:		Moist	x	Air-Dried
Oven-Dried				
Sampling Method	Stockpile:	Mechanically Split:		Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x
Ultrasonic Bath				
Estimated Wet Mass of specimen required:		200 g.	Soak Time: 7.0 hours	Shaking Apparatus
<b>Specimen:</b>	Pan No. <b>A</b>	B) Tare Wt. <b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>206.2</b>	Pan No. <b>A</b>	Tare Wt. <b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>157.7</b>	Dry Mass of Washed Sample + Tare Wt.		<b>66.1</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>157.7</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>66.1</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>206.2</b>	Dry Mass passing #200		<b>91.6</b>
F=(E-D)/D) Water Content of Specimen	<b>30.8%</b>	% Passing #200		<b>58.1%</b>

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.2	0.20	115	0.1%	99.9%
#40	0.425	1.6	1.40	75	1.0%	99.0%
#60	0.250	4.5	2.90	60	2.9%	97.1%
#100	0.150	13.7	9.20	40	8.7%	91.3%
#140	0.106	41.1	27.40	30	26.1%	73.9%
#200	0.075	64.1	23.00	20	40.6%	59.4%
Pan	<0.075	66.1	2.0	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



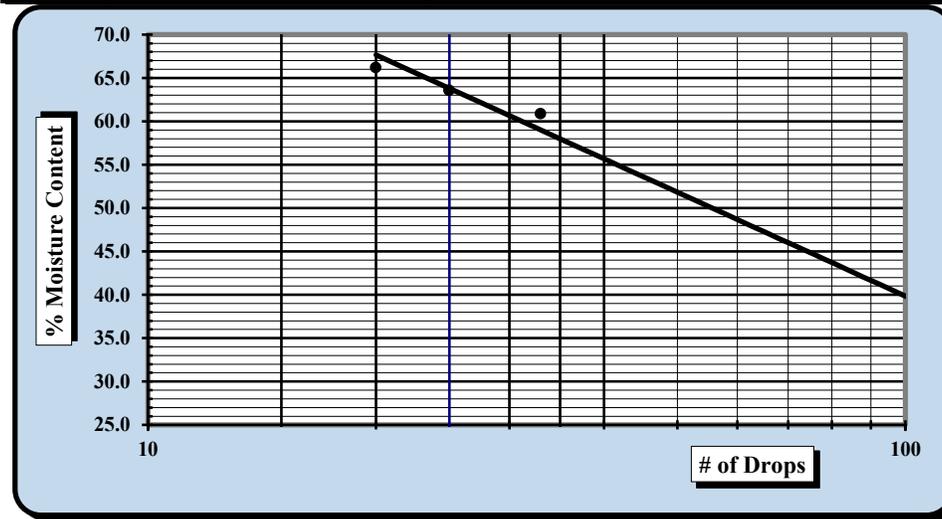
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-11A/S4	Depth(ft): 8.5'-10.0'

Sample Description: Light Brown Sandy Fat CLAY (CH)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		16	17	18			19	20	
A	Tare Weight	11.87	11.88	11.90			11.82	11.89	
B	Wet Soil Weight + A	21.20	22.09	21.57			19.96	20.46	
C	Dry Soil Weight + A	17.67	18.12	17.72			18.56	18.95	
D	Water Weight (B-C)	3.53	3.97	3.85			1.40	1.51	
E	Dry Soil Weight (C-A)	5.80	6.24	5.82			6.74	7.06	
F	% Moisture (D/E)*100	60.9%	63.6%	66.2%			20.8%	21.4%	
N	# OF DROPS	33	25	20			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						<b>21.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>64</b>
Plastic Limit	<b>21</b>
Plastic Index	<b>43</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 3%

Notes / Deviations / References:

**MC = 33.5%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/20/2017</u> Date
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# SIEVE ANALYSIS OF SOIL

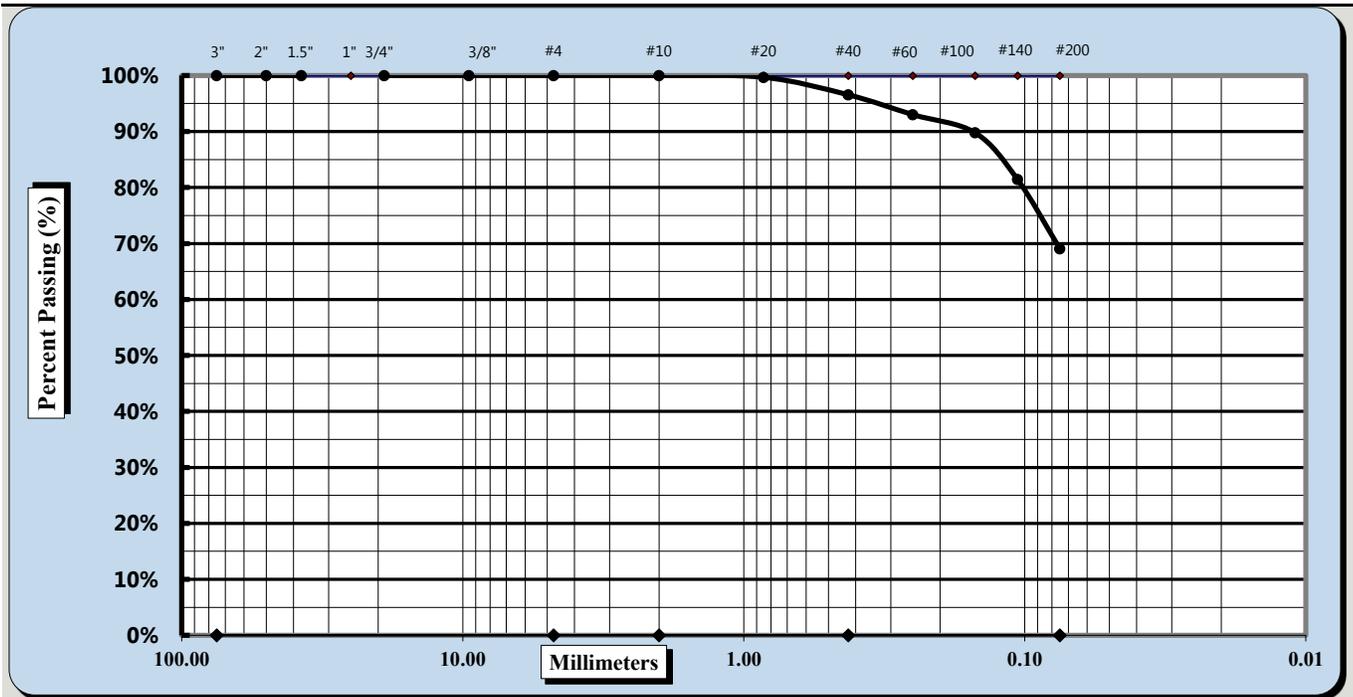


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/7/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	16 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-11A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Light Brown Sandy Fat CLAY (CH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	27.5%
Gravel	0.0%	Medium Sand	3.4%	Silt & Clay	69.1%
Liquid Limit	64	Plastic Limit	21	Plastic Index	43
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	33.5%	CBR	N/A

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/7/17
Project Name: Kings Bluff Water Main		Lab Report #: 16 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-11A/S4)	Type: Split Spoon	Elev/Depth: 8.5'-10.0'

Sample Description: Light Brown Sandy Fat CLAY (CH)

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates: 11/3-11/7/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded? None
Procedure for obtaining Specimen:		Moist	x	Air-Dried
Sampling Method	Stockpile:		Mechanically Split:	Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x
Estimated Wet Mass of specimen required:		200 g.	Soak Time: 7.0 hours	Shaking Apparatus
<b>Specimen:</b>	Pan No.	<b>HN</b>	B) Tare Wt.	<b>0.0</b>
Method B of ASTM D1140 or D6913 Sec. 11.4.3				
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>214.0</b>	Pan No.	<b>HN</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>160.3</b>	Dry Mass of Washed Sample + Tare Wt. <b>51.8</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>160.3</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>51.8</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>214.0</b>	Dry Mass passing #200 <b>108.5</b>	
F=(E-D)/D) Water Content of Specimen		<b>33.5%</b>	% Passing #200 <b>67.7%</b>	

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.5	0.50	115	0.3%	99.7%
#40	0.425	5.5	5.00	75	3.4%	96.6%
#60	0.250	11.2	5.70	60	7.0%	93.0%
#100	0.150	16.4	5.20	40	10.2%	89.8%
#140	0.106	29.8	13.40	30	18.6%	81.4%
#200	0.075	49.6	19.80	20	30.9%	69.1%
Pan	<0.075	51.8	2.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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# LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-11A/S5	Depth(ft): 13.5'-15.0'

Sample Description: Light Brown Fat CLAY (CH)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1D	2D	3D			4D	5D		
A	Tare Weight	19.90	20.53	20.27				20.46	20.30	
B	Wet Soil Weight + A	29.80	30.02	29.16				28.83	29.09	
C	Dry Soil Weight + A	26.43	26.65	25.91				27.55	27.70	
D	Water Weight (B-C)	3.37	3.37	3.25				1.28	1.39	
E	Dry Soil Weight (C-A)	6.53	6.12	5.64				7.09	7.40	
F	% Moisture (D/E)*100	51.6%	55.1%	57.6%				18.1%	18.8%	
N	# OF DROPS	34	25	19				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>18.5%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>55</b>
Plastic Limit	<b>19</b>
Plastic Index	<b>36</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: <1%

Notes / Deviations / References:

**MC = 25.1%**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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### SIEVE ANALYSIS OF SOIL

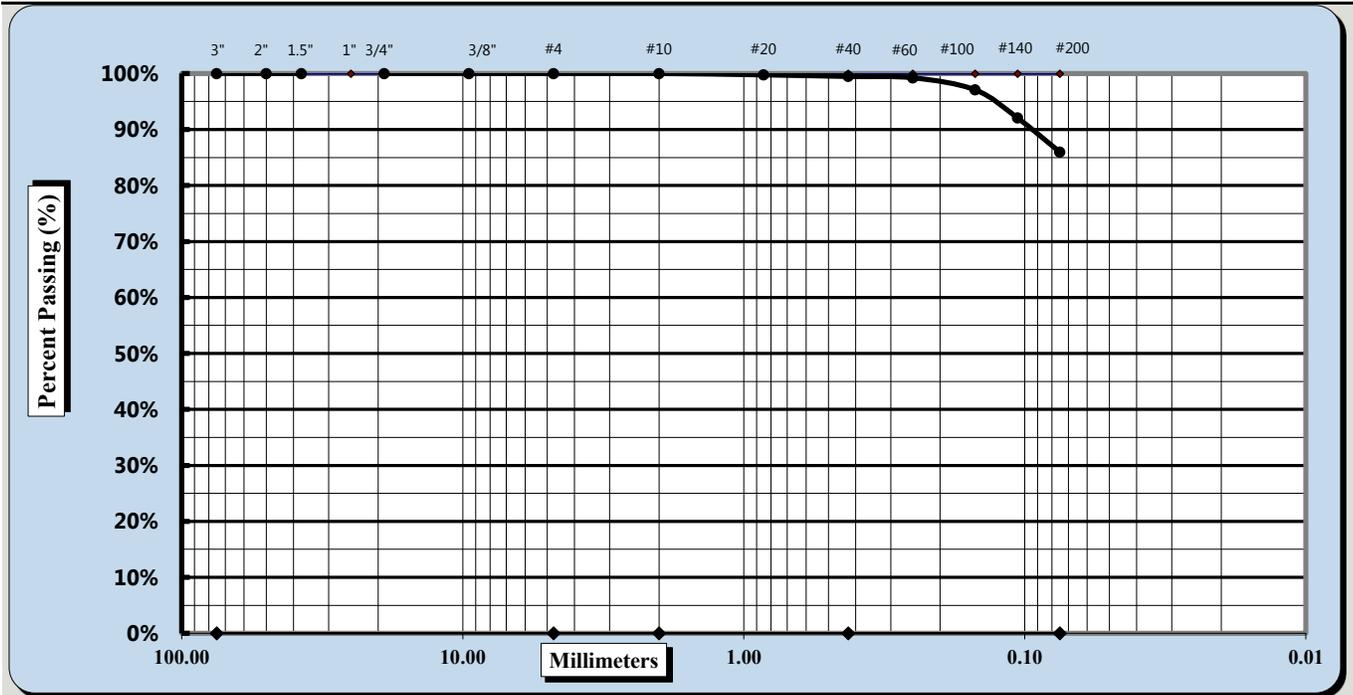


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/7/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	17 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-11A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Light Brown Fat CLAY (CH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	13.5%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	86.0%
Liquid Limit	55	Plastic Limit	19	Plastic Index	36
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	25.1%	CBR	N/A

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/22/2017</u> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/7/17
Project Name: Kings Bluff Water Main		Lab Report #: 17 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-11A/S5)	Type: Split Spoon	Elev/Depth: 13.5'-15.0'

Sample Description: Light Brown Fat CLAY (CH)						
Estimate Max. Particle Size (99% Passing):			#10	Testing Dates: 11/3-11/7/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath
Estimated Wet Mass of specimen required:			200 g.	Soak Time: 7.0 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No.	<b>BK</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>214.0</b>	Pan No.	<b>BK</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>171.1</b>	Dry Mass of Washed Sample + Tare Wt.		<b>26.8</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>171.1</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>26.8</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>214.0</b>	Dry Mass passing #200		<b>144.3</b>
F=(E-D)/D) Water Content of Specimen			<b>25.1%</b>	% Passing #200		<b>84.3%</b>
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.4	0.40	115	0.2%	99.8%
#40	0.425	0.9	0.50	75	0.5%	99.5%
#60	0.250	1.3	0.40	60	0.8%	99.2%
#100	0.150	5.0	3.70	40	2.9%	97.1%
#140	0.106	13.6	8.60	30	7.9%	92.1%
#200	0.075	24.0	10.40	20	14.0%	86.0%
Pan	<0.075	26.8	2.8	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	W-12B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	1-2.5
Project No.:	R-2017-861-001	Sample No.:	SS-1
Lab ID:	R-2017-861-001-013	Color:	Tan

( Minus No. 40 sieve material)

### As Received Water Content

Tare Number	1545
Wt. of Tare & Wet Sample (g)	526.87
Wt. of Tare & Dry Sample (g)	464.71
Weight of Tare (g)	147.49
Weight of Water (g)	62.16
Weight of Dry Sample (g)	317.22

<b>Water Content (%)</b>	<b>19.6</b>
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# NON - PLASTIC MATERIAL

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<i>Tested By</i>	<i>PF</i>	<i>Date</i>	<i>11/16/17</i>	<i>Checked By</i>	<i>NC</i>	<i>Date</i>	<i>11/18/17</i>
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## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	W-12B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	6-7.5
Project No.:	R-2017-861-001	Sample No.:	SS-3
Lab ID:	R-2017-861-001-015	Soil Description:	TAN LEAN CLAY

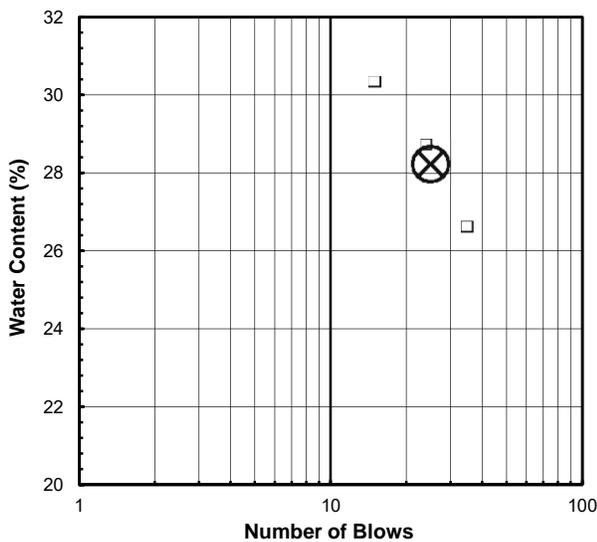
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1556	13	36	22	U
Wt. of Tare & Wet Sample (g):	926.64	40.71	38.76	40.55	L
Wt. of Tare & Dry Sample (g):	772.91	36.22	34.29	35.59	T
Weight of Tare (g):	146.71	19.33	18.71	19.24	I
Weight of Water (g):	153.7	4.5	4.5	5.0	P
Weight of Dry Sample (g):	626.2	16.9	15.6	16.4	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>24.5</b>	<b>26.6</b>	<b>28.7</b>	<b>30.3</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>24</b>	<b>15</b>	<b>T</b>

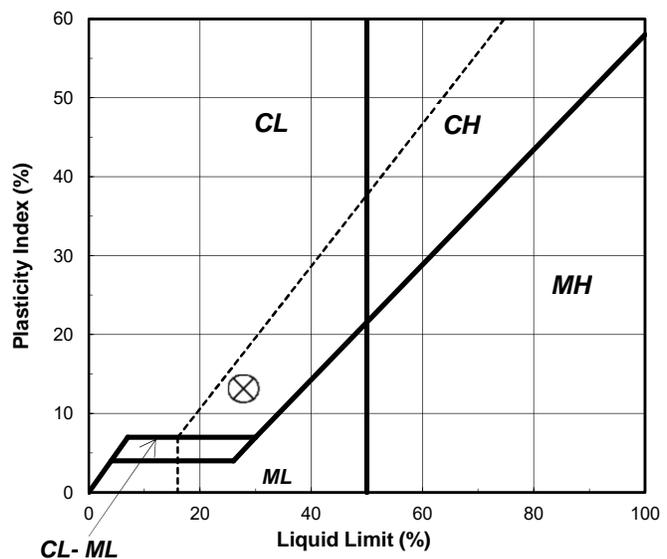
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	8	1		<b>Liquid Limit (%):</b> 28
Wt. of Tare & Wet Sample (g):	25.11	23.22		<b>Plastic Limit (%):</b> 15
Wt. of Tare & Dry Sample (g):	24.25	22.42		<b>Plasticity Index (%):</b> 13
Weight of Tare (g):	18.42	17.06		<b>USCS Symbol:</b> CL
Weight of Water (g):	0.9	0.8		
Weight of Dry Sample (g):	5.8	5.4		
<b>Moisture Content (%):</b>	<b>14.8</b>	<b>14.9</b>	<b>-0.2</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/20/17 Checked By NC Date 11/21/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client: S&ME, Inc.	Boring No.: W-12B	
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 13.5-15	
Project No.: R-2017-861-001	Sample No.: SS-5	
Lab ID: R-2017-861-001-017	Soil Description: BROWN FAT CLAY	

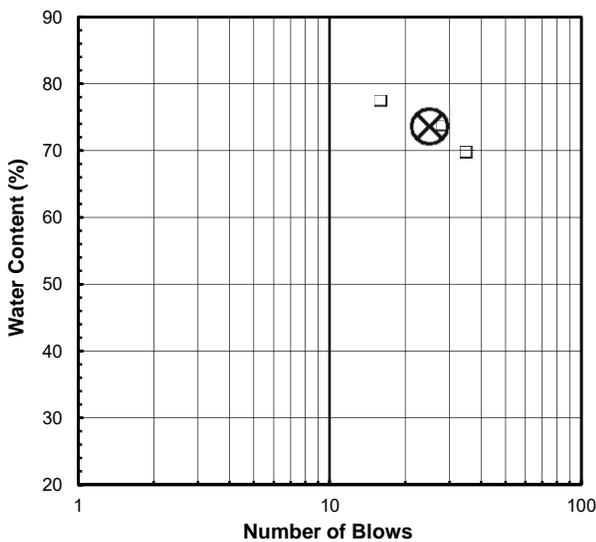
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried)**  
**see material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1461	14	30	27	U
Wt. of Tare & Wet Sample (g):	782.86	39.89	40.58	40.44	L
Wt. of Tare & Dry Sample (g):	612.94	31.14	31.85	31.16	T
Weight of Tare (g):	146.10	18.58	19.99	19.17	I
Weight of Water (g):	169.9	8.8	8.7	9.3	P
Weight of Dry Sample (g):	466.8	12.6	11.9	12.0	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>36.4</b>	<b>69.7</b>	<b>73.6</b>	<b>77.4</b>	<b>N</b>
<b>Number of Blows:</b>	<b>35</b>	<b>28</b>	<b>16</b>		<b>T</b>

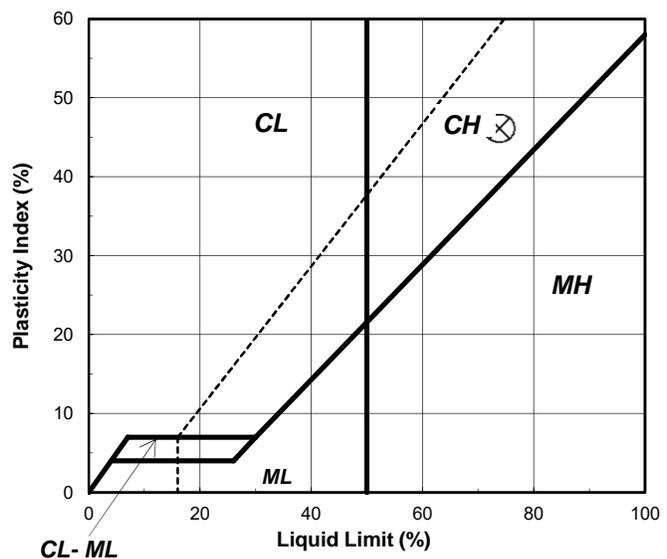
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	8	6		<b>Liquid Limit (%):</b> 74
Wt. of Tare & Wet Sample (g):	24.56	24.74		<b>Plastic Limit (%):</b> 28
Wt. of Tare & Dry Sample (g):	23.25	23.39		<b>Plasticity Index (%):</b> 46
Weight of Tare (g):	18.56	18.66		<b>USCS Symbol:</b> CH
Weight of Water (g):	1.3	1.4		
Weight of Dry Sample (g):	4.7	4.7		
<b>Moisture Content (%):</b>	<b>27.9</b>	<b>28.5</b>	<b>-0.6</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/20/17 Checked By NC Date 11/21/17

## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



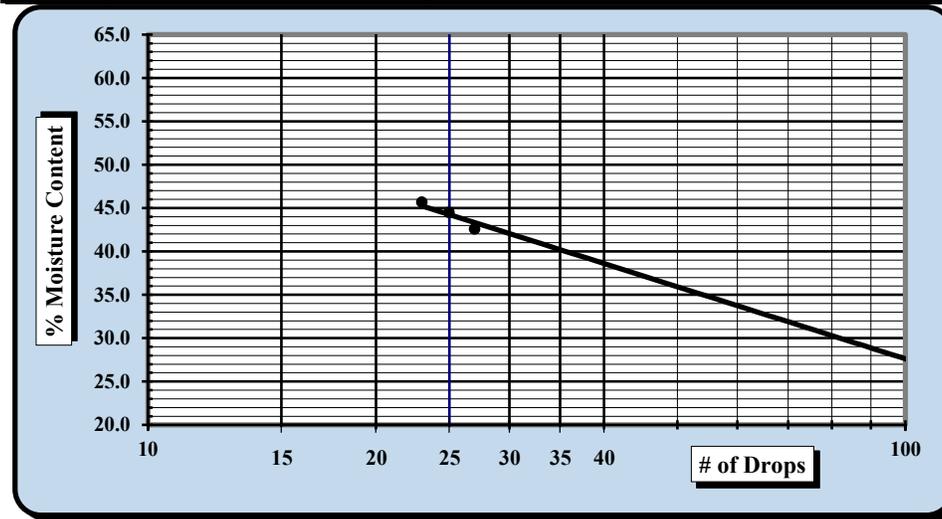
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	9/14/17
Project Name:	Kings Bluff Water Main	Test Date(s)	9/5-9/14/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	128	Type: Soil Boring	Sample Date: Various
Location:	Various (NC)	Sample: R-5A/S3	Depth(ft): 6.0'-7.5'

Sample Description: <b>Brown-Red Sandy CLAY</b>					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3			4	5		
A	Tare Weight	11.07	10.64	11.60				11.35	10.72	
B	Wet Soil Weight + A	20.51	19.18	21.52				20.60	20.04	
C	Dry Soil Weight + A	17.69	16.55	18.41				19.24	18.65	
D	Water Weight (B-C)	2.82	2.63	3.11				1.36	1.39	
E	Dry Soil Weight (C-A)	6.62	5.91	6.81				7.89	7.93	
F	% Moisture (D/E)*100	42.6%	44.5%	45.7%				17.2%	17.5%	
N	# OF DROPS	27	25	23				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>17.4%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>45</b>
Plastic Limit	<b>17</b>
Plastic Index	<b>28</b>
Group Symbol	<b>CL</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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## SIEVE ANALYSIS OF SOIL

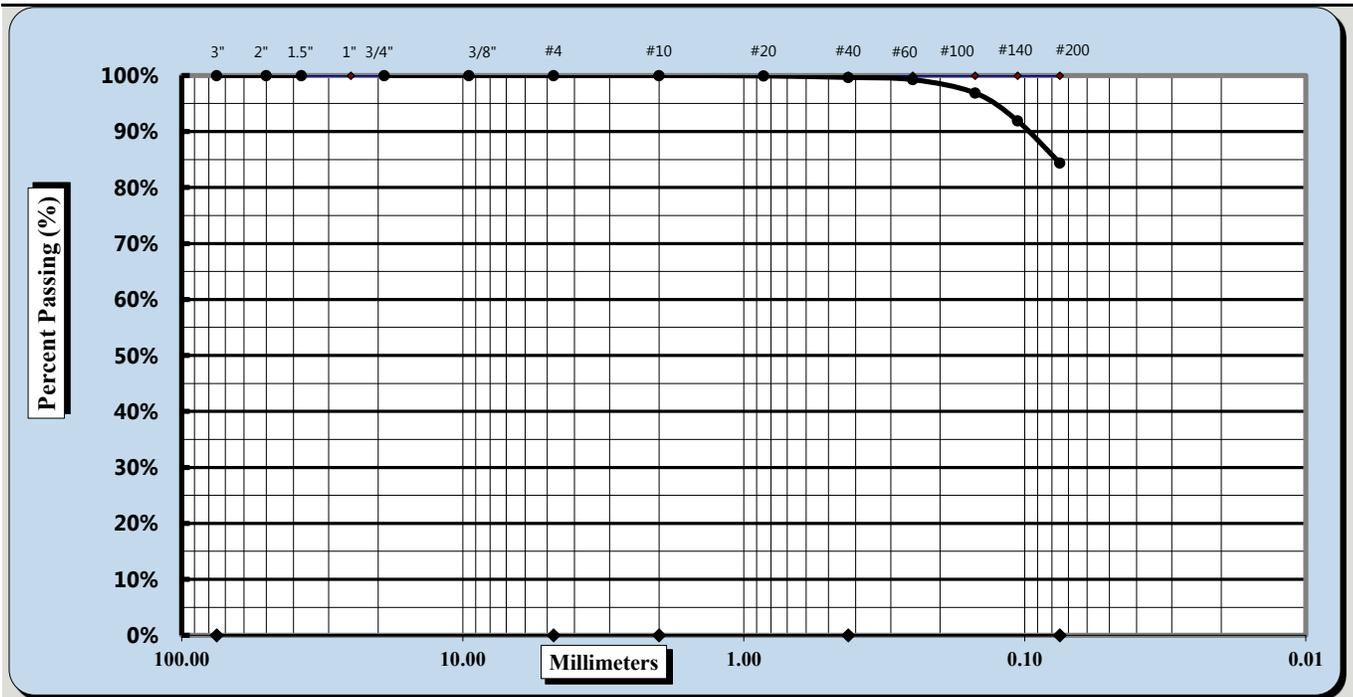


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	11 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-5A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Light Brown Sandy CLAY		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#10	Coarse Sand 0.0%
Gravel	0.0%	Medium Sand 0.3%
Liquid Limit	N/A	Plastic Limit N/A
Maximum Dry Density	N/A	Assumed SG(D854) 2.700
Optimum Moisture	N/A	Natural Moisture 36.0%
		Fine Sand 15.3%
		Silt & Clay 84.4%
		Plastic Index N/A
		% Absorption N/A
		CBR N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 9/14/17
Project Name: Kings Bluff Water Main	Lab Report #: 11 of 27
Client Name: McKim & Creed	Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-5A/S5)	Type: Split Spoon
	Elev/Depth: 13.5'-15.0'

Sample Description: Light Brown Sandy CLAY						
Estimate Max. Particle Size (99% Passing):			<b>#10</b>	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?			Soaked without Dispersant		x	Ultrasonic Bath
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 24 hours	
					Shaking Apparatus	
<b>Specimen:</b>	Pan No.	<b>52B</b>	B) Tare Wt.	Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>204.5</b>	Pan No.	<b>52B</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>150.4</b>	Dry Mass of Washed Sample + Tare Wt. <b>26.6</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>150.4</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>26.6</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>204.5</b>	Dry Mass passing #200 <b>123.8</b>		
F=(E-D)/D) Water Content of Specimen			<b>36.0%</b>	% Passing #200 <b>82.3%</b>		
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.1	0.10	115	0.1%	99.9%
#40	0.425	0.5	0.40	75	0.3%	99.7%
#60	0.250	1.1	0.60	60	0.7%	99.3%
#100	0.150	4.7	3.60	40	3.1%	96.9%
#140	0.106	12.2	7.50	30	8.1%	91.9%
#200	0.075	23.5	11.30	20	15.6%	84.4%
Pan	<0.075	26.6	3.1	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



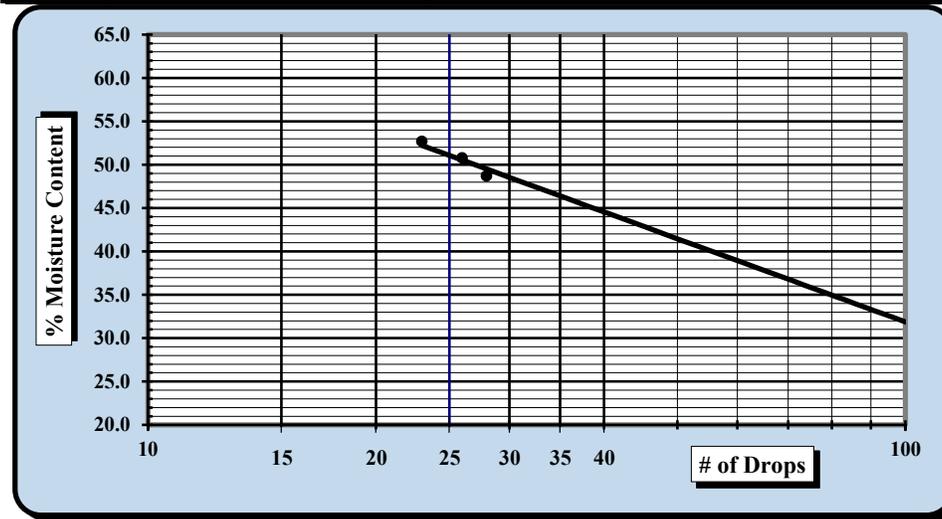
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	9/14/17
Project Name:	Kings Bluff Water Main	Test Date(s)	9/5-9/14/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	128	Type: Soil Boring	Sample Date: Various
Location:	Various (NC)	Sample: R-5B/S2	Depth(ft): 3.5'-5.0'

Sample Description: <b>Brown-Red Sandy CLAY</b>					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(M)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		6	7	8			9	10		
A	Tare Weight	11.25	11.70	10.90				11.99	11.73	
B	Wet Soil Weight + A	20.74	22.36	21.76				21.35	20.77	
C	Dry Soil Weight + A	17.63	18.77	18.01				19.72	19.20	
D	Water Weight (B-C)	3.11	3.59	3.75				1.63	1.57	
E	Dry Soil Weight (C-A)	6.38	7.07	7.11				7.73	7.47	
F	% Moisture (D/E)*100	48.7%	50.8%	52.7%				21.1%	21.0%	
N	# OF DROPS	28	26	23				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>21.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>51</b>
Plastic Limit	<b>21</b>
Plastic Index	<b>30</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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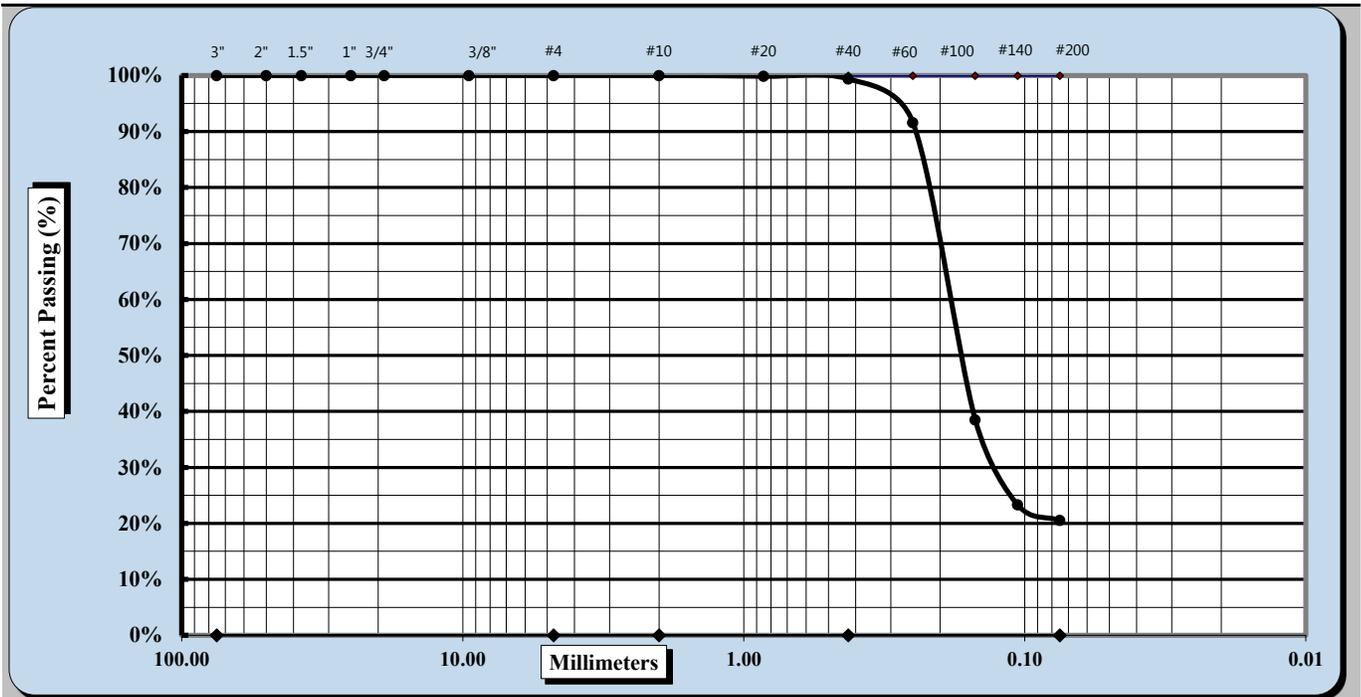
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	12 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
Location:	Various (NC)	Date Sampled:	Various
Log/Sample Id.	128 (R-5B/S7)	Type:	Split Spoon
Sample Description:	Light Brown Silty SAND (SM) with Clay Lumps		
		Elev/Depth:	23.5'-25.0'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	78.9%	
Gravel	0.0%	Medium Sand	0.6%	Silt & Clay	20.5%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	27.6%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	12 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-5B/S7)	Type:	Split Spoon
		Elev/Depth:	23.5'-25.0'

Sample Description: Light Brown Silty SAND (SM) with Clay Lumps							
Estimate Max. Particle Size (99% Passing):		#10	Testing Dates:		9/5-9/14/17		
Method A (1%)		Method B (0.1%)	x	Material Excluded?	None		
Procedure used to Obtain Specimen:		Moist	x	Air-Dried		Oven-Dried	
Sampling Method:	Stockpile:		Mechanically Split:		Quartered:	x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant	x	Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g	Soak Time:	5 hours	Shaking Apparatus?		
<b>Specimen:</b>	Pan No.	<b>HC</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>210.8</b>	Pan No.	<b>HC</b>	B) Tare Wt.	<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>165.2</b>	Dry Mass of Specimen after Wash +Tare			<b>132.3</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>165.2</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>132.3</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>210.8</b>	Dry Mass passing #200			<b>32.9</b>	
F=(E-D)/D Water Content of Specimen		<b>27.6%</b>	% Passing #200			<b>19.9%</b>	
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.1	0.1	115	<b>0.2</b>	0.1%	99.9%
#40	0.425	0.5	0.5	75	<b>1.0</b>	0.6%	99.4%
#60	0.250	6.1	7.8	60	<b>13.9</b>	8.4%	91.6%
#100	0.150	49.3	52.3	40	<b>101.6</b>	61.5%	38.5%
#140	0.106	63.0	63.7	30	<b>126.7</b>	76.7%	23.3%
#200	0.075	65.7	65.6	20	<b>131.3</b>	79.5%	20.5%
Pan	<0.075	66.2	66.0	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



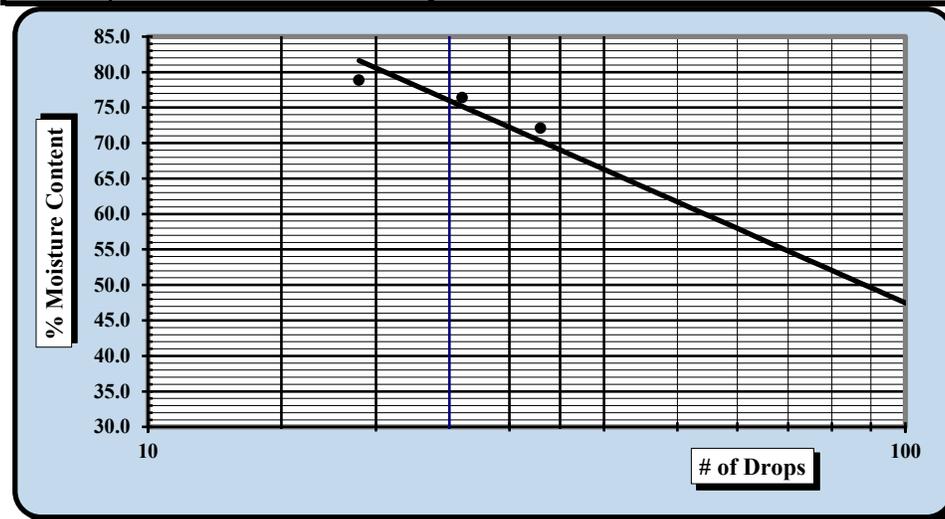
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: W-14A/S3	Depth(ft): 6.0'-7.5'

Sample Description: Light Brown Fat CLAY (CH)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		6D	7D	8D			9D	10D		
A	Tare Weight	19.87	20.20	19.56				20.26	20.10	
B	Wet Soil Weight + A	28.70	29.16	28.29				27.81	28.05	
C	Dry Soil Weight + A	25.00	25.28	24.44				26.34	26.50	
D	Water Weight (B-C)	3.70	3.88	3.85				1.47	1.55	
E	Dry Soil Weight (C-A)	5.13	5.08	4.88				6.08	6.40	
F	% Moisture (D/E)*100	72.1%	76.4%	78.9%				24.2%	24.2%	
N	# OF DROPS	33	26	19				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>24.2%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>76</b>
Plastic Limit	<b>24</b>
Plastic Index	<b>52</b>
Group Symbol	<b>CH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

**MC = 35.8%, No gradation ran on sample**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

<u>Gunnar Goslin</u> Technical Responsibility	 Signature	<u>Staff Professional</u> Position	<u>11/20/2017</u> Date
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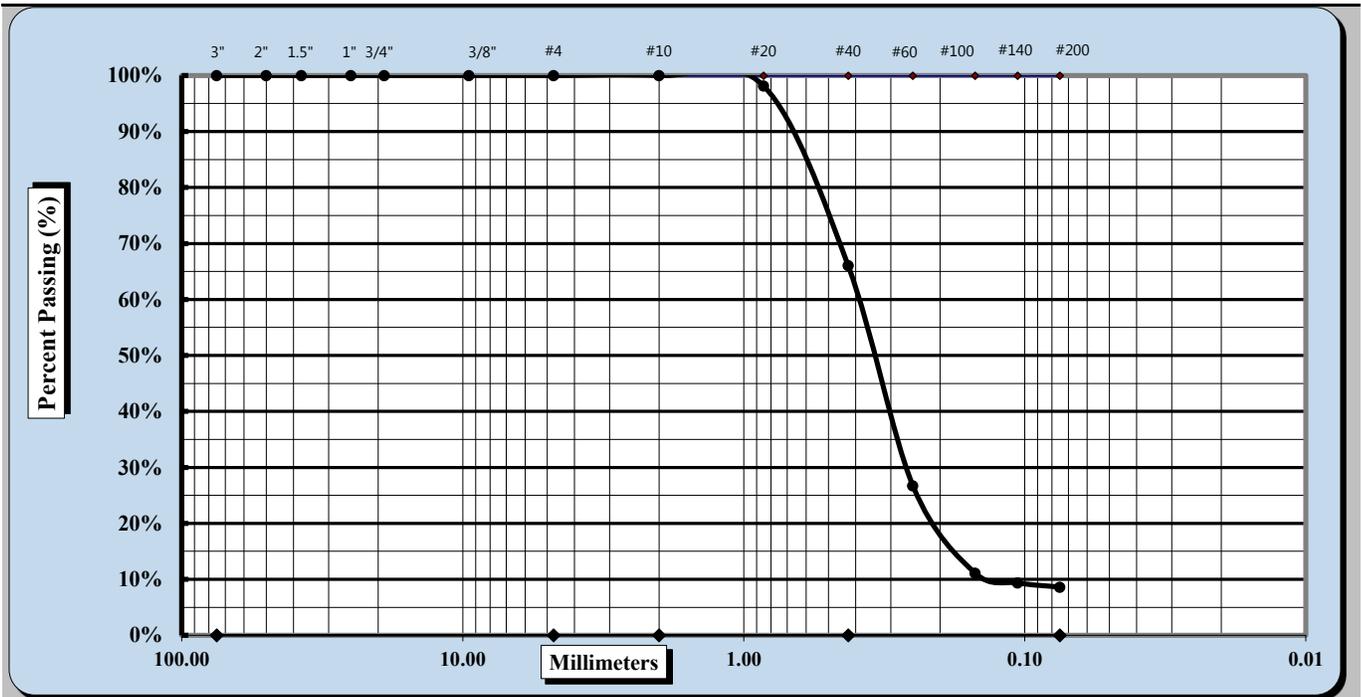
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 13 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-6A/S4)	Type: Split Spoon
Sample Description: Light Brown Poorly Graded SAND with Silt (SP-SM)	Elev/Depth: 8.5'-10.0'



## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	13 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-6A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Light Brown Poorly Graded SAND with Silt (SP-SM)								
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates:		9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x		Material Excluded? None		
Procedure used to Obtain Specimen:		Moist		x		Air-Dried		
						Oven-Dried		
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x		
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath		
Estimated Wet Mass of specimen required:		200 g		Soak Time: 5 hours		Shaking Apparatus?		
<b>Specimen:</b>	Pan No.	<b>52</b>	B) Tare Wt.	<b>0.0</b>				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>211.8</b>		Pan No.	<b>52</b>	B) Tare Wt.	<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>173.1</b>		Dry Mass of Specimen after Wash +Tare			<b>158.4</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>173.1</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>158.4</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>211.8</b>		Dry Mass passing #200			<b>14.7</b>	
F=(E-D)/D) Water Content of Specimen		<b>22.4%</b>		% Passing #200			<b>8.5%</b>	
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing	
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	<i>Total Sample Cumulative Percentages</i>		
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>	<i>CMR<sub>N</sub></i>	<i>PR</i>	<i>PP (Method A)</i>	
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%	
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%	
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%	
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%	
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%	
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%	
#20	0.850	1.6	1.6	115	<b>3.2</b>	1.8%	98.2%	
#40	0.425	28.7	30.1	75	<b>58.8</b>	34.0%	66.0%	
#60	0.250	62.8	64.1	60	<b>126.9</b>	73.3%	26.7%	
#100	0.150	76.7	77.2	40	<b>153.9</b>	88.9%	11.1%	
#140	0.106	78.4	78.5	30	<b>156.9</b>	90.6%	9.4%	
#200	0.075	79.1	79.1	20	<b>158.2</b>	91.4%	8.6%	
Pan	<0.075	79.3	79.2	Technician:				

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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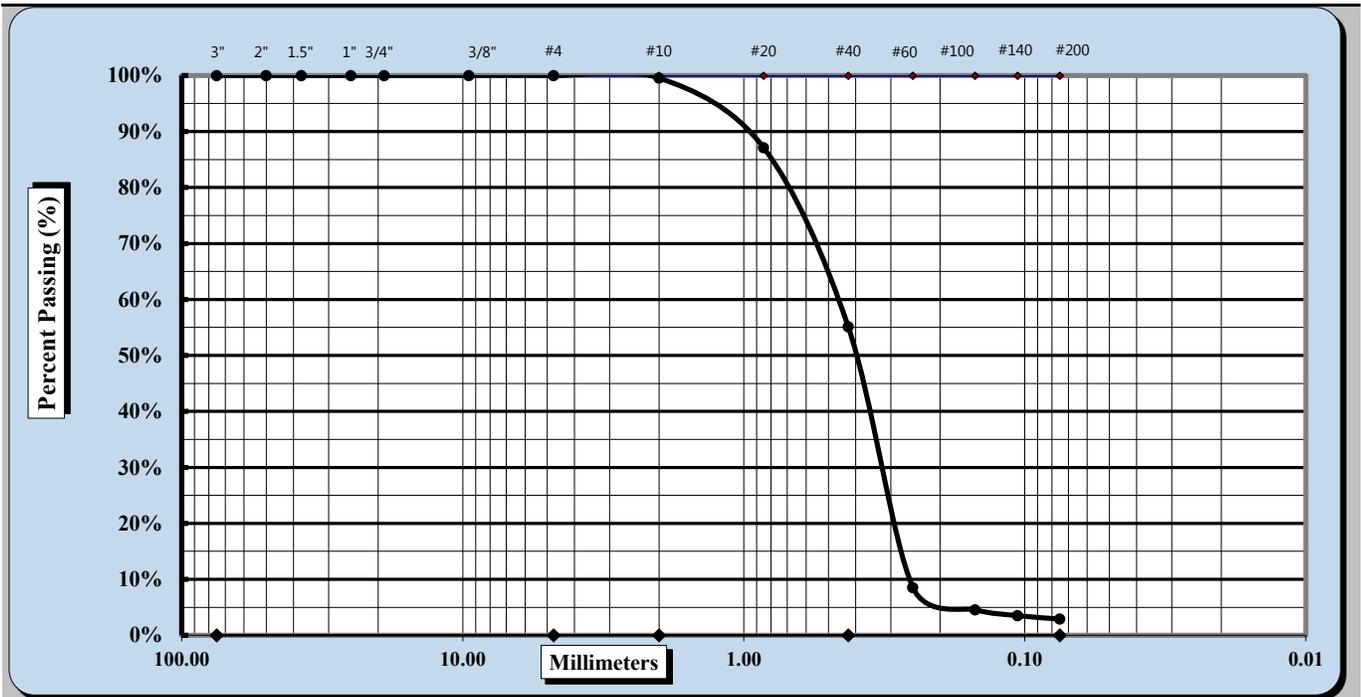
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 14 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-6A/S6)	Type: Split Spoon
Sample Description: Light Gray Poorly Graded SAND (SP)	Elev/Depth: 18.5'-20.0'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size #10	Coarse Sand 0.4%	Fine Sand 52.3%
Gravel 0.0%	Medium Sand 44.4%	Silt & Clay 2.9%
Liquid Limit N/A	Plastic Limit N/A	Plastic Index N/A
Maximum Dry Density N/A	Assumed SG(D854) 2.650	% Absorption N/A
Optimum Moisture N/A	Natural Moisture 17.9%	CBR N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	14 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-6A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Light Gray Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>BK</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>211.6</b>	Pan No. <b>BK</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>179.5</b>	Dry Mass of Specimen after Wash +Tare <b>174.6</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>179.5</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>174.6</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>211.6</b>	Dry Mass passing #200 <b>4.9</b>	
F=(E-D)/D) Water Content of Specimen	<b>17.9%</b>	% Passing #200 <b>2.7%</b>	

Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.2	0.6	180	<b>0.8</b>	0.4%	99.6%
#20	0.850	12.6	10.5	115	<b>23.1</b>	12.9%	87.1%
#40	0.425	37.6	42.9	75	<b>80.5</b>	44.8%	55.2%
#60	0.250	81.5	82.7	60	<b>164.2</b>	91.5%	8.5%
#100	0.150	85.4	85.9	40	<b>171.3</b>	95.4%	4.6%
#140	0.106	86.5	86.7	30	<b>173.2</b>	96.5%	3.5%
#200	0.075	87.1	87.2	20	<b>174.3</b>	97.1%	2.9%
Pan	<0.075	87.2	87.2	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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### SIEVE ANALYSIS OF SOIL

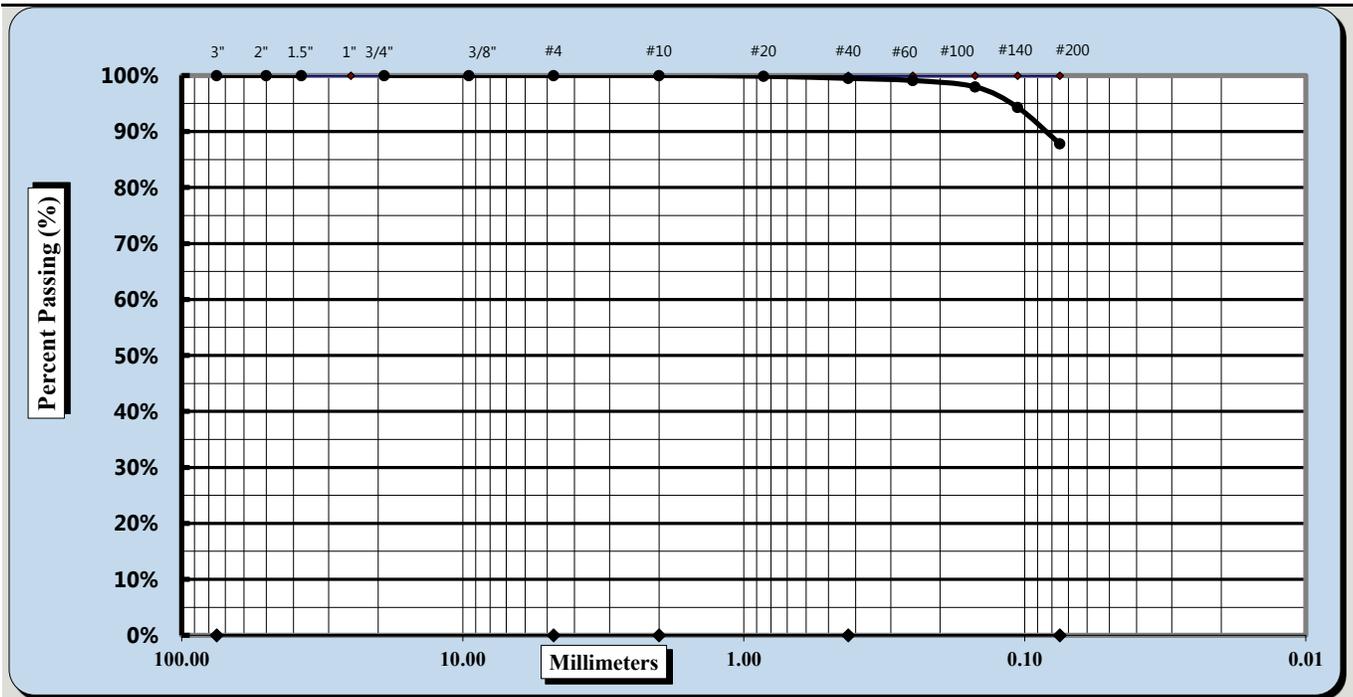


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	15 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-6B/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Light Gray Sandy CLAY		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	11.7%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	87.8%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	27.0%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 9/14/17
Project Name: Kings Bluff Water Main		Lab Report #: 15 of 27
Client Name: McKim & Creed		Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various (NC)		
Log/Sample Id. 128 (R-6B/S4)	Type: Split Spoon	Elev/Depth: 8.5'-10.0'

Sample Description: Light Gray Sandy CLAY						
Estimate Max. Particle Size (99% Passing):			#10	Testing Dates: 9/5-9/14/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath
Estimated Wet Mass of specimen required:			200 g.	Soak Time: 24 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No. 520	B) Tare Wt. 0.0		Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)			200.9	Pan No. 520	Tare Wt. 0.0	
C) Total Specimen Dry Wt. + Tare Wt. (g.)			158.2	Dry Mass of Washed Sample + Tare Wt.		22.8
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			158.2	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		22.8
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			200.9	Dry Mass passing #200		135.4
F=(E-D)/D) Water Content of Specimen			27.0%	% Passing #200		85.6%
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.2	0.20	115	0.1%	99.9%
#40	0.425	0.8	0.60	75	0.5%	99.5%
#60	0.250	1.4	0.60	60	0.9%	99.1%
#100	0.150	3.2	1.80	40	2.0%	98.0%
#140	0.106	9.0	5.80	30	5.7%	94.3%
#200	0.075	19.3	10.30	20	12.2%	87.8%
Pan	<0.075	22.9	3.6	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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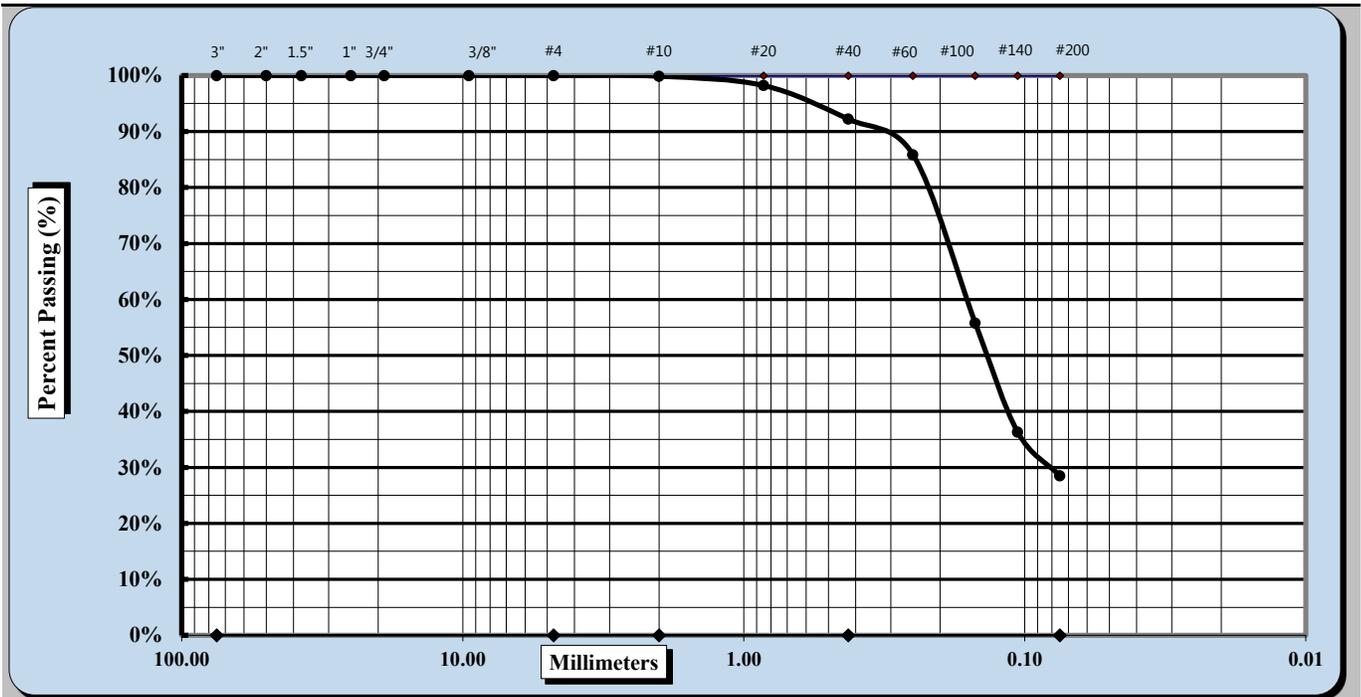
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	16 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-6B/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'
Sample Description:	Light Gray Silty SAND (SM) with Clay		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.1%	Fine Sand	63.7%
Gravel	0.0%	Medium Sand	7.7%	Silt & Clay	28.5%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	25.8%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	16 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-6B/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Light Gray Silty SAND (SM) with Clay

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>BD</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>211.9</b>	Pan No. <b>BD</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>168.5</b>	Dry Mass of Specimen after Wash +Tare <b>122.8</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>168.5</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>122.8</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>211.9</b>	Dry Mass passing #200 <b>45.7</b>	
F=(E-D)/D) Water Content of Specimen	<b>25.8%</b>	% Passing #200 <b>27.1%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.2	180	<b>0.2</b>	0.1%	99.9%
#20	0.850	1.1	1.9	115	<b>3.0</b>	1.8%	98.2%
#40	0.425	5.4	7.7	75	<b>13.1</b>	7.8%	92.2%
#60	0.250	10.2	13.6	60	<b>23.8</b>	14.1%	85.9%
#100	0.150	35.2	39.3	40	<b>74.5</b>	44.2%	55.8%
#140	0.106	52.6	54.7	30	<b>107.3</b>	63.7%	36.3%
#200	0.075	60.0	60.5	20	<b>120.5</b>	71.5%	28.5%
Pan	<0.075	61.3	61.5	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/7/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/3-11/6/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location: Various*	Sample: RT-7A/S3	Depth(ft): 6.0'-7.5'	

Sample Description: Light Brown Sandy Lean CLAY (CL)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		11D	12D	13D			14D	15D		
A	Tare Weight	19.61	19.68	17.11				17.09	17.05	
B	Wet Soil Weight + A	30.33	30.22	26.80				25.84	25.85	
C	Dry Soil Weight + A	26.95	26.80	23.62				24.30	24.27	
D	Water Weight (B-C)	3.38	3.42	3.18				1.54	1.58	
E	Dry Soil Weight (C-A)	7.34	7.12	6.51				7.21	7.22	
F	% Moisture (D/E)*100	46.0%	48.0%	48.8%				21.4%	21.9%	
N	# OF DROPS	26	21	17				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>21.7%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>46</b>
Plastic Limit	<b>22</b>
Plastic Index	<b>24</b>
Group Symbol	<b>CL</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

**MC = 22.6%, No gradation ran on sample**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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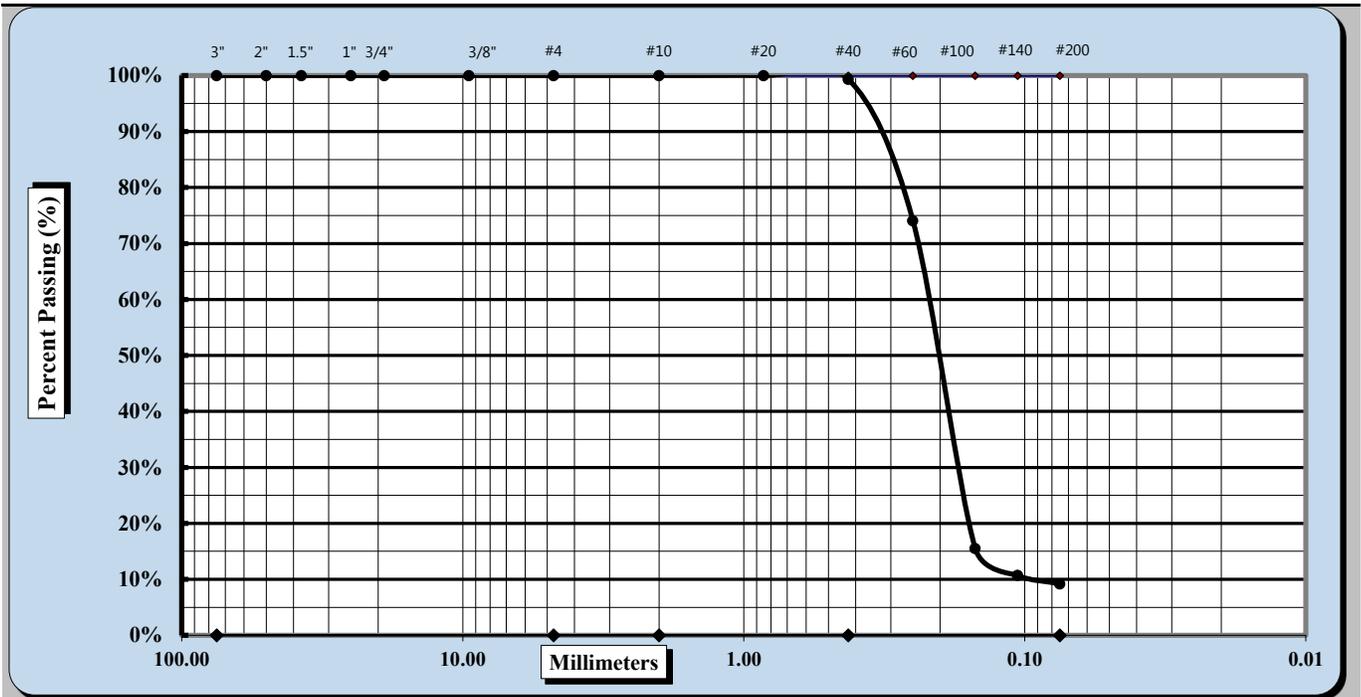
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 11/7/2017
Project Name: Kings Bluff Water Main	Lab Report #: 18 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (RT-7A/S5)	Elev/Depth: 13.5'-15.0'
Sample Description: Brown-Orange Poorly Graded SAND with Silt (SP-SM)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size #10	Coarse Sand 0.0%	Fine Sand 90.1%
Gravel 0.0%	Medium Sand 0.7%	Silt & Clay 9.2%
Liquid Limit N/A	Plastic Limit N/A	Plastic Index N/A
Maximum Dry Density N/A	Assumed SG(D854) 2.650	% Absorption N/A
Optimum Moisture N/A	Natural Moisture 24.5%	CBR N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/7/17
Project Name:	Kings Bluff Water Main	Lab Report #:	18 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (RT-7A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Brown-Orange Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing): **#10**      Testing Dates: 11/3-11/6/17

Method A (1%)      Method B (0.1%)      x      Material Excluded?      None

Procedure used to Obtain Specimen:      Moist      x      Air-Dried      Oven-Dried

Sampling Method:      Stockpile:      Mechanically Split:      Quartered:      x

Dispersion Process:      Soaked without Dispersant      Soaked with Dispersant      x      Ultrasonic Bath

Estimated Wet Mass of specimen required:      200 g      Soak Time: 7.0 hours      Shaking Apparatus?

**Specimen:**      Pan No.      **1520**      B) Tare Wt.      **0.0**      Method B of ASTM D1140 or D6913 sec. 11.4.3

A) Total Specimen Wet Wt. + Tare Wt. (g.)      **209.7**      Pan No.      **1520**      B) Tare Wt.      **0.0**

C) Total Specimen Dry Wt. + Tare Wt. (g.)      **168.4**      Dry Mass of Specimen after Wash +Tare      **153.2**

D = (C-B) Total Specimen Dry Weight (**S<sub>w</sub>M<sub>d</sub>**)      **168.4**      Dry Mass of Specimen after Wash (**S<sub>w</sub>M<sub>d</sub>**)      **153.2**

E = (A-B) Moist Specimen Mass (**S<sub>w</sub>M<sub>m</sub>**)      **209.7**      Dry Mass passing #200      **15.2**

F=(E-D)/D Water Content of Specimen      **24.5%**      % Passing #200      **9.0%**

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.0	0.0	115	<b>0.0</b>	0.0%	100.0%
#40	0.425	0.5	0.6	75	<b>1.1</b>	0.7%	99.3%
#60	0.250	21.3	22.4	60	<b>43.7</b>	26.0%	74.0%
#100	0.150	71.1	71.2	40	<b>142.3</b>	84.5%	15.5%
#140	0.106	75.3	75.1	30	<b>150.4</b>	89.3%	10.7%
#200	0.075	76.5	76.4	20	<b>152.9</b>	90.8%	9.2%
Pan	<0.075	76.7	76.5	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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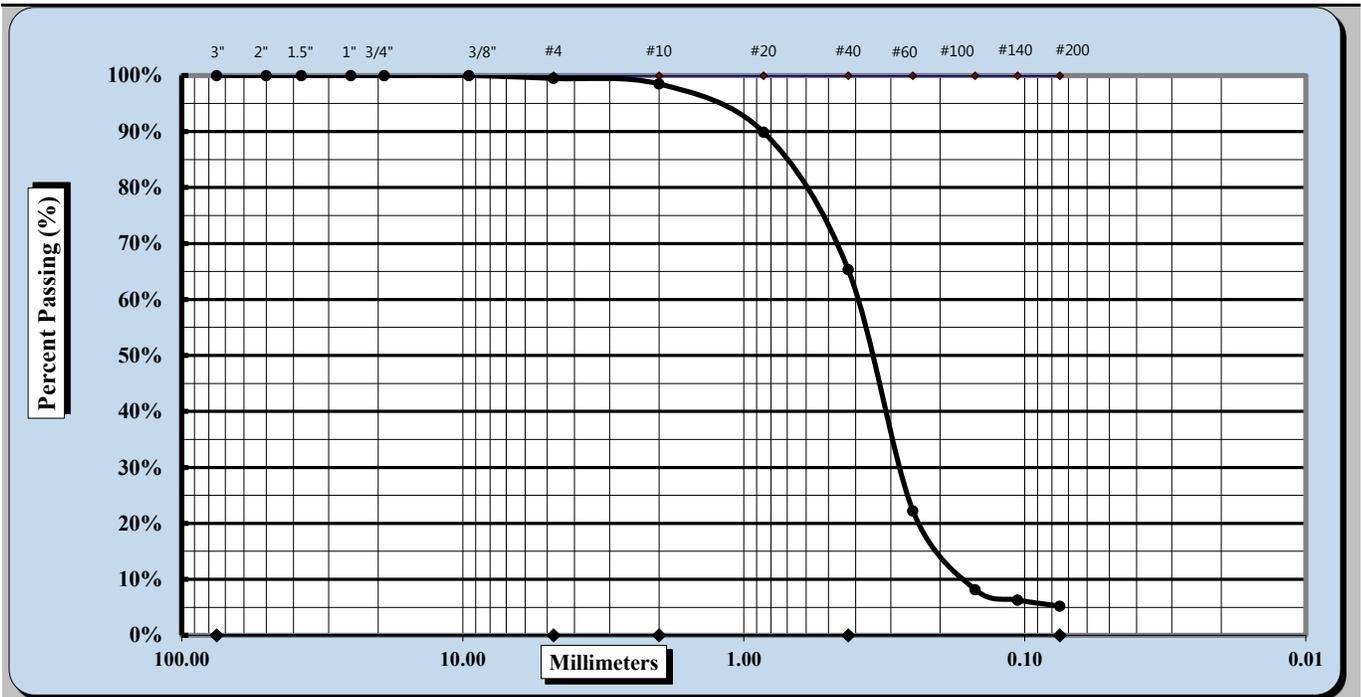
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 11/7/2017
Project Name: Kings Bluff Water Main	Lab Report #: 19 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (RT-7A/S7)	Type: Split Spoon
Sample Description: Light Gray Poorly Graded SAND with Silt (SP-SM)	Elev/Depth: 23.5'-25.0'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#4	Coarse Sand 1.0%
Gravel	0.5%	Medium Sand 33.2%
Liquid Limit	N/A	Plastic Limit N/A
Maximum Dry Density	N/A	Assumed SG(D854) 2.650
Optimum Moisture	N/A	Natural Moisture 23.0%
		Fine Sand 60.1%
		Silt & Clay 5.2%
		Plastic Index N/A
		% Absorption N/A
		CBR N/A

Notes / Deviations / References:

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<u>Gunnar Goslin</u> Technical Responsibility	 Signature	Staff Professional Position	11/22/2017 Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/7/17
Project Name:	Kings Bluff Water Main	Lab Report #:	19 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (RT-7A/S7)	Type:	Split Spoon
		Elev/Depth:	23.5'-25.0'

Sample Description: Light Gray Poorly Graded SAND with Silt (SP-SM)							
Estimate Max. Particle Size (99% Passing):		<b>#4</b>	Testing Dates: 11/3-11/6/17				
Method A (1%)		Method B (0.1%)	x	Material Excluded?		None	
Procedure used to Obtain Specimen:		Moist	x	Air-Dried		Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x	Ultrasonic Bath
Estimated Wet Mass of specimen required:		200 g		Soak Time: 7.0 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>51</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>212.6</b>		Pan No.	<b>51</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>172.8</b>		Dry Mass of Specimen after Wash +Tare			<b>164.1</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>172.8</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>164.1</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>212.6</b>		Dry Mass passing #200			<b>8.7</b>
F=(E-D)/D) Water Content of Specimen		<b>23.0%</b>		% Passing #200			<b>5.0%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>	<i>CMR<sub>N</sub></i>	<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.9	325	<b>0.9</b>	0.5%	99.5%
#10	2.000	0.8	1.8	180	<b>2.6</b>	1.5%	98.5%
#20	0.850	7.0	10.5	115	<b>17.5</b>	10.1%	89.9%
#40	0.425	27.1	32.8	75	<b>59.9</b>	34.7%	65.3%
#60	0.250	65.7	68.7	60	<b>134.4</b>	77.8%	22.2%
#100	0.150	79.2	79.5	40	<b>158.7</b>	91.8%	8.2%
#140	0.106	81.1	80.8	30	<b>161.9</b>	93.7%	6.3%
#200	0.075	82.2	81.6	20	<b>163.8</b>	94.8%	5.2%
Pan	<0.075	82.3	81.7	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/7/17
Project Name:	Kings Bluff Water Main	Lab Report #:	20 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (RT-7A/S9)	Type:	Split Spoon
		Elev/Depth:	33.5'-35.0'

Sample Description: Light Gray Poorly Graded SAND (SP)							
Estimate Max. Particle Size (99% Passing):		<b>#4</b>	Testing Dates: 11/3-11/6/17				
Method A (1%)		Method B (0.1%)	x	Material Excluded?		None	
Procedure used to Obtain Specimen:		Moist	x	Air-Dried		Oven-Dried	
Sampling Method:	Stockpile:	Mechanically Split:		Quartered: <span style="float: right;">x</span>			
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x	Ultrasonic Bath
Estimated Wet Mass of specimen required:		200 g		Soak Time: 7.0 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>LD</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>208.3</b>		Pan No.	<b>LD</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>174.4</b>		Dry Mass of Specimen after Wash +Tare			<b>166.4</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>174.4</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>166.4</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>208.3</b>		Dry Mass passing #200			<b>8.0</b>
F=(E-D)/D) Water Content of Specimen		<b>19.4%</b>		% Passing #200			<b>4.6%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	<b>% Retained</b>	<b>% Passing</b>
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>	<i>CMR<sub>N</sub></i>	<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	3.8	2.6	325	<b>6.4</b>	3.7%	96.3%
#10	2.000	8.5	6.1	180	<b>14.6</b>	8.4%	91.6%
#20	0.850	26.5	21.6	115	<b>48.1</b>	27.6%	72.4%
#40	0.425	62.9	56.6	75	<b>119.5</b>	68.5%	31.5%
#60	0.250	77.5	73.5	60	<b>151.0</b>	86.6%	13.4%
#100	0.150	81.5	79.6	40	<b>161.1</b>	92.4%	7.6%
#140	0.106	82.1	81.4	30	<b>163.5</b>	93.8%	6.3%
#200	0.075	83.4	82.5	20	<b>165.9</b>	95.1%	4.9%
Pan	<0.075	83.6	82.7	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS OF SOIL

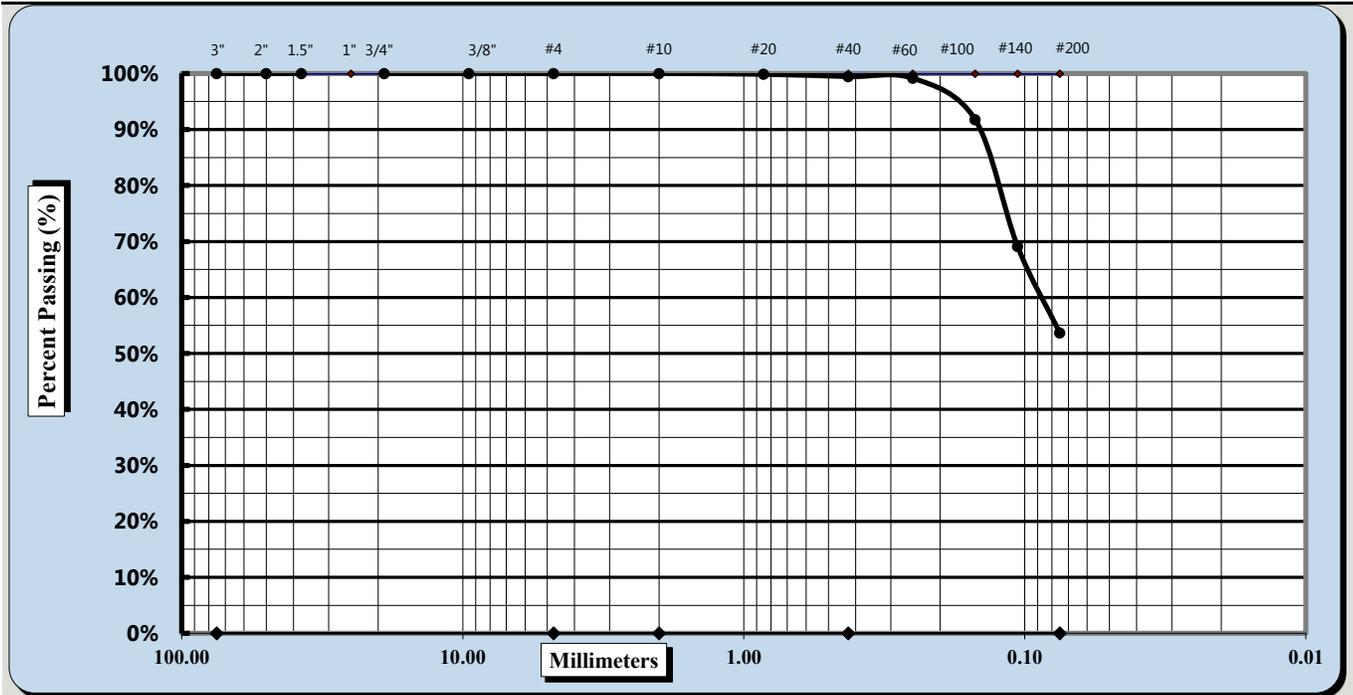


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	21 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (RT-7A/S11)	Type:	Split Spoon
		Elev/Depth:	43.5'-45.0'
Sample Description:	Dark Gray Sandy CLAY		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#10	Coarse Sand 0.0%
Gravel	0.0%	Medium Sand 0.5%
Liquid Limit	N/A	Plastic Limit N/A
Maximum Dry Density	N/A	Assumed SG(D854) 2.700
Optimum Moisture	N/A	Natural Moisture 24.4%
		Fine Sand 45.8%
		Silt & Clay 53.7%
		Plastic Index N/A
		% Absorption N/A
		CBR N/A

Notes / Deviations / References:

**No LL or PL ran on sample**

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 11/13/17
Project Name: Kings Bluff Water Main	Lab Report #: 21 of 32
Client Name: McKim & Creed	Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Date Sampled: Various	
Location: Various/Water Main/R-O-W	
Log/Sample Id. 155 (RT-7A/S11)	Type: Split Spoon
Elev/Depth: 43.5'-45.0'	

Sample Description: Dark Gray Sandy CLAY

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates: 11/8-11/13/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded? None
Procedure for obtaining Specimen:		Moist	x	Air-Dried
Oven-Dried				
Sampling Method	Stockpile:	Mechanically Split:		Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x
Ultrasonic Bath				
Estimated Wet Mass of specimen required:		200 g.	Soak Time: 4.5 hours	Shaking Apparatus
<b>Specimen:</b>	Pan No. <b>DK</b>	B) Tare Wt. <b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>207.8</b>	Pan No. <b>DK</b>	Tare Wt. <b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>167.0</b>	Dry Mass of Washed Sample + Tare Wt.		<b>86.0</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>167.0</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>86.0</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>207.8</b>	Dry Mass passing #200		<b>81.0</b>
F=(E-D)/D) Water Content of Specimen	<b>24.4%</b>	% Passing #200		<b>48.5%</b>

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.2	0.20	115	0.1%	99.9%
#40	0.425	0.9	0.70	75	0.5%	99.5%
#60	0.250	1.4	0.50	60	0.8%	99.2%
#100	0.150	13.8	12.40	40	8.3%	91.7%
#140	0.106	51.6	37.80	30	30.9%	69.1%
#200	0.075	77.4	25.80	20	46.3%	53.7%
Pan	<0.075	86.0	8.6	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

**No LL or PL ran on sample**

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

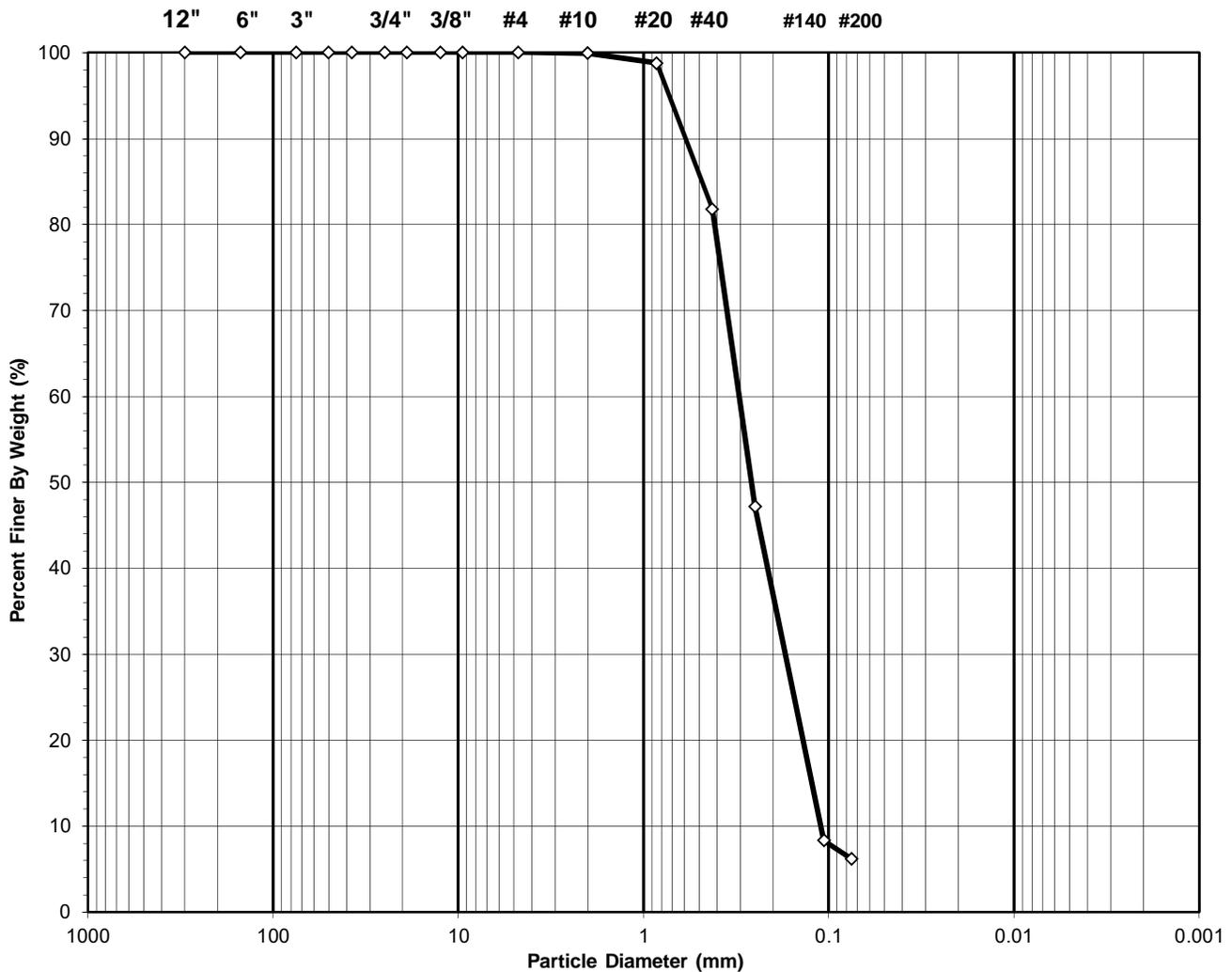
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-018	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
*sp-sc, ASSUMED*

**D60 = 0.30      CC = 0.87**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.17      CU = 2.77**

**D10 = 0.11**

Tested By RT      Date 11/14/17      Checked By NC      Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: RT-7B
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.: R-2017-861-001	Sample No.: SS-4
Lab ID: R-2017-861-001-018	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	26	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	596.08	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	529.56	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	200.59	Weight of Tare (g):	NA
Weight of Water (g):	66.52	Weight of Water (g):	NA
Weight of Dry Sample (g):	328.97	Weight of Dry Sample (g):	NA
*Moisture Content (%):	20.2	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	328.97
Dry Weight of - 3/4" Sample (g):	329.0	Weight of - #200 Material (g):	20.36
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	308.61
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.00	0.00	0.00	100.00	<b>100.00</b>
#10	2.00	0.17	0.05	0.05	99.95	<b>99.95</b>
#20	0.850	3.81	1.16	1.21	98.79	<b>98.79</b>
#40	0.425	55.88	16.99	18.20	81.80	<b>81.80</b>
#60	0.250	113.83	34.60	52.80	47.20	<b>47.20</b>
#140	0.106	127.80	38.85	91.65	8.35	<b>8.35</b>
#200	0.075	7.12	2.16	93.81	6.19	<b>6.19</b>
Pan	-	20.36	6.19	100.00	-	-

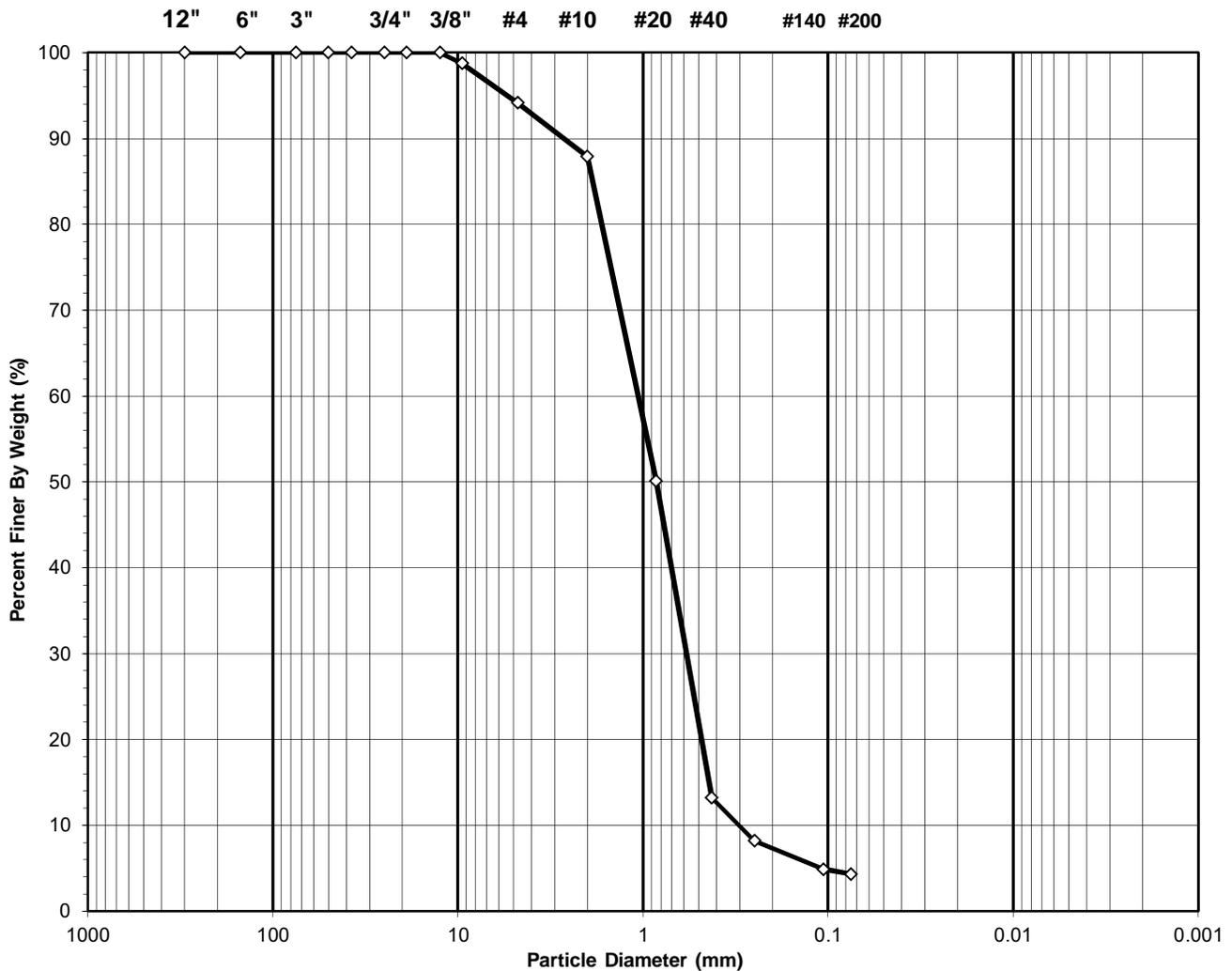
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	13.5-15
Project No.:	R-2017-861-001	Sample No.:	SS-5
Lab ID:	R-2017-861-001-019	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp, ASSUMED**

**D60 = 1.06      CC = 1.05**

**USCS Classification:**  
**POORLY GRADED SAND**

**D30 = 0.58      CU = 3.51**

**D10 = 0.30**

Tested By RT      Date 11/14/17      Checked By NC      Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 13.5-15
Project No.:	R-2017-861-001	Sample No.: SS-5
Lab ID:	R-2017-861-001-019	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	582	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	725.76	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	666.15	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	307.49	Weight of Tare (g):	NA
Weight of Water (g):	59.61	Weight of Water (g):	NA
Weight of Dry Sample (g):	358.66	Weight of Dry Sample (g):	NA
*Moisture Content (%):	16.6	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	358.66
Dry Weight of - 3/4" Sample (g):	358.7	Weight of - #200 Material (g):	15.53
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	343.13
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	4.48	1.25	1.25	98.75	<b>98.75</b>
#4	4.75	16.45	4.59	5.84	94.16	<b>94.16</b>
#10	2.00	22.42	6.25	12.09	87.91	<b>87.91</b>
#20	0.850	135.67	37.83	49.91	50.09	<b>50.09</b>
#40	0.425	132.27	36.88	86.79	13.21	<b>13.21</b>
#60	0.250	18.01	5.02	91.81	8.19	<b>8.19</b>
#140	0.106	11.76	3.28	95.09	4.91	<b>4.91</b>
#200	0.075	2.07	0.58	95.67	4.33	<b>4.33</b>
Pan	-	15.53	4.33	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17



## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	18.5-20
Project No.:	R-2017-861-001	Sample No.:	SS-6
Lab ID:	R-2017-861-001-020	Color:	Gray

( Minus No. 40 sieve material)

### As Received Water Content

Tare Number	1522
Wt. of Tare & Wet Sample (g)	867.35
Wt. of Tare & Dry Sample (g)	696.29
Weight of Tare (g)	148.59
Weight of Water (g)	171.06
Weight of Dry Sample (g)	547.70

<b>Water Content (%)</b>	<b>31.2</b>
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# NON - PLASTIC MATERIAL

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<i>Tested By</i>	<i>PF</i>	<i>Date</i>	<i>11/15/17</i>	<i>Checked By</i>	<i>NC</i>	<i>Date</i>	<i>11/15/17</i>
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## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client S&ME, Inc.  
 Client Reference CFPUA Kings Bluff Watermain 1306-17-013  
 Project No. R-2017-861-001  
 Lab ID R-2017-861-001-020

Boring No. RT-7B  
 Depth (ft) 18.5-20  
 Sample No. SS-6  
 Soil Color **GRAY**

Minus #10 for Hygroscopic Moisture Content		Hydrometer Specimen Data	
Tare No.	28	Air Dried - #10 Hydrometer Material (g)	62.75
Wgt. Tare + Wet Soil (g)	17.47	Corrected Dry Wt. of - #10 Material (g)	62.24
Wgt. Tare + Dry Soil (g)	17.38		
Weight of Tare (g)	6.38	Weight of - #200 Material (g)	25.84
Weight of Water (g)	0.09	Weight of - #10 ; + #200 Material (g)	36.40
Weight of Dry Soil (g)	11.00		
<b>Moisture Content (%)</b>	<b>0.8</b>	<b>J-FACTOR (%FINER THAN #10)</b>	<b>1.0000</b>
Soil Specimen Data			
Tare No.	Z10		
Wgt. Tare + Air Dry Soil (g)	663.79		
Weight of Tare (g)	201.97		
Air Dried Wgt. Total Sample (g)	461.82	Dry Weight of Material Retained on #10 (g)	0.00
Total Dry Sample Weight (g)	458.07	Corrected Dry Sample Wt - #10 (g)	458.07

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.5	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.00	0.0	0.0	100.0	100.0
#10	2.00	0.00	0.0	0.0	100.0	100.0
#20	0.85	0.19	0.3	0.3	99.7	99.7
#40	0.425	0.64	1.0	1.3	98.7	98.7
#60	0.250	0.44	0.7	2.0	98.0	98.0
#140	0.106	25.97	41.7	43.8	56.2	56.2
#200	0.075	9.16	14.7	58.5	41.5	41.5
Pan	-	25.84	41.5	100.0	-	-

**Notes :**

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017

**HYDROMETER ANALYSIS**  
ASTM D 422-63 (2007)

Client	S&ME, Inc.	Boring No.	RT-7B
Client Reference	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft)	18.5-20
Project No.	R-2017-861-001	Sample No.	SS-6
Lab ID	R-2017-861-001-020	Soil Color	<b>GRAY</b>

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	21.5	21.4	6.32	15.2	24.1	0.01322	0.0334	<b>24.1</b>
5	17.5	21.4	6.32	11.2	17.8	0.01322	0.0217	<b>17.8</b>
15	16.5	21.4	6.32	10.2	16.2	0.01322	0.0126	<b>16.2</b>
30	16.0	21.4	6.32	9.7	15.4	0.01322	0.0089	<b>15.4</b>
60	16.0	21.7	6.21	9.8	15.6	0.01317	0.0063	<b>15.6</b>
250	14.0	22.5	5.90	8.1	12.9	0.01305	0.0031	<b>12.9</b>
1440	12.0	22.0	6.09	5.9	9.4	0.01313	0.0013	<b>9.4</b>

Soil Specimen Data	Other Corrections	
Wgt. of Dry Material (g)	62.24	
Weight of Deflocculant (g)	5.0	
	Hygroscopic Moisture Factor	0.992
	a - Factor	0.99
	Percent Finer than # 10	100.00
	Specific Gravity	2.70 Assumed

**Notes:**

**Hydrometer Bulb ID:** N- 095

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017

# ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	28.5-30
Project No.:	R-2017-861-001	Sample No.:	SS-8
Lab ID:	R-2017-861-001-021	Soil Description:	GRAY LEAN CLAY

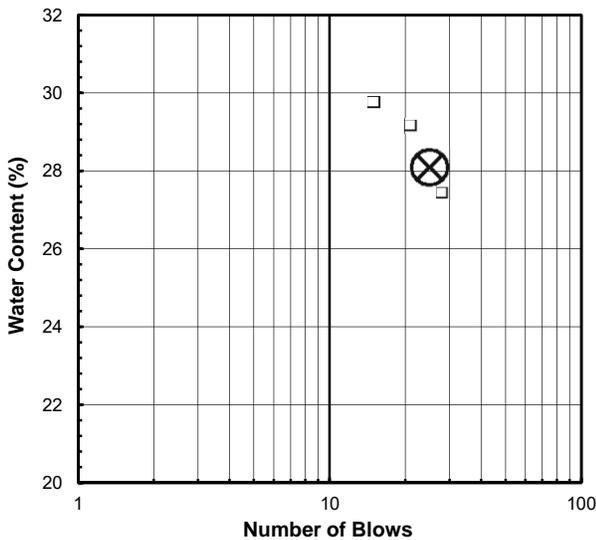
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried)**  
**see material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test			
	1	2	3	M
Tare Number:	1490	7	40	3
Wt. of Tare & Wet Sample (g):	836.85	40.02	38.48	39.51
Wt. of Tare & Dry Sample (g):	688.02	35.48	33.88	34.74
Weight of Tare (g):	144.63	18.94	18.10	18.70
Weight of Water (g):	148.8	4.5	4.6	4.8
Weight of Dry Sample (g):	543.4	16.5	15.8	16.0
Was As Received MC Preserved:	<b>Yes</b>			
<b>Moisture Content (%):</b>	<b>27.4</b>	<b>27.4</b>	<b>29.2</b>	<b>29.7</b>
<b>Number of Blows:</b>	<b>28</b>	<b>21</b>	<b>15</b>	<b>T</b>

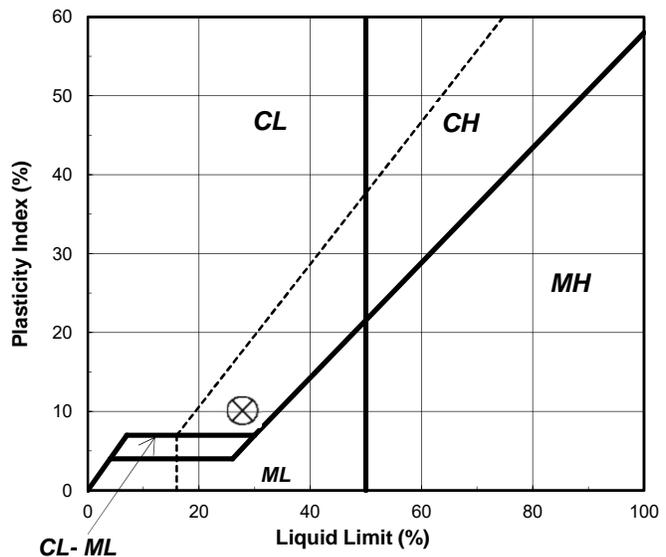
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	9	46		<b>Liquid Limit (%):</b> 28
Wt. of Tare & Wet Sample (g):	25.44	25.78		<b>Plastic Limit (%):</b> 18
Wt. of Tare & Dry Sample (g):	24.39	24.75		<b>Plasticity Index (%):</b> 10
Weight of Tare (g):	18.70	19.03		<b>USCS Symbol:</b> CL
Weight of Water (g):	1.1	1.0		
Weight of Dry Sample (g):	5.7	5.7		
<b>Moisture Content (%):</b>	<b>18.5</b>	<b>18.0</b>	<b>0.4</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



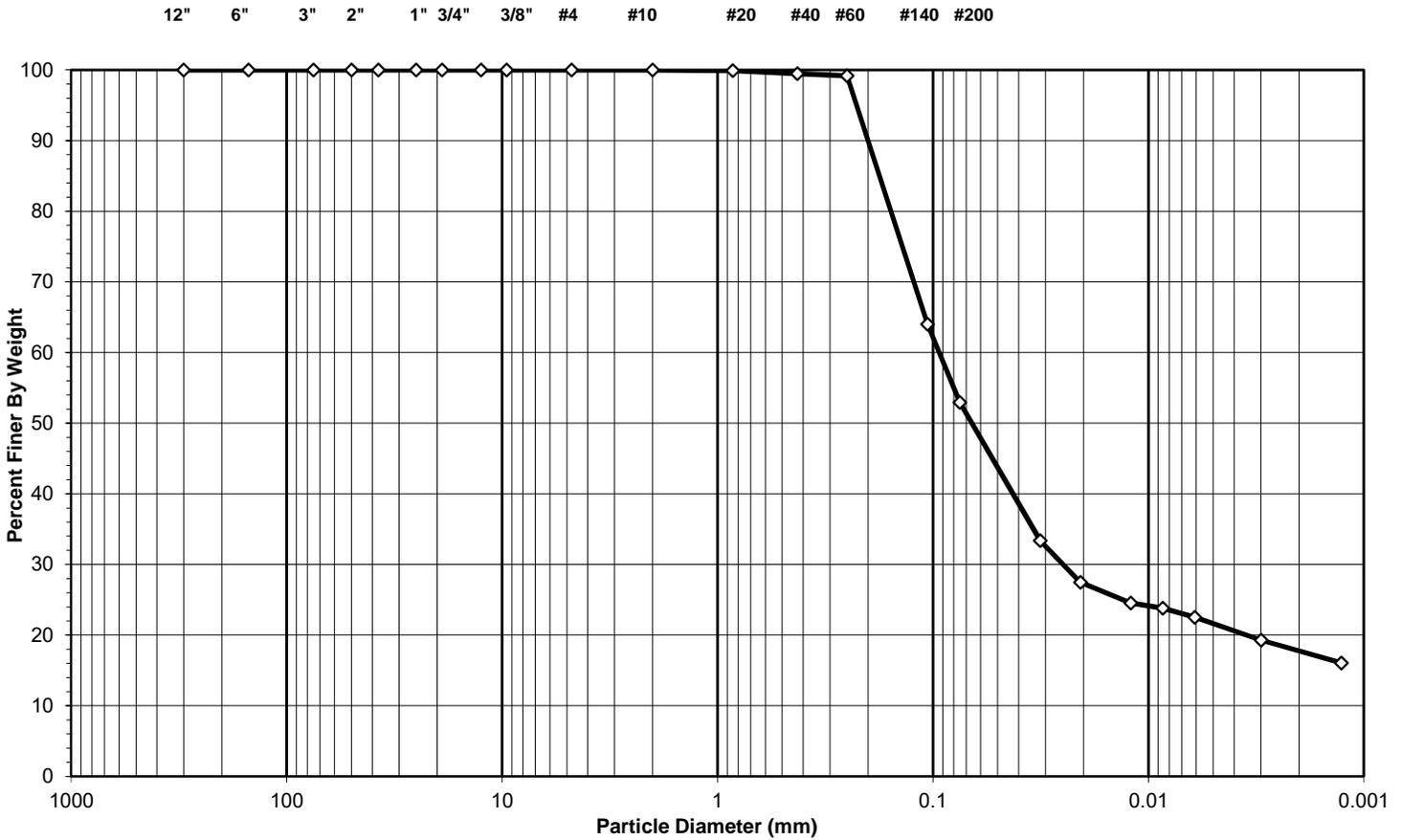
Tested By PF Date 11/15/17 Checked By NC Date 11/17/17

**SIEVE AND HYDROMETER ANALYSIS**  
ASTM D 422-63 (2007)

Client: S&ME, Inc.  
 Client Reference: CFPUA Kings Bluff Watermain 1306-17-013  
 Project No.: R-2017-861-001  
 Lab ID: R-2017-861-001-021

Boring No.: RT-7B  
 Depth (ft): 28.5-30  
 Sample No.: SS-8  
 Soil Color: **GRAY**

USCS USDA	SIEVE ANALYSIS										HYDROMETER		
	cobble		gravel			sand					silt and clay fraction		
	cobble		gravel			sand					silt		clay



USCS Summary		
Sieve Sizes (mm)		Percentage
Greater Than #4	Gravel	0.00
#4 To #200	Sand	47.08
Finer Than #200	Silt & Clay	52.92
<b>USCS Symbol</b>	<b>CL, TESTED</b>	
<b>USCS Classification</b>	<b>SANDY LEAN CLAY</b>	

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	S&ME, Inc.	Boring No.	RT-7B
Client Reference	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft)	28.5-30
Project No.	R-2017-861-001	Sample No.	SS-8
Lab ID	R-2017-861-001-021	Soil Color	<b>GRAY</b>

Minus #10 for Hygroscopic Moisture Content		Hydrometer Specimen Data	
Tare No.	T35	Air Dried - #10 Hydrometer Material (g)	68.23
Wgt. Tare + Wet Soil (g)	18.12	Corrected Dry Wt. of - #10 Material (g)	67.29
Wgt. Tare + Dry Soil (g)	17.96		
Weight of Tare (g)	6.45	Weight of - #200 Material (g)	35.61
Weight of Water (g)	0.16	Weight of - #10 ; + #200 Material (g)	31.68
Weight of Dry Soil (g)	11.51		
<b>Moisture Content (%)</b>	<b>1.4</b>	<b>J-FACTOR (%FINER THAN #10)</b>	<b>1.0000</b>
Soil Specimen Data			
Tare No.	55		
Wgt. Tare + Air Dry Soil (g)	701.48		
Weight of Tare (g)	203.62		
Air Dried Wgt. Total Sample (g)	497.86	Dry Weight of Material Retained on #10 (g)	0.00
Total Dry Sample Weight (g)	491.03	Corrected Dry Sample Wt - #10 (g)	491.03

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.5	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.00	0.0	0.0	100.0	100.0
#10	2.00	0.00	0.0	0.0	100.0	100.0
#20	0.85	0.05	0.1	0.1	99.9	99.9
#40	0.425	0.29	0.4	0.5	99.5	99.5
#60	0.250	0.22	0.3	0.8	99.2	99.2
#140	0.106	23.65	35.1	36.0	64.0	64.0
#200	0.075	7.47	11.1	47.1	52.9	52.9
Pan	-	35.61	52.9	100.0	-	-

**Notes :**

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017

**HYDROMETER ANALYSIS**  
ASTM D 422-63 (2007)

Client	S&ME, Inc.	Boring No.	RT-7B
Client Reference	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft)	28.5-30
Project No.	R-2017-861-001	Sample No.	SS-8
Lab ID	R-2017-861-001-021	Soil Color	<b>GRAY</b>

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	29.0	21.4	6.32	22.7	33.4	0.01322	0.0318	<b>33.4</b>
5	25.0	21.4	6.32	18.7	27.5	0.01322	0.0206	<b>27.5</b>
15	23.0	21.4	6.32	16.7	24.5	0.01322	0.0121	<b>24.5</b>
30	22.5	21.4	6.32	16.2	23.8	0.01322	0.0086	<b>23.8</b>
60	21.5	21.7	6.21	15.3	22.5	0.01317	0.0061	<b>22.5</b>
250	19.0	22.5	5.90	13.1	19.3	0.01305	0.0030	<b>19.3</b>
1440	17.0	22.0	6.09	10.9	16.1	0.01313	0.0013	<b>16.1</b>

Soil Specimen Data	Other Corrections	
Wgt. of Dry Material (g)	67.29	
Weight of Deflocculant (g)	5.0	
	Hygroscopic Moisture Factor	0.986
	a - Factor	0.99
	Percent Finer than # 10	100.00
	Specific Gravity	2.70 Assumed

**Notes:**

**Hydrometer Bulb ID:** N- 095

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	RT-7B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	43.5-45
Project No.:	R-2017-861-001	Sample No.:	SS-11
Lab ID:	R2017-861-001-022	Soil Description:	GRAY LEAN CLAY

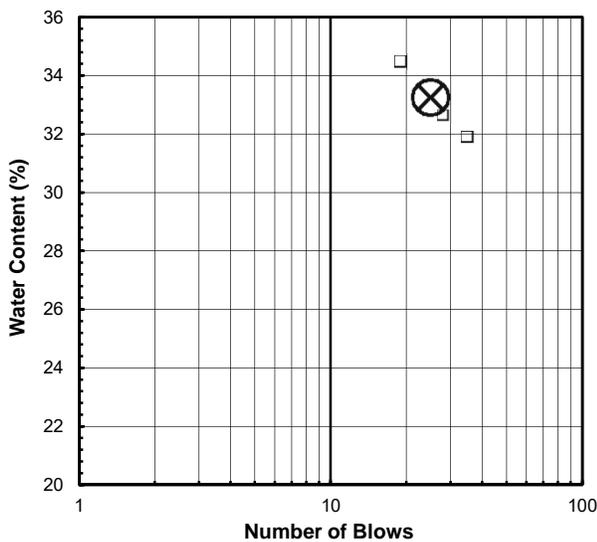
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material, Air dried)**  
*sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1519	32	33	19	U
Wt. of Tare & Wet Sample (g):	935.71	41.58	38.50	40.05	L
Wt. of Tare & Dry Sample (g):	771.52	36.36	33.54	34.52	T
Weight of Tare (g):	147.68	19.99	18.34	18.47	I
Weight of Water (g):	164.2	5.2	5.0	5.5	P
Weight of Dry Sample (g):	623.8	16.4	15.2	16.1	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>26.3</b>	<b>31.9</b>	<b>32.6</b>	<b>34.5</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>28</b>	<b>19</b>	<b>T</b>

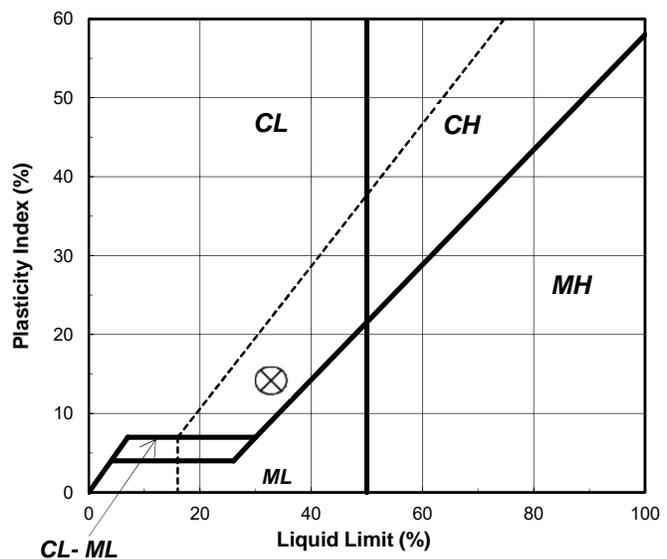
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	41	42		<b>Liquid Limit (%):</b> 33
Wt. of Tare & Wet Sample (g):	24.64	24.18		<b>Plastic Limit (%):</b> 19
Wt. of Tare & Dry Sample (g):	23.60	23.20		<b>Plasticity Index (%):</b> 14
Weight of Tare (g):	18.14	18.11		<b>USCS Symbol:</b> CL
Weight of Water (g):	1.0	1.0		
Weight of Dry Sample (g):	5.5	5.1		
<b>Moisture Content (%):</b>	<b>19.0</b>	<b>19.3</b>	<b>-0.2</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



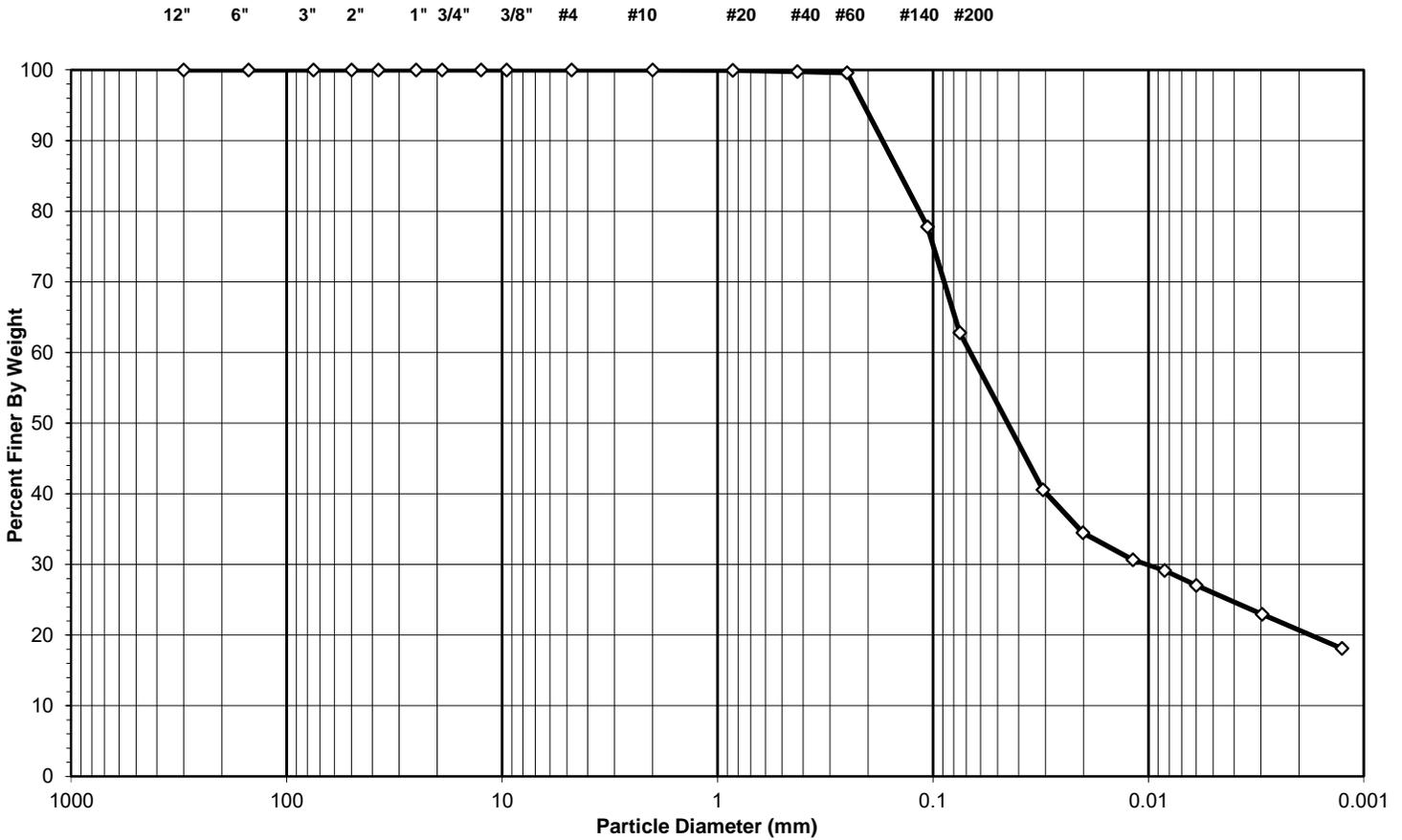
Tested By PF Date 11/14/17 Checked By NC Date 11/15/17

**SIEVE AND HYDROMETER ANALYSIS**  
ASTM D 422-63 (2007)

Client S&ME, Inc.  
 Client Reference CFPUA Kings Bluff Watermain 1306-17-013  
 Project No. R-2017-861-001  
 Lab ID R-2017-861-001-022

Boring No. RT-7B  
 Depth (ft) 43.5-45  
 Sample No. SS-11  
 Soil Color **GRAY**

USCS USDA	SIEVE ANALYSIS										HYDROMETER		
	cobble		gravel			sand					silt and clay fraction		
	cobble	gravel	gravel	sand	silt	clay							



USCS Summary		
Sieve Sizes (mm)		Percentage
Greater Than #4	Gravel	0.00
#4 To #200	Sand	37.21
Finer Than #200	Silt & Clay	62.79
<b>USCS Symbol</b>	<b>CL, TESTED</b>	
<b>USCS Classification</b>	<b>SANDY LEAN CLAY</b>	

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client S&ME, Inc.  
 Client Reference CFPUA Kings Bluff Watermain 1306-17-013  
 Project No. R-2017-861-001  
 Lab ID R-2017-861-001-022

Boring No. RT-7B  
 Depth (ft) 43.5-45  
 Sample No. SS-11  
 Soil Color **GRAY**

Minus #10 for Hygroscopic Moisture Content		Hydrometer Specimen Data	
Tare No.	T37	Air Dried - #10 Hydrometer Material (g)	66.08
Wgt. Tare + Wet Soil (g)	17.51	Corrected Dry Wt. of - #10 Material (g)	65.12
Wgt. Tare + Dry Soil (g)	17.35		
Weight of Tare (g)	6.48	Weight of - #200 Material (g)	40.89
Weight of Water (g)	0.16	Weight of - #10 ; + #200 Material (g)	24.23
Weight of Dry Soil (g)	10.87		
<b>Moisture Content (%)</b>	<b>1.5</b>	<b>J-FACTOR (%FINER THAN #10)</b>	<b>1.0000</b>
Soil Specimen Data			
Tare No.	51		
Wgt. Tare + Air Dry Soil (g)	719.94		
Weight of Tare (g)	200.85		
Air Dried Wgt. Total Sample (g)	519.09	Dry Weight of Material Retained on #10 (g)	0.00
Total Dry Sample Weight (g)	511.56	Corrected Dry Sample Wt - #10 (g)	511.56

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.5	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.00	0.0	0.0	100.0	100.0
#10	2.00	0.00	0.0	0.0	100.0	100.0
#20	0.85	0.04	0.1	0.1	99.9	99.9
#40	0.425	0.11	0.2	0.2	99.8	99.8
#60	0.250	0.11	0.2	0.4	99.6	99.6
#140	0.106	14.19	21.8	22.2	77.8	77.8
#200	0.075	9.78	15.0	37.2	62.8	62.8
Pan	-	40.89	62.8	100.0	-	-

**Notes :**

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017

**HYDROMETER ANALYSIS**  
ASTM D 422-63 (2007)

Client	S&ME, Inc.	Boring No.	RT-7B
Client Reference	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft)	43.5-45
Project No.	R-2017-861-001	Sample No.	SS-11
Lab ID	R-2017-861-001-022	Soil Color	<b>GRAY</b>

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	33.0	21.4	6.32	26.7	40.6	0.01322	0.0308	<b>40.6</b>
5	29.0	21.4	6.32	22.7	34.5	0.01322	0.0201	<b>34.5</b>
15	26.5	21.4	6.32	20.2	30.7	0.01322	0.0118	<b>30.7</b>
30	25.5	21.4	6.32	19.2	29.2	0.01322	0.0084	<b>29.2</b>
60	24.0	21.7	6.21	17.8	27.1	0.01317	0.0060	<b>27.1</b>
250	21.0	22.5	5.90	15.1	23.0	0.01305	0.0030	<b>23.0</b>
1440	18.0	22.0	6.09	11.9	18.1	0.01313	0.0013	<b>18.1</b>

Soil Specimen Data	Other Corrections	
Wgt. of Dry Material (g)	65.12	
Weight of Deflocculant (g)	5.0	
	Hygroscopic Moisture Factor	0.985
	a - Factor	0.99
	Percent Finer than # 10	100.00
	Specific Gravity	2.70 Assumed

**Notes:**

**Hydrometer Bulb ID:** N- 095

Tested By RT Date 11/17/2017 Checked By NC Date 11/20/2017



## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	A-6
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-023	Color:	Gray

( Minus No. 40 sieve material)

### As Received Water Content

Tare Number	1535
Wt. of Tare & Wet Sample (g)	568.61
Wt. of Tare & Dry Sample (g)	481.28
Weight of Tare (g)	148.11
Weight of Water (g)	87.33
Weight of Dry Sample (g)	333.17

<b>Water Content (%)</b>	<b>26.2</b>
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# NON - PLASTIC MATERIAL

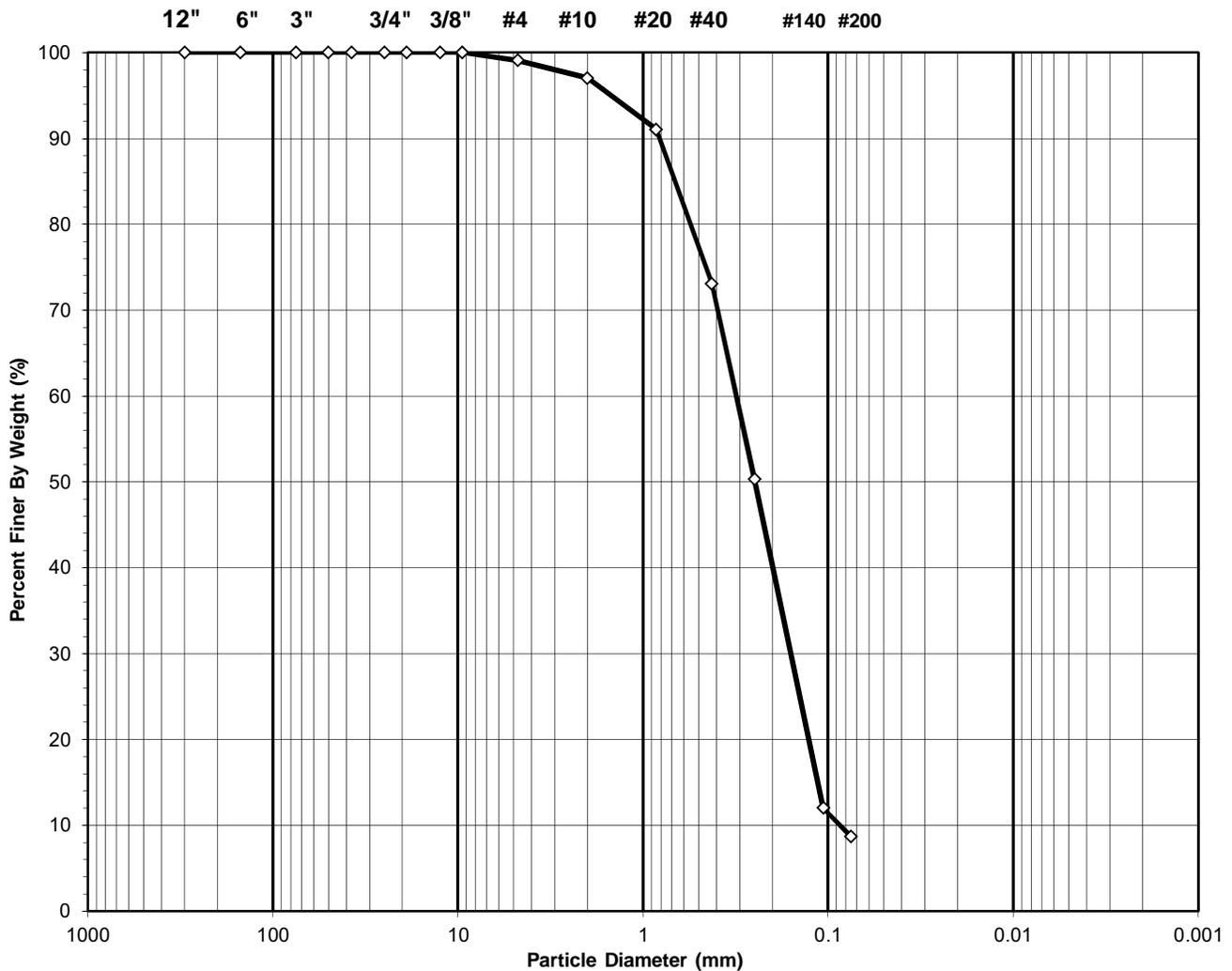
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<i>Tested By</i>	<i>PF</i>	<i>Date</i>	<i>11/14/17</i>	<i>Checked By</i>	<i>NC</i>	<i>Date</i>	<i>11/15/17</i>
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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-6
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	13.5-15
Project No.:	R-2017-861-001	Sample No.:	SS-5
Lab ID:	R-2017-861-001-024	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
*sp-sc, ASSUMED*

**D60 = 0.31      CC = 0.94**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.16      CU = 3.65**

**D10 = 0.09**

Tested By RT      Date 11/14/17      Checked By NC      Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: A-6
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 13.5-15
Project No.: R-2017-861-001	Sample No.: SS-5
Lab ID: R-2017-861-001-024	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1562	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	990.39	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	890.74	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	310.71	Weight of Tare (g):	NA
Weight of Water (g):	99.65	Weight of Water (g):	NA
Weight of Dry Sample (g):	580.03	Weight of Dry Sample (g):	NA
*Moisture Content (%):	17.2	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	580.03
Dry Weight of - 3/4" Sample (g):	580.0	Weight of - #200 Material (g):	50.54
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	529.49
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	5.21	0.90	0.90	99.10	99.10
#10	2.00	11.96	2.06	2.96	97.04	97.04
#20	0.850	34.65	5.97	8.93	91.07	91.07
#40	0.425	104.21	17.97	26.90	73.10	73.10
#60	0.250	131.95	22.75	49.65	50.35	50.35
#140	0.106	222.31	38.33	87.98	12.02	12.02
#200	0.075	19.20	3.31	91.29	8.71	8.71
Pan	-	50.54	8.71	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 11/13/2017
Project Name: Kings Bluff Water Main	Lab Report #: 22 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (W-16A/S3)	Elev/Depth: 6.0'-7.5'
Sample Description: Light Gray Silty SAND (SM) with Clay Lumps	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	0.1%
Gravel	0.0%	Medium Sand	0.6%
Liquid Limit	N/A	Plastic Limit	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650
Optimum Moisture	N/A	Natural Moisture	21.2%
		Fine Sand	68.3%
		Silt & Clay	31.0%
		Plastic Index	N/A
		% Absorption	N/A
		CBR	N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	22 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-16A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'

Sample Description: Light Gray Silty SAND (SM) with Clay Lumps							
Estimate Max. Particle Size (99% Passing):		#4		Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>LD</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>209.8</b>		Pan No.		<b>LD</b>	
				B) Tare Wt.		<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>173.1</b>		Dry Mass of Specimen after Wash +Tare			
				<b>123.2</b>			
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>173.1</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			
				<b>123.2</b>			
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>209.8</b>		Dry Mass passing #200			
				<b>49.9</b>			
F=(E-D)/D) Water Content of Specimen		<b>21.2%</b>		% Passing #200			
				<b>28.8%</b>			
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						Total Sample Cumulative Percentages	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.1	180		0.1%	99.9%
#20	0.850	0.1	0.3	115		0.2%	99.8%
#40	0.425	0.5	0.7	75		0.7%	99.3%
#60	0.250	2.3	2.8	60		2.9%	97.1%
#100	0.150	25.4	26.7	40		30.1%	69.9%
#140	0.106	48.6	49.4	30		56.6%	43.4%
#200	0.075	59.5	60.0	20		69.0%	31.0%
Pan	<0.075	61.4	61.9	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 11/13/2017
Project Name: Kings Bluff Water Main	Lab Report #: 23 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Date Sampled: Various	
Location: Various/Water Main/R-O-W	
Log/Sample Id. 155 (W-16A/S5)	Type: Split Spoon
Elev/Depth: 13.5'-15.0'	
Sample Description: Gray Silty SAND (SM)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	0.4%
Gravel	0.3%	Medium Sand	16.6%
Liquid Limit	N/A	Plastic Limit	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650
Optimum Moisture	N/A	Natural Moisture	20.3%
		Fine Sand	53.7%
		Silt & Clay	29.0%
		Plastic Index	N/A
		% Absorption	N/A
		CBR	N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	23 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-16A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Gray Silty SAND (SM)

Estimate Max. Particle Size (99% Passing): **#4** Testing Dates: 11/8-11/13/17

Method A (1%)  Method B (0.1%)  x Material Excluded?  None

Procedure used to Obtain Specimen: Moist  x Air-Dried  Oven-Dried

Sampling Method: Stockpile:  Mechanically Split:  Quartered:

Dispersion Process: Soaked without Dispersant  Soaked with Dispersant  x Ultrasonic Bath

Estimated Wet Mass of specimen required: 200 g Soak Time: 4.5 hours Shaking Apparatus?

**Specimen:** Pan No. **51** B) Tare Wt. **0.0** Method B of ASTM D1140 or D6913 sec. 11.4.3

A) Total Specimen Wet Wt. + Tare Wt. (g.) **214.3** Pan No. **51** B) Tare Wt. **0.0**

C) Total Specimen Dry Wt. + Tare Wt. (g.) **178.1** Dry Mass of Specimen after Wash +Tare **132.6**

D = (C-B) Total Specimen Dry Weight (**S<sub>w</sub>M<sub>d</sub>**) **178.1** Dry Mass of Specimen after Wash (**S<sub>w</sub>M<sub>d</sub>**) **132.6**

E = (A-B) Moist Specimen Mass (**S<sub>w</sub>M<sub>m</sub>**) **214.3** Dry Mass passing #200 **45.5**

F=(E-D)/D Water Content of Specimen **20.3%** % Passing #200 **25.5%**

Portion >>>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		Retained (Portions of Total Specimen)		Overloading	Cumulative Mass Retained	Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.3	0.2	325	<b>0.5</b>	0.3%	99.7%
#10	2.000	0.4	0.9	180	<b>1.3</b>	0.7%	99.3%
#20	0.850	3.4	6.7	115	<b>10.1</b>	5.7%	94.3%
#40	0.425	10.8	20.0	75	<b>30.8</b>	17.3%	82.7%
#60	0.250	21.2	33.7	60	<b>54.9</b>	30.8%	69.2%
#100	0.150	35.9	46.9	40	<b>82.8</b>	46.5%	53.5%
#140	0.106	49.7	56.4	30	<b>106.1</b>	59.6%	40.4%
#200	0.075	62.3	64.1	20	<b>126.4</b>	71.0%	29.0%
Pan	<0.075	66.1	66.5	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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# SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	24 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-17A/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Gray Sandy SILT with Wood Pieces		



# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/13/17
Project Name: Kings Bluff Water Main		Lab Report #: 24 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-17A/S2)	Type: Split Spoon	Elev/Depth: 3.5'-5.0'

Sample Description: Gray Sandy SILT with Wood Pieces						
Estimate Max. Particle Size (99% Passing):			#4	Testing Dates: 11/8-11/13/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x
Estimated Wet Mass of specimen required:		200 g.		Soak Time: 4.5 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No. 1520	B) Tare Wt. 0.0		Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)		202.4		Pan No. 1520	Tare Wt. 0.0	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		146.4		Dry Mass of Washed Sample + Tare Wt.		74.0
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		146.4		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		74.0
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		202.4		Dry Mass passing #200		72.4
F=(E-D)/D) Water Content of Specimen		38.3%		% Passing #200		49.5%
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	3.3	3.30	325	2.3%	97.7%
#10	2.000	6.1	2.80	180	4.2%	95.8%
#20	0.850	11.4	5.30	115	7.8%	92.2%
#40	0.425	23.9	12.50	75	16.3%	83.7%
#60	0.250	40.5	16.60	60	27.7%	72.3%
#100	0.150	57.2	16.70	40	39.1%	60.9%
#140	0.106	66.7	9.50	30	45.6%	54.4%
#200	0.075	71.7	5.00	20	49.0%	51.0%
Pan	<0.075	73.7	2.0	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))**Material retained on #4, #10, and #20 sieves were wood pieces of varying sizes.**

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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### SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	25 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-17A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Gray-Brown Silty SAND (SM) with Wood Pieces and Rock Fragments		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	3/8"	Coarse Sand	5.1%	Fine Sand	32.1%
Gravel	23.2%	Medium Sand	12.6%	Silt & Clay	27.0%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	46.8%	CBR	N/A

Notes / Deviations / References:

**Material retained on 3/8" sieve was a rock and #4, #10, and #20 sieves were wood pieces of varying sizes.**

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 11/13/17
Project Name: Kings Bluff Water Main	Lab Report #: 25 of 32
Client Name: McKim & Creed	Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (W-17A/S4)	Type: Split Spoon
	Elev/Depth: 8.5'-10.0'

Sample Description: Gray-Brown Silty SAND (SM) with Wood Pieces and Rock Fragments							
Estimate Max. Particle Size (99% Passing):			<b>3/8"</b>	Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x	Material Excluded? None		
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried	
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process?			Soaked without Dispersant		x	Ultrasonic Bath	
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 4.5 hours		
					Shaking Apparatus		
<b>Specimen:</b>	Pan No.	<b>BK</b>	B) Tare Wt. <b>0.0</b>		Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>69.0</b>		Pan No.	<b>BK</b>	
					Tare Wt.	<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>47.0</b>		Dry Mass of Washed Sample + Tare Wt. <b>34.7</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>47.0</b>		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>34.7</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>69.0</b>		Dry Mass passing #200 <b>12.3</b>		
F=(E-D)/D) Water Content of Specimen			<b>46.8%</b>		% Passing #200 <b>26.2%</b>		
Sieve Size		Cumulative Mass Retained		Increment Mass Retained		Limits for Sieve Overloading	
						<b>% Retained</b>	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub></i>	<i>MR<sub>N</sub></i>	<i>8" diameter</i>		<i>CPR<sub>N</sub></i>	<i>PP<sub>N</sub> (Method A)</i>
1.0"	25.00	0.0	0.00	1100		0.0%	100.0%
3/4"	19.00	0.0	0.00	900		0.0%	100.0%
3/8"	9.50	6.2	6.20	550		13.2%	86.8%
#4	4.75	10.9	4.70	325		23.2%	76.8%
#10	2.000	13.3	2.40	180		28.3%	71.7%
#20	0.850	15.3	2.00	115		32.6%	67.4%
#40	0.425	19.2	3.90	75		40.9%	59.1%
#60	0.250	24.1	4.90	60		51.3%	48.7%
#100	0.150	29.3	5.20	40		62.3%	37.7%
#140	0.106	32.6	3.30	30		69.4%	30.6%
#200	0.075	34.3	1.70	20		73.0%	27.0%
Pan	<0.075	34.7	0.4	Technician:			

Notes/Deviations/References:  $PP_N = 100 (1 - (CMR_N / S_w M_d))$ **Material retained on 3/8" sieve was a rock and #4, #10, and #20 sieves were wood pieces of varying sizes.****The 69 grams tested was the entire amount of sample recovery in the bag for this sample.**

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

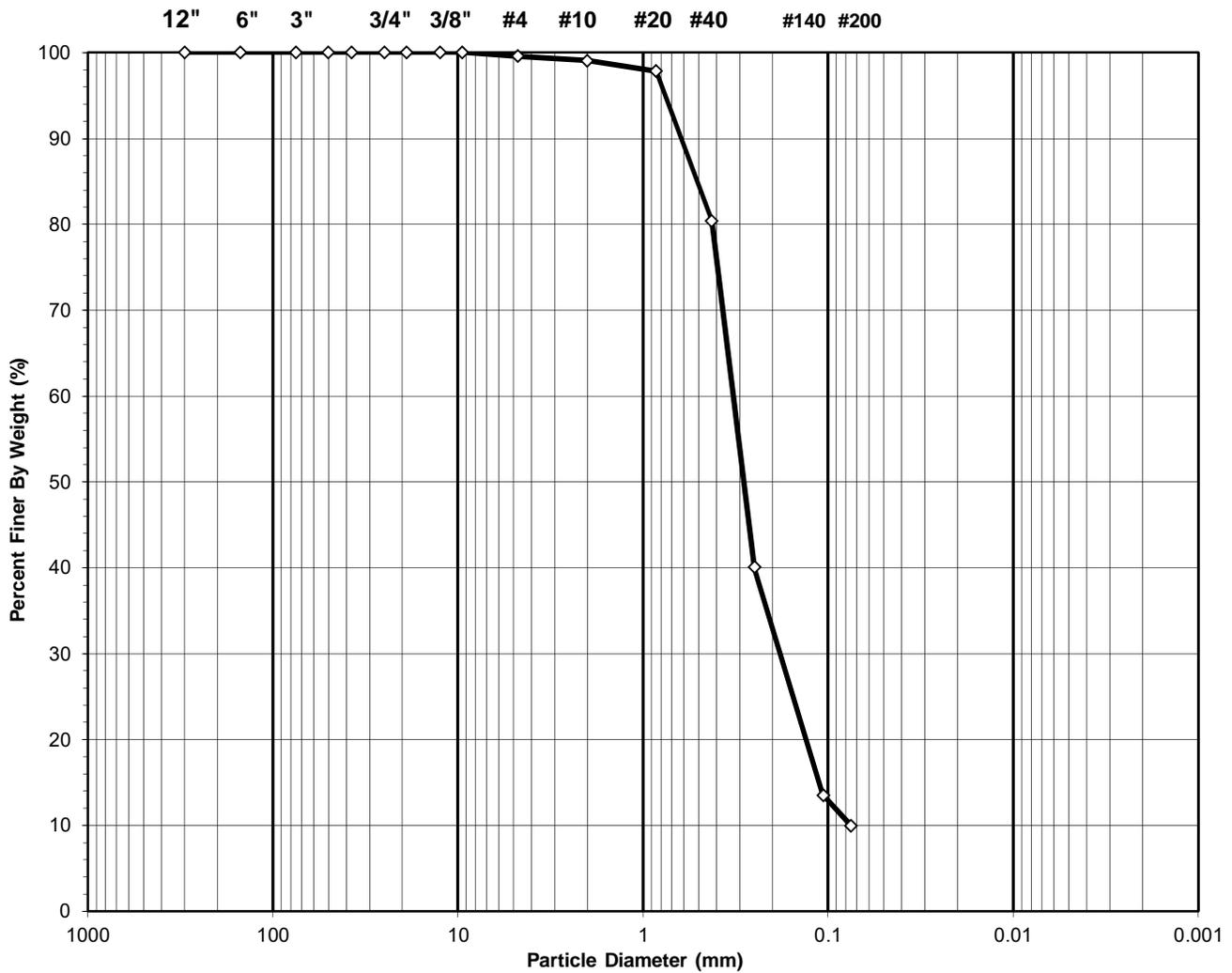
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-17C
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-025	Soil Color:	Dark Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp-sc, ASSUMED**

**D60 = 0.32      CC = 1.33**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.18      CU = 4.32**

**D10 = 0.08**

Tested By RT      Date 11/14/17      Checked By NC      Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-17C
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-025	Soil Color: Dark Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1558	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	479.41	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	417.92	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.22	Weight of Tare (g):	NA
Weight of Water (g):	61.49	Weight of Water (g):	NA
Weight of Dry Sample (g):	109.70	Weight of Dry Sample (g):	NA
*Moisture Content (%):	56.1	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	109.70
Dry Weight of - 3/4" Sample (g):	109.7	Weight of - #200 Material (g):	10.94
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	98.76
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.45	0.41	0.41	99.59	<b>99.59</b>
#10	2.00	0.56	0.51	0.92	99.08	<b>99.08</b>
#20	0.850	1.35	1.23	2.15	97.85	<b>97.85</b>
#40	0.425	19.11	17.42	19.57	80.43	<b>80.43</b>
#60	0.250	44.28	40.36	59.94	40.06	<b>40.06</b>
#140	0.106	29.11	26.54	86.47	13.53	<b>13.53</b>
#200	0.075	3.90	3.56	90.03	9.97	<b>9.97</b>
Pan	-	10.94	9.97	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By **RT**      Date **11/14/17**      Checked By **NC**      Date **11/14/17**

## ATTERBERG LIMITS

ASTM D 4318-17

Client: S&ME, Inc.	Boring No.: W-17C	
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10	
Project No.: R-2017-861-001	Sample No.: SS-4	
Lab ID: R2017-861-001-026	Soil Description: GRAY LEAN CLAY	

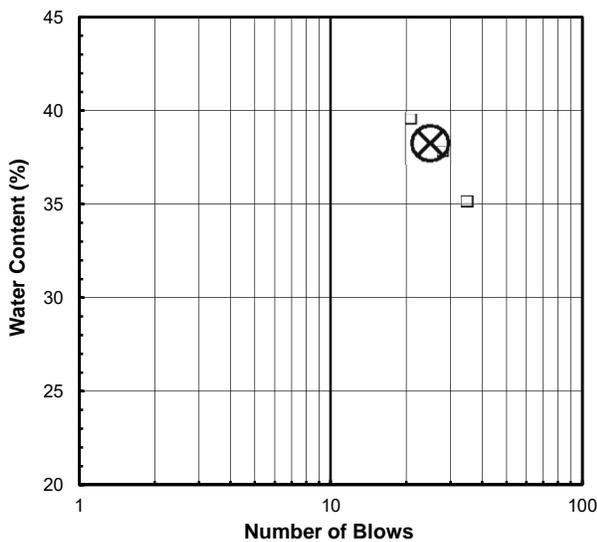
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	579	13	18	22	U
Wt. of Tare & Wet Sample (g):	572.31	39.71	40.97	39.69	L
Wt. of Tare & Dry Sample (g):	516.04	34.42	35.00	33.90	T
Weight of Tare (g):	308.51	19.34	19.21	19.24	I
Weight of Water (g):	56.3	5.3	6.0	5.8	P
Weight of Dry Sample (g):	207.5	15.1	15.8	14.7	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>27.1</b>	<b>35.1</b>	<b>37.8</b>	<b>39.5</b>	<b>N</b>
<b>Number of Blows:</b>	<b>35</b>	<b>28</b>	<b>21</b>	<b>15</b>	<b>T</b>

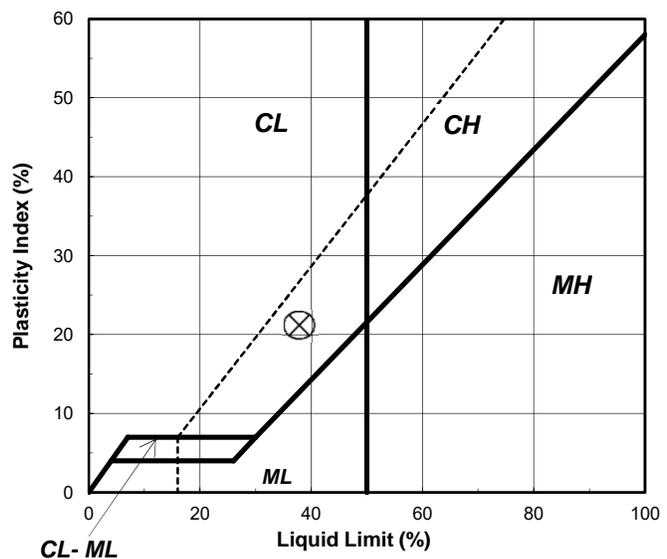
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	48	2		<b>Liquid Limit (%):</b> 38
Wt. of Tare & Wet Sample (g):	25.20	24.88		<b>Plastic Limit (%):</b> 17
Wt. of Tare & Dry Sample (g):	24.27	23.93		<b>Plasticity Index (%):</b> 21
Weight of Tare (g):	19.02	18.42		<b>USCS Symbol:</b> CL
Weight of Water (g):	0.9	0.9		
Weight of Dry Sample (g):	5.3	5.5		
<b>Moisture Content (%):</b>	<b>17.7</b>	<b>17.2</b>	<b>0.5</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**

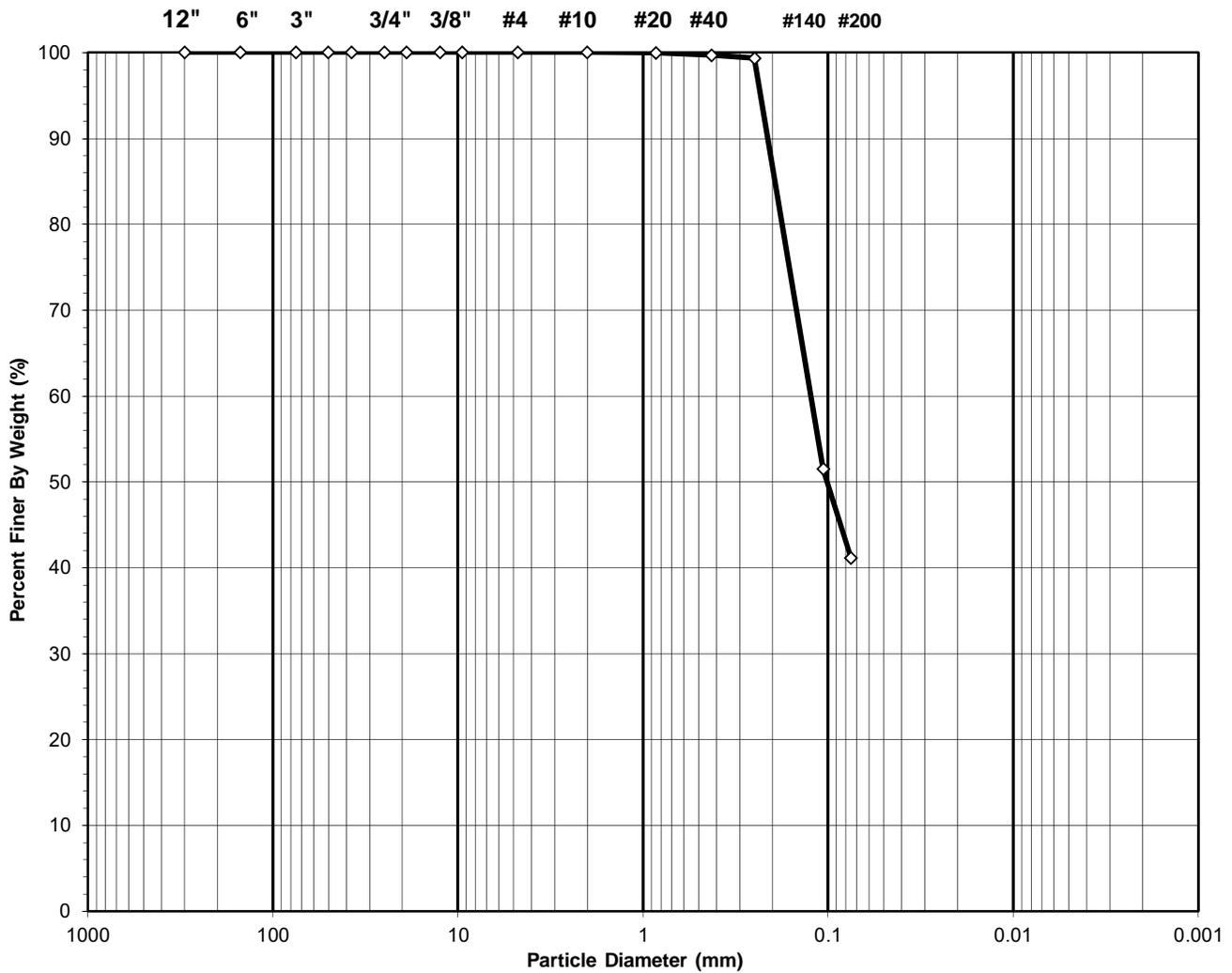


Tested By PF Date 11/14/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-17E
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-027	Soil Color:	Light Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-17E
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.: R-2017-861-001	Sample No.: SS-2
Lab ID: R-2017-861-001-027	Soil Color: Light Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	581	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	415.31	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	386.38	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.91	Weight of Tare (g):	NA
Weight of Water (g):	28.93	Weight of Water (g):	NA
Weight of Dry Sample (g):	77.47	Weight of Dry Sample (g):	NA
*Moisture Content (%):	37.3	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	77.47
Dry Weight of - 3/4" Sample (g):	77.5	Weight of - #200 Material (g):	31.89
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	45.58
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.00	0.00	0.00	100.00	100.00
#20	0.850	0.02	0.03	0.03	99.97	99.97
#40	0.425	0.21	0.27	0.30	99.70	99.70
#60	0.250	0.28	0.36	0.66	99.34	99.34
#140	0.106	37.07	47.85	48.51	51.49	51.49
#200	0.075	8.00	10.33	58.84	41.16	41.16
Pan	-	31.89	41.16	100.00	-	-

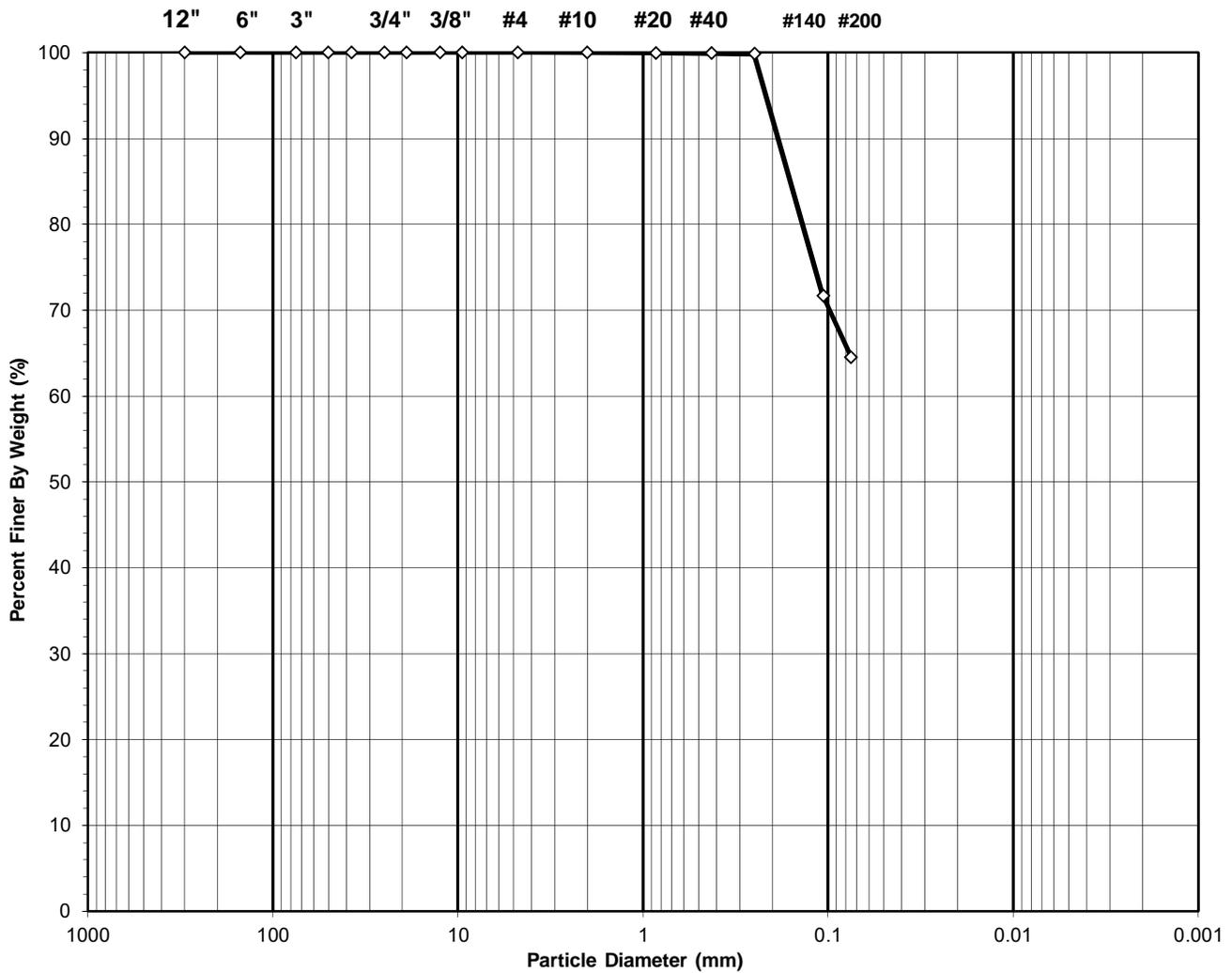
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/14/17 Checked By NC Date 11/14/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-17E
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-028	Soil Color:	Gray

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**cl, ASSUMED**

**USCS Classification:**  
**SANDY LEAN CLAY**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-17E
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.: R-2017-861-001	Sample No.: SS-4
Lab ID: R-2017-861-001-028	Soil Color: Gray

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	587	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	575.33	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	518.63	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.85	Weight of Tare (g):	NA
Weight of Water (g):	56.70	Weight of Water (g):	NA
Weight of Dry Sample (g):	209.78	Weight of Dry Sample (g):	NA
*Moisture Content (%):	27.0	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	209.78
Dry Weight of - 3/4" Sample (g):	209.8	Weight of - #200 Material (g):	135.36
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	74.42
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.00	0.00	0.00	100.00	100.00
#20	0.850	0.05	0.02	0.02	99.98	99.98
#40	0.425	0.06	0.03	0.05	99.95	99.95
#60	0.250	0.19	0.09	0.14	99.86	99.86
#140	0.106	59.08	28.16	28.31	71.69	71.69
#200	0.075	15.04	7.17	35.48	64.52	64.52
Pan	-	135.36	64.52	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-17H
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-029	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-17H
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.: R-2017-861-001	Sample No.: SS-2
Lab ID: R-2017-861-001-029	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1560	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	538.01	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	487.97	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	305.42	Weight of Tare (g):	NA
Weight of Water (g):	50.04	Weight of Water (g):	NA
Weight of Dry Sample (g):	182.55	Weight of Dry Sample (g):	NA
*Moisture Content (%):	27.4	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	182.55
Dry Weight of - 3/4" Sample (g):	182.6	Weight of - #200 Material (g):	28.11
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	154.44
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.02	0.01	0.01	99.99	99.99
#20	0.850	0.05	0.03	0.04	99.96	99.96
#40	0.425	0.29	0.16	0.20	99.80	99.80
#60	0.250	5.75	3.15	3.35	96.65	96.65
#140	0.106	128.10	70.17	73.52	26.48	26.48
#200	0.075	20.23	11.08	84.60	15.40	15.40
Pan	-	28.11	15.40	100.00	-	-

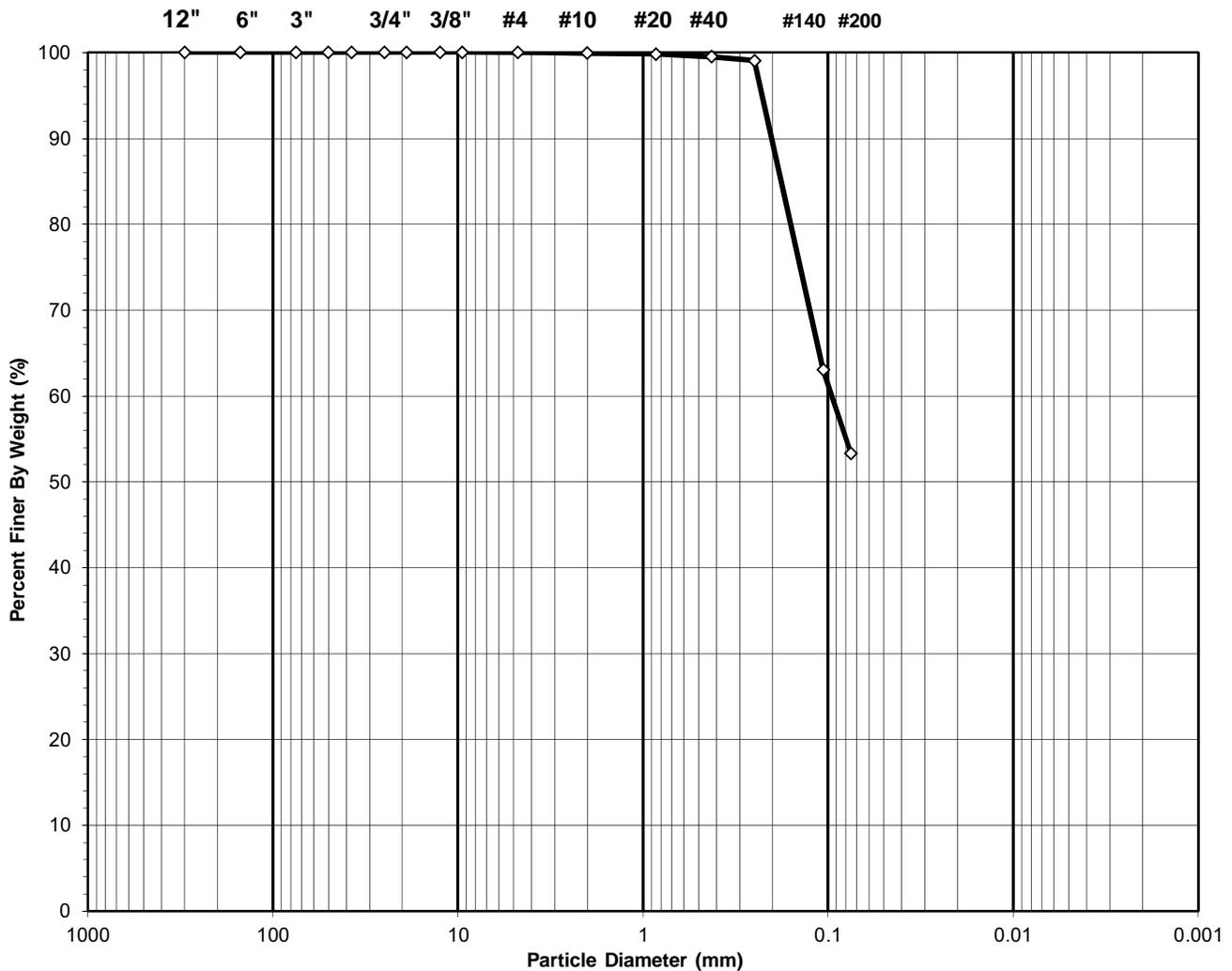
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-17H
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-030	Soil Color:	Gray

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**cl, ASSUMED**

**USCS Classification:**  
**SANDY LEAN CLAY**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-17H
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.:	R-2017-861-001	Sample No.: SS-4
Lab ID:	R-2017-861-001-030	Soil Color: Gray

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	589	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	554.15	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	501.85	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.58	Weight of Tare (g):	NA
Weight of Water (g):	52.30	Weight of Water (g):	NA
Weight of Dry Sample (g):	193.27	Weight of Dry Sample (g):	NA
*Moisture Content (%):	27.1	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	193.27
Dry Weight of - 3/4" Sample (g):	193.3	Weight of - #200 Material (g):	103.06
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	90.21
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.13	0.07	0.07	99.93	99.93
#20	0.850	0.17	0.09	0.16	99.84	99.84
#40	0.425	0.65	0.34	0.49	99.51	99.51
#60	0.250	0.84	0.43	0.93	99.07	99.07
#140	0.106	69.65	36.04	36.96	63.04	63.04
#200	0.075	18.77	9.71	46.68	53.32	53.32
Pan	-	103.06	53.32	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17



## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	17 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-8A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Light Brown Silty SAND (SM) with Clay

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates:		9/5-9/14/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded?	None	
Procedure used to Obtain Specimen:		Moist	x	Air-Dried		Oven-Dried
Sampling Method:	Stockpile:		Mechanically Split:			Quartered:
						x
Dispersion Process:		Soaked without Dispersant		x	Soaked with Dispersant	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 5 hours		Shaking Apparatus?
<b>Specimen:</b>	Pan No.	<b>158</b>	B) Tare Wt.	<b>0.0</b>		
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>						
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>212.0</b>		Pan No.	<b>158</b>	B) Tare Wt.
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>173.6</b>		Dry Mass of Specimen after Wash +Tare		<b>115.8</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>173.6</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>115.8</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>212.0</b>		Dry Mass passing #200		<b>57.8</b>
F=(E-D)/D Water Content of Specimen		<b>22.1%</b>		% Passing #200		<b>33.3%</b>

Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.7	1.1	115	<b>1.8</b>	1.0%	99.0%
#40	0.425	12.3	16.8	75	<b>29.1</b>	16.8%	83.2%
#60	0.250	33.7	40.7	60	<b>74.4</b>	42.9%	57.1%
#100	0.150	48.7	53.1	40	<b>101.8</b>	58.6%	41.4%
#140	0.106	53.5	55.9	30	<b>109.4</b>	63.0%	37.0%
#200	0.075	57.1	57.6	20	<b>114.7</b>	66.1%	33.9%
Pan	<0.075	57.9	57.9	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	18 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-8A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Light Gray Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)	Method B (0.1%)	x	Material Excluded? None
Procedure used to Obtain Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method:	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x Ultrasonic Bath
Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours
		Shaking Apparatus?	
<b>Specimen:</b>	Pan No. <b>BL</b>	B) Tare Wt. <b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>212.1</b>	Pan No. <b>BL</b>	B) Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>175.7</b>	Dry Mass of Specimen after Wash +Tare <b>164.8</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>175.7</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>164.8</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>212.1</b>	Dry Mass passing #200 <b>10.9</b>	
F=(E-D)/D) Water Content of Specimen	<b>20.7%</b>	% Passing #200 <b>6.2%</b>	

Portion >>>		Cumulative Mass Retained (Portions of Total Specimen)		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.5	0.6	115	<b>1.1</b>	0.6%	99.4%
#40	0.425	20.8	22.0	75	<b>42.8</b>	24.4%	75.6%
#60	0.250	60.3	61.9	60	<b>122.2</b>	69.6%	30.4%
#100	0.150	78.3	78.4	40	<b>156.7</b>	89.2%	10.8%
#140	0.106	81.2	80.7	30	<b>161.9</b>	92.1%	7.9%
#200	0.075	82.6	81.7	20	<b>164.3</b>	93.5%	6.5%
Pan	<0.075	82.8	81.9	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 9/14/17
Project Name: Kings Bluff Water Main		Lab Report #: 19 of 27
Client Name: McKim & Creed		Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various (NC)		
Log/Sample Id. 128 (R-8B/S7)	Type: Split Spoon	Elev/Depth: 23.5'-25.0'

Sample Description: Brown-Orange Poorly Graded SAND with Silt (SP-SM)

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates: 9/5-9/14/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded? None
Procedure for obtaining Specimen:		Moist	x	Air-Dried
Sampling Method	Stockpile:		Mechanically Split:	Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x
Estimated Wet Mass of specimen required:		200 g.	Soak Time: 5 hours	Shaking Apparatus
<b>Specimen:</b>	Pan No. <b>7</b>	B) Tare Wt. <b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>205.1</b>	Pan No. <b>7</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>164.4</b>	Dry Mass of Washed Sample + Tare Wt. <b>154.3</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>164.4</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>154.3</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>205.1</b>	Dry Mass passing #200 <b>10.1</b>	
F=(E-D)/D) Water Content of Specimen		<b>24.8%</b>	% Passing #200 <b>6.1%</b>	

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.1	0.10	325	0.1%	99.9%
#10	2.000	0.2	0.10	180	0.1%	99.9%
#20	0.850	11.2	11.00	115	6.8%	93.2%
#40	0.425	65.8	54.60	75	40.0%	60.0%
#60	0.250	143.0	77.20	60	87.0%	13.0%
#100	0.150	151.3	8.30	40	92.0%	8.0%
#140	0.106	153.0	1.70	30	93.1%	6.9%
#200	0.075	154.0	1.00	20	93.7%	6.3%
Pan	<0.075	154.2	0.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

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## SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	26 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-19A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'
Sample Description:	Brown-Gray Silty SAND (SM) with Wood Pieces		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	3/8"	Coarse Sand 2.6%
Gravel	1.9%	Medium Sand 7.9%
Liquid Limit	N/A	Plastic Limit N/A
Maximum Dry Density	N/A	Assumed SG(D854) 2.650
Optimum Moisture	N/A	Natural Moisture 56.8%
		Fine Sand 64.8%
		Silt & Clay 22.8%
		Plastic Index N/A
		% Absorption N/A
		CBR N/A

Notes / Deviations / References:

**Material retained on 3/8" sieve was a rock and #4, #10, and #20 sieves were wood pieces of varying sizes.**

Gunnar Goslin  
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 11/13/17
Project Name: Kings Bluff Water Main		Lab Report #: 26 of 32
Client Name: McKim & Creed		Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various/Water Main/R-O-W		
Log/Sample Id. 155 (W-19A/S3)	Type: Split Spoon	Elev/Depth: 6.0'-7.5'

Sample Description: Brown-Gray Silty SAND (SM) with Wood Pieces						
Estimate Max. Particle Size (99% Passing):			<b>3/8"</b>	Testing Dates: 11/8-11/13/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?		Soaked without Dispersant		Soaked with Dispersant		x
Estimated Wet Mass of specimen required:			200 g.	Soak Time: 4.5 hours		Shaking Apparatus
<b>Specimen:</b>	Pan No.	<b>HN</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>205.2</b>	Pan No.	<b>HN</b>	Tare Wt. <b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>130.9</b>	Dry Mass of Washed Sample + Tare Wt. <b>102.6</b>		
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>130.9</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>102.6</b>		
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>205.2</b>	Dry Mass passing #200 <b>28.3</b>		
F=(E-D)/D) Water Content of Specimen			<b>56.8%</b>	% Passing #200 <b>21.6%</b>		
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.3	0.30	550	0.2%	99.8%
#4	4.75	2.5	2.20	325	1.9%	98.1%
#10	2.000	5.9	3.40	180	4.5%	95.5%
#20	0.850	9.8	3.90	115	7.5%	92.5%
#40	0.425	16.3	6.50	75	12.5%	87.5%
#60	0.250	38.6	22.30	60	29.5%	70.5%
#100	0.150	69.8	31.20	40	53.3%	46.7%
#140	0.106	90.4	20.60	30	69.1%	30.9%
#200	0.075	101.1	10.70	20	77.2%	22.8%
Pan	<0.075	102.7	1.6	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

**Material retained on 3/8", #4, #10, and #20 sieves were wood pieces of varying sizes.**

Gunnar Goslin  
Technical Responsibility

Signature

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Position

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Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	27 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-19A/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Gray Poorly Graded SAND (SP) with Wood Pieces								
Estimate Max. Particle Size (99% Passing):		<b>#4</b>		Testing Dates:		11/8-11/13/17		
Method A (1%)		Method B (0.1%)		x		Material Excluded? None		
Procedure used to Obtain Specimen:		Moist		x		Air-Dried		
						Oven-Dried		
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x		
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath		
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?		
<b>Specimen:</b>	Pan No.	<b>A</b>	B) Tare Wt.	<b>0.0</b>				<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>208.8</b>		Pan No.	<b>A</b>	B) Tare Wt.	<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>164.0</b>		Dry Mass of Specimen after Wash +Tare			<b>159.0</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>164.0</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>159.0</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>208.8</b>		Dry Mass passing #200			<b>5.0</b>	
F=(E-D)/D) Water Content of Specimen		<b>27.3%</b>		% Passing #200			<b>3.0%</b>	
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	<b>% Retained</b>	<b>% Passing</b>	
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	<i>Total Sample Cumulative Percentages</i>		
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>	<i>CMR<sub>N</sub></i>	<i>PR</i>	<i>PP (Method A)</i>	
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%	
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%	
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%	
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%	
#4	4.75	0.6	0.5	325	<b>1.1</b>	0.7%	99.3%	
#10	2.000	1.7	2.0	180	<b>3.7</b>	2.3%	97.7%	
#20	0.850	6.1	7.3	115	<b>13.4</b>	8.2%	91.8%	
#40	0.425	28.3	30.5	75	<b>58.8</b>	35.9%	64.1%	
#60	0.250	58.3	58.3	60	<b>116.6</b>	71.1%	28.9%	
#100	0.150	72.4	72.5	40	<b>144.9</b>	88.4%	11.6%	
#140	0.106	77.2	78.3	30	<b>155.5</b>	94.8%	5.2%	
#200	0.075	78.5	80.1	20	<b>158.6</b>	96.7%	3.3%	
Pan	<0.075	78.6	80.3	Technician:				

Notes/Deviations/References:

**Material retained on #4, #10, was wood pieces of varying size, and #20 was wood pieces and sand grains of varying size.**

Gunnar Goslin  
Technical Responsibility

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# SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	20 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
Location:	Various (NC)		
Log/Sample Id.	128 (R-9A/S3)	Type:	Split Spoon
Sample Description:	Light Gray Sandy CLAY	Elev/Depth:	6.0'-7.5'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	34.2%
Gravel	0.0%	Medium Sand	4.8%	Silt & Clay	60.9%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	24.4%	CBR	N/A

Notes / Deviations / References:

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 9/14/17
Project Name: Kings Bluff Water Main		Lab Report #: 20 of 27
Client Name: McKim & Creed		Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various (NC)		
Log/Sample Id. 128 (R-9A/S3)	Type: Split Spoon	Elev/Depth: 6.0'-7.5'

Sample Description: Light Gray Sandy CLAY

Estimate Max. Particle Size (99% Passing):		<b>#10</b>	Testing Dates: 9/5-9/14/17	
Method A (1%)		Method B (0.1%)	x	Material Excluded? None
Procedure for obtaining Specimen:		Moist	x	Air-Dried
Sampling Method	Stockpile:		Mechanically Split:	Quartered: x
Dispersion Process?	Soaked without Dispersant		Soaked with Dispersant	x
Estimated Wet Mass of specimen required:		200 g.	Soak Time: 5 hours	Shaking Apparatus

<b>Specimen:</b>	Pan No. <b>10</b>	B) Tare Wt. <b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3		
A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>201.2</b>	Pan No. <b>10</b>	Tare Wt. <b>0.0</b>		
C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>161.8</b>	Dry Mass of Washed Sample + Tare Wt.		<b>66.6</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>161.8</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>66.6</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>201.2</b>	Dry Mass passing #200		<b>95.2</b>	
F=(E-D)/D) Water Content of Specimen	<b>24.4%</b>	% Passing #200		<b>58.8%</b>	

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	0.7	0.70	115	0.4%	99.6%
#40	0.425	7.8	7.10	75	4.8%	95.2%
#60	0.250	18.7	10.90	60	11.6%	88.4%
#100	0.150	32.3	13.60	40	20.0%	80.0%
#140	0.106	48.4	16.10	30	29.9%	70.1%
#200	0.075	63.2	14.80	20	39.1%	60.9%
Pan	<0.075	66.6	3.4	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
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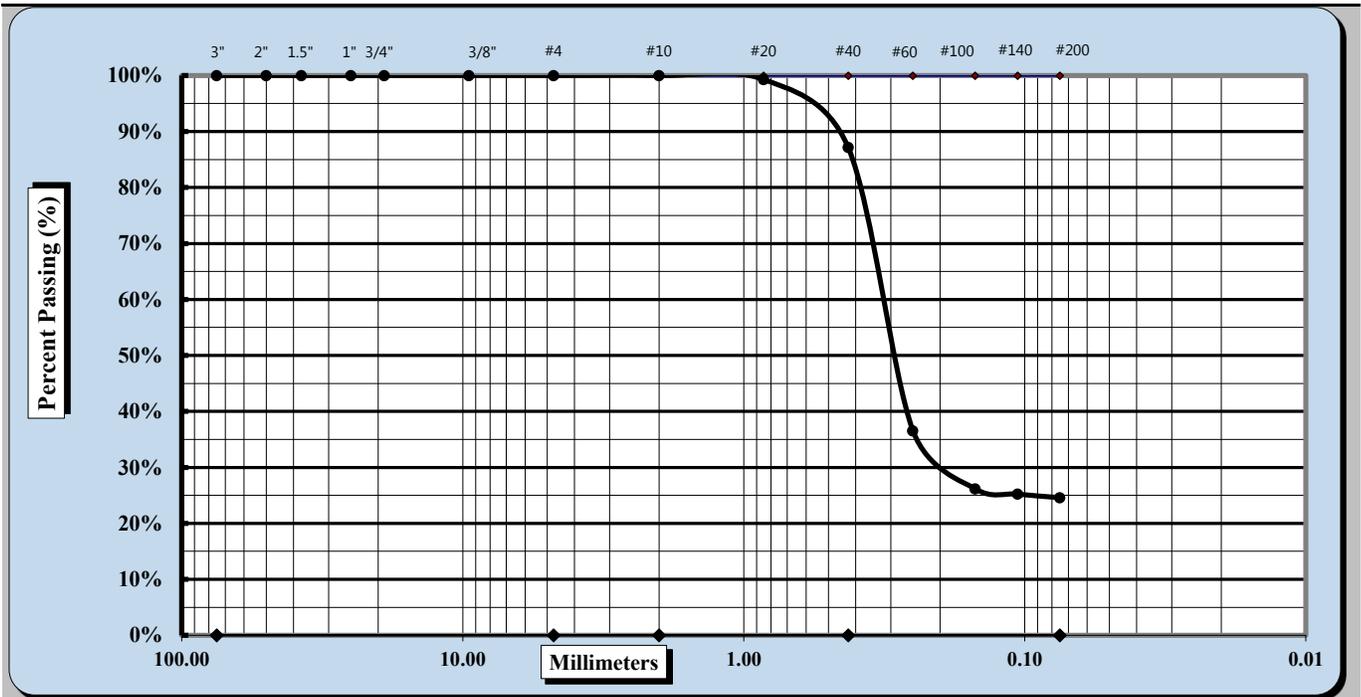
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	21 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-9A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Gray Silty SAND (SM) with Clay		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	62.6%
Gravel	0.0%	Medium Sand	12.8%	Silt & Clay	24.6%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	32.6%	CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	21 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-9A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Gray Silty SAND (SM) with Clay							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates:		9/5-9/14/17	
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>GP</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>209.7</b>		Pan No.		<b>GP</b>	
				B) Tare Wt.		<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>158.2</b>		Dry Mass of Specimen after Wash +Tare		<b>119.3</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>158.2</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>119.3</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>209.7</b>		Dry Mass passing #200		<b>38.9</b>	
F=(E-D)/D) Water Content of Specimen		<b>32.6%</b>		% Passing #200		<b>24.6%</b>	
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.0	180		0.0%	100.0%
#20	0.850	0.5	0.6	115		0.7%	99.3%
#40	0.425	9.5	10.8	75		12.8%	87.2%
#60	0.250	49.3	51.1	60		63.5%	36.5%
#100	0.150	57.8	59.0	40		73.8%	26.2%
#140	0.106	58.7	59.6	30		74.8%	25.2%
#200	0.075	59.3	60.0	20		75.4%	24.6%
Pan	<0.075	59.4	60.0	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

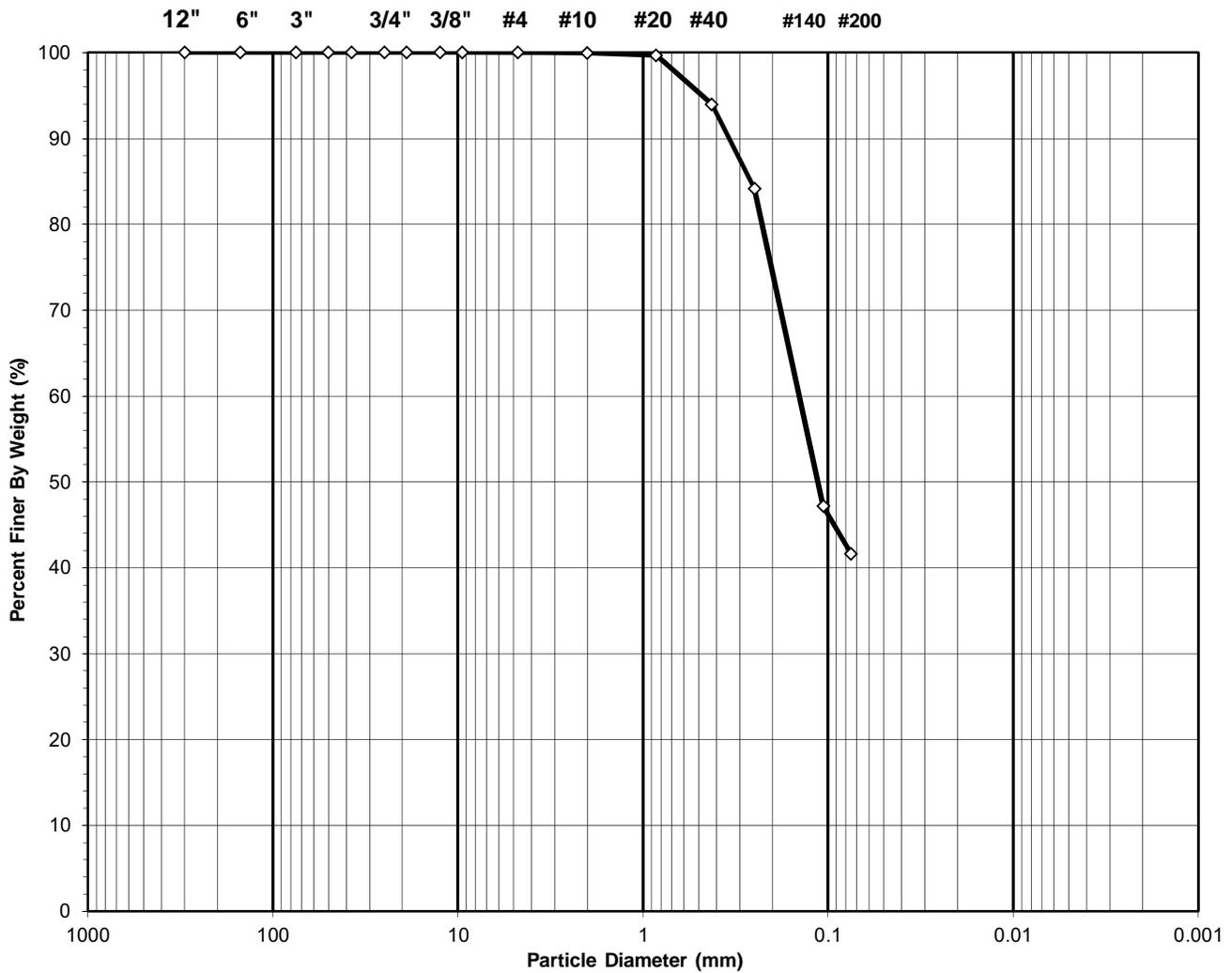
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-11
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	1-2.5
Project No.:	R-2017-861-001	Sample No.:	SS-1
Lab ID:	R-2017-861-001-031	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: A-11
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 1-2.5
Project No.:	R-2017-861-001	Sample No.: SS-1
Lab ID:	R-2017-861-001-031	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	577	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	887.63	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	815.15	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	309.31	Weight of Tare (g):	NA
Weight of Water (g):	72.48	Weight of Water (g):	NA
Weight of Dry Sample (g):	505.84	Weight of Dry Sample (g):	NA
*Moisture Content (%):	14.3	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	505.84
Dry Weight of - 3/4" Sample (g):	505.8	Weight of - #200 Material (g):	210.62
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	295.22
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.09	0.02	0.02	99.98	99.98
#20	0.850	1.40	0.28	0.29	99.71	99.71
#40	0.425	28.87	5.71	6.00	94.00	94.00
#60	0.250	49.62	9.81	15.81	84.19	84.19
#140	0.106	187.15	37.00	52.81	47.19	47.19
#200	0.075	28.09	5.55	58.36	41.64	41.64
Pan	-	210.62	41.64	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By    RT                      Date    11/15/17                      Checked By    NC                      Date    11/15/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	A-11
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	6-7.5
Project No.:	R-2017-861-001	Sample No.:	SS-3
Lab ID:	R-2017-861-001-032	Soil Description:	BROWN FAT CLAY

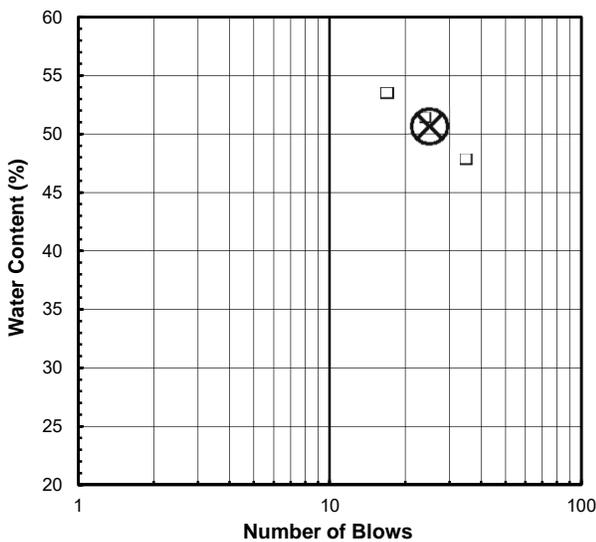
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1571	15	18	32	U
Wt. of Tare & Wet Sample (g):	788.95	39.46	39.41	40.27	L
Wt. of Tare & Dry Sample (g):	689.89	32.94	32.56	33.21	T
Weight of Tare (g):	309.65	19.29	19.21	20.00	I
Weight of Water (g):	99.1	6.5	6.8	7.1	P
Weight of Dry Sample (g):	380.2	13.7	13.4	13.2	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>26.1</b>	<b>47.8</b>	<b>51.3</b>	<b>53.4</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>24</b>	<b>17</b>	<b>T</b>

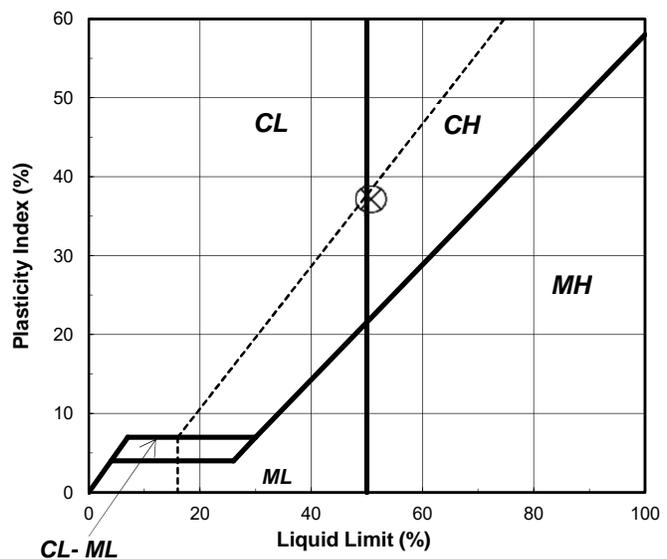
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	2	7		<b>Liquid Limit (%):</b> 51
Wt. of Tare & Wet Sample (g):	24.70	25.23		<b>Plastic Limit (%):</b> 14
Wt. of Tare & Dry Sample (g):	23.92	24.44		<b>Plasticity Index (%):</b> 37
Weight of Tare (g):	18.41	18.95		<b>USCS Symbol:</b> CH
Weight of Water (g):	0.8	0.8		
Weight of Dry Sample (g):	5.5	5.5		
<b>Moisture Content (%):</b>	<b>14.2</b>	<b>14.4</b>	<b>-0.2</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**

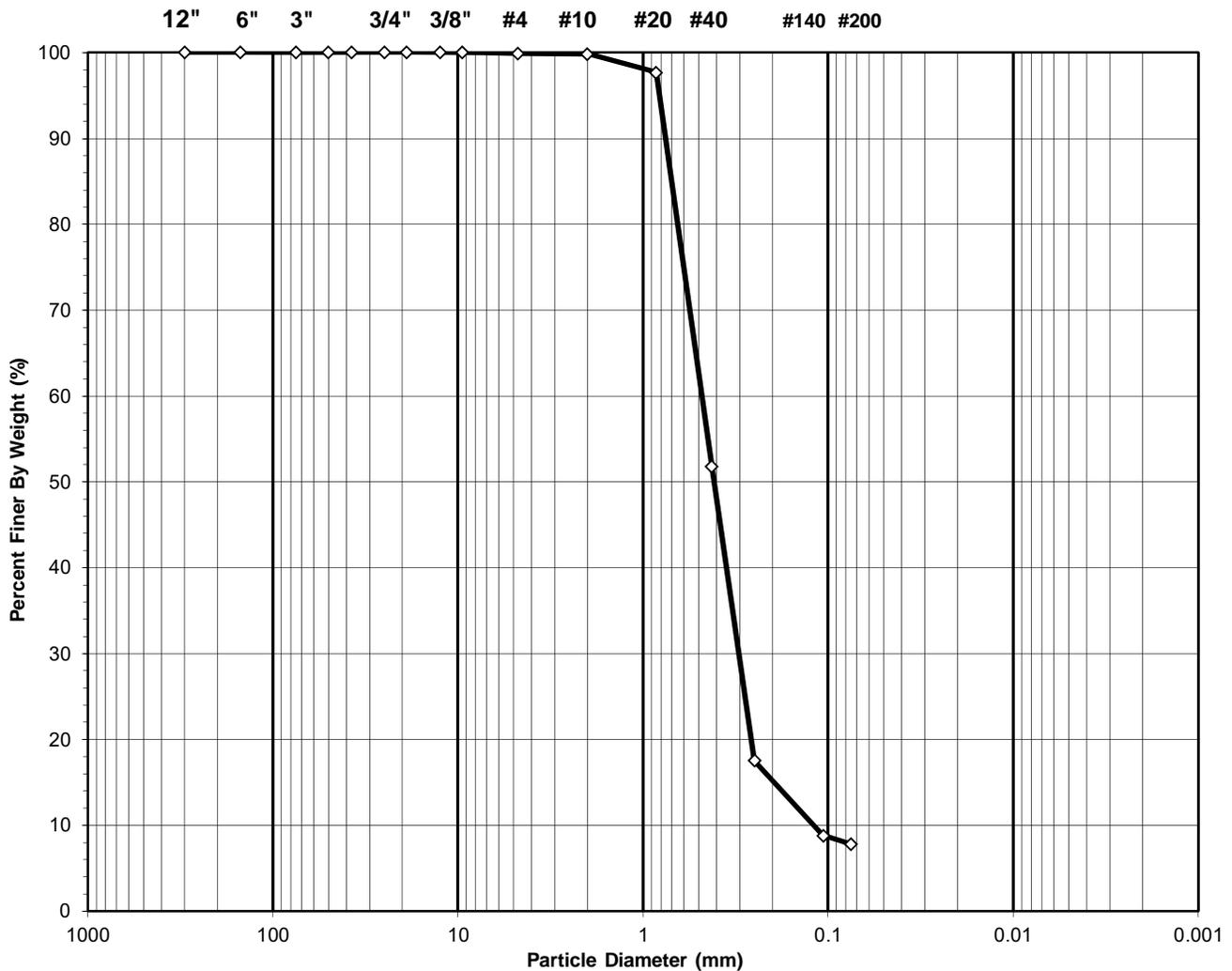


Tested By PF Date 11/20/17 Checked By NC Date 11/21/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-12
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-033	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
*sp-sc, ASSUMED*

**D60 = 0.48      CC = 1.60**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.30      CU = 4.03**

**D10 = 0.12**

Tested By **RT**      Date **11/15/17**      Checked By **NC**      Date **11/15/17**

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: A-12
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-033	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1569	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	884.55	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	815.62	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	307.41	Weight of Tare (g):	NA
Weight of Water (g):	68.93	Weight of Water (g):	NA
Weight of Dry Sample (g):	508.21	Weight of Dry Sample (g):	NA
*Moisture Content (%):	13.6	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	508.21
Dry Weight of - 3/4" Sample (g):	508.2	Weight of - #200 Material (g):	39.57
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	468.64
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.44	0.09	0.09	99.91	99.91
#10	2.00	0.45	0.09	0.18	99.82	99.82
#20	0.850	10.84	2.13	2.31	97.69	97.69
#40	0.425	233.26	45.90	48.21	51.79	51.79
#60	0.250	174.12	34.26	82.47	17.53	17.53
#140	0.106	44.43	8.74	91.21	8.79	8.79
#200	0.075	5.10	1.00	92.21	7.79	7.79
Pan	-	39.57	7.79	100.00	-	-

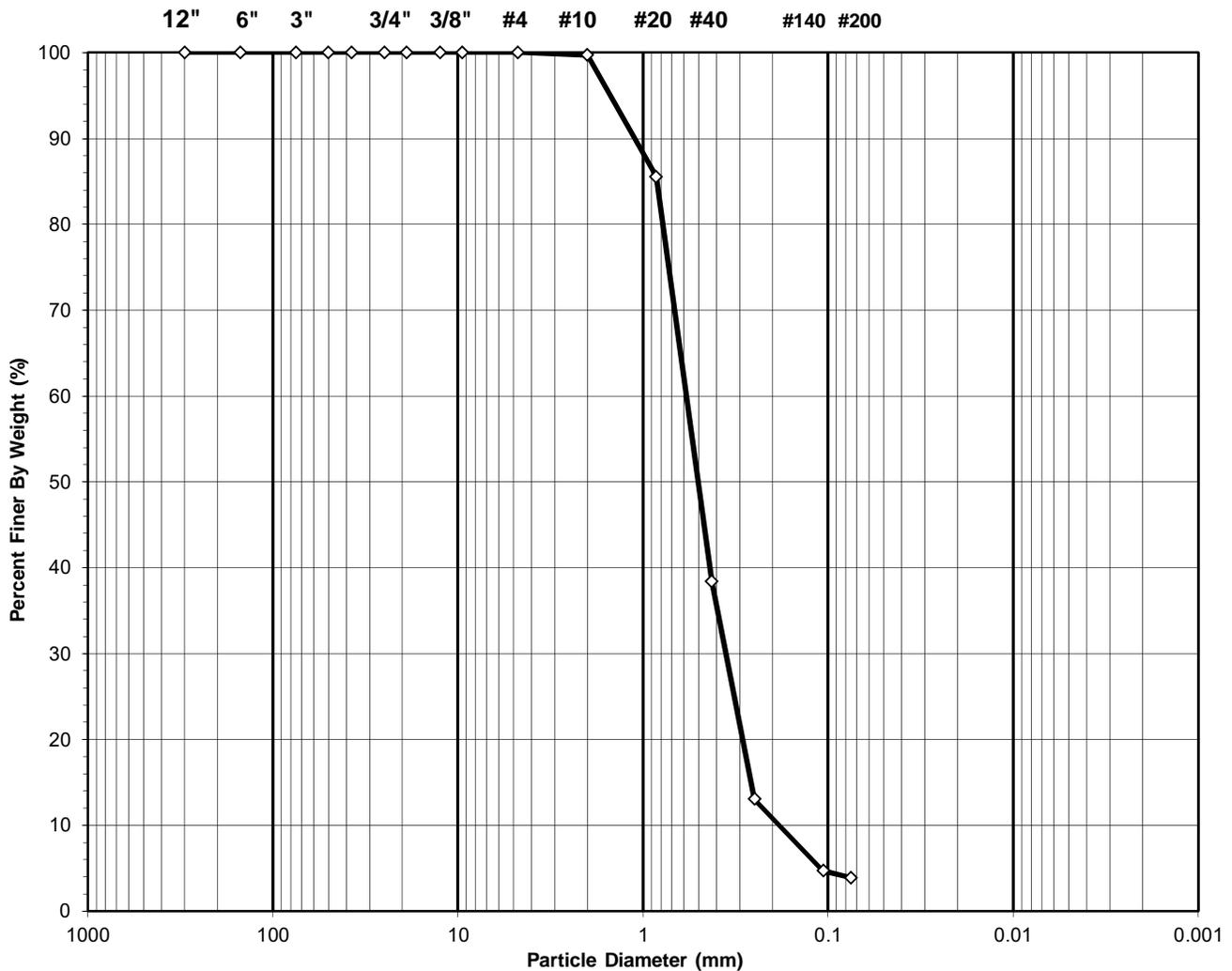
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-12
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-034	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp, ASSUMED**

**D60 = 0.58      CC = 1.19**

**USCS Classification:**  
**POORLY GRADED SAND**

**D30 = 0.36      CU = 3.20**

**D10 = 0.18**

Tested By RT      Date 11/15/17      Checked By NC      Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: A-12
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.:	R-2017-861-001	Sample No.: SS-4
Lab ID:	R-2017-861-001-034	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	588	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	881.55	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	790.22	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.79	Weight of Tare (g):	NA
Weight of Water (g):	91.33	Weight of Water (g):	NA
Weight of Dry Sample (g):	481.43	Weight of Dry Sample (g):	NA
*Moisture Content (%):	19.0	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	481.43
Dry Weight of - 3/4" Sample (g):	481.4	Weight of - #200 Material (g):	18.87
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	462.56
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	1.27	0.26	0.26	99.74	99.74
#20	0.850	68.20	14.17	14.43	85.57	85.57
#40	0.425	227.03	47.16	61.59	38.41	38.41
#60	0.250	121.99	25.34	86.93	13.07	13.07
#140	0.106	40.21	8.35	95.28	4.72	4.72
#200	0.075	3.86	0.80	96.08	3.92	3.92
Pan	-	18.87	3.92	100.00	-	-

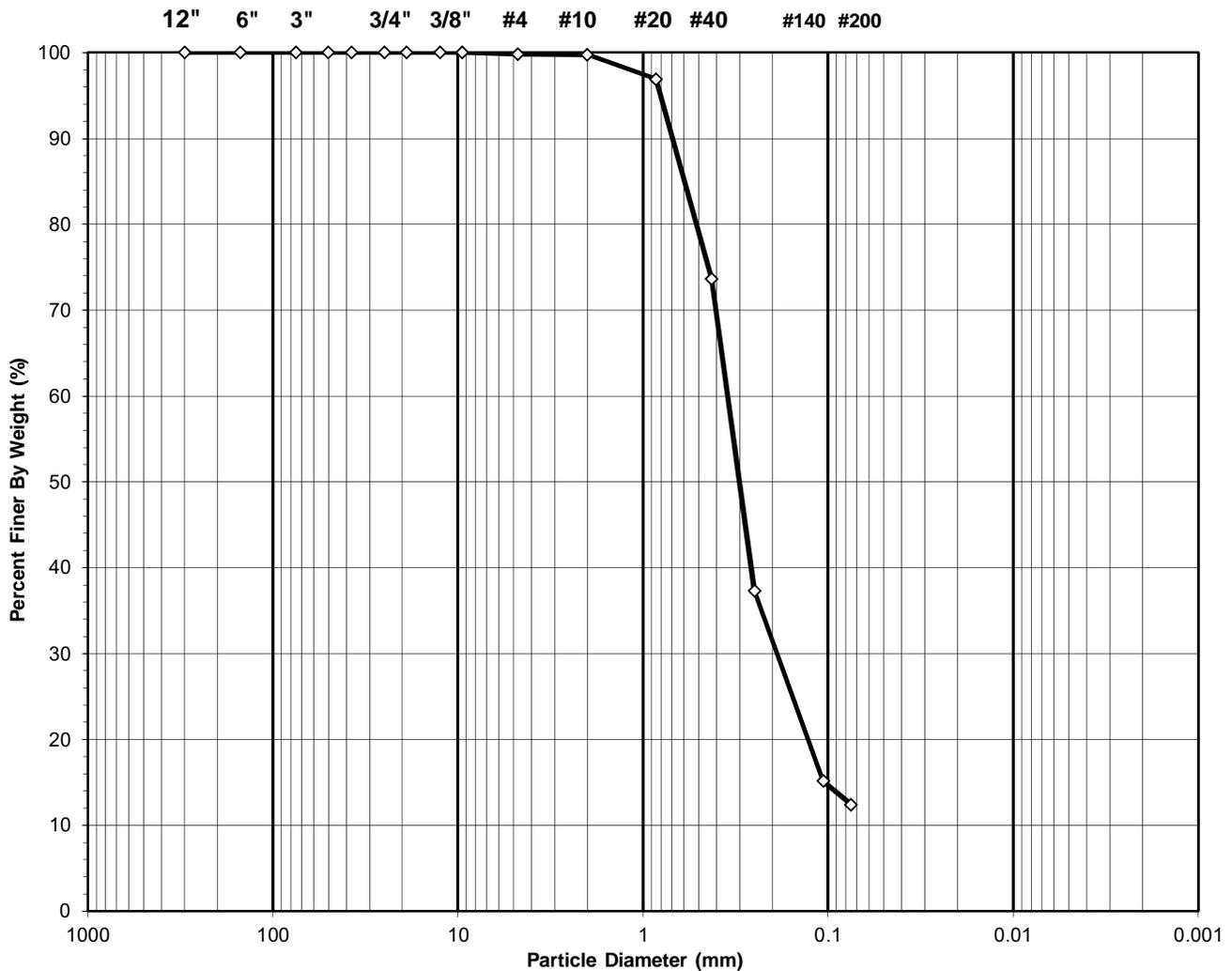
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-22B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-035	Soil Color:	Dark Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sm, ASSUMED**

**USCS Classification:**  
**SILTY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-22B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-035	Soil Color: Dark Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1564	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	865.06	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	776.81	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	307.93	Weight of Tare (g):	NA
Weight of Water (g):	88.25	Weight of Water (g):	NA
Weight of Dry Sample (g):	468.88	Weight of Dry Sample (g):	NA
*Moisture Content (%):	18.8	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	468.88
Dry Weight of - 3/4" Sample (g):	468.9	Weight of - #200 Material (g):	58.24
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	410.64
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.75	0.16	0.16	99.84	<b>99.84</b>
#10	2.00	0.42	0.09	0.25	99.75	<b>99.75</b>
#20	0.850	13.33	2.84	3.09	96.91	<b>96.91</b>
#40	0.425	109.03	23.25	26.35	73.65	<b>73.65</b>
#60	0.250	170.24	36.31	62.65	37.35	<b>37.35</b>
#140	0.106	103.99	22.18	84.83	15.17	<b>15.17</b>
#200	0.075	12.88	2.75	87.58	12.42	<b>12.42</b>
Pan	-	58.24	12.42	100.00	-	-

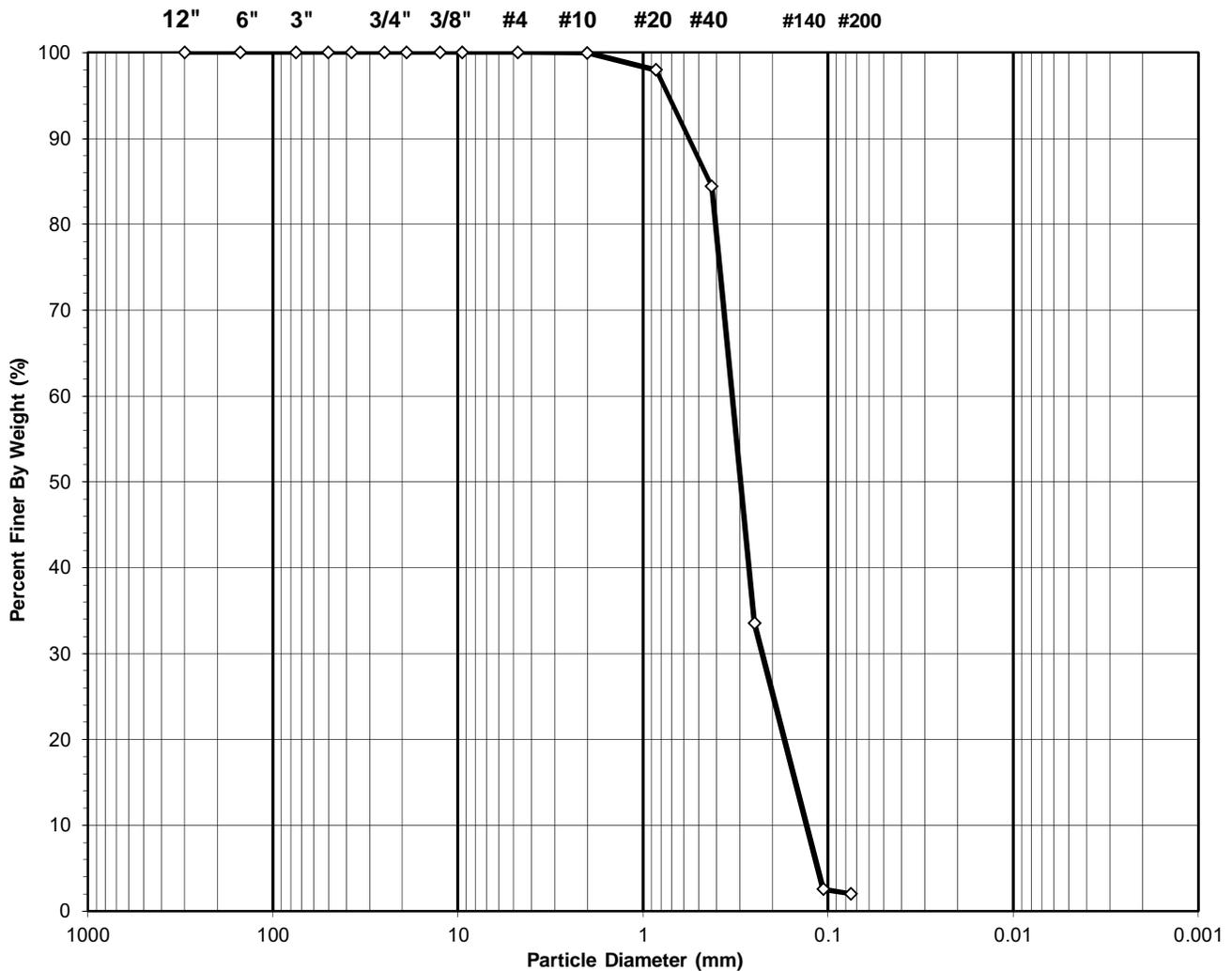
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By    RT                      Date    11/15/17                      Checked By    NC                      Date    11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-22B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-036	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp, ASSUMED**

**D60 = 0.33      CC = 1.20**

**USCS Classification:**  
**POORLY GRADED SAND**

**D30 = 0.23      CU = 2.53**

**D10 = 0.13**

Tested By RT      Date 11/15/17      Checked By NC      Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-22B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.:	R-2017-861-001	Sample No.: SS-4
Lab ID:	R-2017-861-001-036	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	576	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	611.83	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	557.38	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.36	Weight of Tare (g):	NA
Weight of Water (g):	54.45	Weight of Water (g):	NA
Weight of Dry Sample (g):	249.02	Weight of Dry Sample (g):	NA
*Moisture Content (%):	21.9	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	249.02
Dry Weight of - 3/4" Sample (g):	249.0	Weight of - #200 Material (g):	5.09
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	243.93
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.00	0.00	0.00	100.00	<b>100.00</b>
#10	2.00	0.05	0.02	0.02	99.98	<b>99.98</b>
#20	0.850	4.97	2.00	2.02	97.98	<b>97.98</b>
#40	0.425	33.81	13.58	15.59	84.41	<b>84.41</b>
#60	0.250	126.55	50.82	66.41	33.59	<b>33.59</b>
#140	0.106	77.24	31.02	97.43	2.57	<b>2.57</b>
#200	0.075	1.31	0.53	97.96	2.04	<b>2.04</b>
Pan	-	5.09	2.04	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

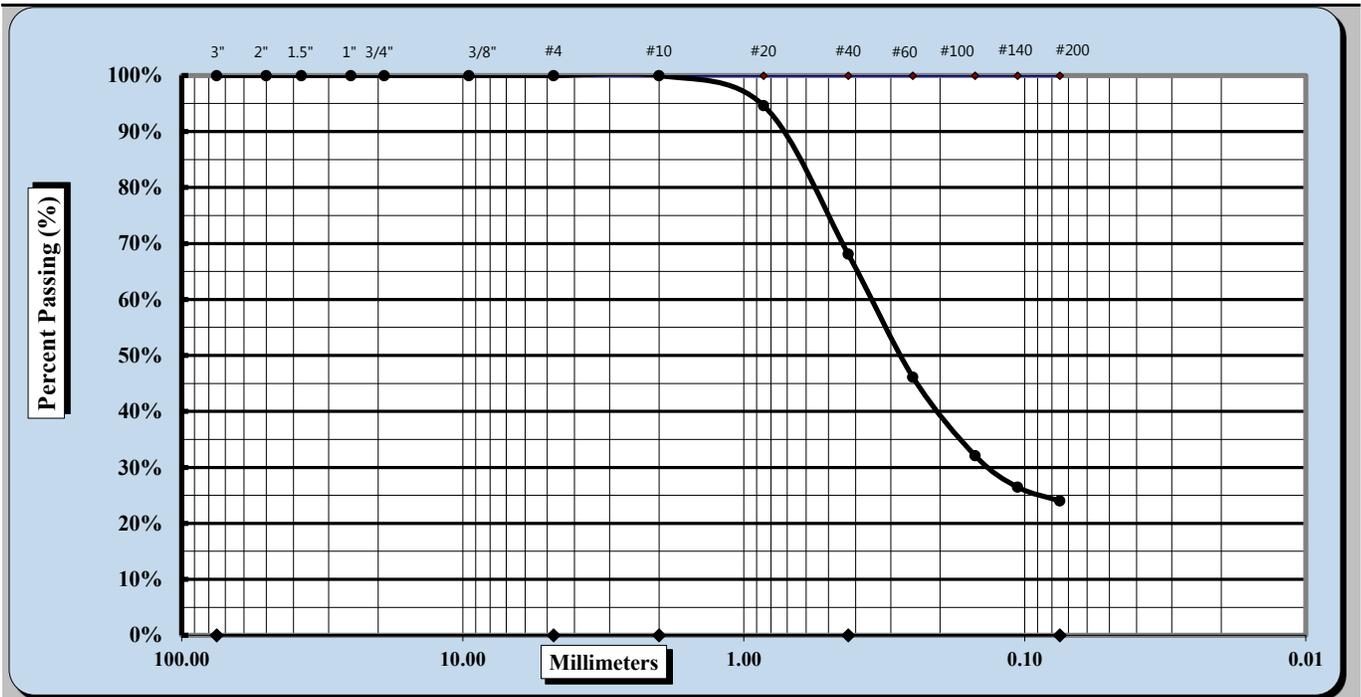
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 22 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-10A/S3)	Elev/Depth: 6.0'-7.5'
Sample Description: Brown-Orange Clayey SAND (SC)	



## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	22 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-10A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'

Sample Description: Brown-Orange Clayey SAND (SC)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates:		9/5-9/14/17	
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>H</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>204.2</b>		Pan No.		<b>H</b>	
				B) Tare Wt.		<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>169.6</b>		Dry Mass of Specimen after Wash +Tare		<b>129.6</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>169.6</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>129.6</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>204.2</b>		Dry Mass passing #200		<b>40.0</b>	
F=(E-D)/D) Water Content of Specimen		<b>20.4%</b>		% Passing #200		<b>23.6%</b>	
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.0	180		0.0%	100.0%
#20	0.850	5.6	3.5	115		5.4%	94.6%
#40	0.425	31.0	23.1	75		31.9%	68.1%
#60	0.250	49.0	42.4	60		53.9%	46.1%
#100	0.150	58.6	56.6	40		67.9%	32.1%
#140	0.106	62.3	62.4	30		73.5%	26.5%
#200	0.075	64.0	64.9	20		76.0%	24.0%
Pan	<0.075	64.3	65.2	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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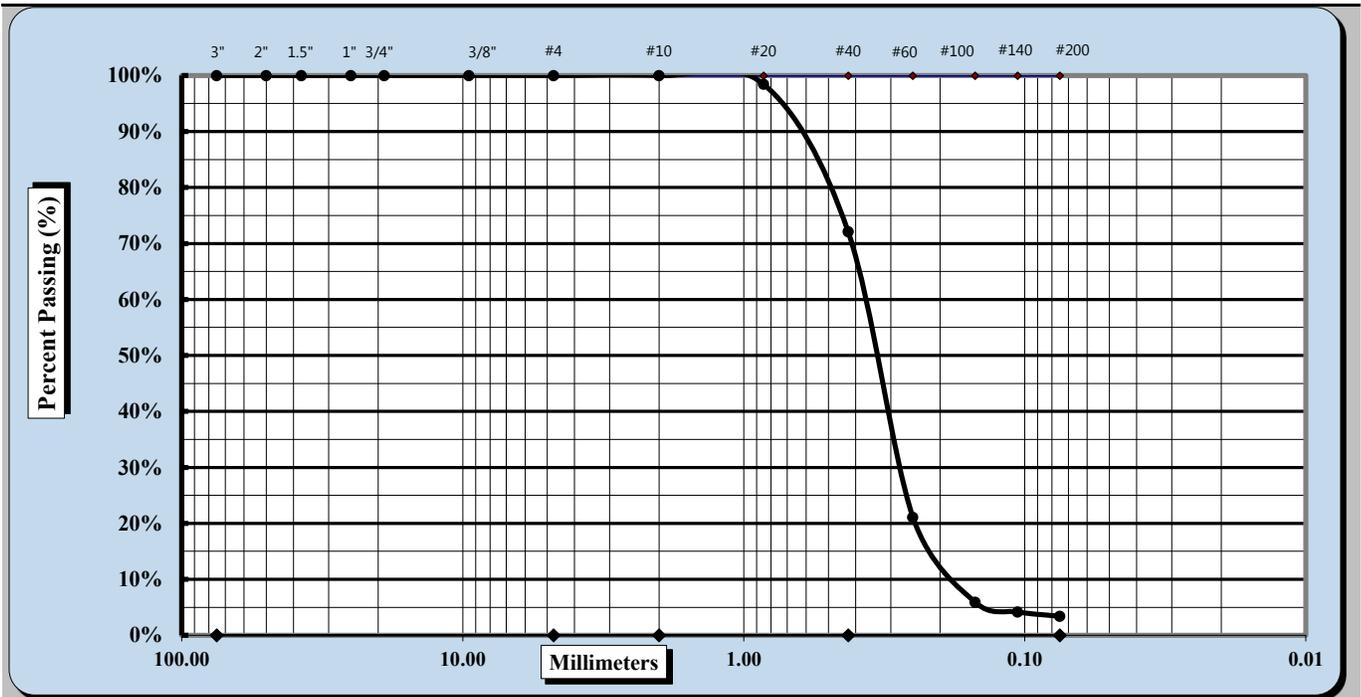
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 23 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-10A/S6)	Elev/Depth: 18.5'-20.0'
Sample Description: Gray-Brown Poorly Graded SAND (SP)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%
Gravel	0.0%	Medium Sand	27.9%
Liquid Limit	N/A	Plastic Limit	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650
Optimum Moisture	N/A	Natural Moisture	20.9%
		Fine Sand	68.7%
		Silt & Clay	3.4%
		Plastic Index	N/A
		% Absorption	N/A
		CBR	N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	23 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-10A/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Gray-Brown Poorly Graded SAND (SP)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates:		9/5-9/14/17	
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>A</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>203.1</b>		Pan No.		<b>A</b>	
						B) Tare Wt. <b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>168.0</b>		Dry Mass of Specimen after Wash +Tare <b>162.5</b>			
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>168.0</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> ) <b>162.5</b>			
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>203.1</b>		Dry Mass passing #200 <b>5.5</b>			
F=(E-D)/D) Water Content of Specimen		<b>20.9%</b>		% Passing #200 <b>3.3%</b>			
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.0	180		0.0%	100.0%
#20	0.850	1.2	1.4	115		1.5%	98.5%
#40	0.425	23.0	23.9	75		27.9%	72.1%
#60	0.250	65.9	66.7	60		78.9%	21.1%
#100	0.150	78.9	79.2	40		94.1%	5.9%
#140	0.106	80.4	80.6	30		95.8%	4.2%
#200	0.075	81.1	81.2	20		96.6%	3.4%
Pan	<0.075	81.2	81.3	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## SIEVE ANALYSIS OF SOIL



Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	24 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-10B/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Light Brown Sandy CLAY		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size	#10	Coarse Sand 0.0%
Gravel	0.0%	Fine Sand 45.0%
Liquid Limit	N/A	Medium Sand 4.8%
Maximum Dry Density	N/A	Plastic Limit N/A
Optimum Moisture	N/A	Silt & Clay 50.2%
	Assumed SG(D854) 2.700	Plastic Index N/A
	Natural Moisture 27.7%	% Absorption N/A
		CBR N/A

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 9/14/17
Project Name: Kings Bluff Water Main	Lab Report #: 24 of 27
Client Name: McKim & Creed	Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Date Sampled: Various	
Location: Various (NC)	
Log/Sample Id. 128 (R-10B/S4)	Type: Split Spoon
Elev/Depth: 8.5'-10.0'	

Sample Description: Light Brown Sandy CLAY

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)		Method B (0.1%)	x
Material Excluded?		None	
Procedure for obtaining Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process?	Soaked without Dispersant	Soaked with Dispersant	x
		Ultrasonic Bath	
Estimated Wet Mass of specimen required:	200 g.	Soak Time: 5 hours	Shaking Apparatus

<b>Specimen:</b>	Pan No.	<b>T</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>208.6</b>	Pan No.	<b>T</b>	Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>163.4</b>	Dry Mass of Washed Sample + Tare Wt.		<b>89.5</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>163.4</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>89.5</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>208.6</b>	Dry Mass passing #200		<b>73.9</b>	
F=(E-D)/D) Water Content of Specimen		<b>27.7%</b>	% Passing #200		<b>45.2%</b>	

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	1.3	1.30	115	0.8%	99.2%
#40	0.425	7.8	6.50	75	4.8%	95.2%
#60	0.250	15.7	7.90	60	9.6%	90.4%
#100	0.150	25.7	10.00	40	15.7%	84.3%
#140	0.106	49.9	24.20	30	30.5%	69.5%
#200	0.075	81.3	31.40	20	49.8%	50.2%
Pan	<0.075	89.5	8.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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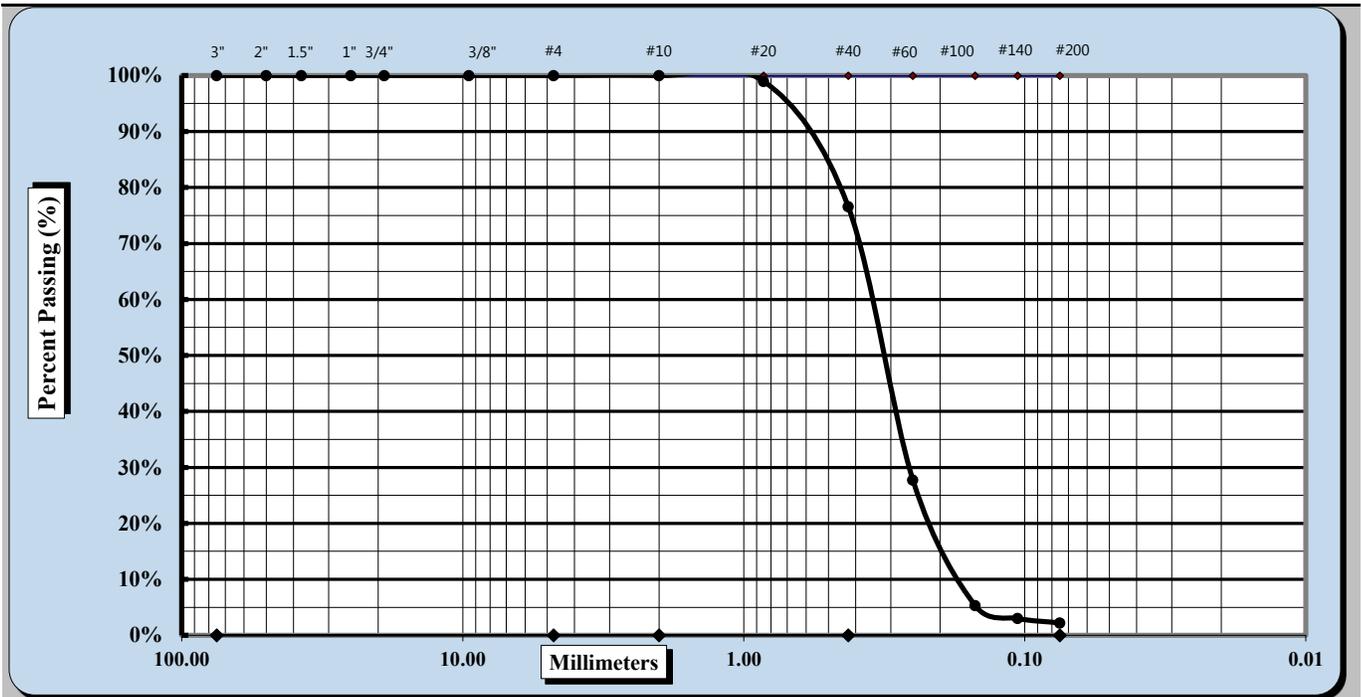
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 9/14/2017
Project Name: Kings Bluff Water Main	Lab Report #: 25 of 27
Client Name: McKim & Creed	Date Received: 9/1/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various (NC)	Date Sampled: Various
Log/Sample Id. 128 (R-10B/S6)	Type: Split Spoon
Sample Description: Light Gray Poorly Graded SAND (SP)	Elev/Depth: 18.5'-20.0'



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant
Maximum Particle Size #10	Coarse Sand 0.0%	Fine Sand 74.4%
Gravel 0.0%	Medium Sand 23.4%	Silt & Clay 2.2%
Liquid Limit N/A	Plastic Limit N/A	Plastic Index N/A
Maximum Dry Density N/A	Assumed SG(D854) 2.650	% Absorption N/A
Optimum Moisture N/A	Natural Moisture 21.1%	CBR N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	25 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-10B/S6)	Type:	Split Spoon	Elev/Depth:	18.5'-20.0'
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Sample Description: Light Gray Poorly Graded SAND (SP)

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
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Method A (1%)	Method B (0.1%)	x	Material Excluded?	None
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Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried	
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Sampling Method:	Stockpile:	Mechanically Split:	Quartered:	x
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Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x	Ultrasonic Bath
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Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours	Shaking Apparatus?
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<b>Specimen:</b>	Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
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A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>213.3</b>	Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>
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C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>176.1</b>	Dry Mass of Specimen after Wash +Tare	<b>172.4</b>
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D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>176.1</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>172.4</b>
---	--------------	---	--------------

E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )	<b>213.3</b>	Dry Mass passing #200	<b>3.7</b>
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F=(E-D)/D) Water Content of Specimen	<b>21.1%</b>	% Passing #200	<b>2.1%</b>
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Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.8	1.0	115	<b>1.8</b>	1.0%	99.0%
#40	0.425	19.2	22.0	75	<b>41.2</b>	23.4%	76.6%
#60	0.250	62.4	64.9	60	<b>127.3</b>	72.3%	27.7%
#100	0.150	83.5	83.3	40	<b>166.8</b>	94.7%	5.3%
#140	0.106	85.8	85.0	30	<b>170.8</b>	97.0%	3.0%
#200	0.075	86.5	85.7	20	<b>172.2</b>	97.8%	2.2%
Pan	<0.075	86.6	85.8	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	A-7
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-037	Soil Description:	TAN LEAN CLAY

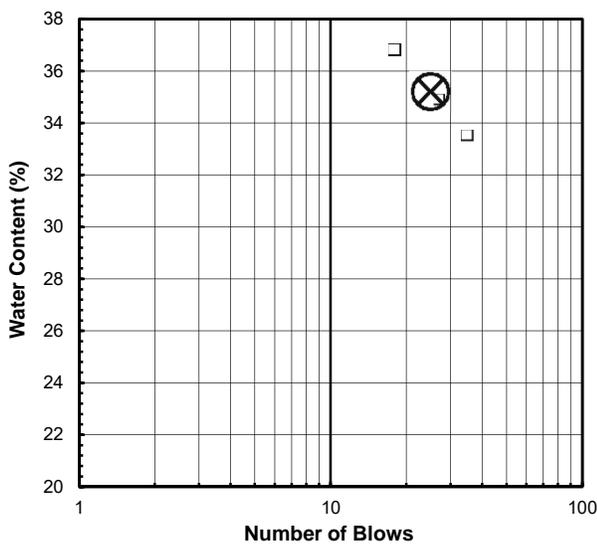
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	584	40	47	3	U
Wt. of Tare & Wet Sample (g):	652.24	41.09	39.14	39.46	L
Wt. of Tare & Dry Sample (g):	582.08	35.32	33.75	33.88	T
Weight of Tare (g):	308.86	18.09	18.30	18.71	I
Weight of Water (g):	70.2	5.8	5.4	5.6	P
Weight of Dry Sample (g):	273.2	17.2	15.5	15.2	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>25.7</b>	<b>33.5</b>	<b>34.9</b>	<b>36.8</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>27</b>	<b>18</b>	<b>T</b>

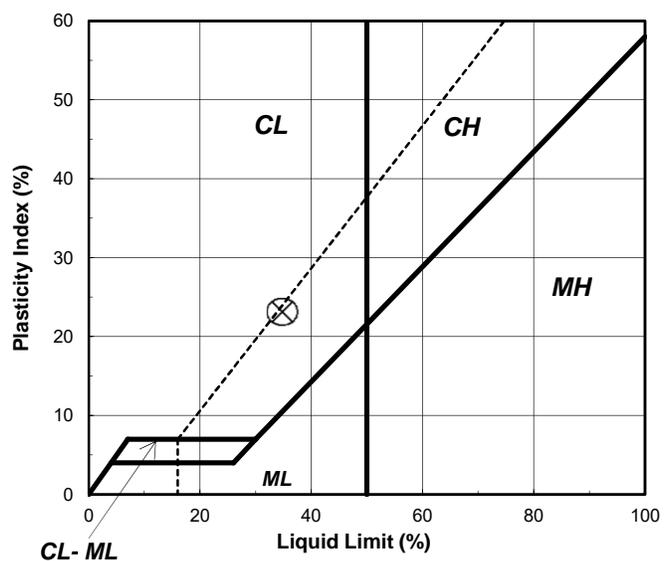
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	46	10		<b>Liquid Limit (%):</b> 35
Wt. of Tare & Wet Sample (g):	25.16	24.57		<b>Plastic Limit (%):</b> 12
Wt. of Tare & Dry Sample (g):	24.52	23.88		<b>Plasticity Index (%):</b> 23
Weight of Tare (g):	19.03	18.26		<b>USCS Symbol:</b> CL
Weight of Water (g):	0.6	0.7		
Weight of Dry Sample (g):	5.5	5.6		
<b>Moisture Content (%):</b>	<b>11.7</b>	<b>12.3</b>	<b>-0.6</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/20/17 Checked By NC Date 11/21/17



# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&amp;ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013	Record Date: 11/13/17
Project Name: Kings Bluff Water Main	Lab Report #: 28 of 32
Client Name: McKim & Creed	Date Received: 10/16/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (A-8/S2)	Type: Split Spoon
	Elev/Depth: 3.5'-5.0'

Sample Description: Gray Clayey SAND (SC)						
Estimate Max. Particle Size (99% Passing):			<b>#10</b>	Testing Dates: 11/8-11/13/17		
Method A (1%)		Method B (0.1%)		x	Material Excluded? None	
Procedure for obtaining Specimen:			Moist	x	Air-Dried	Oven-Dried
Sampling Method		Stockpile:		Mechanically Split:		Quartered: x
Dispersion Process?			Soaked without Dispersant		x	Soaked with Dispersant
Estimated Wet Mass of specimen required:			200 g.		Soak Time: 4.5 hours	
Shaking Apparatus						
<b>Specimen:</b>	Pan No.	<b>H</b>	B) Tare Wt.		Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)			<b>206.7</b>		Pan No.	<b>H</b>
Tare Wt.			<b>0.0</b>			
C) Total Specimen Dry Wt. + Tare Wt. (g.)			<b>172.3</b>		Dry Mass of Washed Sample + Tare Wt.	
Dry Mass of Washed Sample			<b>111.4</b>			
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>172.3</b>		Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
Dry Mass of Washed Sample			<b>111.4</b>			
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )			<b>206.7</b>		Dry Mass passing #200	
Dry Mass passing #200			<b>60.9</b>			
F=(E-D)/D) Water Content of Specimen			<b>20.0%</b>		% Passing #200	
% Passing #200			<b>35.3%</b>			
Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	
		<i>Total Sample Cumulative Percentages</i>				
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.3	0.30	550	0.2%	99.8%
#4	4.75	0.0	-0.30	325	0.0%	100.0%
#10	2.000	0.0	0.00	180	0.0%	100.0%
#20	0.850	1.7	1.70	115	1.0%	99.0%
#40	0.425	15.7	14.00	75	9.1%	90.9%
#60	0.250	40.3	24.60	60	23.4%	76.6%
#100	0.150	81.9	41.60	40	47.5%	52.5%
#140	0.106	105.0	23.10	30	60.9%	39.1%
#200	0.075	110.4	5.40	20	64.1%	35.9%
Pan	<0.075	111.2	0.8	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



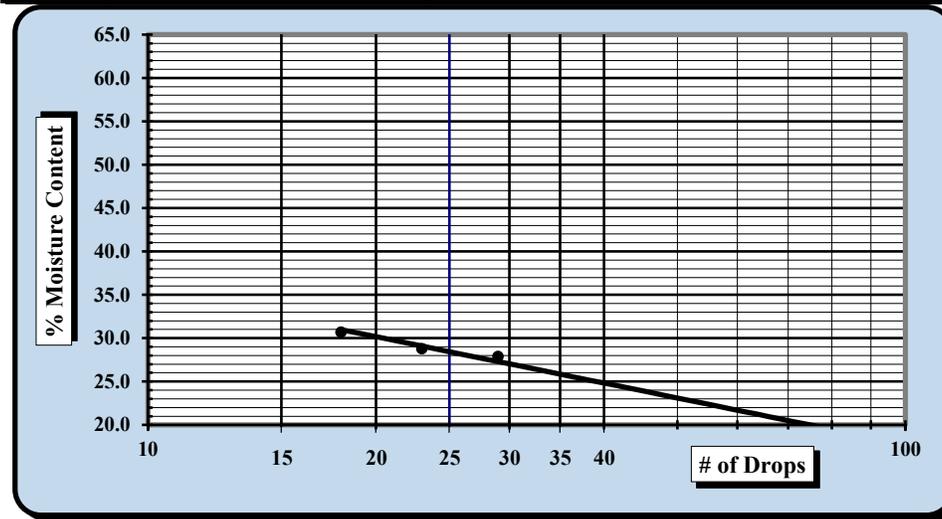
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Report Date:	11/10/17
Project Name:	Kings Bluff Water Main	Test Date(s)	11/8-11/10/17
Client Name:	McKim & Creed		
Client Address:	Wilmington, NC		
Sample Id:	155	Type: Soil Boring	Sample Date: Various
Location:	Various*	Sample: A-8/S4	Depth(ft): 8.5'-10.0'

Sample Description: Gray Clayey SAND (SC)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	14862	7/1/2017	Grooving tool	14629(L)	7/5/2017
LL Apparatus	14707	7/5/2017	Grooving tool		
Oven	14603	1/26/2017	Grooving tool		

Pan #	Tare #:	Liquid Limit					Plastic Limit			
		1	2	3			4	5		
A	Tare Weight	11.08	10.66	11.62				11.36	10.74	
B	Wet Soil Weight + A	22.25	21.36	22.05				20.47	20.39	
C	Dry Soil Weight + A	19.81	18.97	19.60				19.05	18.97	
D	Water Weight (B-C)	2.44	2.39	2.45				1.42	1.42	
E	Dry Soil Weight (C-A)	8.73	8.31	7.98				7.69	8.23	
F	% Moisture (D/E)*100	27.9%	28.8%	30.7%				18.5%	17.3%	
N	# OF DROPS	29	23	18				Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR									
Ave.	Average							<b>17.9%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>28</b>
Plastic Limit	<b>18</b>
Plastic Index	<b>10</b>
Group Symbol	<b>CL</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: N/A

Notes / Deviations / References:

**MC = 39.1%, No gradation ran on sample**

**\*Locations: Various/Water Main/R-O-W**

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/20/2017  
 Date

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## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	R-11B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-038	Soil Description:	TAN LEAN CLAY

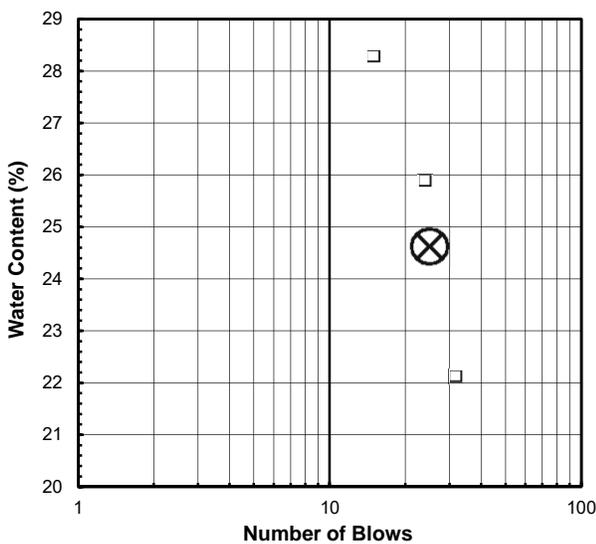
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test			
	1	2	3	M
Tare Number:	1572	21	11	1
Wt. of Tare & Wet Sample (g):	805.50	40.37	40.24	37.80
Wt. of Tare & Dry Sample (g):	731.63	36.57	35.76	33.23
Weight of Tare (g):	308.23	19.38	18.44	17.06
Weight of Water (g):	73.9	3.8	4.5	4.6
Weight of Dry Sample (g):	423.4	17.2	17.3	16.2
Was As Received MC Preserved:	<b>Yes</b>			
<b>Moisture Content (%):</b>	<b>17.4</b>	<b>22.1</b>	<b>25.9</b>	<b>28.3</b>
<b>Number of Blows:</b>	<b>32</b>	<b>24</b>	<b>15</b>	<b>T</b>

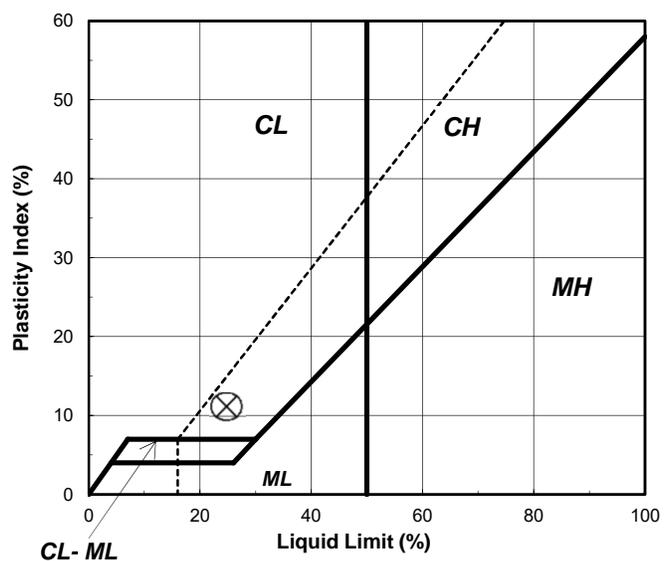
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	9	48		<b>Liquid Limit (%):</b> <b>25</b>
Wt. of Tare & Wet Sample (g):	25.13	25.20		<b>Plastic Limit (%):</b> <b>14</b>
Wt. of Tare & Dry Sample (g):	24.35	24.44		<b>Plasticity Index (%):</b> <b>11</b>
Weight of Tare (g):	18.70	19.02		<b>USCS Symbol:</b> <b>CL</b>
Weight of Water (g):	0.8	0.8		
Weight of Dry Sample (g):	5.7	5.4		
<b>Moisture Content (%):</b>	<b>13.8</b>	<b>14.0</b>	<b>-0.2</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By PF Date 11/20/17 Checked By NC Date 11/21/17

## ATTERBERG LIMITS

ASTM D 4318-17

Client: S&ME, Inc.	Boring No.: R-11B	
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10	
Project No.: R-2017-861-001	Sample No.: SS-4	
Lab ID: R-2017-861-001-040	Soil Description: BROWN LEAN CLAY	

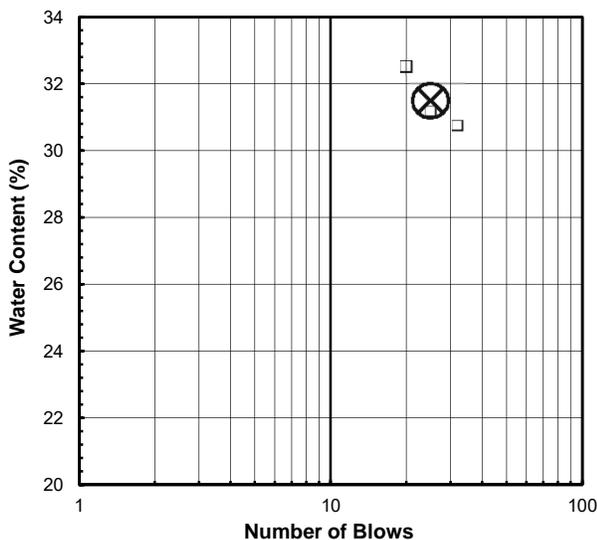
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	1570	18	13	22	U
Wt. of Tare & Wet Sample (g):	1129.75	39.80	41.41	42.09	L
Wt. of Tare & Dry Sample (g):	994.72	34.96	36.17	36.49	T
Weight of Tare (g):	306.47	19.21	19.35	19.25	I
Weight of Water (g):	135.0	4.8	5.2	5.6	P
Weight of Dry Sample (g):	688.3	15.8	16.8	17.2	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>19.6</b>	<b>30.7</b>	<b>31.2</b>	<b>32.5</b>	<b>N</b>
<b>Number of Blows:</b>	<b>32</b>	<b>25</b>	<b>20</b>		<b>T</b>

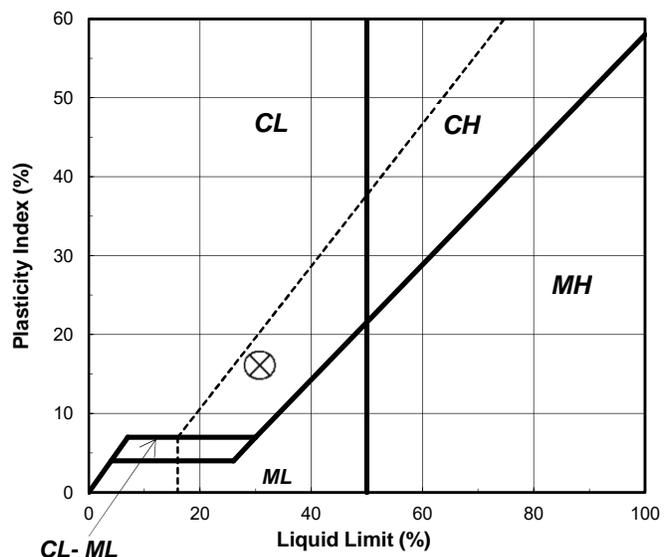
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	2	5		Liquid Limit (%):	31
Wt. of Tare & Wet Sample (g):	24.75	24.78		Plastic Limit (%):	15
Wt. of Tare & Dry Sample (g):	23.90	23.96		Plasticity Index (%):	16
Weight of Tare (g):	18.42	18.56		USCS Symbol:	CL
Weight of Water (g):	0.9	0.8			
Weight of Dry Sample (g):	5.5	5.4			
<b>Moisture Content (%):</b>	<b>15.5</b>	<b>15.2</b>	<b>0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By PF Date 11/17/17 Checked By NC Date 11/18/17

## SIEVE ANALYSIS OF SOIL

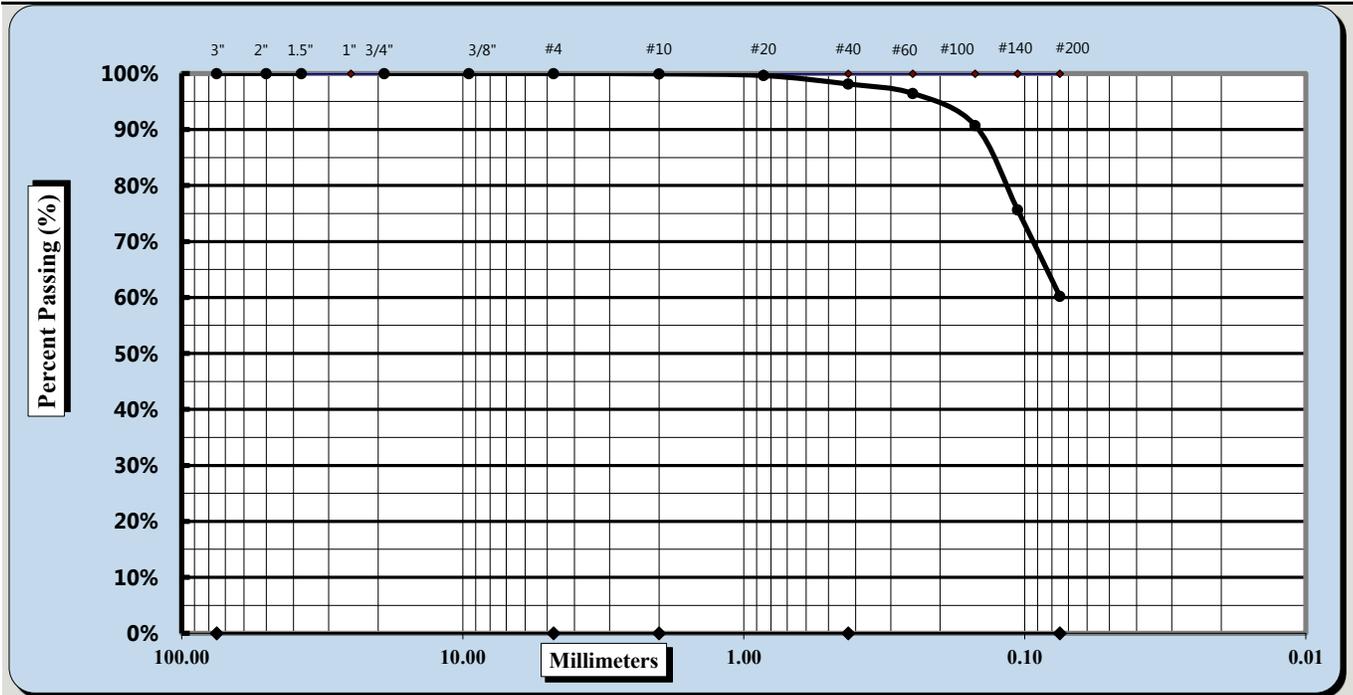


Single sieve set

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	26 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-12/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Light Gray Sandy CLAY		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.1%	Fine Sand	37.9%
Gravel	0.0%	Medium Sand	1.8%	Silt & Clay	60.2%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.700	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	26.4%	CBR	N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Portion

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.: 1306-17-013		Record Date: 9/14/17
Project Name: Kings Bluff Water Main		Lab Report #: 26 of 27
Client Name: McKim & Creed		Date Received: 9/1/17
Received By: J. Faucette	Sampled by: MAD/G. Goslin	Date Sampled: Various
Location: Various (NC)		
Log/Sample Id. 128 (R-12/S4)	Type: Split Spoon	Elev/Depth: 8.5'-10.0'

Sample Description: Light Gray Sandy CLAY

Estimate Max. Particle Size (99% Passing):	<b>#10</b>	Testing Dates:	9/5-9/14/17
Method A (1%)		Method B (0.1%)	x
Material Excluded?		None	
Procedure for obtaining Specimen:	Moist	x	Air-Dried
			Oven-Dried
Sampling Method	Stockpile:	Mechanically Split:	Quartered: x
Dispersion Process?	Soaked without Dispersant	Soaked with Dispersant	x
		Ultrasonic Bath	
Estimated Wet Mass of specimen required:	200 g.	Soak Time: 5 hours	Shaking Apparatus

<b>Specimen:</b>	Pan No.	<b>S</b>	B) Tare Wt.	<b>0.0</b>	Method B of ASTM D1140 or D6913 Sec. 11.4.3	
A) Total Specimen Wet Wt. + Tare Wt. (g.)				<b>209.7</b>	Pan No.	<b>S</b>
					Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)				<b>165.9</b>	Dry Mass of Washed Sample + Tare Wt.	
					<b>76.2</b>	
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )				<b>165.9</b>	Dry Mass of Washed Sample ( <b>S<sub>w</sub>M<sub>d</sub></b> )	
					<b>76.2</b>	
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )				<b>209.7</b>	Dry Mass passing #200	
					<b>89.7</b>	
F=(E-D)/D) Water Content of Specimen				<b>26.4%</b>	% Passing #200	
					<b>54.1%</b>	

Sieve Size		Cumulative Mass Retained	Increment Mass Retained	Limits for Sieve Overloading	% Retained	% Passing
Standard	mm.	CMR <sub>N</sub>	MR <sub>N</sub>	8" diameter	Total Sample Cumulative Percentages	
					CPR <sub>N</sub>	PP <sub>N</sub> (Method A)
1.0"	25.00	0.0	0.00	1100	0.0%	100.0%
3/4"	19.00	0.0	0.00	900	0.0%	100.0%
3/8"	9.50	0.0	0.00	550	0.0%	100.0%
#4	4.75	0.0	0.00	325	0.0%	100.0%
#10	2.000	0.1	0.10	180	0.1%	99.9%
#20	0.850	0.6	0.50	115	0.4%	99.6%
#40	0.425	3.1	2.50	75	1.9%	98.1%
#60	0.250	5.9	2.80	60	3.6%	96.4%
#100	0.150	15.4	9.50	40	9.3%	90.7%
#140	0.106	40.4	25.00	30	24.4%	75.6%
#200	0.075	66.0	25.60	20	39.8%	60.2%
Pan	<0.075	76.2	10.2	Technician:		

Notes/Deviations/References: PP<sub>N</sub> = 100 (1-(CMR<sub>N</sub> / S<sub>w</sub>M<sub>d</sub>))

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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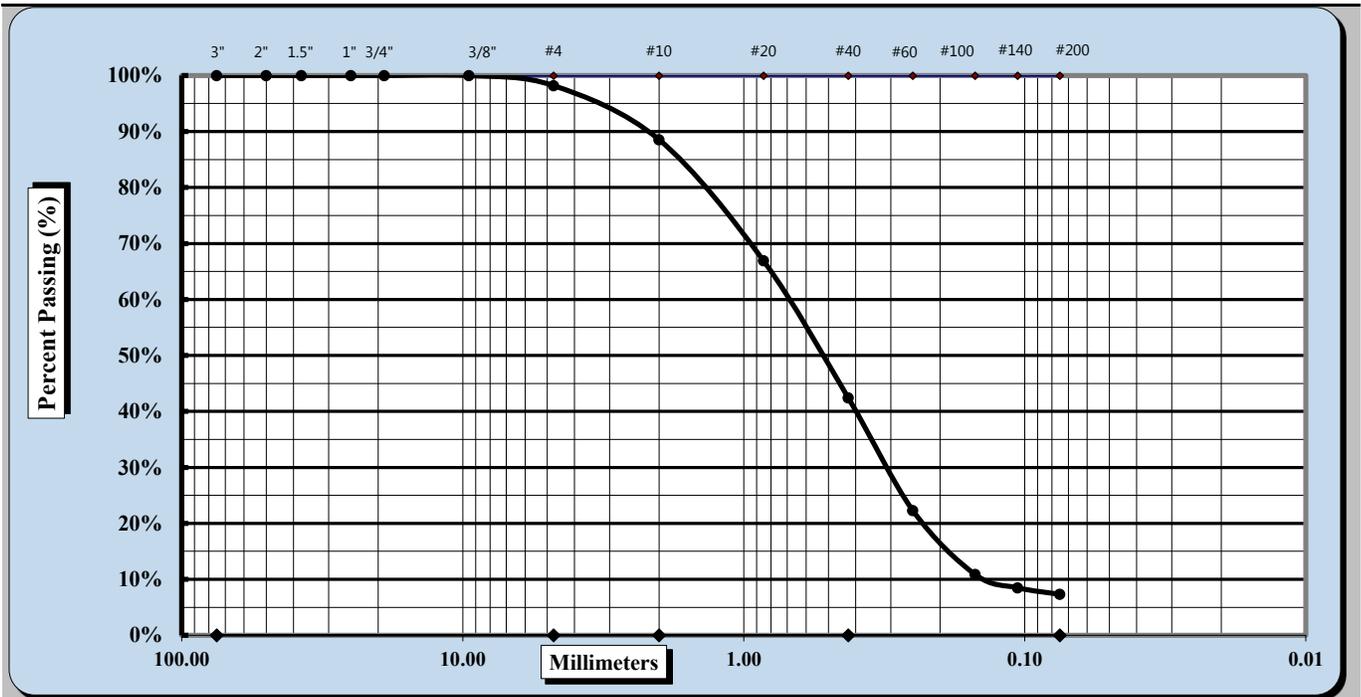
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	9/14/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	27 of 27
Client Name:	McKim & Creed	Date Received:	9/1/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		
Log/Sample Id.	128 (R-12/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'
Sample Description:	Gray Poorly Graded SAND with Silt (SP-SM) with Shell Fragments		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#4	Coarse Sand	9.7%	Fine Sand	35.1%	
Gravel	1.8%	Medium Sand	46.1%	Silt & Clay	7.3%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	20.5%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	9/14/17
Project Name:	Kings Bluff Water Main	Lab Report #:	27 of 27
Client Name:	McKim & Creed	Date Received:	9/1/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various (NC)		

Log/Sample Id.	128 (R-12/S6)	Type:	Split Spoon
		Elev/Depth:	18.5'-20.0'

Sample Description: Gray Poorly Graded SAND with Silt (SP-SM) with Shell Fragments

Estimate Max. Particle Size (99% Passing):	<b>#4</b>	Testing Dates:	9/5-9/14/17
--	-----------	----------------	-------------

Method A (1%)	Method B (0.1%)	x	Material Excluded?	None
---------------	-----------------	---	--------------------	------

Procedure used to Obtain Specimen:	Moist	x	Air-Dried	Oven-Dried	
------------------------------------	-------	---	-----------	------------	--

Sampling Method:	Stockpile:	Mechanically Split:	Quartered:	x
------------------	------------	---------------------	------------	---

Dispersion Process:	Soaked without Dispersant	Soaked with Dispersant	x	Ultrasonic Bath
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Estimated Wet Mass of specimen required:	200 g	Soak Time:	5 hours	Shaking Apparatus?
--	-------	------------	---------	--------------------

<b>Specimen:</b>	Pan No.	<b>HN</b>	B) Tare Wt.	<b>0.0</b>	<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>
------------------	---------	-----------	-------------	------------	--

A) Total Specimen Wet Wt. + Tare Wt. (g.)	<b>214.3</b>	Pan No.	<b>HN</b>	B) Tare Wt.	<b>0.0</b>
---	--------------	---------	-----------	-------------	------------

C) Total Specimen Dry Wt. + Tare Wt. (g.)	<b>177.9</b>	Dry Mass of Specimen after Wash +Tare	<b>165.5</b>
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D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>177.9</b>	Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )	<b>165.5</b>
---	--------------	---	--------------

E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )	<b>214.3</b>	Dry Mass passing #200	<b>12.4</b>
---	--------------	-----------------------	-------------

F=(E-D)/D) Water Content of Specimen	<b>20.5%</b>	% Passing #200	<b>7.0%</b>
--------------------------------------	--------------	----------------	-------------

Portion >>>		Cumulative Mass Retained		Limits for Sieve Overloading	Total Cumulative Mass Retained	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)				Total Sample Cumulative Percentages	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)	8" diameter	CMR <sub>N</sub>	PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.9	2.3	325	<b>3.2</b>	1.8%	98.2%
#10	2.000	9.4	11.0	180	<b>20.4</b>	11.5%	88.5%
#20	0.850	28.0	30.9	115	<b>58.9</b>	33.1%	66.9%
#40	0.425	48.4	54.0	75	<b>102.4</b>	57.6%	42.4%
#60	0.250	66.4	71.9	60	<b>138.3</b>	77.7%	22.3%
#100	0.150	78.0	80.6	40	<b>158.6</b>	89.2%	10.8%
#140	0.106	80.7	82.1	30	<b>162.8</b>	91.5%	8.5%
#200	0.075	82.1	82.8	20	<b>164.9</b>	92.7%	7.3%
Pan	<0.075	82.3	82.9	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

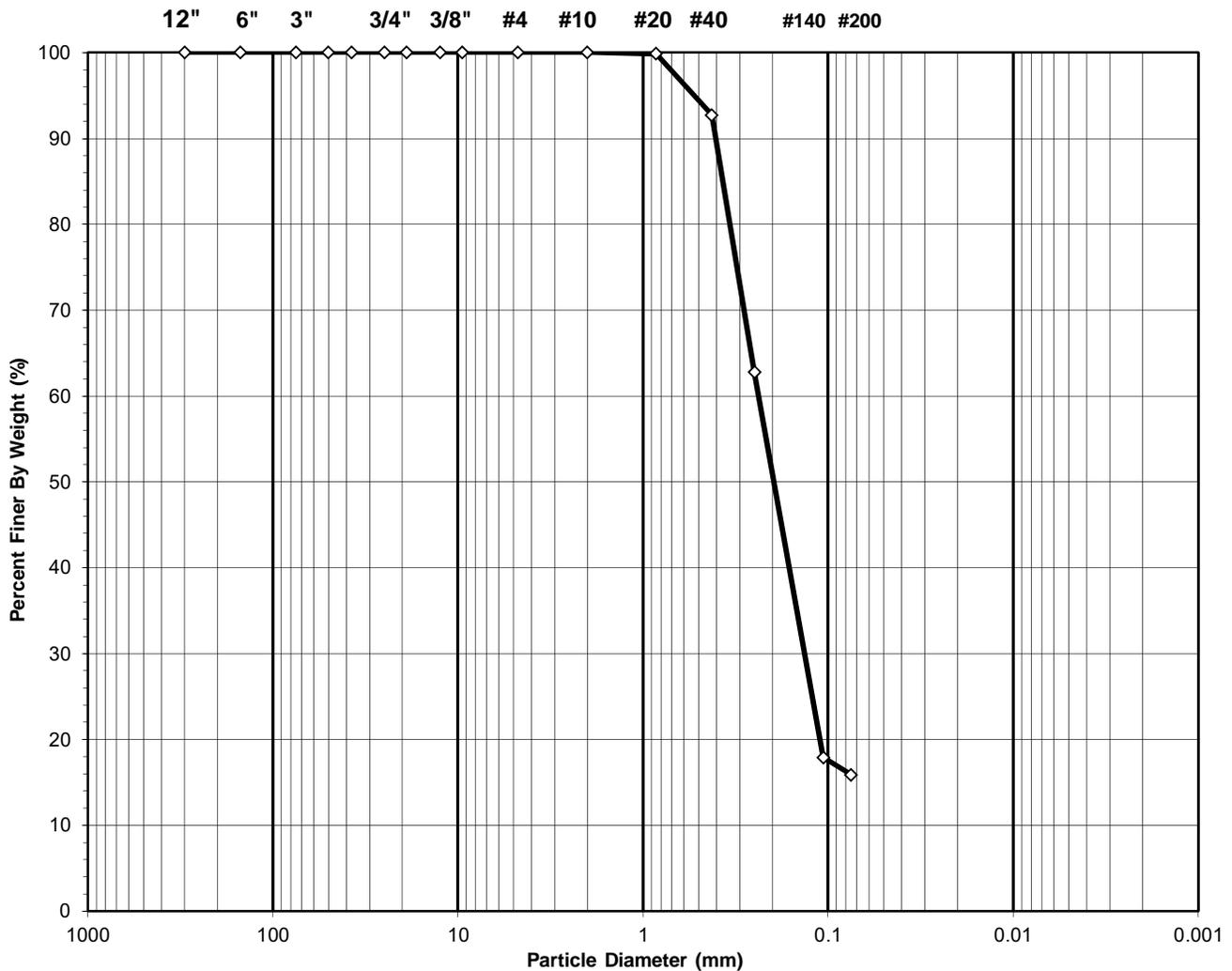
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-9
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-041	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: A-9
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.:	R-2017-861-001	Sample No.: SS-2
Lab ID:	R-2017-861-001-041	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	583	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	827.92	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	752.82	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	309.75	Weight of Tare (g):	NA
Weight of Water (g):	75.10	Weight of Water (g):	NA
Weight of Dry Sample (g):	443.07	Weight of Dry Sample (g):	NA
*Moisture Content (%):	16.9	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	443.07
Dry Weight of - 3/4" Sample (g):	443.1	Weight of - #200 Material (g):	70.42
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	372.65
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.00	0.00	0.00	100.00	100.00
#20	0.850	0.53	0.12	0.12	99.88	99.88
#40	0.425	31.69	7.15	7.27	92.73	92.73
#60	0.250	132.72	29.95	37.23	62.77	62.77
#140	0.106	198.72	44.85	82.08	17.92	17.92
#200	0.075	8.99	2.03	84.11	15.89	15.89
Pan	-	70.42	15.89	100.00	-	-

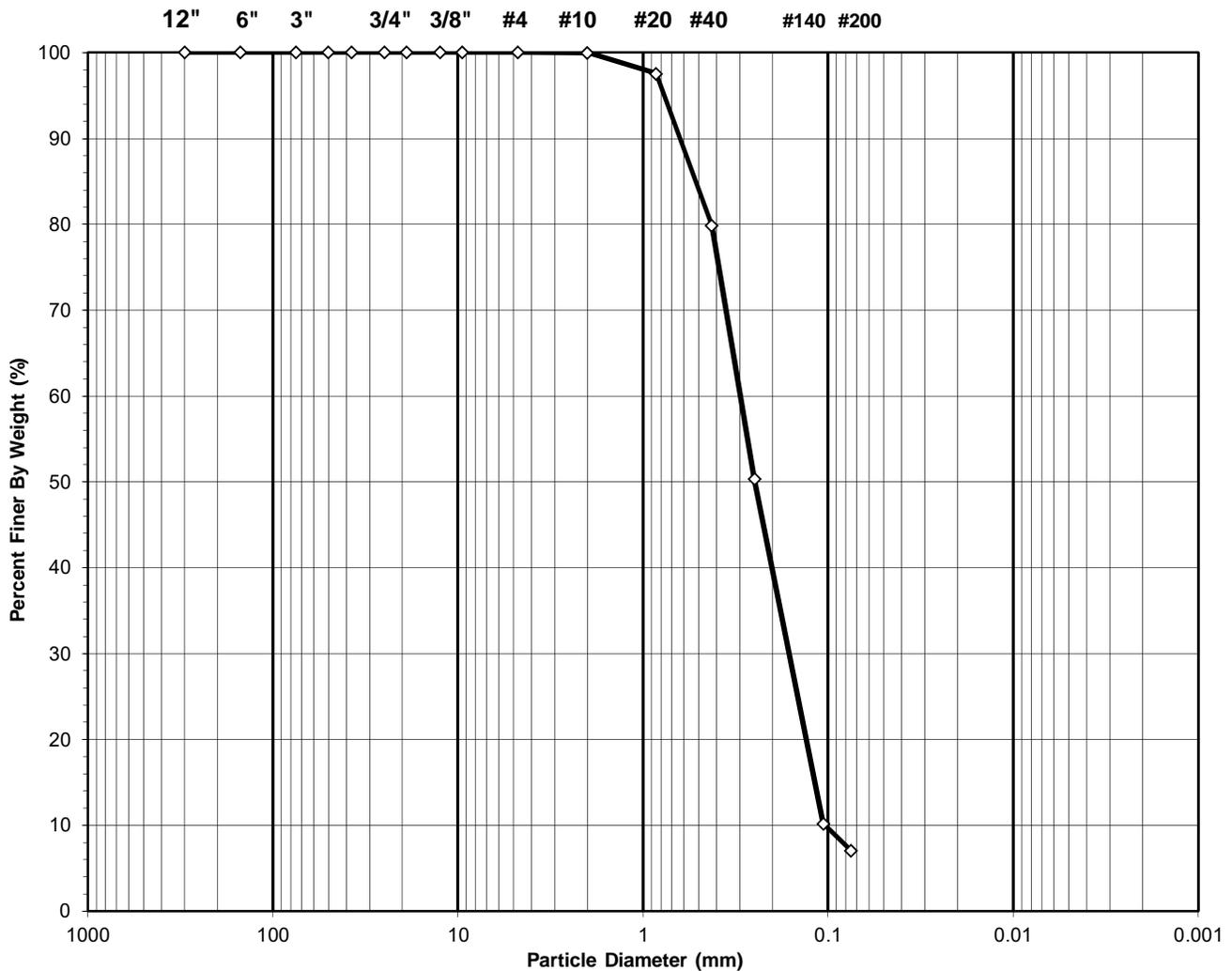
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-9
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-042	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
*sp-sc, ASSUMED*

**D60 = 0.30      CC = 0.85**

**USCS Classification:**  
**POORLY GRADED SAND WITH CLAY**

**D30 = 0.16      CU = 2.87**

**D10 = 0.10**

Tested By **RT**      Date **11/15/17**      Checked By **NC**      Date **11/15/17**

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: A-9
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.: R-2017-861-001	Sample No.: SS-4
Lab ID: R-2017-861-001-042	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	574	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	812.86	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	740.85	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.26	Weight of Tare (g):	NA
Weight of Water (g):	72.01	Weight of Water (g):	NA
Weight of Dry Sample (g):	432.59	Weight of Dry Sample (g):	NA
*Moisture Content (%):	16.6	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	432.59
Dry Weight of - 3/4" Sample (g):	432.6	Weight of - #200 Material (g):	30.48
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	402.11
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.05	0.01	0.01	99.99	99.99
#20	0.850	10.59	2.45	2.46	97.54	97.54
#40	0.425	76.46	17.67	20.13	79.87	79.87
#60	0.250	127.87	29.56	49.69	50.31	50.31
#140	0.106	173.55	40.12	89.81	10.19	10.19
#200	0.075	13.59	3.14	92.95	7.05	7.05
Pan	-	30.48	7.05	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

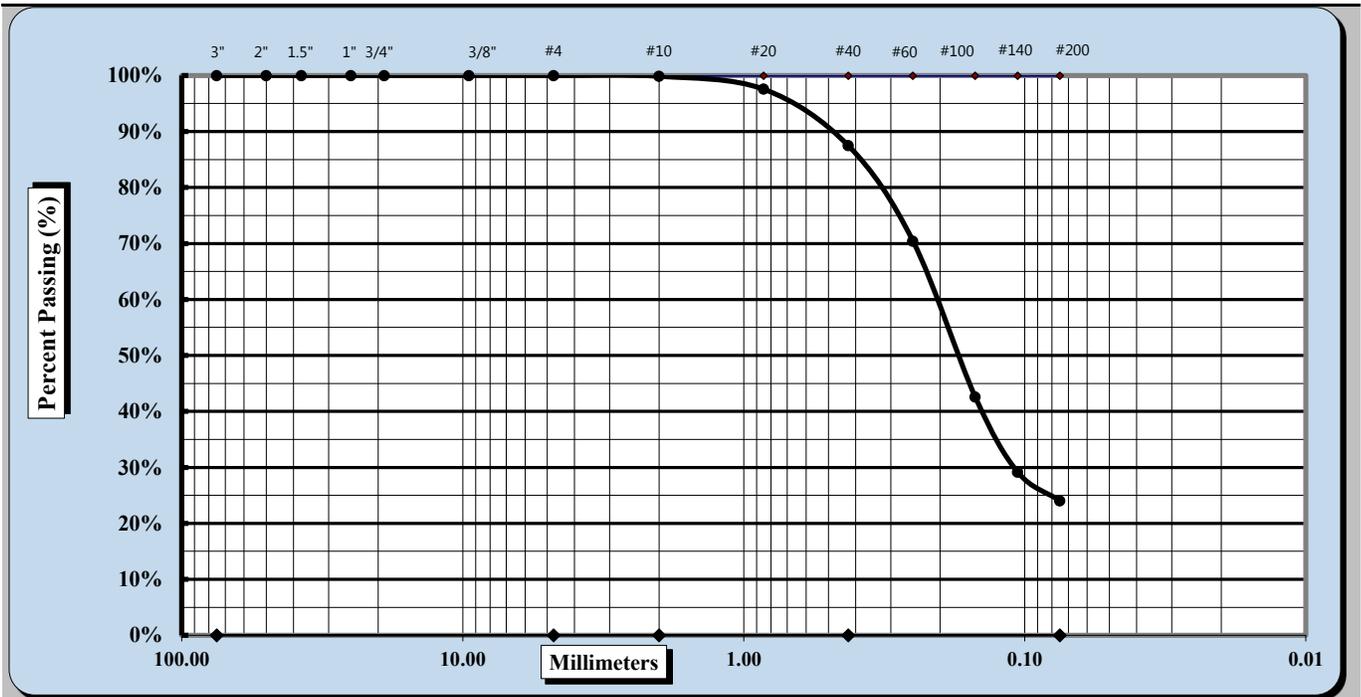
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #: 1306-17-013	Record Date: 11/13/2017
Project Name: Kings Bluff Water Main	Lab Report #: 29 of 32
Client Name: McKim & Creed	Date Received: 10/16/2017
Received By: J. Faucette	Sampled by: MAD/G. Goslin
Location: Various/Water Main/R-O-W	Date Sampled: Various
Log/Sample Id. 155 (W-24A/S3)	Elev/Depth: 6.0'-7.5'
Sample Description: Brown-Gray Clayey SAND (SC)	



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method: B	Procedure for obtaining Specimen: Moist	Dispersion Process: soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.1%
Gravel	0.0%	Medium Sand	12.4%
Liquid Limit	N/A	Plastic Limit	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650
Optimum Moisture	N/A	Natural Moisture	19.6%
		Fine Sand	63.5%
		Silt & Clay	24.0%
		Plastic Index	N/A
		% Absorption	N/A
		CBR	N/A

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	29 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-24A/S3)	Type:	Split Spoon
		Elev/Depth:	6.0'-7.5'

Sample Description: Brown-Gray Clayey SAND (SC)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>211.6</b>		Pan No.	<b>E</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>176.9</b>		Dry Mass of Specimen after Wash +Tare			<b>135.9</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>176.9</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>135.9</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>211.6</b>		Dry Mass passing #200			<b>41.0</b>
F=(E-D)/D) Water Content of Specimen		<b>19.6%</b>		% Passing #200			<b>23.2%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	CMR <sub>N</sub> (1)	CMR <sub>N</sub> (2)			PR	PP (Method A)
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.2	180		0.1%	99.9%
#20	0.850	1.9	2.4	115		2.4%	97.6%
#40	0.425	10.1	12.0	75		12.5%	87.5%
#60	0.250	24.5	27.8	60		29.6%	70.4%
#100	0.150	49.7	51.9	40		57.4%	42.6%
#140	0.106	62.4	62.9	30		70.8%	29.2%
#200	0.075	67.3	67.1	20		76.0%	24.0%
Pan	<0.075	68.1	67.8	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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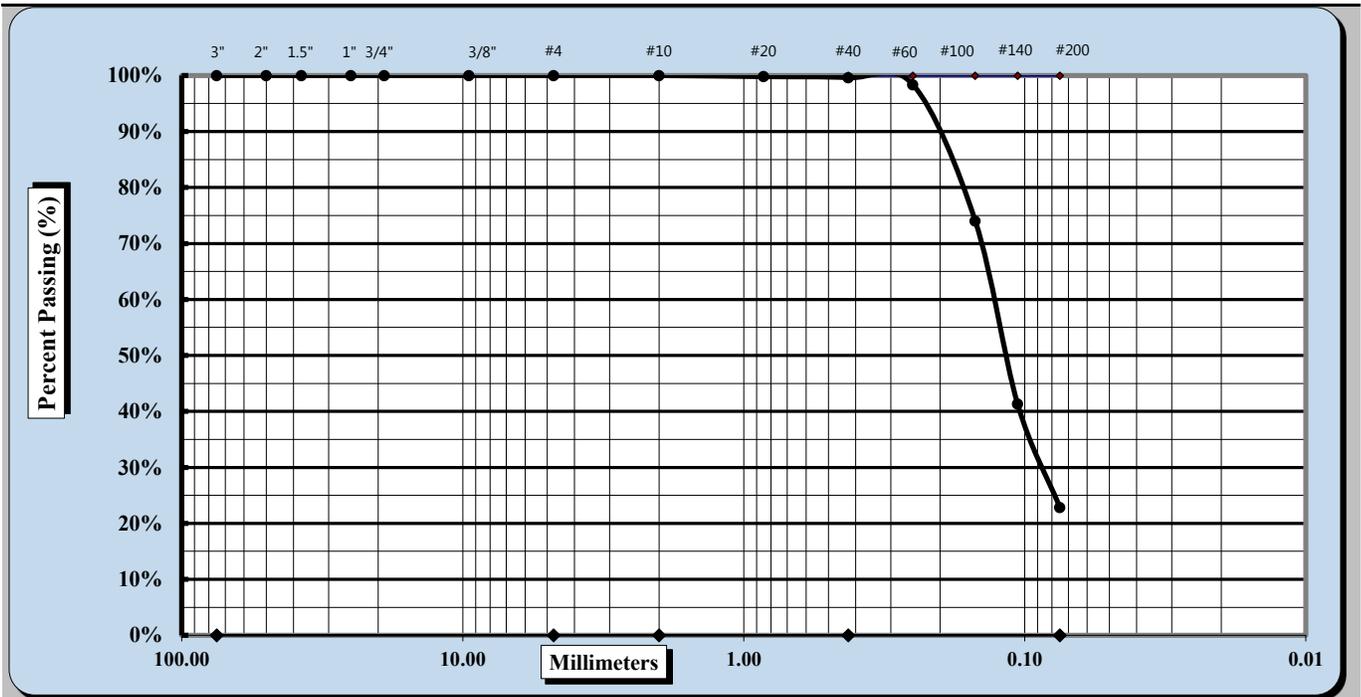
## SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	30 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-24A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'
Sample Description:	Dark Gray Silty SAND (SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	76.8%	
Gravel	0.0%	Medium Sand	0.4%	Silt & Clay	22.8%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	32.1%	CBR	N/A	

Notes / Deviations / References:

**Gunnar Goslin**  
 Technical Responsibility

Signature

**Staff Professional**  
 Position

**11/22/2017**  
 Date

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# SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	30 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-24A/S5)	Type:	Split Spoon
		Elev/Depth:	13.5'-15.0'

Sample Description: Dark Gray Silty SAND (SM)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>T</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>210.4</b>		Pan No.		<b>T</b>	
				B) Tare Wt.		<b>0.0</b>	
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>159.3</b>		Dry Mass of Specimen after Wash +Tare			
				<b>129.1</b>			
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>159.3</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			
				<b>129.1</b>			
E = (A-B) Moist Specimen Mass ( <b>S<sub>w</sub>M<sub>m</sub></b> )		<b>210.4</b>		Dry Mass passing #200			
				<b>30.2</b>			
F=(E-D)/D) Water Content of Specimen		<b>32.1%</b>		% Passing #200			
				<b>19.0%</b>			
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		Total Sample Cumulative Percentages	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>		<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.0	180		0.0%	100.0%
#20	0.850	0.1	0.2	115		0.3%	99.8%
#40	0.425	0.1	0.5	75		0.6%	99.6%
#60	0.250	1.1	1.5	60		2.6%	98.4%
#100	0.150	19.5	21.9	40		41.4%	74.0%
#140	0.106	46.1	47.4	30		93.5%	41.3%
#200	0.075	61.2	61.7	20		122.9%	22.8%
Pan	<0.075	64.4	64.8	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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## ATTERBERG LIMITS

ASTM D 4318-17

Client:	S&ME, Inc.	Boring No.:	W-25B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-043	Color:	Dark Brown ( Minus No. 40 sieve material)

### As Received Water Content

Tare Number	1565
Wt. of Tare & Wet Sample (g)	950.72
Wt. of Tare & Dry Sample (g)	784.35
Weight of Tare (g)	308.85
Weight of Water (g)	166.37
Weight of Dry Sample (g)	475.50

<b>Water Content (%)</b>	<b>35.0</b>
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# NON - PLASTIC MATERIAL

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<i>Tested By</i>	<i>PF</i>	<i>Date</i>	<i>11/14/17</i>	<i>Checked By</i>	<i>NC</i>	<i>Date</i>	<i>11/14/17</i>
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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-25B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-044	Soil Color:	Gray

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sc, ASSUMED**

**USCS Classification:**  
**CLAYEY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.: W-25B
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.:	R-2017-861-001	Sample No.: SS-4
Lab ID:	R-2017-861-001-044	Soil Color: Gray

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1563	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	976.39	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	829.27	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	304.64	Weight of Tare (g):	NA
Weight of Water (g):	147.12	Weight of Water (g):	NA
Weight of Dry Sample (g):	524.63	Weight of Dry Sample (g):	NA
*Moisture Content (%):	28.0	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	524.63
Dry Weight of - 3/4" Sample (g):	524.6	Weight of - #200 Material (g):	99.57
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	425.06
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.00	0.00	0.00	100.00	100.00
#20	0.850	0.11	0.02	0.02	99.98	99.98
#40	0.425	0.32	0.06	0.08	99.92	99.92
#60	0.250	6.39	1.22	1.30	98.70	98.70
#140	0.106	380.16	72.46	73.76	26.24	26.24
#200	0.075	38.08	7.26	81.02	18.98	18.98
Pan	-	99.57	18.98	100.00	-	-

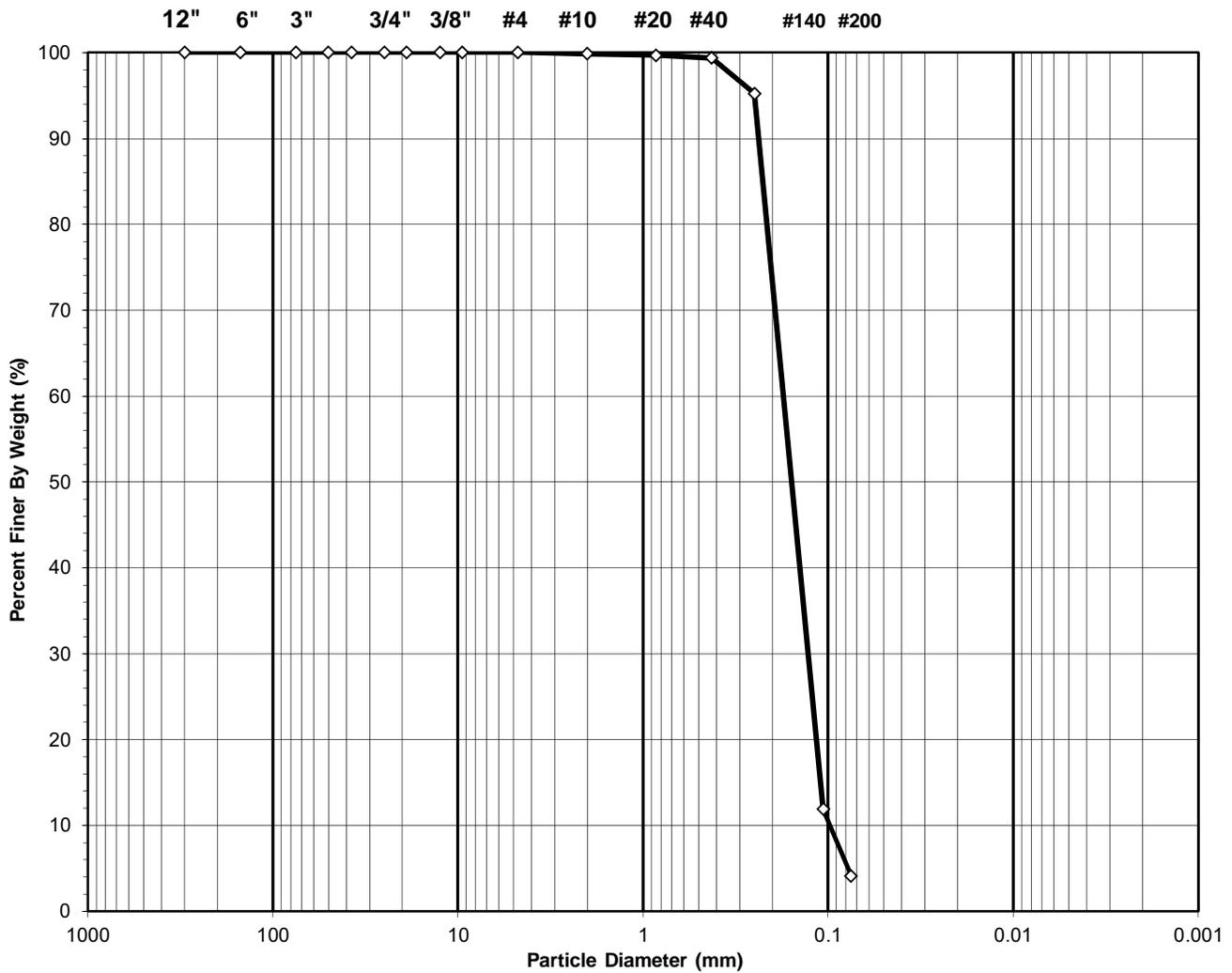
**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	W-26A
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-045	Soil Color:	Tan

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp, ASSUMED**

**D60 = 0.17      CC = 0.96**

**USCS Classification:**  
**POORLY GRADED SAND**

**D30 = 0.13      CU = 1.79**

**D10 = 0.10**

Tested By **RT**      Date **11/15/17**      Checked By **NC**      Date **11/15/17**

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: W-26A
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 8.5-10
Project No.: R-2017-861-001	Sample No.: SS-4
Lab ID: R-2017-861-001-045	Soil Color: Tan

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	585	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	830.72	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	734.93	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	308.89	Weight of Tare (g):	NA
Weight of Water (g):	95.79	Weight of Water (g):	NA
Weight of Dry Sample (g):	426.04	Weight of Dry Sample (g):	NA
*Moisture Content (%):	22.5	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	426.04
Dry Weight of - 3/4" Sample (g):	426.0	Weight of - #200 Material (g):	17.55
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	408.49
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	0.00	0.00	0.00	100.00	100.00
#10	2.00	0.50	0.12	0.12	99.88	99.88
#20	0.850	0.87	0.20	0.32	99.68	99.68
#40	0.425	1.20	0.28	0.60	99.40	99.40
#60	0.250	17.77	4.17	4.77	95.23	95.23
#140	0.106	355.04	83.33	88.11	11.89	11.89
#200	0.075	33.11	7.77	95.88	4.12	4.12
Pan	-	17.55	4.12	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

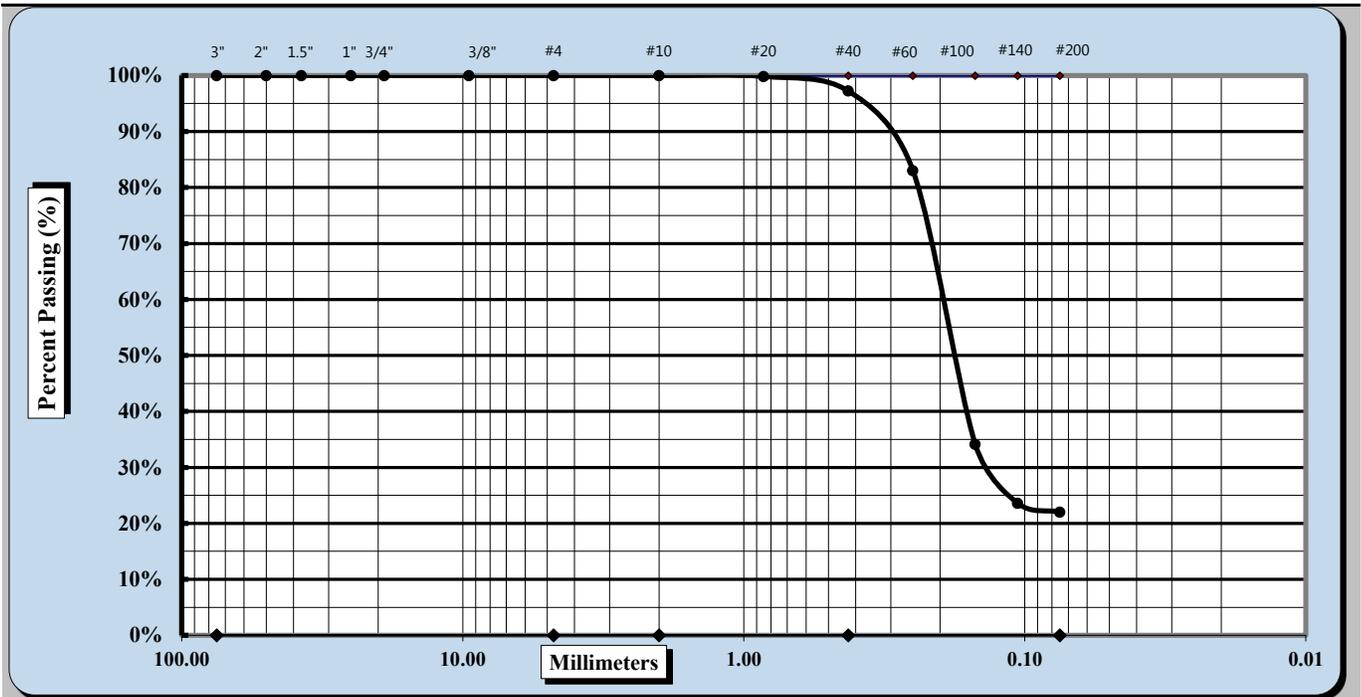
### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	31 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-27B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'
Sample Description:	Gray-Brown Silty SAND (SM)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant	
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	75.2%	
Gravel	0.0%	Medium Sand	2.8%	Silt & Clay	22.0%	
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A	
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A	
Optimum Moisture	N/A	Natural Moisture	13.8%	CBR	N/A	

Notes / Deviations / References:

Gunnar Goslin  
 Technical Responsibility

Signature

Staff Professional  
 Position

11/22/2017  
 Date

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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	31 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-27B/S2)	Type:	Split Spoon
		Elev/Depth:	3.5'-5.0'

Sample Description: Gray-Brown Silty SAND (SM)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>52</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>223.1</b>		Pan No.	<b>52</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>196.1</b>		Dry Mass of Specimen after Wash +Tare			<b>153.7</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>w</sub>M<sub>d</sub></b> )		<b>196.1</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>153.7</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>223.1</b>		Dry Mass passing #200			<b>42.4</b>
F=(E-D)/D Water Content of Specimen		<b>13.8%</b>		% Passing #200			<b>21.6%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve	Total	% Retained	% Passing
Sieve Size		(Portions of Total Specimen)		Overloading	Cumulative Mass Retained	<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>	<i>8" diameter</i>	<i>CMR<sub>N</sub></i>	<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500	<b>0.0</b>	0.0%	100.0%
1.0"	25.00	0.0	0.0	1100	<b>0.0</b>	0.0%	100.0%
3/4"	19.00	0.0	0.0	900	<b>0.0</b>	0.0%	100.0%
3/8"	9.50	0.0	0.0	550	<b>0.0</b>	0.0%	100.0%
#4	4.75	0.0	0.0	325	<b>0.0</b>	0.0%	100.0%
#10	2.000	0.0	0.0	180	<b>0.0</b>	0.0%	100.0%
#20	0.850	0.1	0.2	115	<b>0.3</b>	0.2%	99.8%
#40	0.425	2.4	3.0	75	<b>5.4</b>	2.8%	97.2%
#60	0.250	15.3	18.0	60	<b>33.3</b>	17.0%	83.0%
#100	0.150	63.6	65.6	40	<b>129.2</b>	65.9%	34.1%
#140	0.106	74.6	75.2	30	<b>149.8</b>	76.4%	23.6%
#200	0.075	76.4	76.5	20	<b>152.9</b>	78.0%	22.0%
Pan	<0.075	76.8	76.8	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

11/22/2017  
Date

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### SIEVE ANALYSIS OF SOIL



ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	1306-17-013	Record Date:	11/13/2017
Project Name:	Kings Bluff Water Main	Lab Report #:	32 of 32
Client Name:	McKim & Creed	Date Received:	10/16/2017
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-27B/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'
Sample Description:	Brown Poorly Graded SAND (SP)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist	Dispersion Process:	soaked with dispersant
Maximum Particle Size	#10	Coarse Sand	0.0%	Fine Sand	88.8%
Gravel	0.0%	Medium Sand	7.5%	Silt & Clay	3.7%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Maximum Dry Density	N/A	Assumed SG(D854)	2.650	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	28.7%	CBR	N/A

Notes / Deviations / References:

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<b>Gunnar Goslin</b> Technical Responsibility	 Signature	<b>Staff Professional</b> Position	<b>11/22/2017</b> Date
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## SIEVE ANALYSIS USING SINGLE SIEVE-SET SIEVING



Single Set Sieving 2 portions

ASTM D6913

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project No.:	1306-17-013	Record Date:	11/13/17
Project Name:	Kings Bluff Water Main	Lab Report #:	32 of 32
Client Name:	McKim & Creed	Date Received:	10/16/17
Received By:	J. Faucette	Sampled by:	MAD/G. Goslin
		Date Sampled:	Various
Location:	Various/Water Main/R-O-W		
Log/Sample Id.	155 (W-27B/S4)	Type:	Split Spoon
		Elev/Depth:	8.5'-10.0'

Sample Description: Brown Poorly Graded SAND (SP)							
Estimate Max. Particle Size (99% Passing):		<b>#10</b>		Testing Dates: 11/8-11/13/17			
Method A (1%)		Method B (0.1%)		x		Material Excluded? None	
Procedure used to Obtain Specimen:		Moist		x		Air-Dried	
						Oven-Dried	
Sampling Method:		Stockpile:		Mechanically Split:		Quartered: x	
Dispersion Process:		Soaked without Dispersant		Soaked with Dispersant		x Ultrasonic Bath	
Estimated Wet Mass of specimen required:		200 g		Soak Time: 4.5 hours		Shaking Apparatus?	
<b>Specimen:</b>	Pan No.	<b>HC</b>	B) Tare Wt.	<b>0.0</b>			
<i>Method B of ASTM D1140 or D6913 sec. 11.4.3</i>							
A) Total Specimen Wet Wt. + Tare Wt. (g.)		<b>217.8</b>		Pan No.	<b>HC</b>	B) Tare Wt.	<b>0.0</b>
C) Total Specimen Dry Wt. + Tare Wt. (g.)		<b>169.2</b>		Dry Mass of Specimen after Wash +Tare			<b>163.5</b>
D = (C-B) Total Specimen Dry Weight ( <b>S<sub>m</sub>M<sub>d</sub></b> )		<b>169.2</b>		Dry Mass of Specimen after Wash ( <b>S<sub>w</sub>M<sub>d</sub></b> )			<b>163.5</b>
E = (A-B) Moist Specimen Mass ( <b>S<sub>m</sub>M<sub>m</sub></b> )		<b>217.8</b>		Dry Mass passing #200			<b>5.7</b>
F=(E-D)/D Water Content of Specimen		<b>28.7%</b>		% Passing #200			<b>3.4%</b>
<i>Portion &gt;&gt;&gt;</i>		Cumulative Mass Retained		Limits for Sieve Overloading		Total Cumulative Mass Retained	
Sieve Size		(Portions of Total Specimen)		8" diameter		% Retained	
						<i>Total Sample Cumulative Percentages</i>	
Standard	mm.	<i>CMR<sub>N</sub>(1)</i>	<i>CMR<sub>N</sub>(2)</i>			<i>PR</i>	<i>PP (Method A)</i>
1.5"	37.50	0.0	0.0	1500		0.0%	100.0%
1.0"	25.00	0.0	0.0	1100		0.0%	100.0%
3/4"	19.00	0.0	0.0	900		0.0%	100.0%
3/8"	9.50	0.0	0.0	550		0.0%	100.0%
#4	4.75	0.0	0.0	325		0.0%	100.0%
#10	2.000	0.0	0.0	180		0.0%	100.0%
#20	0.850	0.4	0.5	115		0.5%	99.5%
#40	0.425	6.0	6.7	75		7.5%	92.5%
#60	0.250	30.5	31.4	60		36.6%	63.4%
#100	0.150	74.5	74.5	40		88.1%	11.9%
#140	0.106	80.9	80.8	30		95.6%	4.4%
#200	0.075	81.5	81.4	20		96.3%	3.7%
Pan	<0.075	81.7	81.6	Technician:			

Notes/Deviations/References:

Gunnar Goslin  
Technical Responsibility

Signature

Staff Professional  
Position

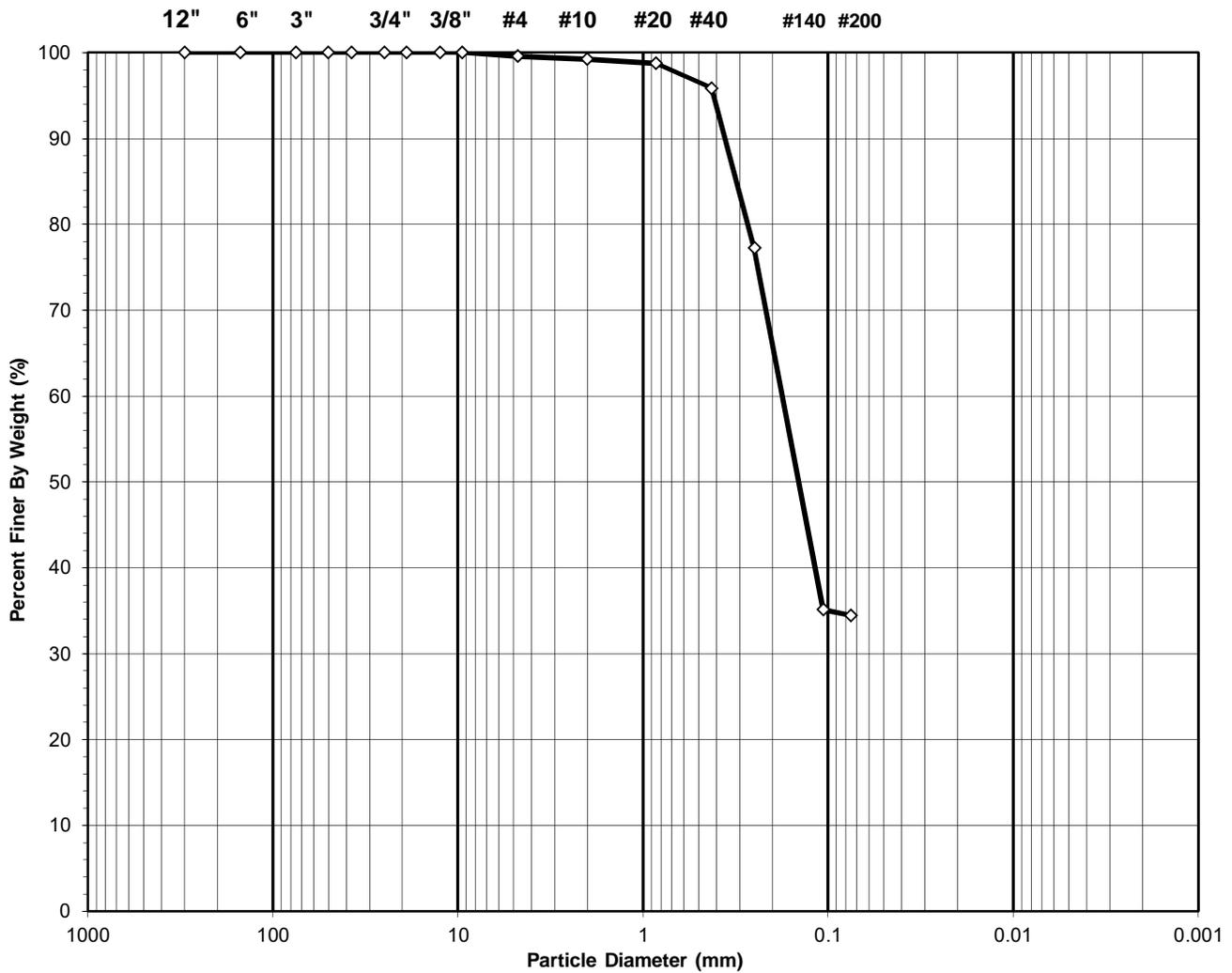
11/22/2017  
Date

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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-18
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	3.5-5
Project No.:	R-2017-861-001	Sample No.:	SS-2
Lab ID:	R-2017-861-001-046	Soil Color:	Light Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sm, ASSUMED**

**USCS Classification:**  
**SILTY SAND**

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: S&ME, Inc.	Boring No.: A-18
Client Reference: CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft): 3.5-5
Project No.: R-2017-861-001	Sample No.: SS-2
Lab ID: R-2017-861-001-046	Soil Color: Light Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1566	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	681.15	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	630.43	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	309.58	Weight of Tare (g):	NA
Weight of Water (g):	50.72	Weight of Water (g):	NA
Weight of Dry Sample (g):	320.85	Weight of Dry Sample (g):	NA
*Moisture Content (%):	15.8	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	320.85
Dry Weight of - 3/4" Sample (g):	320.9	Weight of - #200 Material (g):	110.54
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	210.31
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.00
6"	150	0.00	0.00	0.00	100.00	100.00
3"	75	0.00	0.00	0.00	100.00	100.00
2"	50	0.00	0.00	0.00	100.00	100.00
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.00
1"	25.0	0.00	0.00	0.00	100.00	100.00
3/4"	19.0	0.00	0.00	0.00	100.00	100.00
1/2"	12.50	0.00	0.00	0.00	100.00	100.00
3/8"	9.50	0.00	0.00	0.00	100.00	100.00
#4	4.75	1.37	0.43	0.43	99.57	99.57
#10	2.00	1.04	0.32	0.75	99.25	99.25
#20	0.850	1.64	0.51	1.26	98.74	98.74
#40	0.425	9.24	2.88	4.14	95.86	95.86
#60	0.250	59.73	18.62	22.76	77.24	77.24
#140	0.106	135.04	42.09	64.85	35.15	35.15
#200	0.075	2.25	0.70	65.55	34.45	34.45
Pan	-	110.54	34.45	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-18
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-047	Soil Color:	Dark Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**sp, ASSUMED**

**D60 = 0.22      CC = 0.88**

**USCS Classification:**  
**POORLY GRADED SAND**

**D30 = 0.15      CU = 1.90**

**D10 = 0.11**

Tested By **RT**      Date **11/15/17**      Checked By **NC**      Date **11/15/17**

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	S&ME, Inc.	Boring No.:	A-18
Client Reference:	CFPUA Kings Bluff Watermain 1306-17-013	Depth (ft):	8.5-10
Project No.:	R-2017-861-001	Sample No.:	SS-4
Lab ID:	R-2017-861-001-047	Soil Color:	Dark Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	578	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	784.38	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	691.17	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	310.86	Weight of Tare (g):	NA
Weight of Water (g):	93.21	Weight of Water (g):	NA
Weight of Dry Sample (g):	380.31	Weight of Dry Sample (g):	NA
*Moisture Content (%):	24.5	*Moisture Content (%):	NA

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	380.31
Dry Weight of - 3/4" Sample (g):	380.3	Weight of - #200 Material (g):	12.39
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	367.92
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	0.00	0.00	0.00	100.00	<b>100.00</b>
#10	2.00	0.00	0.00	0.00	100.00	<b>100.00</b>
#20	0.850	1.87	0.49	0.49	99.51	<b>99.51</b>
#40	0.425	11.83	3.11	3.60	96.40	<b>96.40</b>
#60	0.250	98.44	25.88	29.49	70.51	<b>70.51</b>
#140	0.106	253.41	66.63	96.12	3.88	<b>3.88</b>
#200	0.075	2.37	0.62	96.74	3.26	<b>3.26</b>
Pan	-	12.39	3.26	100.00	-	-

**Notes:** \* Moisture Content result is not to be interpreted as the "As Received" Moisture Content.  
The procedure is used only to determine the dry weight of the sample portion being sieved.

Tested By RT Date 11/15/17 Checked By NC Date 11/15/17

## **Appendix IV – Jack and Bore Difficulty Comments**



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**North Carolina Highway 11 South**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-03A, R-03B</b>	Groundwater encountered at depths of 1.5 and 8.4 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-03A</b>	Standard penetration test values ranging from W.O.H. to 2 blows per foot encountered at depths from 3 to 12 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	No	Firm clays and silts are known to occur within the Coastal Plain geology.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-03A, R-03B</b>	Standard penetration test values ranging from 6 to 10 blows per foot.
Medium to dense sands	<b>X</b>			Yes	R-03A, R-03B	Standard penetration test values ranging from 11 to 23 blows per foot
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
- <sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.
- <sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.
- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**John Riegel Road**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-06A, R-06B</b>	Groundwater encountered at depths of 6.0 and 6.3 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-06B</b>	Standard penetration test values ranging from 2 to 3 blows per foot encountered at depths from 3 to 5 feet and 12 to 17 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-06A, R-06B	Standard penetration test values ranging from 6 to 12 blows per foot encountered.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-06A, R-06B</b>	Standard penetration test values ranging from 6 to 8 blows per foot encountered at depths from 8 to 25 feet.
Medium to dense sands	<b>X</b>			Yes	R-06A, R-63B	Standard penetration test values ranging from 11 to 13 blows per foot
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

<sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.

<sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.

<sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.

<sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.

<sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**International Paper Railyard**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>RT-07A, RT-07B</b>	Groundwater encountered at depths of 3.0 and 7.0 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>RT-07A, RT-07B</b>	Standard penetration test values ranging from 4 to 9 blows per foot encountered at various depths.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	RT-07A, RT-07B	Standard penetration test values ranging from 5 to 21 blows per foot encountered at various depths.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>RT-07B</b>	Standard penetration test values ranging from 4 to 9 blows per foot encountered at depths from 5 to 12 feet.
Medium to dense sands	<b>X</b>			Yes	RT-07A, RT-07B	Standard penetration test values ranging from 12 to 18 blows per foot
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

<sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.

<sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.

<sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.

<sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.

<sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**Locks 1 Road**

*The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.*

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-01A, R-01B</b>	Groundwater encountered at depths of 2.0 and 8.2 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-01A</b>	Standard penetration test values ranging from 3 to 4 blows per foot encountered at various depths.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-01A	Standard penetration test values ranging from 5 to 12 blows per foot encountered at various depths.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-01A, R-01B</b>	Standard penetration test values ranging from 2 to 9 blows per foot encountered at depths from 3 to 25 feet.
Medium to dense sands	<b>X</b>			Yes	R-01A, R-01B	Standard penetration test values ranging from 11 to 19 blows per foot
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
- <sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.
- <sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.
- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**Black Rock Road**

*The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.*

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-02A, R-02B</b>	Groundwater encountered at depths of 2.7 and 3.3 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-02A</b>	Standard penetration test values of 3 blows per foot encountered from 12 to 17 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	<b>R-02A, R-02B</b>	Standard penetration test values ranging from 5 to 13 blows per foot encountered from 17 to 25 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-02A, R-02B</b>	Standard penetration test values ranging from 4 to 8 blows per foot encountered at depths from 3 to 12 feet.
Medium to dense sands	<b>X</b>			Yes	R-02A	Standard penetration test value of 14 blows per foot
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
- <sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.
- <sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.
- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**SR 1811**

*The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.*

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-04A,</b>	Groundwater encountered at a depth of 3 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>No</b>	Soft clays are known to occur within the Coastal Plain Geology
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-04A	Standard penetration test value of 16 blows per foot encountered from 22 to 25 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-04A</b>	Standard penetration test values ranging from 5 to 9 blows per foot encountered at depths from 1 to 8 feet and 17 to 22 feet.
Medium to dense sands	<b>X</b>			Yes	R-04A	Standard penetration test values ranging from 12 to 15 blows per foot at depths from 8 to 17 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
- <sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.
- <sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.
- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**RIEGAL COURSE ROAD**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-05A, R-05B</b>	Groundwater encountered at a depth of 3 to 10 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-05A, R-05B</b>	Soft to very soft clays were encountered from depths of 0 to 8, 12 to 22 feet and 17 to 22 feet. SPT values ranged from 2 to 4 blows per foot.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-05A, R-05B	Standard penetration test values ranging from 5 to 9 blows per foot encountered at intermittent depths from 1 to 25 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>No</b>	Very loose to loose sands are known to occur within the Coastal Plain geology.
Medium to dense sands	<b>X</b>			Yes	R-05B	Standard penetration test value of 13 blows per foot encountered at a depth of 13 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

<sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.

<sup>2</sup> "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate tooling and equipment.

<sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.

<sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.

<sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**NEILS EDDY ROAD**

*The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.*

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-08A, R-08B</b>	Groundwater encountered at a depth of 7 to 8.5 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-08B</b>	Encountered from 3 to 8 feet and 28 to 30 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-08A, R-08B	Standard penetration test values ranging from 7 to 12 blows per foot encountered from 3 to 12 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-08B</b>	Standard penetration test values ranging from WOH to 5 blows per foot encountered at depths from 1 to 3 feet and 22 to 27 feet.
Medium to dense sands	<b>X</b>			Yes	R-08A, R-08B	Standard penetration test values ranging from 12 to 20 blows per foot at depths from 7 to 25 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
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- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**PORT ROYAL ROAD**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	R-09A, R-09B	Groundwater encountered at a depth of 7.5 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		Yes	R-09A, R-09B	Encountered intermittently from 1 to 22 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-08A, R-08B	Standard penetration test values ranging from 5 to 7 blows per foot encountered from 3 to 7 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		Yes	R-09A	Standard penetration test value of 3 blows per foot encountered at a depth of 12 to 17 feet.
Medium to dense sands	<b>X</b>			Yes	R-09A, R-09B	Standard penetration test values ranging from 24 to 30 blows per foot at depths from 22 to 25 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	Yes	No	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

- <sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.
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- <sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.
- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**BLUE BANKS LOOP ROAD**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-10A, R-10B, R-10C</b>	Groundwater encountered at depths of a depth of 2.5 to 15 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-10B, R-10C</b>	SPT values ranging from WOR to 4 bpf from depths of 1 to 5.5 feet and 8 to 12 feet.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-10A, R-10B, R-10C	SPT values ranging from 5 to 16 blows per foot. Encountered from 1 to 12 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-10B</b>	SPT value of 9 bpf. Encountered from 17 to 22 feet.
Medium to dense sands	<b>X</b>			Yes	R-10A, R-10B, R-10C	Standard penetration test values ranging from 14 to 34 blows per foot at depths from 8 to 25 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

<sup>1</sup> "Subsurface Conditions and Jack & Bore Difficulty" and "Site Subsurface Conditions and Jack & Bore Difficulty" are professional opinions based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface conditions known to be difficult for jack and bore construction. The suitability of each site for jack and bore construction must be evaluated individually.

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<sup>3</sup> "Difficulties May Occur" that can be addressed by tooling, equipment, and contractor means and methods.

<sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.

<sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**VERNON ROAD**

The "Jack and Bore" construction technique is generally not suitable for use below the groundwater level. Dewatering would be required. Substantial Problems<sup>4</sup> may be encountered if the "Jack and Bore" construction technique is utilized below the groundwater level depending on soil conditions, downhole tooling, and contractor means and methods.

SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-11B</b>	Groundwater encountered at a depth of a depth of 3 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>No</b>	Soft Clays are known to occur within the Coastal Plain geology
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	R-11B	SPT value of 8 bpf. Encountered from 3 to 5.5 and 8 to 12 feet.
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>No</b>	Very loose to loose sands are known to occur within the Coastal Plain geology.
Medium to dense sands	<b>X</b>			Yes	R-11B	Standard penetration test values ranging from 27 to 31 blows per foot at depths from 12 to 25 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

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- <sup>4</sup> "Substantial Problems" up to and including conditions that may be unsuitable for use of the jack and bore construction method.
- <sup>5</sup> Manmade conditions such as foundations, utilities, environmental contamination, excavation slopes, etc. are not addressed.



**JACK AND BORE DIFFICULTY COMMENTS**  
**CFPUA Kings Bluff Water Main**  
**Bladen, Columbus, and Brunswick Counties, North Carolina**  
**S&ME Project No. 1306-17-013**  
**MT MISERY ROAD**

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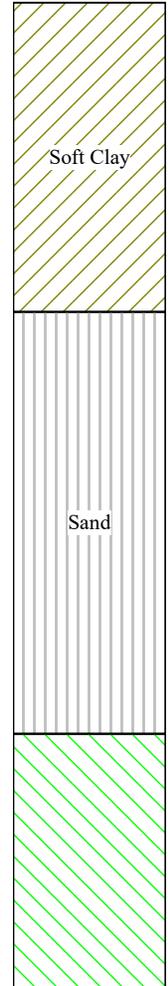
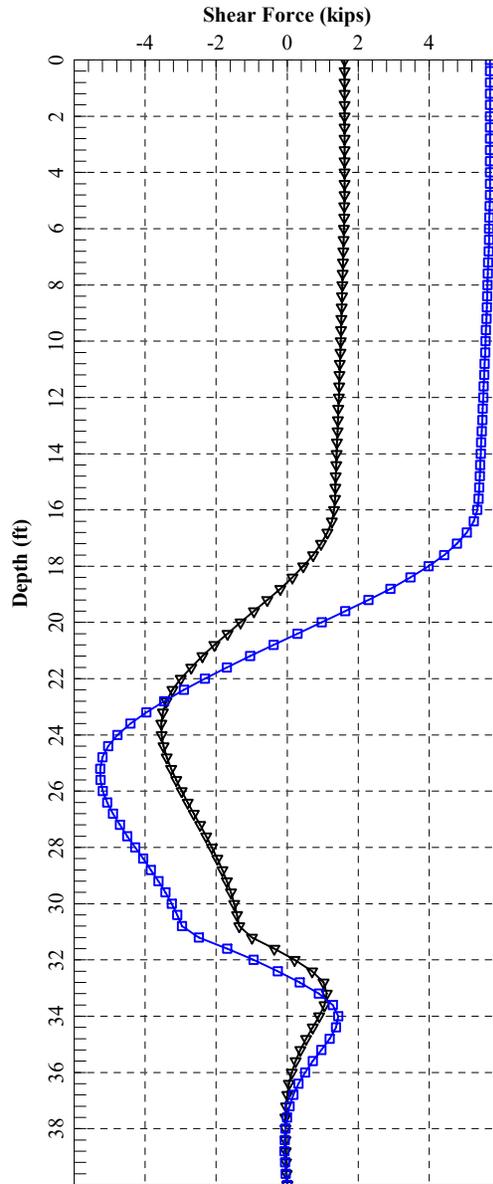
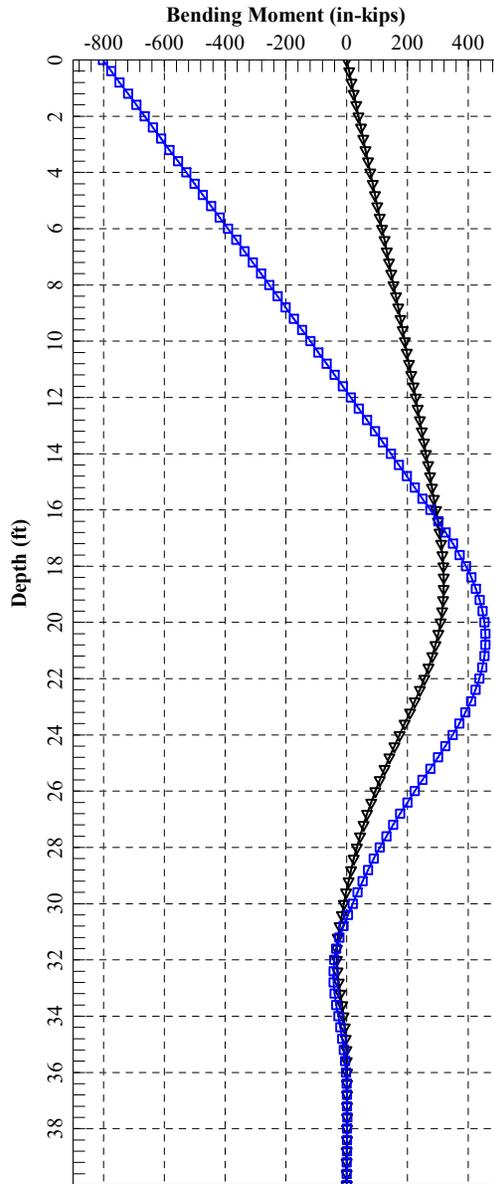
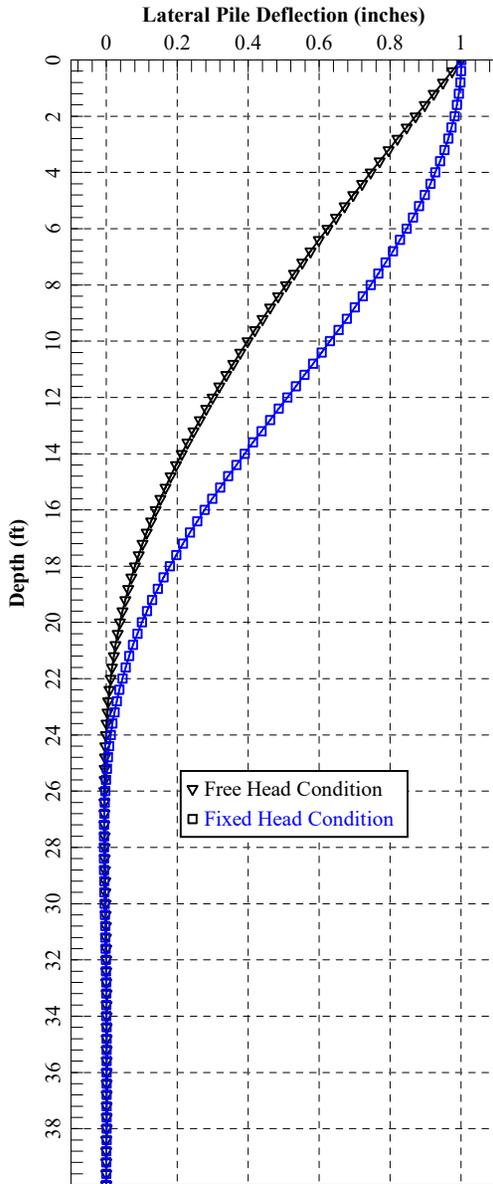
SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1</sup>				SITE SUBSURFACE CONDITIONS AND JACK & BORE DIFFICULTY <sup>1,5</sup>		
Subsurface Condition	Generally Suitable <sup>2</sup>	Difficulties May Occur <sup>3</sup>	Substantial Problems <sup>4</sup>	Consistent with Geology	Encountered by Borings	Comments
Groundwater			<b>X</b>	-	<b>R-12</b>	Groundwater encountered at a depth of a depth of 1.5 feet. Depth will vary seasonally and with rainfall.
Soft to very soft clays, silts, and organic deposits		<b>X</b>		<b>Yes</b>	<b>R-12</b>	Soft clays were encountered from 8 to 12 feet with an SPT value of 4 bpf.
Firm, medium to very stiff clays and silts	<b>X</b>			Yes	No	Firm to stiff clays are known to occur within the Coastal Plain geology
Hard clays and highly weathered shales	<b>X</b>			No	No	
Very loose to loose sands		<b>X</b>		<b>Yes</b>	<b>R-12</b>	Loose sands encountered from 22 to 25 feet with an SPT value of 6 bpf.
Medium to dense sands	<b>X</b>			Yes	R-12	Standard penetration test values ranging from 11 to 24 blows per foot at depths from 5.5 to 22 feet.
Weathered rocks, marls, chalks, and firmly cemented sands	<b>X</b>			Yes	No	Firmly cemented sands are known to occur within the Coastal Plain geology.
Slightly weathered to un-weathered rock		<b>X</b>		No	No	
Soil with significant gravel, cobbles, and boulders (maximum cobble/boulder size 1/3 pipe diameter, hand excavation may be required, minimum casing size may be controlled by personnel access)			<b>X</b>	No	No	
Mixed face (soil and rock in the same section, or alternating along alignment)			<b>X</b>	<b>Yes</b>	<b>No</b>	Mixed face conditions are known to occur within the Coastal Plain geology.
Rock fill or soil fill containing rock			<b>X</b>	-	No	

**NOTES**

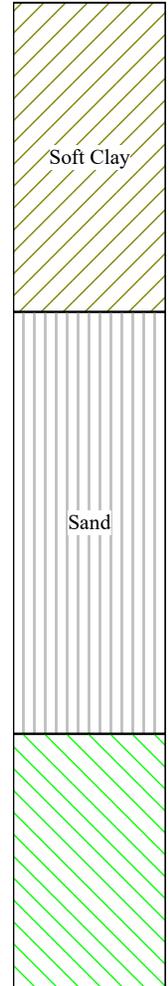
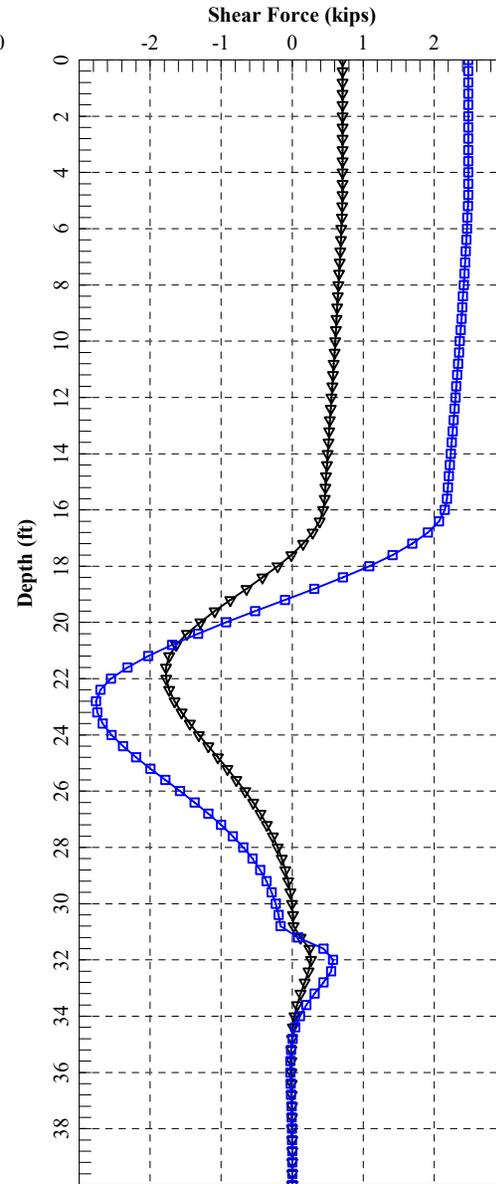
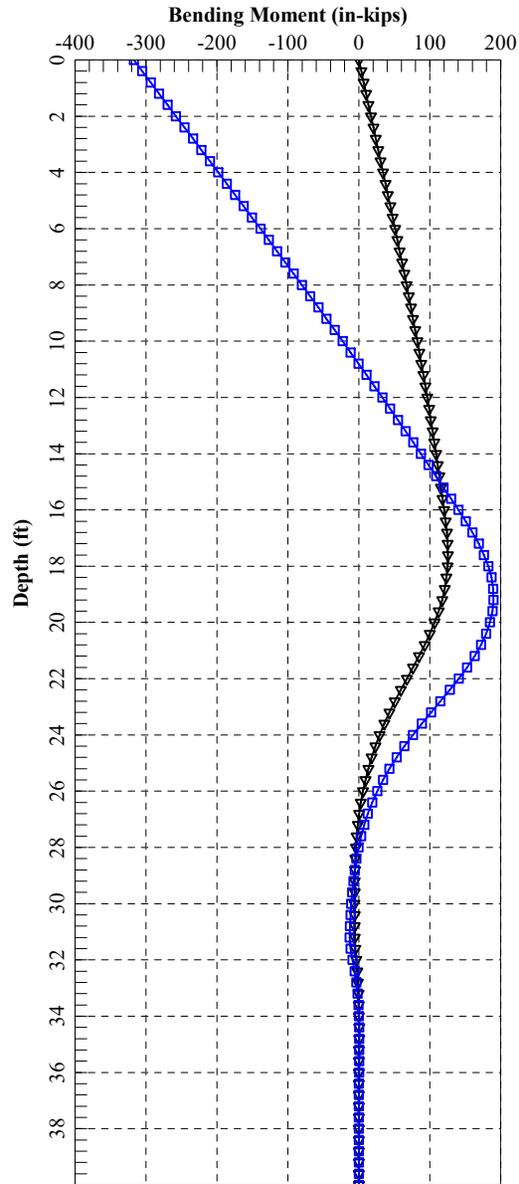
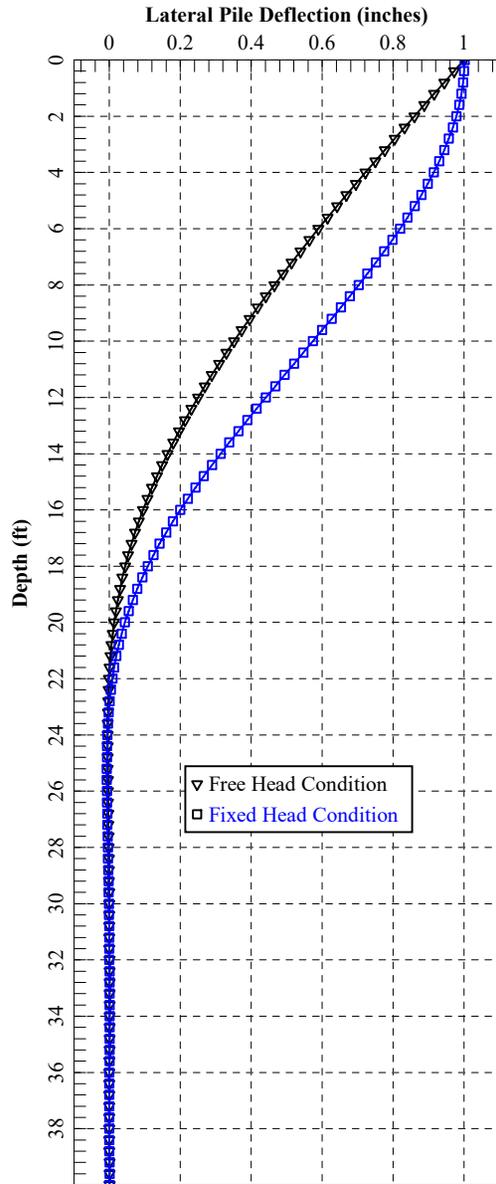
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## **Appendix V – L-File Output**

### HP12x53 Strong Axis



### HP12x53 Weak Axis





Duke Energy  
8645 Trade Street  
Leland, NC 28451  
910-772-4903  
[Bill.wilder@duke-energy.com](mailto:Bill.wilder@duke-energy.com)

July 26, 2019

McKim & Creed Engineering  
Attn: Jess Powell, PE  
243 North Front Street  
Wilmington, NC 28401  
910-343-1048  
[Jess.powell@mckimcreed.com](mailto:Jess.powell@mckimcreed.com)

Re: Duke Energy Transmission Line Right-of-Way Plan Review Conditional Approval  
Project: 54" Raw Water Main – Cape Fear Public Utility Authority Kings Bluff Raw Water Transmission Main – STA 322+00 To STA 337+00  
Line: Cumberland – Delco 230kV Line, OL141, Structure 26-27

Dear Jess,

This office has reviewed the proposed 54" RAW WATER MAIN PLAN AND PROFILE STA 322+00 TO 337+00 plan sheet for CAPE FEAR PUBLIC UTILITY AUTHORITY KINGS BLUFF RAW WATER TRANSMISSION MAIN plan (attached separately via email) and referred to herein as Attachment "A". We find the plans as shown on the referenced drawings to be acceptable and in compliance with the attached transmission right-of-way guidelines and restrictions. Therefore Duke Energy Transmission ("DET") approves the referenced plans, insofar as its transmission easement rights are concerned, subject to the conditions detailed below. If this project construction has not commenced by a period of 12 months from the date of this letter, this approval by DET shall expire, and additional plan review will be required by DET at that time.

In summary, the following details DET's comments:

- **No stockpiling or storage of materials, dirt, or equipment of any kind is permitted within the DET easement area, nor may any combustible materials be placed within the easement area.**
- Contractors operating any and all equipment should be instructed not to operate within 25' of the poles, towers, or other electrical structures including guy anchors. All slopes shall be 4:1 or less. No spoil dirt is to be placed within the rights-of-way limits unless previously approved by DET.
- Any proposed easements must not cross closer than 25' to DET's electrical structures including, but not limited to poles, towers, and guy anchors.
- All underground facilities, such as, but not limited to, storm water pipes and domestic water line pipes, must be capable of a heavy equipment load bearing weight of 80,000 lbs. DET will not be responsible for damages to these installed facilities.
- Any damage to the transmission line or its associated structures, related to this project, and/or claims due to the damage, is the responsibility of the developer/owner.
- We have not reviewed, and therefore have not approved, any plans other than Attachment A. DET restrictions prohibit trees that exceed 12' at maturity or lights that exceed 12' within the rights-of-way

limits, and neither may be within the wire zone. Vegetation that exceeds 12' in height is subject to removal by DET. Additionally, irrigation systems and signs are not permitted.

- CFPUA to have contractor they select for this project to provide DET with work plan and scope for the installation of sheet piling allow DET a minimum of 30 days to review with approval or comments prior to construction begins in DET transmission line corridor.
- All plats, plans, renderings and representations of lots, parcels, designated spaces and/or designated areas having and including area within a Duke Energy easement cannot represent, with setbacks or other means, buildable areas(s) within a Duke Energy easement.
- This approval by DET is subject to the paramount right of DET at all times to make use of its entire easement area for the construction, maintenance, reconstruction, and operation of electric lines.
- This letter only addresses issues related to DET's transmission line easement. Additional easements, approvals, or permits from the underlying property owner(s) or other applicable agencies may be required in order for you to proceed with this project .

DET also offers these additional comments to ensure that other potential conflicts are not created during or after construction:

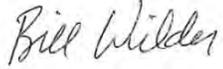
- If there are design changes to any drawings that involve the transmission right-of-way, DET requires a review of the changes for compliance with the rights-of-way guidelines.
- Proper clearances must be maintained at all times. If any transmission line modification by DET is required to maintain proper clearances, the cost will be the responsibility of the developer/owner. Any such line modifications must be approved and scheduled, through DET well in advance of the project start date.
- All current and future property owners are required to adhere to the most current version of the DET transmission right-of-way guidelines and restrictions. (attached separately via email)
- DET heavy equipment access must not be restricted during construction of this project due to grading or any other activity.
- Please contact me prior to the start of this project to attend any pre-construction meetings.
- Underground Utilities with cathodic protection will require a study of anodic interference on existing DET structures. The developer / owner is responsible for any required remediation as determined by DET. This study shall be provided at no cost to DET for their review and acceptance before a Final Approval shall be issued by DET. This study must be submitted to DET prior to the commissioning of the Underground Utilities.

In not objecting to the use of the rights-of-way for use as shown on the drawings, DET is not relinquishing the right to control and maintain the rights-of-way as specified in the recorded easement documents. Any damages to the transmission lines or its associated structures, and claims caused by the damage, is the responsibility of the developer/contractor/owner. It is the responsibility of the developer/contractor/owner to ensure that all work performed in the proximity of the transmission lines complies with all applicable laws and regulations, including but not limited to the National Electric Safety Code ("**NESC**"), the Overhead High-Voltage Line Safety Act ("**OHVLSA**"), and the Occupational Safety and Health Act ("**OSHA**"), and that all persons working near the electric power lines are made aware of the inherent safety hazards associated with these lines.

Please note that this approval is based in part on the accuracy of the information you have supplied on the site plans (Attachment A). You are responsible for indicating the correct location of the DET right of way and its associated electrical structures along with the correct width of the DET rights-of-way limits.

Thank you for the opportunity to work with you on this project. If you have any questions, please feel free to contact me at 910-772-4903.

Sincerely,



Bill Wilder  
Asset Protection Specialist II  
Transmission Right of Way

Attachments: Attachment "A" - Site Plans  
Duke Energy Transmission Right-of-Way Guidelines & Restrictions  
Duke Energy "Look Up & Live" Brochure

Cc: David Folk Duke Energy

Jason Paradis Duke Energy

Anthony W. Boahn McKim & Creed  
[Tboahn@mckimcreed.com](mailto:Tboahn@mckimcreed.com)

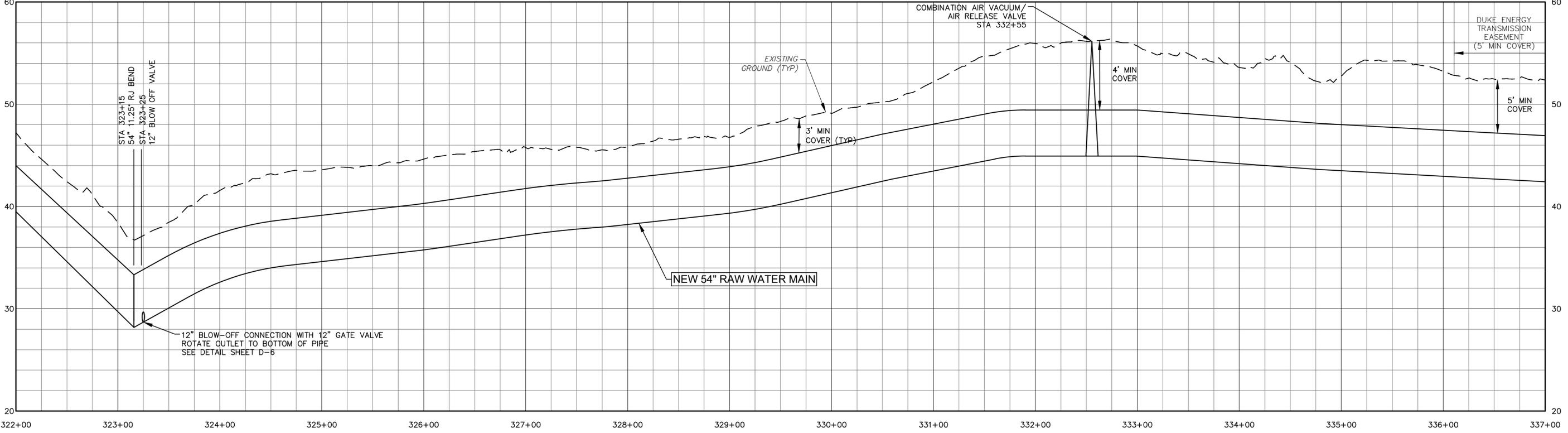
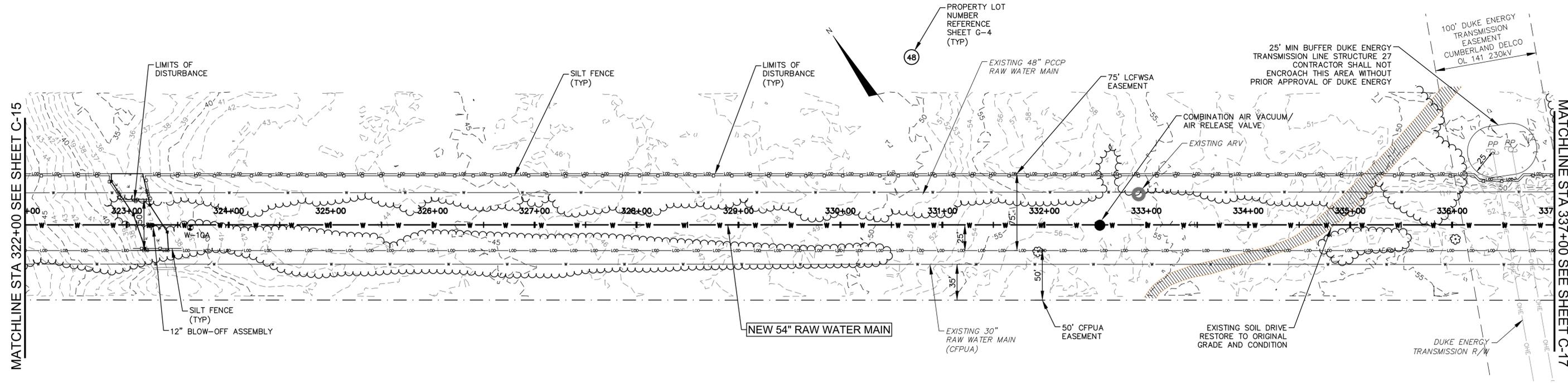
Attachment "A"

The following plan sheet was provided to Duke Energy TRANSMISSION LINE – Asset Protection for this review and conditional approval.

Plan prepared by McKim & Creed and sealed by NC Professional Engineer, Anthony W. Boahn, PE (NC License No. 025512) drawing dated 6/29/2019, sheet C-16, entitled, 54" RAW WATER MAIN PLAN AND PROFILE STA 322+00 TO 337+00 – CAPE FEAR PUBLIC UTILITY AUTHORITY KINGS BLUFF RAW WATER TRANSMISSION MAIN

MATCHLINE STA 322+00 SEE SHEET C-15

MATCHLINE STA 337+00 SEE SHEET C-17

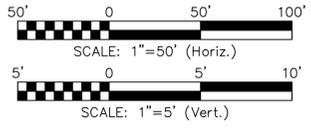


- GENERAL NOTES:**
- LAYOUT BASED ON STANDARD FITTING SIZES USING MAXIMUM JOINT DEFLECTION OF 2 DEGREES AND MINIMUM RADIUS OF 700 FT.
  - CONTRACTOR SHALL TAKE THE NECESSARY STEPS TO PROTECT THE EXISTING 48" RAW WATER MAIN.
  - ALL EXCAVATIONS (TRENCHING, BORING, BORE PITS, ETC) ARE UNCLASSIFIED. GEOTECHNICAL REPORT AND BORING LOGS HAVE BEEN PROVIDED IN PROJECT SPECIFICATIONS.
  - SITE SURVEY WAS PERFORMED BY MCKIM AND CREED IN 2017. ALL COORDINATES ARE TIED TO THE NORTH CAROLINA STATE PLAN COORDINATE SYSTEM (NAD 83 FEET).
  - THE LOCATION OF ALL EXISTING UTILITIES ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY LOCATIONS.
  - NEW 54" RAW WATER MAIN SHALL BE WELDED STEEL PIPE (THICKNESS MIN = 0.22, LINING = CEMENT MORTAR, COATING = POLYURETHANE) OR DUCTILE IRON PIPE (PC 150, LINING = CEMENT MORTAR, COATING = ZINC). CONTRACTOR SHALL UTILIZE ONLY ONE MATERIAL UNLESS APPROVED BY ENGINEER OR MATERIAL IS SHOWN ON PLANS.
  - OSHA MINIMUM APPROACH DISTANCE IS 20 FEET. CONTRACTOR SHALL INSTALL PIPE WHILE MEETING OSHA MINIMUM APPROACH DISTANCE REQUIREMENTS.
  - CONTRACTOR SHALL COORDINATE WITH DUKE TRANSMISSION MINIMUM OF 14 DAYS PRIOR TO CROSSING AND HOLD PRE-CONSTRUCTION CONFERENCE WITH BILL WILDER - DUKE ENERGY ASSET PROTECTION, CELL: 910-520-3911



**MCKIM & CREED**  
 243 NORTH FRONT ST  
 WILMINGTON, NORTH CAROLINA 28401  
 TELE: (910) 343-1048  
 FAX: (910) 251-8282  
 LICENSE: F-1222

**Cape Fear**  
 Public Utility Authority  
 Stewardship. Sustainability. Service.



REV:	DESCRIPTION	DATE:
0	ISSUED FOR BID - NOT FOR CONSTRUCTION	JUN 2019

**54" RAW WATER MAIN  
 PLAN AND PROFILE  
 STA 322+00 TO STA 337+00**

**CAPE FEAR  
 PUBLIC UTILITY AUTHORITY  
 KINGS BLUFF RAW  
 WATER TRANSMISSION MAIN**

CAPE FEAR PUBLIC UTILITY AUTHORITY  
 235 GOVERNMENT CENTER DRIVE  
 WILMINGTON, NC 28403  
 OFFICE: (910)332-6560

DATE: JUNE 2019  
 SCALE: AS SHOWN  
 DRAWN BY: JPV  
 CHECKED BY: AWB  
 PROJECT NO.: 5367-0038

**SHEET NO:  
 C-16**



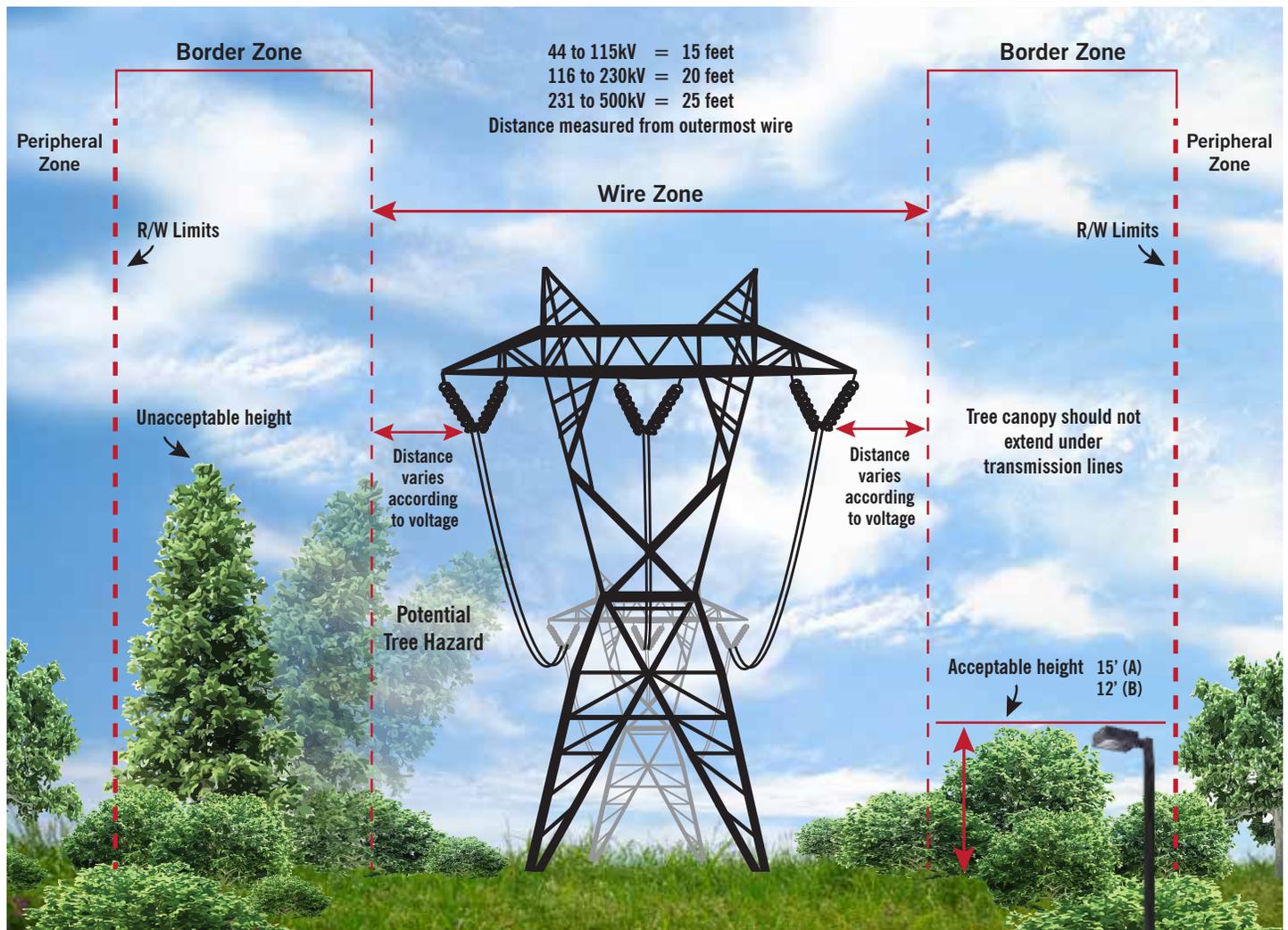
## DUKE ENERGY ELECTRIC TRANSMISSION RIGHT-OF-WAY GUIDELINES/RESTRICTIONS VALID FOR NORTH CAROLINA AND SOUTH CAROLINA (Revised 11/20/2014)

This list of right-of-way restrictions has been developed to answer the most frequently asked questions about property owner use of Duke Energy's electric transmission rights of way. This list does not cover all restrictions or all possible situations. You should contact the Asset Protection right-of-way specialist if you have additional concerns about the rights of way. This list of restrictions is subject to change at any time and without notice. Duke Energy reserves all rights conveyed to it by the right-of-way agreement applicable to the subject property. All activity within the rights of way shall be reviewed by an Asset Protection right-of-way specialist to obtain prior written approval. Engineering plans may be required. Compliance with the Duke Energy Right-of-Way Guidelines/Restrictions or approval of any plans by Duke Energy does not mean that the requirements of any local, county, state or federal government or other applicable agency with governing authority have been satisfied.

1. Structures, buildings, manufactured/mobile homes, satellite systems, swimming pools (any associated equipment and decking), graves, billboards, dumpsters, signs, wells, deer stands, retaining walls, septic systems or tanks (whether above or below ground), debris of any type, flammable material, building material, wrecked or disabled vehicles and all other objects (whether above or below ground) which in Duke Energy's opinion interfere with the electric transmission right of way are not allowed within the right-of-way limits. Transformers, telephone/cable pedestals (and associated equipment) and fire hydrants are not allowed. Manholes, water valves, water meters, backflow preventers and irrigation heads are not permitted. Attachments to Duke Energy structures are prohibited.
2. Fences and gates shall not exceed 10 feet in height and shall be installed greater than 25 feet from poles, towers and guy anchors. Fences shall not parallel the centerline within the rights of way but may cross from one side to the other at any angle not less than 30 degrees with the centerline. If a fence crosses the right of way, a gate (16 feet wide at each crossing) shall be installed by the property owner, per Duke Energy's specifications. The property owner is required to install a Duke Energy lock on the gate to ensure access. Duke Energy will supply a lock.
3. Grading (cuts or fill) shall be no closer than 25 feet from poles, towers, guys and anchors (except for parking areas; see paragraph 7) and the slope shall not exceed 4:1. Grading or filling near Duke Energy facilities which will prevent free equipment access or create ground-to-conductor clearance violations will not be permitted. Storage or stockpiling of dirt or any other material is prohibited. Sedimentation control, including re-vegetation, is required per state regulations.
4. Streets, roads, driveways, sewer/water lines, other utility lines or any underground facilities shall not parallel the centerline within the right of way but may cross, from one side to the other, at any angle not less than 30 degrees with the centerline. No portion of such facility or corresponding easement shall be located within 25 feet of Duke Energy's facilities. Roundabouts, cul-de-sacs and intersections (such as roads, driveways and alleyways) are not permitted.
5. Any drainage feature that allows water to pond, causes erosion, directs stormwater toward the right of way or limits access to or around Duke Energy facilities is prohibited.
6. Contact Duke Energy prior to the construction of lakes, ponds, retention or detention facilities, etc.
7. Parking may be permitted within the right of way, provided that:
  - a. Prior to grading, concrete barriers shall be installed at a minimum of 9 feet from the Duke Energy facilities. During construction, grading shall be no closer than 10 feet to any Duke Energy facility.
  - b. After grading/paving activity is complete, a Duke Energy-approved barrier sufficient to withstand a 15mph vehicular impact shall be erected 9 feet from any Duke Energy facility.
  - c. Any access areas, entrances or exits shall cross (from one side to the other) the right of way at any angle not less than 30 degrees with the centerline and shall not pass within 25 feet of any structure. Parking lot entrances/exits cannot create an intersection within the right of way.
  - d. Lighting within the right-of-way limits must be approved by Duke Energy before installing. Due to engineering design standards, lighting is not allowed in the "Wire Zone." Where lighting is approved ("Border Zone"), the total height may not exceed 15 feet in Area A and 12 feet in Area B. See map on back of this page for Areas. Contact your Asset Protection right-of-way specialist as the "Wire Zone" varies for the different voltage lines.
8. Duke Energy will not object to certain vegetation plantings as long as:
  - a. They do not interfere with the access to or the safe, reliable operation and maintenance of Duke Energy facilities.
  - b. With prior written approval, Duke Energy does not object to low-growing shrubs and grasses within the "Wire Zone." Tree species are not allowed within the "Wire Zone." Trees that are approved in the "Border Zone" may not exceed, at maturity, 15 feet in Area A and 12 feet in Area B. See map on back of page for areas. Contact the Asset Protection right-of-way specialist for "Wire Zone"/"Border Zone" definitions.
  - c. For compliant mature height species, refer to [plants.ces.ncsu.edu/](http://plants.ces.ncsu.edu/) for reference.
  - d. Engineering drawings must indicate the outermost conductor.
  - e. Vegetation that is not in compliance is subject to removal without notice.
  - f. Duke Energy may exercise the right to cut "danger trees" outside the right-of-way limits as required to properly maintain and operate the transmission line.

We hope this is useful information. If you have additional questions or plan any activity not mentioned above, please contact the Asset Protection right-of-way specialist for your area (see map).

## Transmission Right-of-way Zones – Carolinas



**Wire Zone:** Extends beyond the outermost conductor on both sides. (See diagram above.)

**Permitted within the Wire Zone:** Low-growing plants, shrubs and grasses.

**Not permitted within the Wire Zone:** Tree species of any kind.

**Border Zone:** Extends from the edge of the Wire Zone to the outside edge of the Right of Way.

**Permitted within the Border Zone:** Lighting structures and plantings within the Right of Way that do not exceed a vertical height of 15 feet in Area A and 12 feet in Area B. (See Asset Protection Map for location of geographic areas.) For compliant mature height species, refer to [plants/ces.ncsu.edu/](http://plants/ces.ncsu.edu/).

**Not permitted within the Border Zone:** Any object that exceeds vertical height restrictions. These restrictions are based on flat ground elevations. If the ground elevations differ, no object at any time may exceed the outermost conductor's ground elevation.

**Peripheral Zone:** Outside the Right of Way and adjacent to Border Zones.

**Permitted within the Peripheral Zone:** Trees may be planted in the Peripheral Zone. Duke Energy recommends customers exercise caution selecting and planning trees in this zone.

**Not permitted in the Peripheral Zone:** Trees with canopies are subject to routine trimming and possible removal.

### In all zones:

When an outage risk is identified, Duke Energy will attempt to notify the affected customer. However, the company may need to take immediate action if trees cannot be pruned to appropriate levels. This may include trees and shrubs that are within 20 feet of the power line at the maximum peak load or during weather conditions that create line sag and sway.

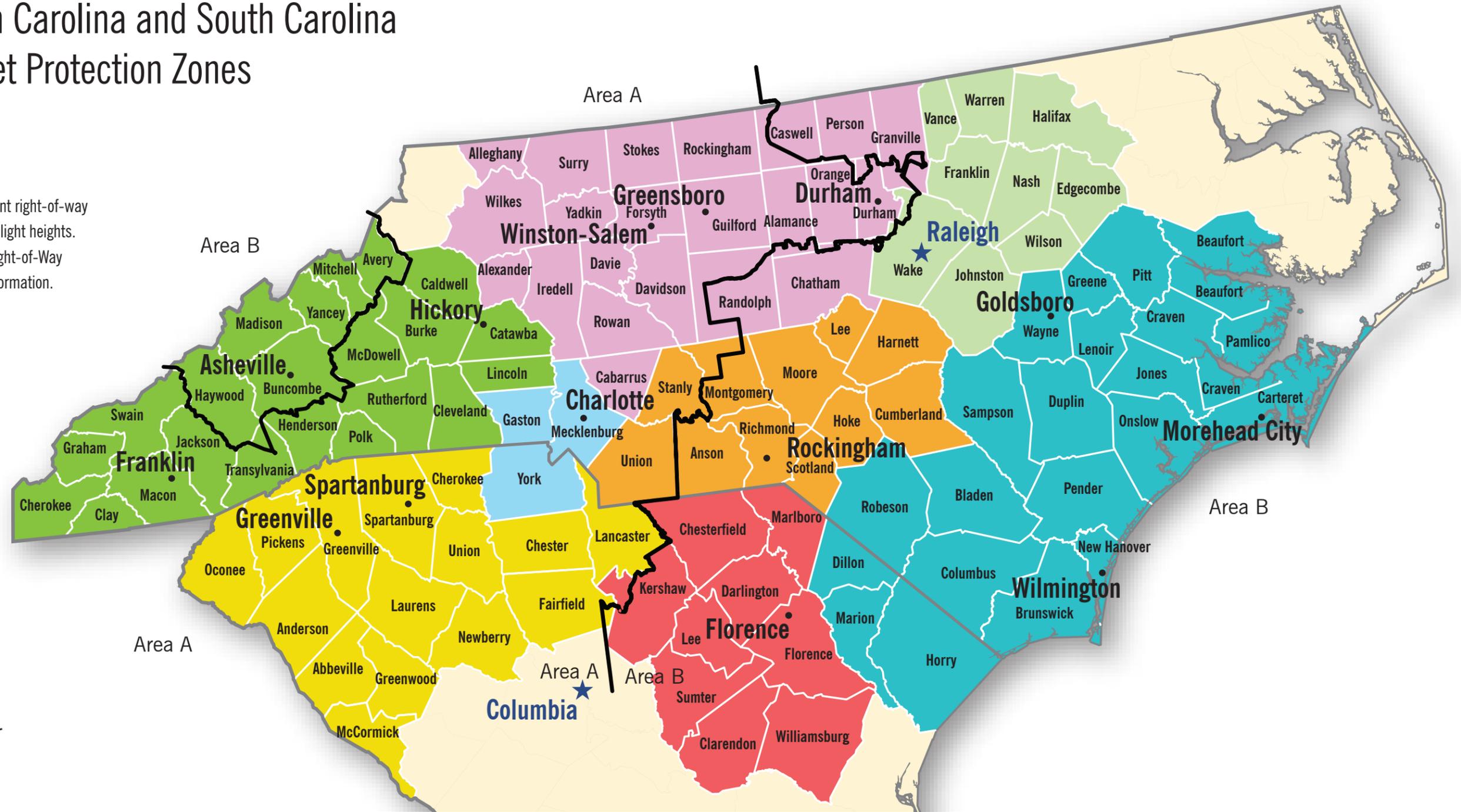
**Written approvals by Duke Energy are required for all plans.**

We hope this is useful information. If you have additional questions on line voltages or plan any activity not mentioned above, please contact the Asset Protection Specialist for your area. (See Map.)

\*Right of Way is intended to reference the easement rights granted to Duke Energy. Actual zone size may vary based upon the particular Right of Way.

# Duke Energy North Carolina and South Carolina Transmission Asset Protection Zones

Area A and Area B have different right-of-way restrictions related to tree and light heights. Please refer to the attached Right-of-Way Restrictions Guide for more information.



— Area divider

## Asset Protection Right-of-Way Specialist Zones

- |  |   |  |  |
|--|---|--|--|
| <span style="color: green;">■</span> Zone 1 – Craig Garrett 828.258.5018<br>craig.garrett@duke-energy.com    | <span style="color: lightblue;">■</span> Zone 3 – Stephen Lord 704.812.2316<br>stephen.lord@duke-energy.com | <span style="color: orange;">■</span> Zone 5 – Lorick Fanning 910.944.5249<br>lorick.fanning@duke-energy.com | <span style="color: lightgreen;">■</span> Zone 7 – Bruce Pait 919.431.4831<br>bruce.pait@duke-energy.com |
| <span style="color: yellow;">■</span> Zone 2 – Johnny Wagner 864.234.4382<br>jonathan.wagner@duke-energy.com | <span style="color: pink;">■</span> Zone 4 – Ethan Pardue 336.526.2524<br>ethan.pardue@duke-energy.com      | <span style="color: red;">■</span> Zone 6 – Lorick Fanning 910.944.5249<br>lorick.fanning@duke-energy.com    | <span style="color: teal;">■</span> Zone 8 – Bill Wilder 910.772.4903<br>bill.wilder@duke-energy.com     |

Legend – updated 1/2/19





## Your safety is our priority

We have a goal at Duke Energy – to eliminate injury and death from needless power line contacts. We want to provide you with the information you need to stay safe at work.

## Important OSHA minimum approach regulation

The following table is from OSHA 1910.333 and applies to nonqualified persons working in proximity to energized power lines. The minimum approach distance is to be maintained for nonqualified workers. When using equipment classified as a crane or derrick, OSHA 29 CFR 1926.1407-1411 must be followed.

OSHA - 1910.333 Applies to NonQualified Persons Minimum Approach Distance	
Up to 50 kV	10 Feet
50 kV up to 200 kV	15 Feet
200 kV up to 350	20 Feet
350 to 500 kV	25 Feet
500 kV to 750 kV	35 Feet

## Important OSHA crane regulation

Cranes and derricks near transmission power lines – OSHA 29 CFR 1926.1407-1411

This regulation applies to power-operated equipment used in construction that can hoist, lower and horizontally move a suspended load. Such equipment includes, but is not limited to:

If any part of equipment, load line or load could get closer than 20 feet to less than 350 kV power lines or 50 feet for greater than 350 kV power lines, you must speak with a Duke Energy representative before beginning work.

Such equipment includes, but is not limited to:

- Articulating cranes (such as knuckle boom cranes)
- Floating cranes
- Locomotive cranes
- Multipurpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load
- Industrial cranes (such as carry deck cranes)
- Pedestal cranes
- Straddle cranes
- Derricks
- Overhead bridge and gantry cranes NOT permanently installed
- Crawler cranes
- Cranes on barges
- Side boom tractors
- Base-mounted drum hoists only when used with derricks
- Tower cranes
- Portal cranes
- Service/mechanic trucks with a hoisting device
- Dedicated pile drivers
- Mobile cranes (such as wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted and boom truck cranes)
- Variations of these types of equipment



## Look up and live.

Working around high-voltage transmission lines



Know how to protect yourself, your crew and the public when working around transmission lines.

## Contact us

For more information, please visit [duke-energy.com/safety](http://duke-energy.com/safety) or call:

Duke Energy Carolinas  
800.777.9898 or 800.POWERON

Duke Energy Indiana  
800.521.2232

Duke Energy Kentucky or Ohio  
800.544.6900

Duke Energy Progress  
800.452.2777

Duke Energy Florida  
800.700.8744

Duke Energy cares about your safety. This brochure contains important information for:

- Anyone working around power lines
- Grading contractors
- Forklift operators
- Crane operators
- Developers (residential, commercial, industrial)
- Architects and engineers
- Dump truck operators

550 South Tryon Street  
Charlotte, NC 28202



[www.duke-energy.com](http://www.duke-energy.com)

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## Know your voltage, know your clearance

## A planned project is a safe project

Federal law requires that all contractors maintain at least a 10-foot clearance from overhead power lines up to 50 kV. Greater clearance is required for higher-voltage power lines and cranes and derricks in construction.

Contact Duke Energy at least three working days before you start working near overhead power lines and equipment so that safety recommendations can be made.

Treat all transmission lines, regardless of their operating voltage, with caution:

- 44 kV and 100 kV lines look similar.
- Never assume a voltage based on the illustration.
- Minimum clearance includes maximum sag, which must be calculated for each instance.
- Injury or death can occur without touching power lines.
- Assume all overhead power lines are energized.
- Contact Duke Energy if you are in doubt about safe operating distances.

### Fact 1.

Power lines that serve your homes and businesses are not insulated like home appliance cords.

### Fact 2.

Power lines carry 4,000 to 500,000 volts of electricity that can seriously injure or kill on contact.

### Fact 3.

The simplest way to stay safe is to know where your power lines are located and stay away.

Check the job site for hazards and know the location of all overhead power lines and electric equipment, including poles and guy wires.

Consider all overhead lines as energized. Mark the work site boundaries to keep workers, vehicles, tools and equipment a safe distance from electric lines and equipment.

Hold a pre-work safety meeting, pointing out areas where overhead lines and electric equipment are located.

We can help you:

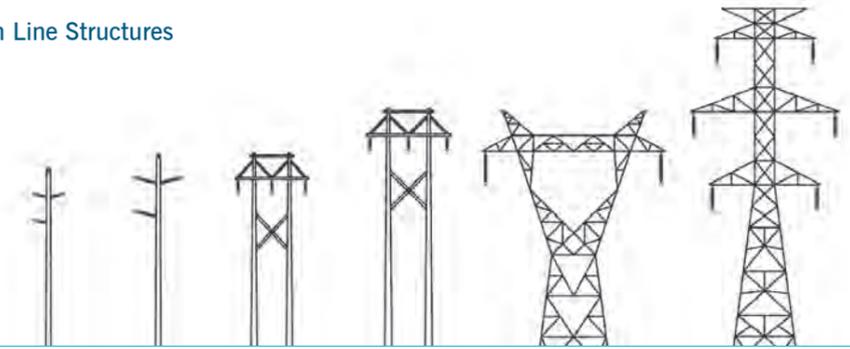
- Confirm voltage
- Confirm clearance
- Confirm wire height under peak conditions
- Provide safety guidance around power lines
- Review and approve drawings for:
  - Compliance with right-of-way restrictions
  - Compliance to National Electric Safety Code
- Identify the best, safe solution

Emergency situations

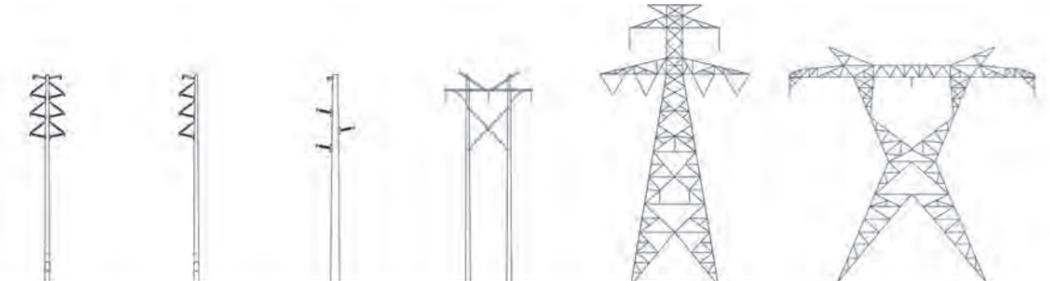
If your equipment makes contact with an overhead power line, notify Duke Energy immediately and take these precautions:

- Have someone call 911.
- Do not attempt to turn off engines or generators.
- Move equipment away from the line only if it is safe to do so.
- Remain on equipment until utility workers arrive and de-energize the line.
- Warn others to stay away. Those on the ground can be injured or killed if they make contact with the equipment.
- If you must leave the equipment because of fire or other dangers, jump off with your feet together. Never touch the ground and equipment at the same time. Keeping your feet together, shuffle or hop away until you are clear of the area.

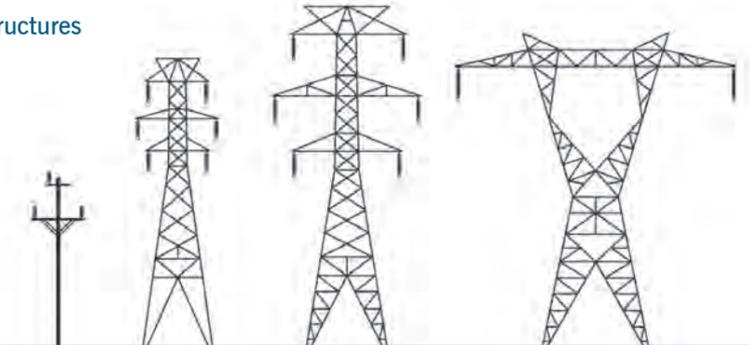
Duke Energy Midwest Transmission Line Structures



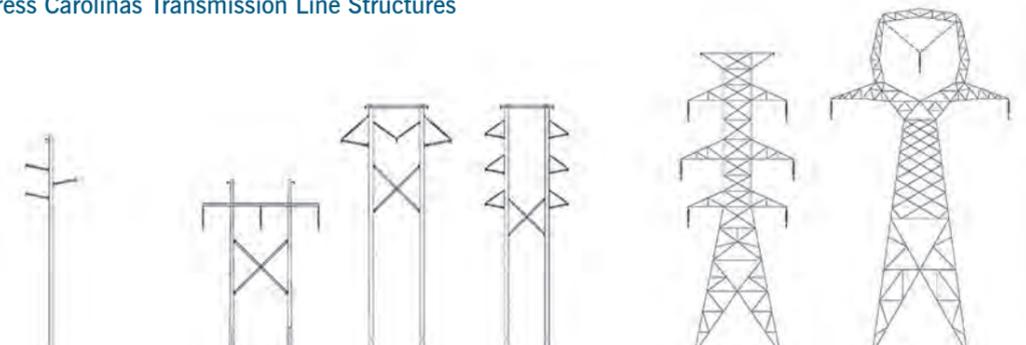
Duke Energy Florida Transmission Line Structures



Duke Energy Carolinas Transmission Line Structures



Duke Energy Progress Carolinas Transmission Line Structures



For more information, visit [duke-energy.com/safety](http://duke-energy.com/safety).



Duke Energy  
8645 Trade Street  
Leland, NC 28451  
910-772-4903  
[Bill.wilder@duke-energy.com](mailto:Bill.wilder@duke-energy.com)

July 24, 2019

McKim & Creed Engineering  
Attn: Jess Powell, PE  
243 North Front Street  
Wilmington, NC 28401  
910-343-1048  
[Jess.powell@mckimcreed.com](mailto:Jess.powell@mckimcreed.com)

Re: Duke Energy Transmission Line Right-of-Way Plan Review Conditional Approval  
Project: 54" Raw Water Main – Cape Fear Public Utility Authority Kings Bluff Raw Water Transmission Main – STA 742+00 to STA 757+00  
Line: Sutton Plant – Delco 115kV North Line, OL099, Structure 92-93

Dear Jess,

This office has reviewed the proposed 54" RAW WATER MAIN PLAN AND PROFILE STA 742+00 TO 757+00 plan sheet for CAPE FEAR PUBLIC UTILITY AUTHORITY KINGS BLUFF RAW WATER TRANSMISSION MAIN plan (attached separately via email) and referred to herein as Attachment "A". We find the plans as shown on the referenced drawings to be acceptable and in compliance with the attached transmission right-of-way guidelines and restrictions. Therefore Duke Energy Transmission ("DET") approves the referenced plans, insofar as its transmission easement rights are concerned, subject to the conditions detailed below. If this project construction has not commenced by a period of 12 months from the date of this letter, this approval by DET shall expire, and additional plan review will be required by DET at that time.

In summary, the following details DET's comments:

- **No stockpiling or storage of materials, dirt, or equipment of any kind is permitted within the DET easement area, nor may any combustible materials be placed within the easement area.**
- Contractors operating any and all equipment should be instructed not to operate within 25' of the poles, towers, or other electrical structures including guy anchors. All slopes shall be 4:1 or less. No spoil dirt is to be placed within the rights-of-way limits unless previously approved by DET.
- Any proposed easements must not cross closer than 25' to DET's electrical structures including, but not limited to poles, towers, and guy anchors.
- All underground facilities, such as, but not limited to, storm water pipes and domestic water line pipes, must be capable of a heavy equipment load bearing weight of 80,000 lbs. DET will not be responsible for damages to these installed facilities.
- Any damage to the transmission line or its associated structures, related to this project, and/or claims due to the damage, is the responsibility of the developer/owner.
- We have not reviewed, and therefore have not approved, any plans other than Attachment A. DET restrictions prohibit trees that exceed 12' at maturity or lights that exceed 12' within the rights-of-way

limits, and neither may be within the wire zone. Vegetation that exceeds 12' in height is subject to removal by DET. Additionally, irrigation systems and signs are not permitted.

- CFPUA to have contractor they select for this project to provide DET with work plan and scope for the installation of sheet piling allow DET a minimum of 30 days to review with approval or comments prior to construction begins in DET transmission line corridor.
- All plats, plans, renderings and representations of lots, parcels, designated spaces and/or designated areas having and including area within a Duke Energy easement cannot represent, with setbacks or other means, buildable areas(s) within a Duke Energy easement.
- This approval by DET is subject to the paramount right of DET at all times to make use of its entire easement area for the construction, maintenance, reconstruction, and operation of electric lines.
- This letter only addresses issues related to DET's transmission line easement. Additional easements, approvals, or permits from the underlying property owner(s) or other applicable agencies may be required in order for you to proceed with this project .

DET also offers these additional comments to ensure that other potential conflicts are not created during or after construction:

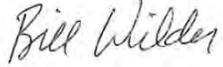
- If there are design changes to any drawings that involve the transmission right-of-way, DET requires a review of the changes for compliance with the rights-of-way guidelines.
- Proper clearances must be maintained at all times. If any transmission line modification by DET is required to maintain proper clearances, the cost will be the responsibility of the developer/owner. Any such line modifications must be approved and scheduled, through DET well in advance of the project start date.
- All current and future property owners are required to adhere to the most current version of the DET transmission right-of-way guidelines and restrictions. (attached separately via email)
- DET heavy equipment access must not be restricted during construction of this project due to grading or any other activity.
- Please contact me prior to the start of this project to attend any pre-construction meetings.
- Underground Utilities with cathodic protection will require a study of anodic interference on existing DET structures. The developer / owner is responsible for any required remediation as determined by DET. This study shall be provided at no cost to DET for their review and acceptance before a Final Approval shall be issued by DET. This study must be submitted to DET prior to the commissioning of the Underground Utilities.

In not objecting to the use of the rights-of-way for use as shown on the drawings, DET is not relinquishing the right to control and maintain the rights-of-way as specified in the recorded easement documents. Any damages to the transmission lines or its associated structures, and claims caused by the damage, is the responsibility of the developer/contractor/owner. It is the responsibility of the developer/contractor/owner to ensure that all work performed in the proximity of the transmission lines complies with all applicable laws and regulations, including but not limited to the National Electric Safety Code ("**NESC**"), the Overhead High-Voltage Line Safety Act ("**OHVLSA**"), and the Occupational Safety and Health Act ("**OSHA**"), and that all persons working near the electric power lines are made aware of the inherent safety hazards associated with these lines.

Please note that this approval is based in part on the accuracy of the information you have supplied on the site plans (Attachment A). You are responsible for indicating the correct location of the DET right of way and its associated electrical structures along with the correct width of the DET rights-of-way limits.

Thank you for the opportunity to work with you on this project. If you have any questions, please feel free to contact me at 910-772-4903.

Sincerely,



Bill Wilder  
Asset Protection Specialist II  
Transmission Right of Way

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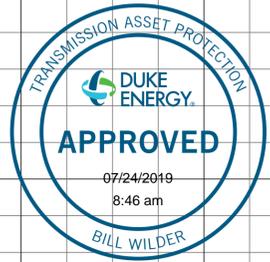
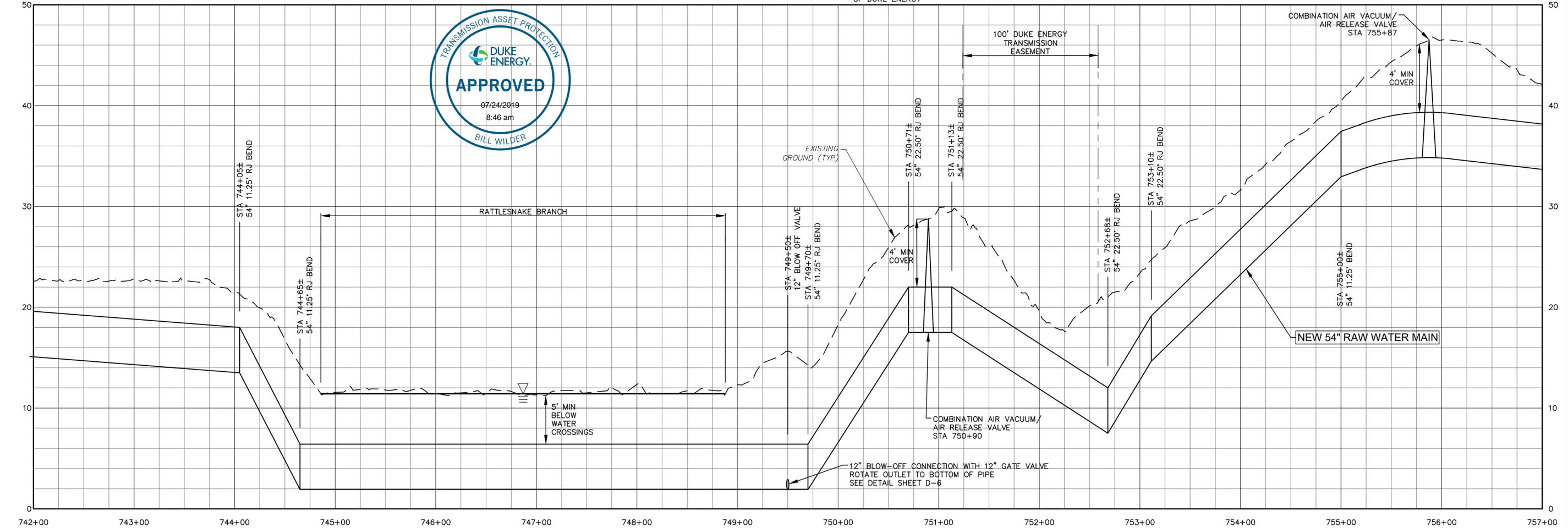
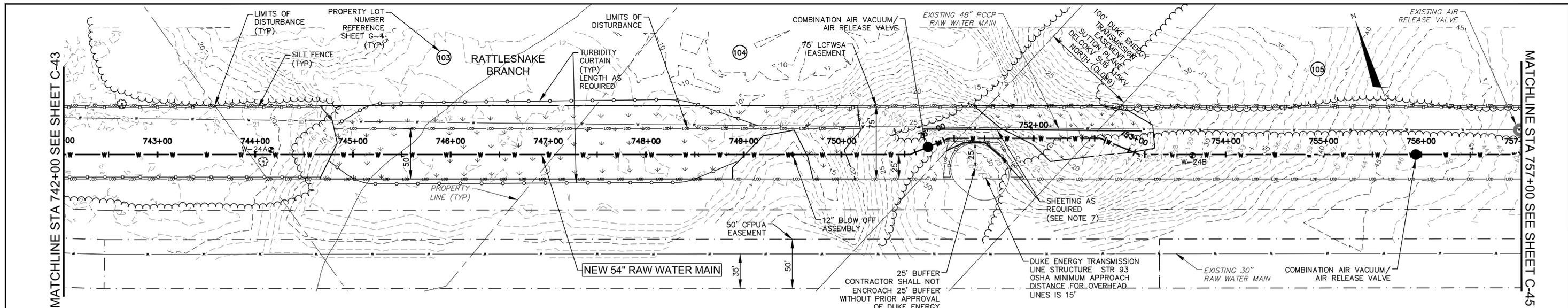
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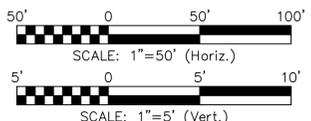
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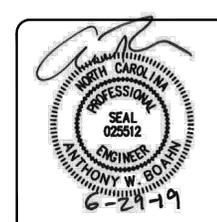
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  - THE LOCATION OF ALL EXISTING UTILITIES ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY LOCATIONS.
  - NEW 54" RAW WATER MAIN SHALL BE WELDED STEEL PIPE (THICKNESS MIN = 0.22, LINING = CEMENT MORTAR, COATING = POLYURETHANE) OR DUCTILE IRON PIPE (PC 150, LINING = CEMENT MORTAR, COATING = ZINC). CONTRACTOR SHALL UTILIZE ONLY ONE MATERIAL UNLESS APPROVED BY ENGINEER OR MATERIAL IS SHOWN ON PLANS.

- CONTRACTOR SHALL INSTALL SHEETING AS REQUIRED TO INSTALL THE NEW RAW WATER MAIN AND PROTECT THE EXISTING RAW WATER MAIN AND THE DUKE ENERGY OVERHEAD POWER STRUCTURES. CONTRACTOR SHALL SUBMIT A PROPOSED SHEETING/SHORING PLAN FOR REVIEW MIN 30 DAYS PRIOR TO CONSTRUCTION. ANY INSTALLED SHEETING SHALL BE REMOVED FROM DUKE ENERGY R/W.
- GROUND TO CONDUCTOR CLEARANCE AT DUKE TRANSMISSION CROSSING LOCATION IS APPROXIMATELY 35'. CONTRACTOR MUST HAVE NO EQUIPMENT HIGHER THAN 20' ABOVE GRADE IN THIS AREA. CONTRACTOR SHALL INSTALL PIPE AND ANY SHEETING/SHORING WHILE MEETING OSHA MINIMUM APPROACH DISTANCE REQUIREMENTS

- CONTRACTOR SHALL COORDINATE WITH DUKE TRANSMISSION MINIMUM OF 14 DAYS PRIOR TO CROSSING AND HOLD PRE-CONSTRUCTION CONFERENCE WITH BILL WILDER - DUKE ENERGY ASSET PROTECTION, CELL: 910-520-3911



**54" RAW WATER MAIN  
PLAN AND PROFILE  
STA 742+00 TO STA 757+00**



**CAPE FEAR  
PUBLIC UTILITY AUTHORITY  
KINGS BLUFF RAW  
WATER TRANSMISSION MAIN**

CAPE FEAR PUBLIC UTILITY AUTHORITY  
235 GOVERNMENT CENTER DRIVE  
WILMINGTON, NC 28403  
OFFICE: (910)332-6560

DATE: JUNE 2019  
SCALE: AS SHOWN  
DRAWN BY: JPV  
CHECKED BY: AWB  
PROJECT NO.: 5367-0038

**SHEET NO:  
C-44**

**MCKIM & CREED**  
243 NORTH FRONT ST  
WILMINGTON, NORTH CAROLINA 28401  
TELE: (910) 343-1048  
FAX: (910) 251-8282  
LICENSE: F-1222

**Cape Fear**  
Public Utility Authority  
Stewardship. Sustainability. Service.

REV:	DESCRIPTION	DATE:
0	ISSUED FOR BID - NOT FOR CONSTRUCTION	JUN 2019

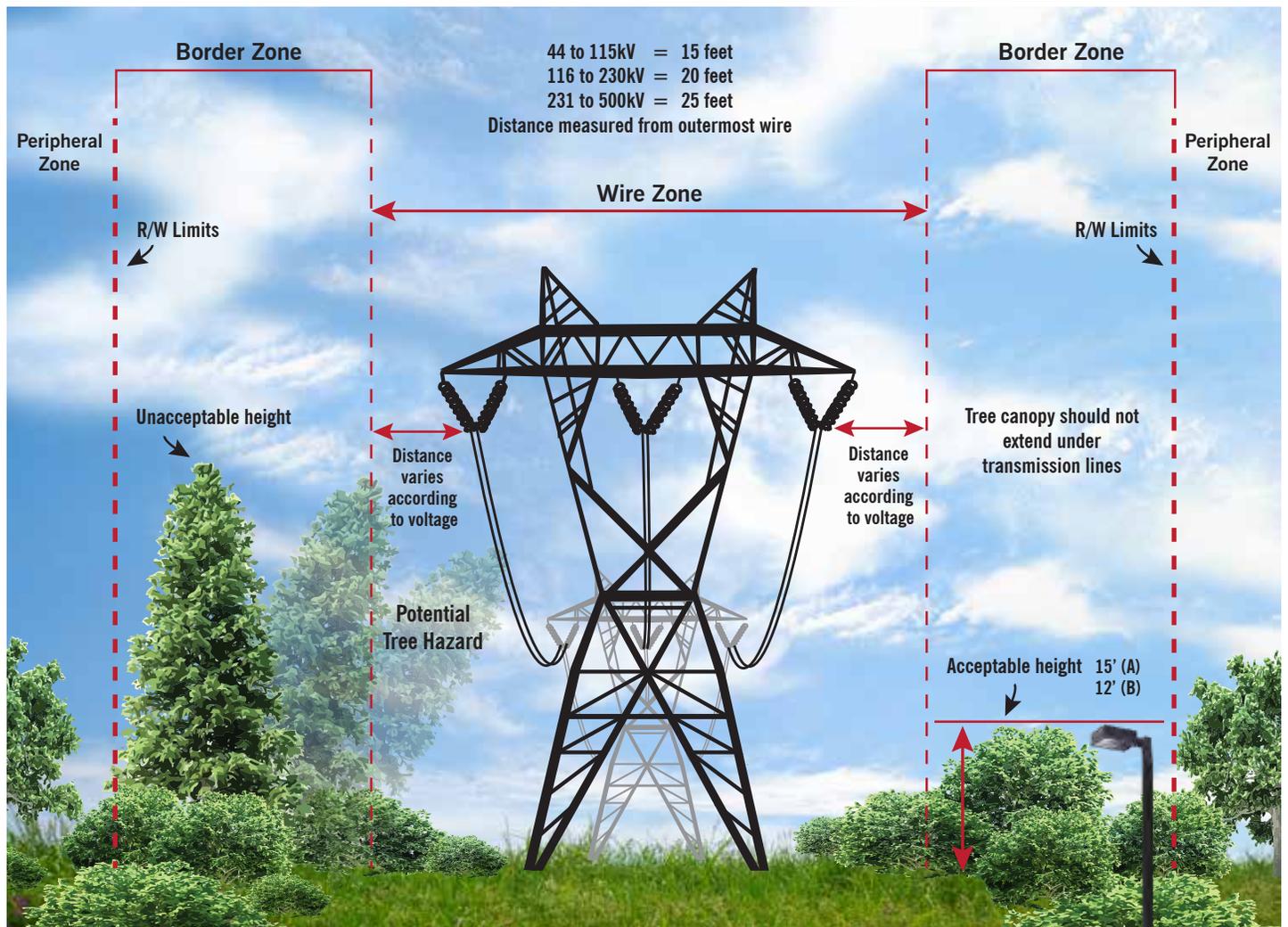
## DUKE ENERGY ELECTRIC TRANSMISSION RIGHT-OF-WAY GUIDELINES/RESTRICTIONS VALID FOR NORTH CAROLINA AND SOUTH CAROLINA (Revised 11/20/2014)

This list of right-of-way restrictions has been developed to answer the most frequently asked questions about property owner use of Duke Energy's electric transmission rights of way. This list does not cover all restrictions or all possible situations. You should contact the Asset Protection right-of-way specialist if you have additional concerns about the rights of way. This list of restrictions is subject to change at any time and without notice. Duke Energy reserves all rights conveyed to it by the right-of-way agreement applicable to the subject property. All activity within the rights of way shall be reviewed by an Asset Protection right-of-way specialist to obtain prior written approval. Engineering plans may be required. Compliance with the Duke Energy Right-of-Way Guidelines/Restrictions or approval of any plans by Duke Energy does not mean that the requirements of any local, county, state or federal government or other applicable agency with governing authority have been satisfied.

1. Structures, buildings, manufactured/mobile homes, satellite systems, swimming pools (any associated equipment and decking), graves, billboards, dumpsters, signs, wells, deer stands, retaining walls, septic systems or tanks (whether above or below ground), debris of any type, flammable material, building material, wrecked or disabled vehicles and all other objects (whether above or below ground) which in Duke Energy's opinion interfere with the electric transmission right of way are not allowed within the right-of-way limits. Transformers, telephone/cable pedestals (and associated equipment) and fire hydrants are not allowed. Manholes, water valves, water meters, backflow preventers and irrigation heads are not permitted. Attachments to Duke Energy structures are prohibited.
2. Fences and gates shall not exceed 10 feet in height and shall be installed greater than 25 feet from poles, towers and guy anchors. Fences shall not parallel the centerline within the rights of way but may cross from one side to the other at any angle not less than 30 degrees with the centerline. If a fence crosses the right of way, a gate (16 feet wide at each crossing) shall be installed by the property owner, per Duke Energy's specifications. The property owner is required to install a Duke Energy lock on the gate to ensure access. Duke Energy will supply a lock.
3. Grading (cuts or fill) shall be no closer than 25 feet from poles, towers, guys and anchors (except for parking areas; see paragraph 7) and the slope shall not exceed 4:1. Grading or filling near Duke Energy facilities which will prevent free equipment access or create ground-to-conductor clearance violations will not be permitted. Storage or stockpiling of dirt or any other material is prohibited. Sedimentation control, including re-vegetation, is required per state regulations.
4. Streets, roads, driveways, sewer/water lines, other utility lines or any underground facilities shall not parallel the centerline within the right of way but may cross, from one side to the other, at any angle not less than 30 degrees with the centerline. No portion of such facility or corresponding easement shall be located within 25 feet of Duke Energy's facilities. Roundabouts, cul-de-sacs and intersections (such as roads, driveways and alleyways) are not permitted.
5. Any drainage feature that allows water to pond, causes erosion, directs stormwater toward the right of way or limits access to or around Duke Energy facilities is prohibited.
6. Contact Duke Energy prior to the construction of lakes, ponds, retention or detention facilities, etc.
7. Parking may be permitted within the right of way, provided that:
  - a. Prior to grading, concrete barriers shall be installed at a minimum of 9 feet from the Duke Energy facilities. During construction, grading shall be no closer than 10 feet to any Duke Energy facility.
  - b. After grading/paving activity is complete, a Duke Energy-approved barrier sufficient to withstand a 15mph vehicular impact shall be erected 9 feet from any Duke Energy facility.
  - c. Any access areas, entrances or exits shall cross (from one side to the other) the right of way at any angle not less than 30 degrees with the centerline and shall not pass within 25 feet of any structure. Parking lot entrances/exits cannot create an intersection within the right of way.
  - d. Lighting within the right-of-way limits must be approved by Duke Energy before installing. Due to engineering design standards, lighting is not allowed in the "Wire Zone." Where lighting is approved ("Border Zone"), the total height may not exceed 15 feet in Area A and 12 feet in Area B. See map on back of this page for Areas. Contact your Asset Protection right-of-way specialist as the "Wire Zone" varies for the different voltage lines.
8. Duke Energy will not object to certain vegetation plantings as long as:
  - a. They do not interfere with the access to or the safe, reliable operation and maintenance of Duke Energy facilities.
  - b. With prior written approval, Duke Energy does not object to low-growing shrubs and grasses within the "Wire Zone." Tree species are not allowed within the "Wire Zone." Trees that are approved in the "Border Zone" may not exceed, at maturity, 15 feet in Area A and 12 feet in Area B. See map on back of page for areas. Contact the Asset Protection right-of-way specialist for "Wire Zone"/"Border Zone" definitions.
  - c. For compliant mature height species, refer to [plants.ces.ncsu.edu/](http://plants.ces.ncsu.edu/) for reference.
  - d. Engineering drawings must indicate the outermost conductor.
  - e. Vegetation that is not in compliance is subject to removal without notice.
  - f. Duke Energy may exercise the right to cut "danger trees" outside the right-of-way limits as required to properly maintain and operate the transmission line.

We hope this is useful information. If you have additional questions or plan any activity not mentioned above, please contact the Asset Protection right-of-way specialist for your area (see map).

## Transmission Right-of-way Zones – Carolinas



**Wire Zone:** Extends beyond the outermost conductor on both sides. (See diagram above.)

**Permitted within the Wire Zone:** Low-growing plants, shrubs and grasses.

**Not permitted within the Wire Zone:** Tree species of any kind.

**Border Zone:** Extends from the edge of the Wire Zone to the outside edge of the Right of Way.

**Permitted within the Border Zone:** Lighting structures and plantings within the Right of Way that do not exceed a vertical height of 15 feet in Area A and 12 feet in Area B. (See Asset Protection Map for location of geographic areas.) For compliant mature height species, refer to [plants/ces.ncsu.edu/](http://plants/ces.ncsu.edu/).

**Not permitted within the Border Zone:** Any object that exceeds vertical height restrictions. These restrictions are based on flat ground elevations. If the ground elevations differ, no object at any time may exceed the outermost conductor's ground elevation.

**Peripheral Zone:** Outside the Right of Way and adjacent to Border Zones.

**Permitted within the Peripheral Zone:** Trees may be planted in the Peripheral Zone. Duke Energy recommends customers exercise caution selecting and planning trees in this zone.

**Not permitted in the Peripheral Zone:** Trees with canopies are subject to routine trimming and possible removal.

### In all zones:

When an outage risk is identified, Duke Energy will attempt to notify the affected customer. However, the company may need to take immediate action if trees cannot be pruned to appropriate levels. This may include trees and shrubs that are within 20 feet of the power line at the maximum peak load or during weather conditions that create line sag and sway.

**Written approvals by Duke Energy are required for all plans.**

We hope this is useful information. If you have additional questions on line voltages or plan any activity not mentioned above, please contact the Asset Protection Specialist for your area. (See Map.)

\*Right of Way is intended to reference the easement rights granted to Duke Energy. Actual zone size may vary based upon the particular Right of Way.

# Duke Energy North Carolina and South Carolina Transmission Asset Protection Zones

Area A and Area B have different right-of-way restrictions related to tree and light heights. Please refer to the attached Right-of-Way Restrictions Guide for more information.



## Asset Protection Right-of-Way Specialist Zones

- |  |   |  |  |
|--|---|--|--|
| <span style="color: green;">■</span> Zone 1 – Craig Garrett 828.258.5018<br>craig.garrett@duke-energy.com    | <span style="color: lightblue;">■</span> Zone 3 – Stephen Lord 704.812.2316<br>stephen.lord@duke-energy.com | <span style="color: orange;">■</span> Zone 5 – Lorick Fanning 910.944.5249<br>lorick.fanning@duke-energy.com | <span style="color: lightgreen;">■</span> Zone 7 – Bruce Pait 919.431.4831<br>bruce.pait@duke-energy.com |
| <span style="color: yellow;">■</span> Zone 2 – Johnny Wagner 864.234.4382<br>jonathan.wagner@duke-energy.com | <span style="color: pink;">■</span> Zone 4 – Ethan Pardue 336.526.2524<br>ethan.pardue@duke-energy.com      | <span style="color: red;">■</span> Zone 6 – Lorick Fanning 910.944.5249<br>lorick.fanning@duke-energy.com    | <span style="color: teal;">■</span> Zone 8 – Bill Wilder 910.772.4903<br>bill.wilder@duke-energy.com     |

Legend – updated 1/2/19



## Your safety is our priority

We have a goal at Duke Energy – to eliminate injury and death from needless power line contacts. We want to provide you with the information you need to stay safe at work.

## Important OSHA minimum approach regulation

The following table is from OSHA 1910.333 and applies to nonqualified persons working in proximity to energized power lines. The minimum approach distance is to be maintained for nonqualified workers. When using equipment classified as a crane or derrick, OSHA 29 CFR 1926.1407-1411 must be followed.

OSHA - 1910.333 Applies to NonQualified Persons Minimum Approach Distance	
Up to 50 kV	10 Feet
50 kV up to 200 kV	15 Feet
200 kV up to 350	20 Feet
350 to 500 kV	25 Feet
500 kV to 750 kV	35 Feet

## Important OSHA crane regulation

Cranes and derricks near transmission power lines – OSHA 29 CFR 1926.1407-1411

This regulation applies to power-operated equipment used in construction that can hoist, lower and horizontally move a suspended load. Such equipment includes, but is not limited to:

If any part of equipment, load line or load could get closer than 20 feet to less than 350 kV power lines or 50 feet for greater than 350 kV power lines, you must speak with a Duke Energy representative before beginning work.

Such equipment includes, but is not limited to:

- Articulating cranes (such as knuckle boom cranes)
- Floating cranes
- Locomotive cranes
- Multipurpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load
- Industrial cranes (such as carry deck cranes)
- Pedestal cranes
- Straddle cranes
- Derricks
- Overhead bridge and gantry cranes NOT permanently installed
- Crawler cranes
- Cranes on barges
- Side boom tractors
- Base-mounted drum hoists only when used with derricks
- Tower cranes
- Portal cranes
- Service/mechanic trucks with a hoisting device
- Dedicated pile drivers
- Mobile cranes (such as wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted and boom truck cranes)
- Variations of these types of equipment



## Look up and live.

Working around high-voltage transmission lines



Know how to protect yourself, your crew and the public when working around transmission lines.

## Contact us

For more information, please visit [duke-energy.com/safety](http://duke-energy.com/safety) or call:

Duke Energy Carolinas  
800.777.9898 or 800.POWERON

Duke Energy Indiana  
800.521.2232

Duke Energy Kentucky or Ohio  
800.544.6900

Duke Energy Progress  
800.452.2777

Duke Energy Florida  
800.700.8744

Duke Energy cares about your safety. This brochure contains important information for:

- Anyone working around power lines
- Grading contractors
- Forklift operators
- Crane operators
- Developers (residential, commercial, industrial)
- Architects and engineers
- Dump truck operators

550 South Tryon Street  
Charlotte, NC 28202



[www.duke-energy.com](http://www.duke-energy.com)

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## Know your voltage, know your clearance

## A planned project is a safe project

Federal law requires that all contractors maintain at least a 10-foot clearance from overhead power lines up to 50 kV. Greater clearance is required for higher-voltage power lines and cranes and derricks in construction.

Contact Duke Energy at least three working days before you start working near overhead power lines and equipment so that safety recommendations can be made.

Treat all transmission lines, regardless of their operating voltage, with caution:

- 44 kV and 100 kV lines look similar.
- Never assume a voltage based on the illustration.
- Minimum clearance includes maximum sag, which must be calculated for each instance.
- Injury or death can occur without touching power lines.
- Assume all overhead power lines are energized.
- Contact Duke Energy if you are in doubt about safe operating distances.

### Fact 1.

Power lines that serve your homes and businesses are not insulated like home appliance cords.

### Fact 2.

Power lines carry 4,000 to 500,000 volts of electricity that can seriously injure or kill on contact.

### Fact 3.

The simplest way to stay safe is to know where your power lines are located and stay away.

Check the job site for hazards and know the location of all overhead power lines and electric equipment, including poles and guy wires.

Consider all overhead lines as energized. Mark the work site boundaries to keep workers, vehicles, tools and equipment a safe distance from electric lines and equipment.

Hold a pre-work safety meeting, pointing out areas where overhead lines and electric equipment are located.

We can help you:

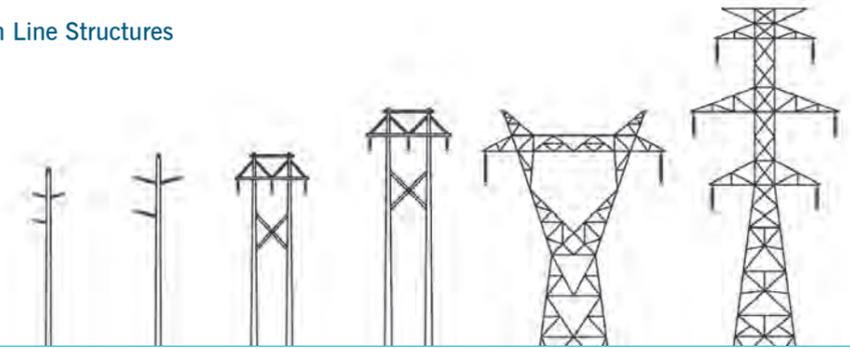
- Confirm voltage
- Confirm clearance
- Confirm wire height under peak conditions
- Provide safety guidance around power lines
- Review and approve drawings for:
  - Compliance with right-of-way restrictions
  - Compliance to National Electric Safety Code
- Identify the best, safe solution

Emergency situations

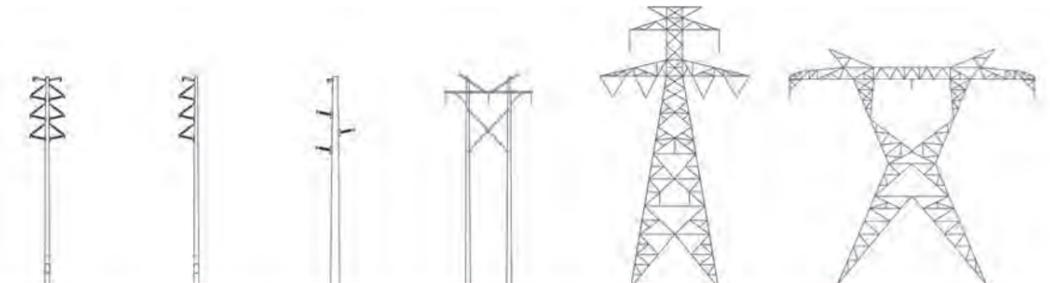
If your equipment makes contact with an overhead power line, notify Duke Energy immediately and take these precautions:

- Have someone call 911.
- Do not attempt to turn off engines or generators.
- Move equipment away from the line only if it is safe to do so.
- Remain on equipment until utility workers arrive and de-energize the line.
- Warn others to stay away. Those on the ground can be injured or killed if they make contact with the equipment.
- If you must leave the equipment because of fire or other dangers, jump off with your feet together. Never touch the ground and equipment at the same time. Keeping your feet together, shuffle or hop away until you are clear of the area.

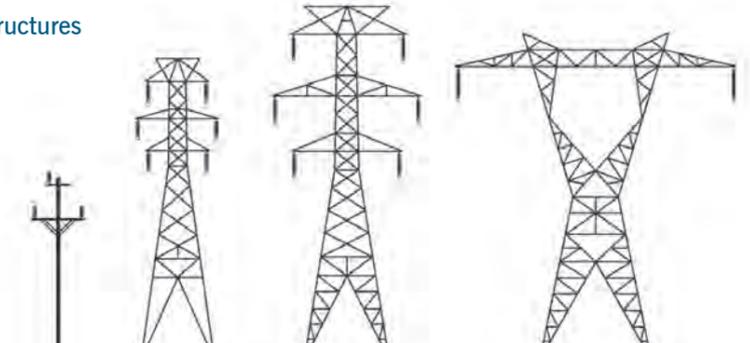
Duke Energy Midwest Transmission Line Structures



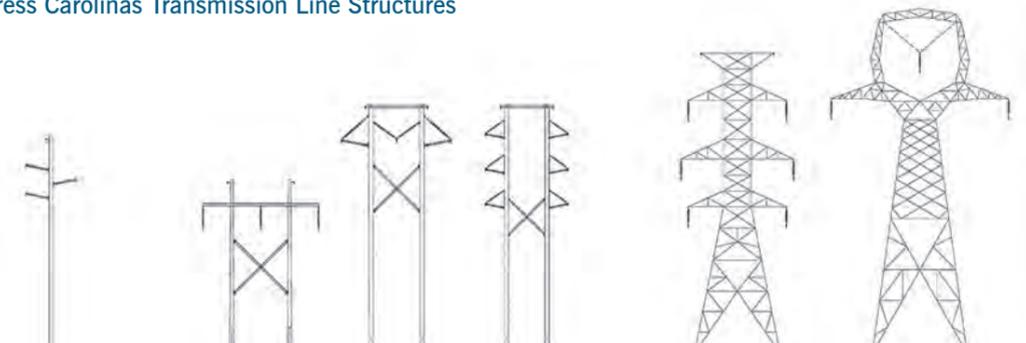
Duke Energy Florida Transmission Line Structures



Duke Energy Carolinas Transmission Line Structures



Duke Energy Progress Carolinas Transmission Line Structures



For more information, visit [duke-energy.com/safety](http://duke-energy.com/safety).

# **SMARTBALL®**

# **INSPECTION REPORT**

## **48-inch Diameter PCCP Raw Water Main**

Report Prepared for:

**Lower Cape Fear Water & Sewer Authority**

Prepared by:

**Pure Technologies U.S. Inc.**

**August 2017**



# SmartBall® Inspection Report

## 48-inch Diameter PCCP Raw Water Main

Prepared for  
**Lower Cape Fear Water & Sewer Authority**

Prepared by  
**Pure Technologies U.S. Inc.**

**August 2, 2017**

### **Quality Assurance and Quality Control Statement**

By my signature, I attest that this report has been prepared and reviewed in accordance with Pure Technologies U.S. Inc. Quality Assurance and Quality Control procedures:



8/2/17

---

C.J. Roebuck, Senior Project Manager

Date

### **DISCLAIMER**

*The information contained in this report is provided 'as is' without warranty of any kind, either express or implied. Pure Technologies U.S. Inc. is not liable for any lost profits, lost savings or other incidental, special, or consequential damage arising out of the monitoring system or the information contained in this report. Please refer to the terms and conditions attached to the SmartBall® Agreement and Pure's Technical Support Agreement for further details.*

### **NOTICE**

*This report contains confidential commercial information regarding proprietary equipment, methods, and data analysis, which is the property of Pure Technologies U.S. Inc. It is for the sole use of the Lower Cape Fear Water & Sewer Authority and is not to be distributed to third parties without the express written consent of Pure Technologies U.S. Inc.*



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**APPENDIX A Acoustic Event Details**

**APPENDIX B SmartBall Methodology**

**APPENDIX C How Pipes Leak**

## 1. Executive Summary

The Lower Cape Fear Water & Sewer Authority (LCFWSA) retained the services of Pure Technologies U.S. Inc. (Pure Technologies) to perform a SmartBall® inspection of a 14-mile section of 48-inch diameter prestressed concrete cylinder pipe (PCCP) raw water main on Thursday May 18, 2017. This section of pipeline conveys raw water from the Kings Bluff Raw Water Pump Station to a 3-million-gallon ground storage tank (ground storage tank) located near the Brunswick County Northwest Water Treatment Plant. The purpose of the SmartBall inspection was to identify and locate leaks and pockets of trapped gas along the pipeline. Acoustic and sensor data was collected and recorded as the SmartBall tool traversed the pipeline. This data was evaluated to identify acoustic events associated with leaks and pockets of trapped gas.

Pure Technologies detected one (1) acoustic event characteristic of a leak and zero (0) acoustic events characteristic of pockets of trapped gas. The results of the inspection are summarized in Table 1.1 and Table 1.2.

Table 1.1: SmartBall Inspection Details	
<b>Total Length Inspected:</b>	72,891 feet
<b>Pipe Material:</b>	PCCP
<b>Diameter of Pipe:</b>	48 inch
<b>Product:</b>	Raw Water
<b>Duration of the Inspection:</b>	6 hours, 30 minutes
<b>Average SmartBall Tool Velocity:</b>	3.1 feet/second

Table 1.2: SmartBall Inspection Results	
<b>Total Number of Leaks:</b>	1
<b>Total Number of Static Air/Trapped Gas Events:</b>	0
<b>Total Number of Gas Slugs:</b>	0
<b>Total Number of Migratory Air/Entrained Air Events:</b>	0

Additional details about the acoustic events characteristic of leaks are provided in the following table.

Table 1.3: Leak #1	
<b>Leak Distance from Nearest Upstream Tracking Location</b>	2360 feet downstream of the 36-inch tee to the Brunswick County Northwest Water Treatment Plant near Station 705+00
<b>Leak Distance from Nearest Downstream Tracking Location</b>	273.4 feet upstream of the ARV at Station 730+00 (SmartBall Tool Extraction Point)
<b>Leak Size</b>	Small
<b>Leak Details</b>	Suspected Feature-Related Event
<b>Location Confidence Comments</b>	Low confidence (+/- 10 meters) in event location due to excessive noise preventing tracking at extraction and lack of features between extraction and SBR #17.

**Approximate Location of Leak**



The location and small size of the detected anomaly leads to the conclusion that the suspected leak could be a valve seated incorrectly. The location lines up with the valve from the raw water main to the ground storage tank adjacent to the LCFWSA Interim Booster Station site. It is advised that this valve be worked to ensure it is operating and sitting correctly. If the valve is functioning properly the location should be investigated further to determine the source of the detected leak.

---

## 2. Project Background

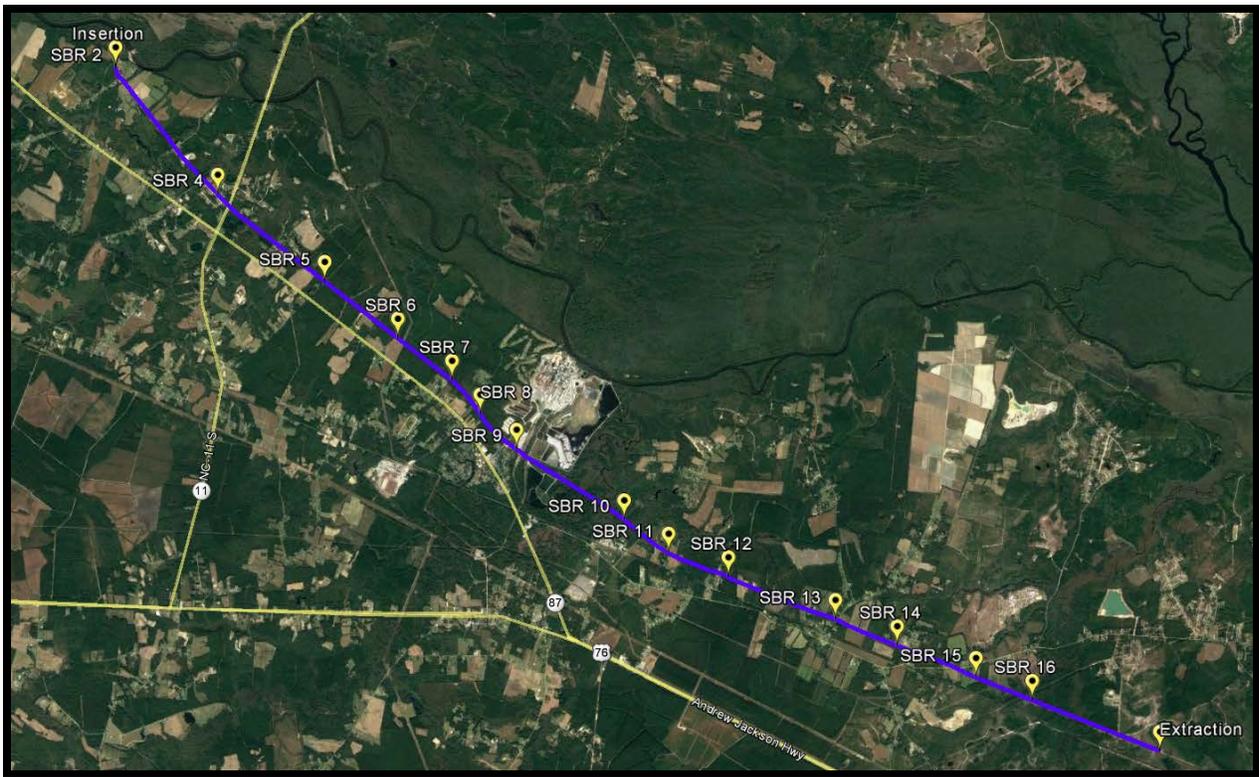
The LCFWSA retained the services of Pure Technologies to perform a SmartBall inspection of the 48-inch diameter PCCP raw water main on Thursday May. 18, 2017. The inspection was being performed as preventative maintenance on the 14-mile section of pipeline which was installed almost 40 years ago, in 1978.

### 2.1 Description of the Subject Pipeline

This 14-mile segment of raw water main was constructed in the early 1980's and conveys raw water from the LCFWSA Kings Bluff Pump Station (Kings Bluff PS) to a 3-million-gallon ground tank located near the Brunswick County Northwest Water Treatment Plant. The pipeline is owned by LCFWSA and operated by Brunswick County Public Utilities (Brunswick County). The SmartBall inspection started at the pig launcher outside of the Kings Bluff PS and ended at the ARV manhole outside of the LCFWSA Interim Booster Pump Station, covering 72,891 ft.

The approximate pipeline location and the SmartBall tracking locations are shown in Figure 2.1. The pipeline begins at the Kings Bluff PS and runs east approximately 14 miles where it discharges raw water to a 3-million-gallon ground storage tank (ground storage tank).

The pipeline is mostly 48-inch diameter with a short run of 60-inch diameter after the ground storage tank before returning to 48-inch approximately 5,000 feet downstream of the Interim Booster Pump Station. Pipeline appurtenances include air release valves, blow offs, and metered service to Brunswick County's Northwest Water Treatment Plant. The pipeline contains vertical and horizontal fabricated bends up to 45 degrees. During the SmartBall inspection, the operating pressure of the pipeline was measured to be 54 pounds per square inch (psi). This section of pipeline was pigged in 2005 so obstructions were not anticipated to be encountered during the inspection.



*Figure 2.1: General Layout of 48-inch Diameter PCCP Raw Water Main  
Direction of flow: West to East*

### **3. Structural Analysis and Inspection Results**

#### **3.1 Pressure Monitoring and Hydraulic Analysis**

##### **3.1.1 Methodology**

A hydraulic evaluation is conducted in order to understand the operational and surge pressures within a pipeline. When pipe wall degradation is combined with surge pressures, the likelihood of pipe failure can be significantly increased. Evaluation of the pump station operation, such as pump startup mode, typical and peak flows, operating and surge pressures, and surge protection can provide important information on the stresses imparted on the pipeline.

Hydraulic pressure transients occur in pipelines when the steady-state conditions of the system change due to pressure and/or flow disturbances (e.g., the rapid closure of a valve, pump start-up/shutdown, gas pockets). The magnitude of a transient is related to several factors including the flow rate within the pipeline, the time (how fast) in which the change in steady-state condition occurs, and pipe hoop rigidity. During a transient event, the kinetic energy of the flow momentum is converted into potential energy, a rise in pressure, and strain energy in the pipe walls with the propagation of pressure waves. The resultant pressure transient is superimposed on the existing, steady-state pressure within the pipeline. Gas pockets combined with pressure transients can also have a significant impact on the structural integrity of the pipeline as vacuum conditions may be created. The rapid collapse of these gas pocket vacuum regions may cause cavitation as the transient passes, resulting in mechanical wear on the pipe wall and thereby increasing the risk of failure if the structural capacity has been compromised.

Conventional pressure monitors collect data in intervals of seconds or minutes while transients may occur in fractions of seconds and may be missed by traditional equipment. The LPR-31i pressure monitor, utilized on this project, continuously samples pressure at a high rate and records data every few minutes under normal operating conditions; however, when a transient pressure event is detected in the pipeline, the device records at the high sample rate 20 Hz to provide an accurate recording of the pressure transient event.

##### **3.1.2 Hydraulic Analyses**

A hydraulic evaluation of the subject pipeline was conducted to understand the operational and surge pressures. In order to identify the hydraulic stresses acting on the pipeline, pressure data was collected from two sites: Brunswick County Meter Vault and the ARV located downstream of the pig launcher at the Kings Bluff PS Site (Post Pig Launcher ARV). Data was collected for 20 days, from March 15, 2017 to April 4, 2017.

As part of the hydraulic analysis, an LPR-31i was installed directly onto the line in the Brunswick County Meter Vault as shown in Figure 3.1. The other LPR-31i was installed at the Post Pig Launcher ARV near the insertion location.



*Figure 3.1 LPR-31i Monitoring Location at the Brunswick County Meter Vault*

### *3.1.2.1 Brunswick County Meter Vault*

Maximum, minimum, and average pressures were recorded by the pressure logger at 4-minute intervals. The maximum pressure recorded during the monitoring period was 25.1 psi, and the minimum pressure recorded was 8.9 psi, with an average pressure of 19.8 psi. A chart of the pressures recorded over the full monitoring period at the Brunswick County Vault is included in Figure 3.2. Maximum pressures in a given 4-minute recording interval are plotted along red lines, minimum pressures are plotted along blue lines, and average pressures are plotted along green lines.

The standard deviation of the recorded pressure data is 1.1 psi. Of all the pressure samples recorded, 68.2% are between 18.6 psi and 20.8 psi, and 95.4% are between 17.4 psi and 21.8 psi.

### *3.1.2.2 Post Pig Launcher ARV*

Maximum, minimum, and average pressures were recorded by the pressure logger at 4-minute intervals. The maximum pressure recorded during the monitoring period was 96.8 psi, and the minimum pressure recorded was 11.0 psi, with an average pressure of 54.1 psi. A chart of the pressures recorded over the full monitoring period is included in Figure 3.3. Maximum pressures in a given 4-minute recording interval are plotted along red lines, minimum pressures are plotted along blue lines, and average pressures are plotted along green lines.

The standard deviation of the recorded pressure data is 9.9 psi. Of all the pressure samples recorded, 68.2% are between 43.0 psi and 63.1 psi, and 95.4% are between 32.0 psi and 72.1 psi.

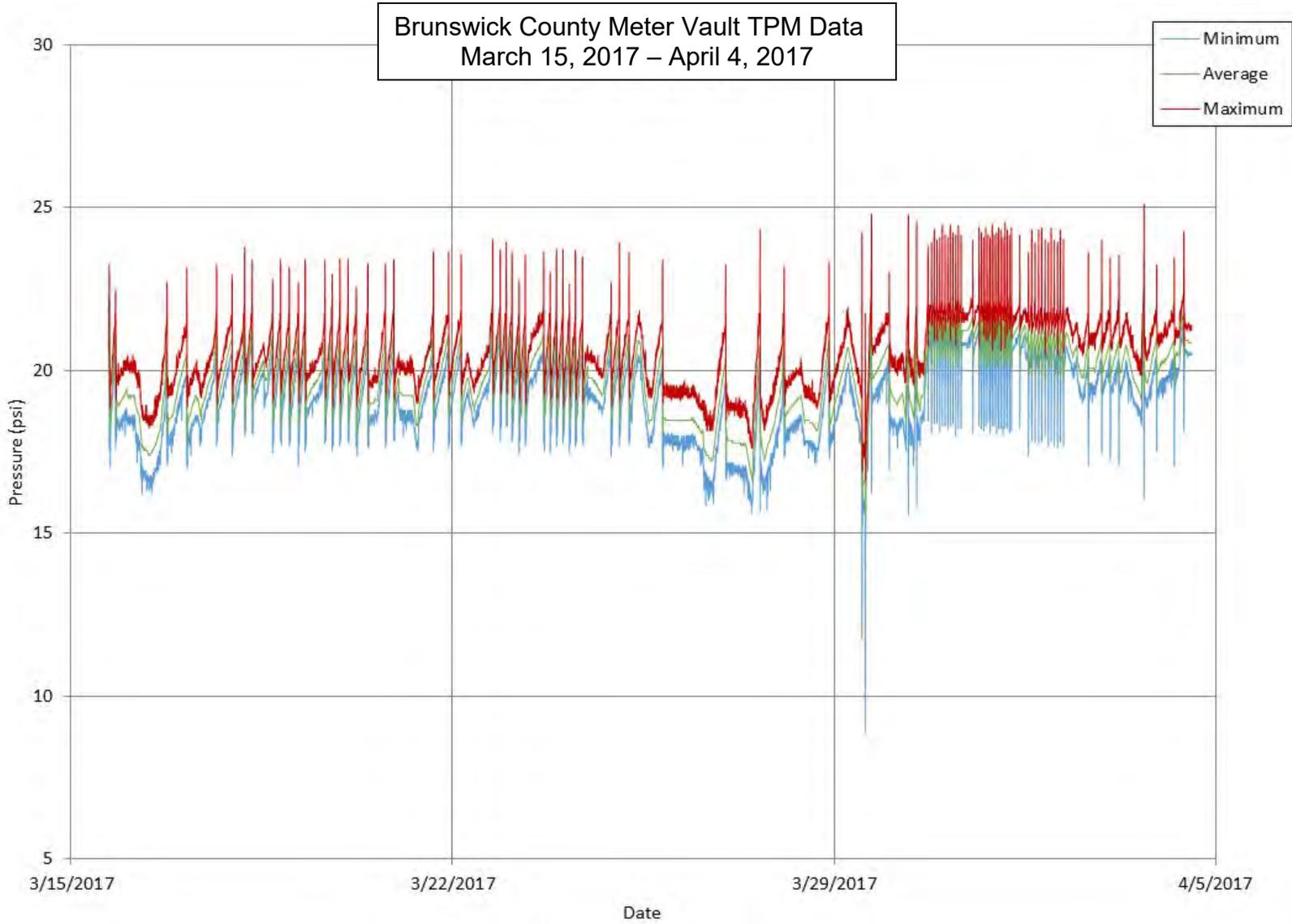


Figure 3.2: Pressure Recordings for Brunswick County Meter Vault TPM Data

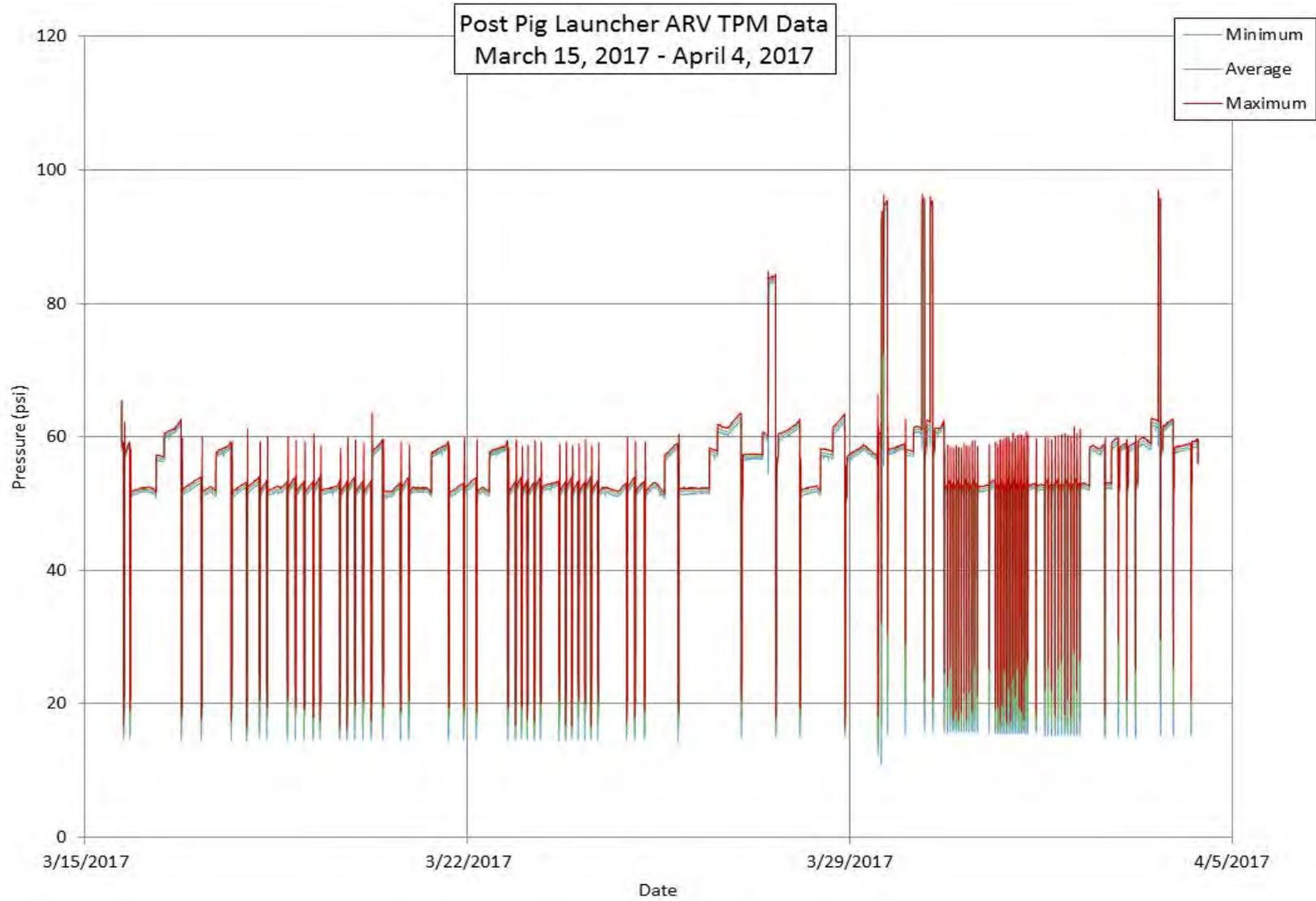


Figure 3.3: Pressure Recordings for Post Pig Launcher ARV TPM Data

### 3.2 Pressure Monitoring Results

To translate the recorded pressures from the installation location along the downstream length of the transmission main, basic assumptions about the transmission of the transient pressures were made:

1. Observed transient pressures are superimposed on the steady-state pressure at each point along the pipeline.
2. The observed transient amplitude (above the background steady-state pressure) is consistent along the length of the pipeline.
3. Dynamic losses along the length of the pipeline are neglected; the static elevation pressure differences are assumed to govern and are used in the translation of the recorded pressures.

Hydraulic surge modeling may be performed to refine these assumptions, or additional transient pressure monitoring locations may be selected based on these initial findings if there are areas of particular concern.

The maximum recorded pressure at the Brunswick County Meter Vault of 25.1 psi occurred on April 3, 2017. Based on the observed system operating pattern, the maximum pressure correlates with a pump shut off. The transient pressure logger was installed on the 48-inch transmission main, at approximately 72.0 feet above MSL. The low point of the transmission main is approximately 19.0 feet below MSL, according to the 'Lower Cape Fear Water & Sewer Authority Raw Water Transmission Main Photo Plans' drawings, dated April, 1978. Based on these elevations and the maximum recorded pressure, the maximum pressure in the transmission main during the monitoring period with normal operations at the low point would have been approximately 59.0 psi.

The minimum recorded pressure of 8.9 psi was recorded during pump stop operation on March 29, 2017. The high point of the water main is 63.0 feet above MSL. Based on the elevations and assumptions stated above, the minimum pressure in the water main during the monitoring period was approximately 7.2 psi.

Minor and moderate transient pressure events were detected during the monitoring period which coincide with pump operation on and off. This is consistent with the normal diurnal operation of a typical raw water force main. Sample weeks of transient pressure data are shown in Figures 3.4 and 3.5. The day with the maximum pressure event is shown in Figure 3.6, and the day with the minimum pressure event is shown in Figure 3.7.

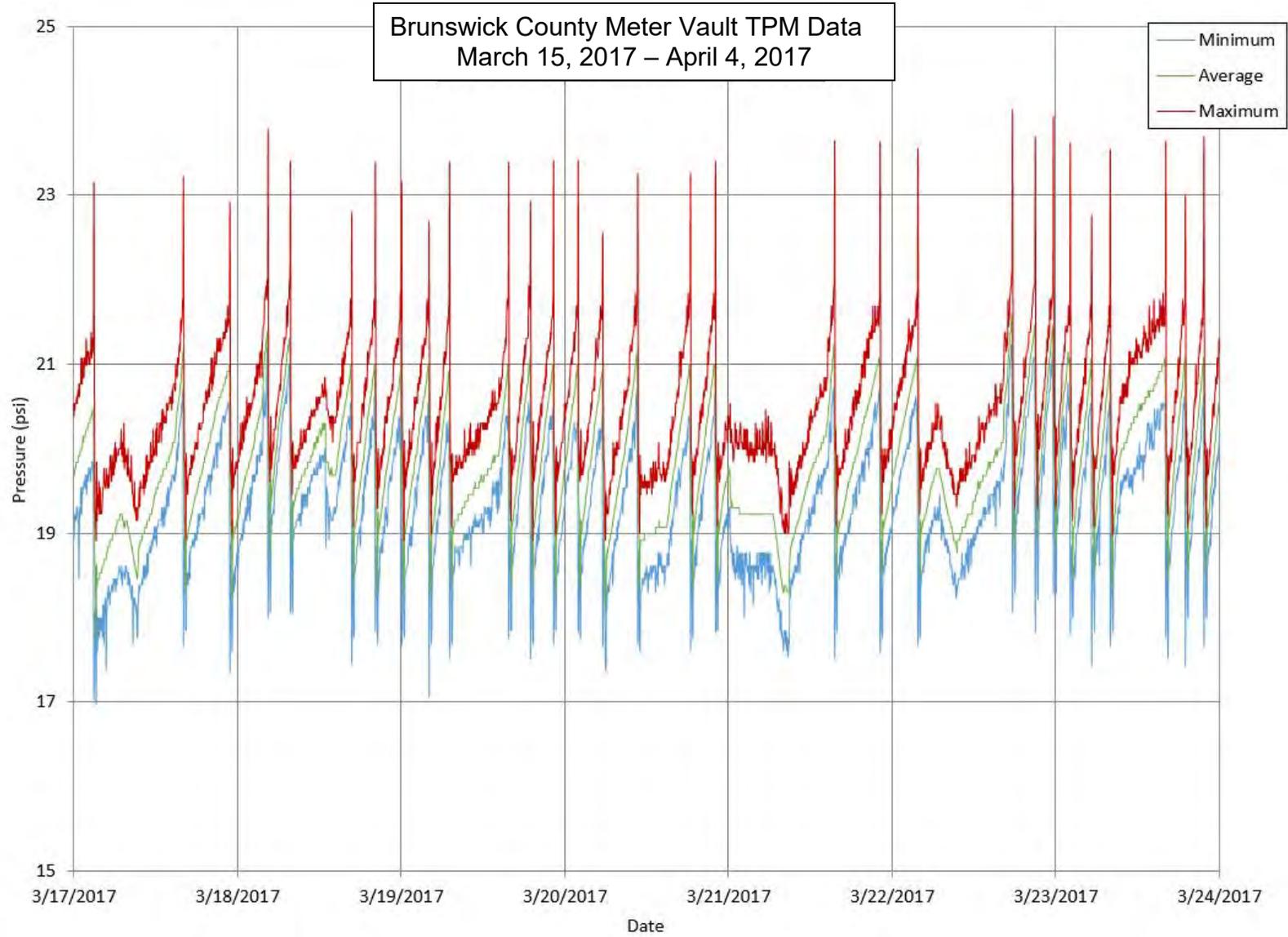


Figure 3.4: Pressure Recordings: March 17, 2017 to March 24, 2017

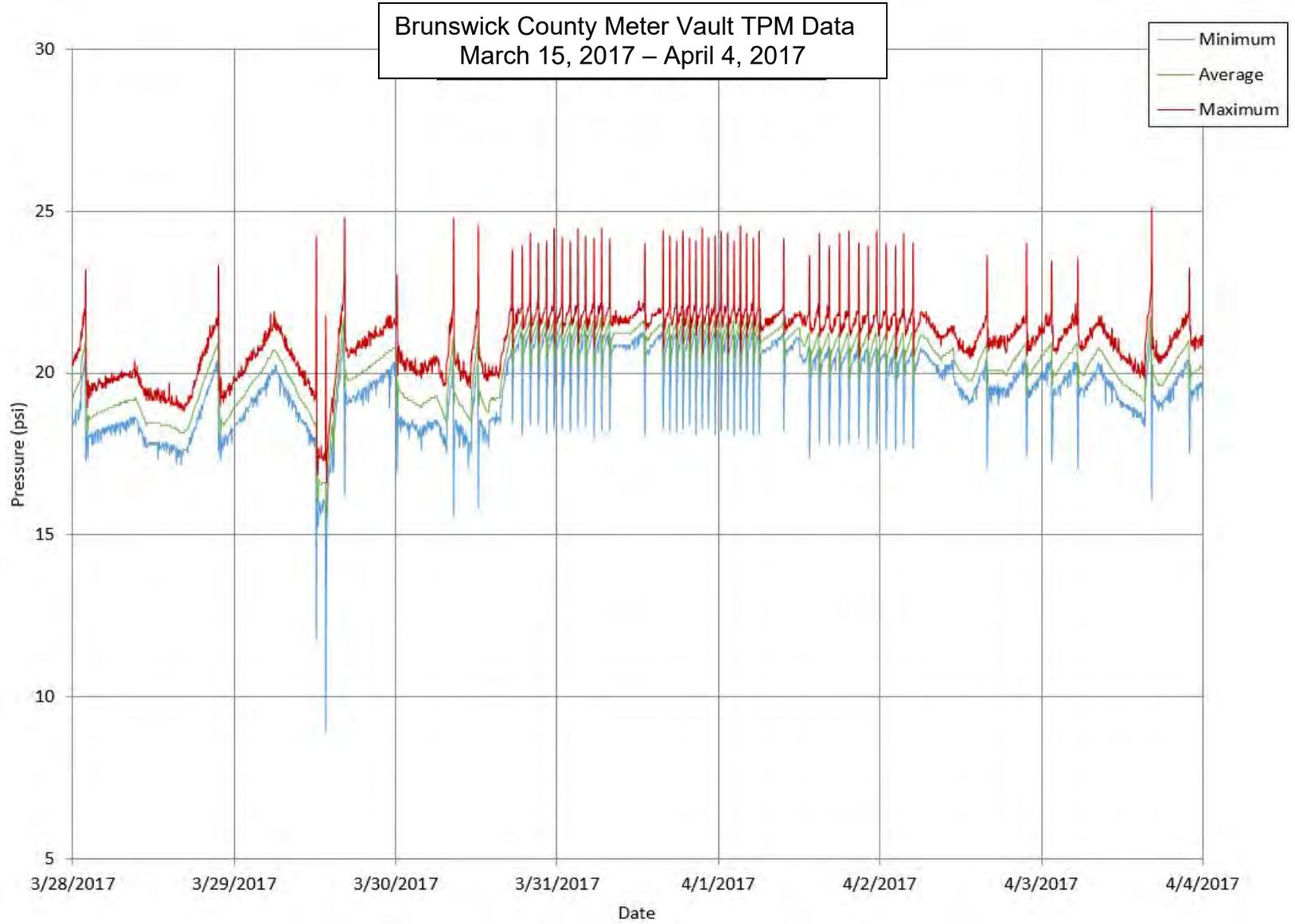


Figure 3.5: Pressure Recordings: March 28, 2017 to April 4, 2017

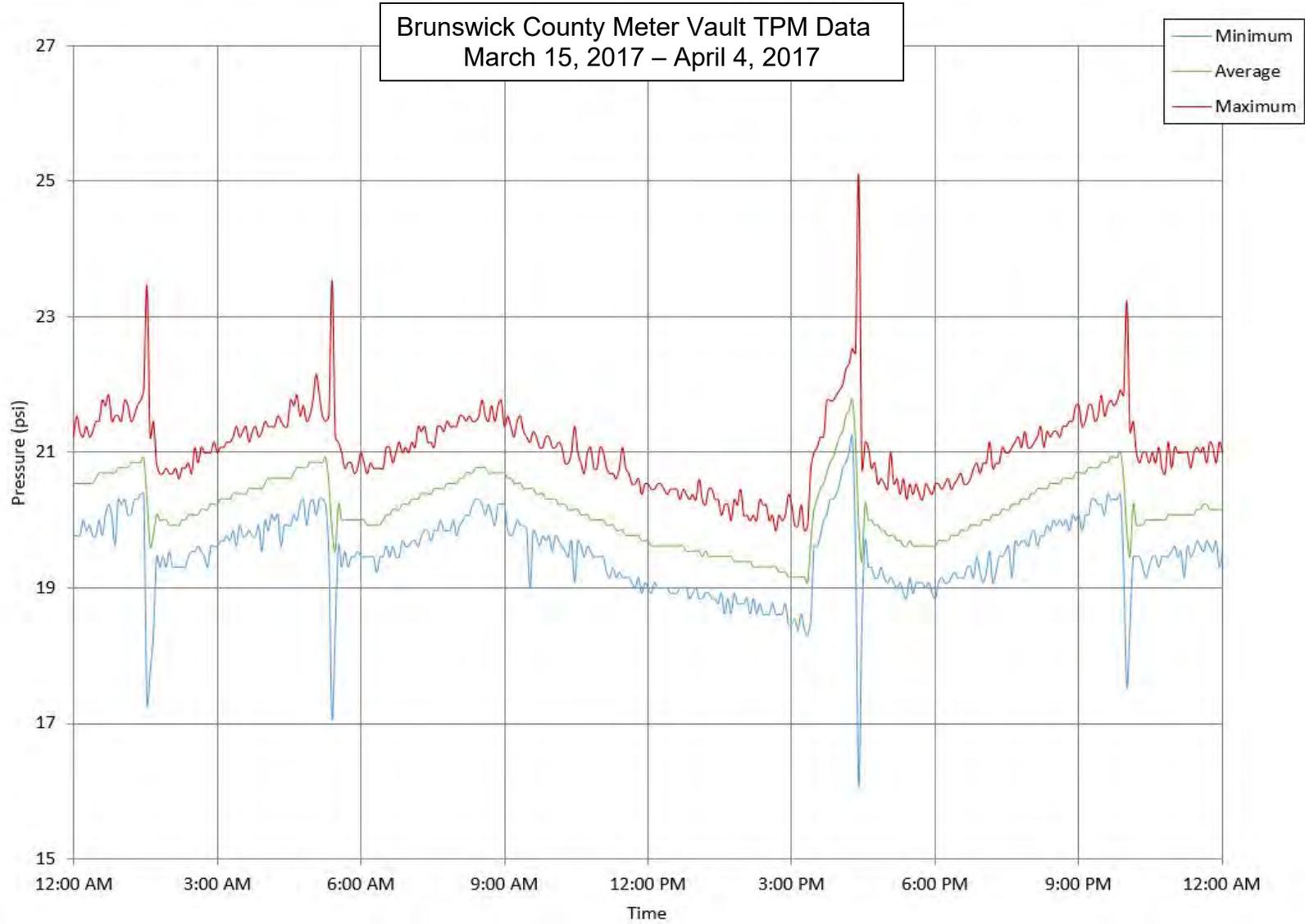


Figure 3.6: Maximum Pressure Day: April 3, 2017

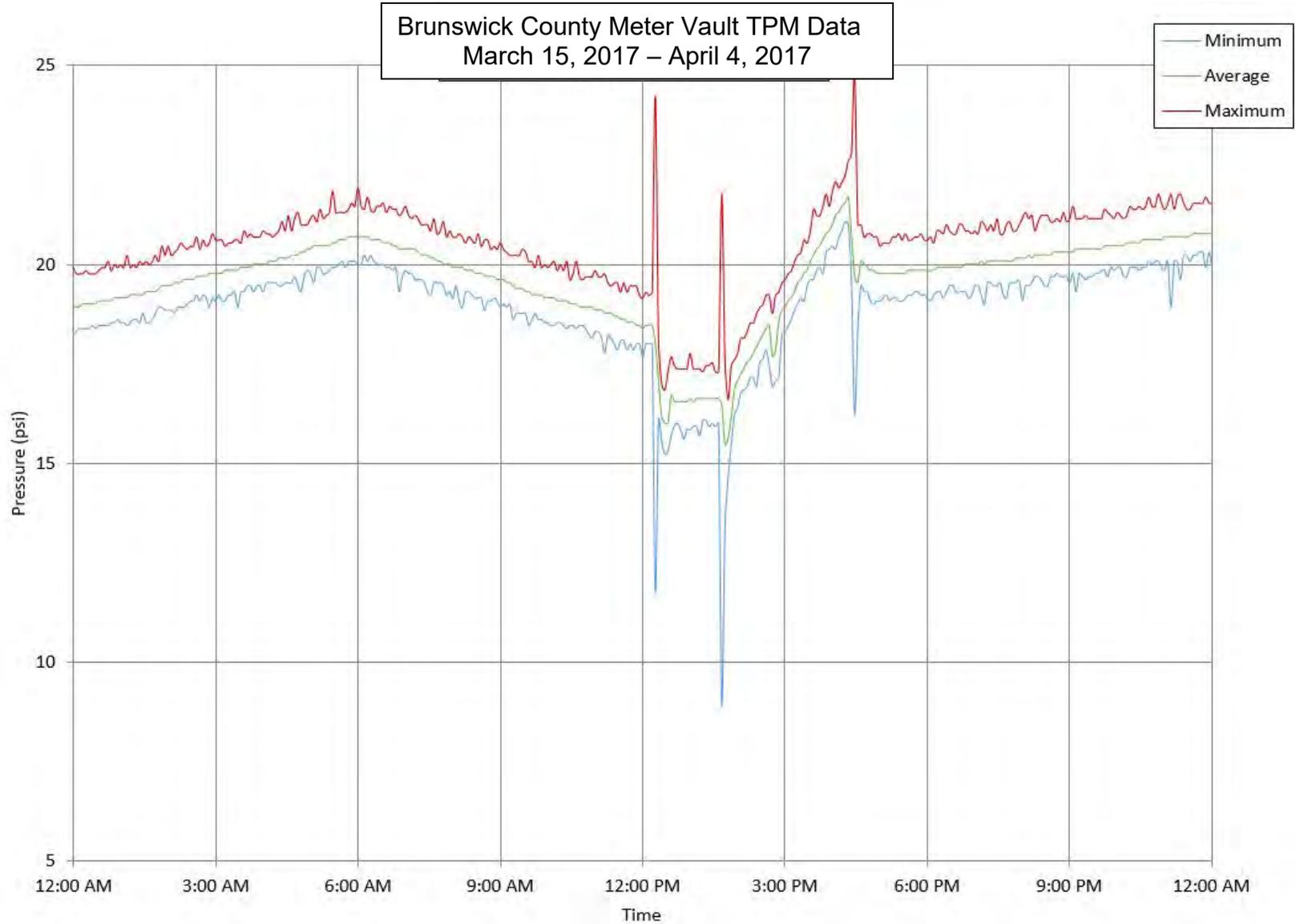


Figure 3.7: Minimum Pressure Day: March 29, 2017



The maximum recorded pressure at the Post Pig Launcher ARV of 96.8 psi occurred on April 3, 2017. Based on the observed system operating pattern, the maximum pressure correlates with a pump startup. The transient pressure logger was installed on the 48-inch transmission main, at approximately 53.0 feet above MSL. The low point of the water main is approximately 19.0 feet below MSL. Based on these elevations and the maximum recorded pressure, the maximum pressure in the water main during the monitoring period with normal operations at the low point would have been approximately 128.2 psi.

The minimum recorded pressure of 11.0 psi was recorded during a pump shutdown on March 29, 2017. The high point of the transmission main is 63.0 feet above MSL. Based on the elevations and assumptions stated above, the minimum pressure in the transmission main during the monitoring period was approximately 6.6 psi.

Moderate transient pressure events were detected during the monitoring period which coincide with pump operation on and off. This is consistent with the normal diurnal operation of a typical raw water force main. Sample weeks of transient pressure data are shown in Figures 3.8 and 3.9. The day with the maximum pressure event is shown in Figure 3.10, and the day with the minimum pressure event is shown in Figure 3.11.

Cyclic loading is well understood to be a mode of failure and is a primary design consideration. It is understood that a component subjected to fluctuating stresses, such as cyclic loading or regularly occurring transients, may fail at stress levels much lower than its fracture strength. Strength reduction due to fatigue is attributed to two primary factors: cycle frequency and amplitude. In the case of pipelines, the recurring amplitude is half the pressure differential and the frequency is the pressure cycle.

Based on typical operation, structural fatigue is not a concern for the 48-inch portion of the transmission main due to compliance of the AWWA C301 standard which states that the internal transient pressure may not exceed 40% of the design pressure. However, SCADA and other operational records should be evaluated to determine the source of the maximum and minimum pressure events, occurring on March 29 and April 3, in order to prevent them from occurring again in the future.

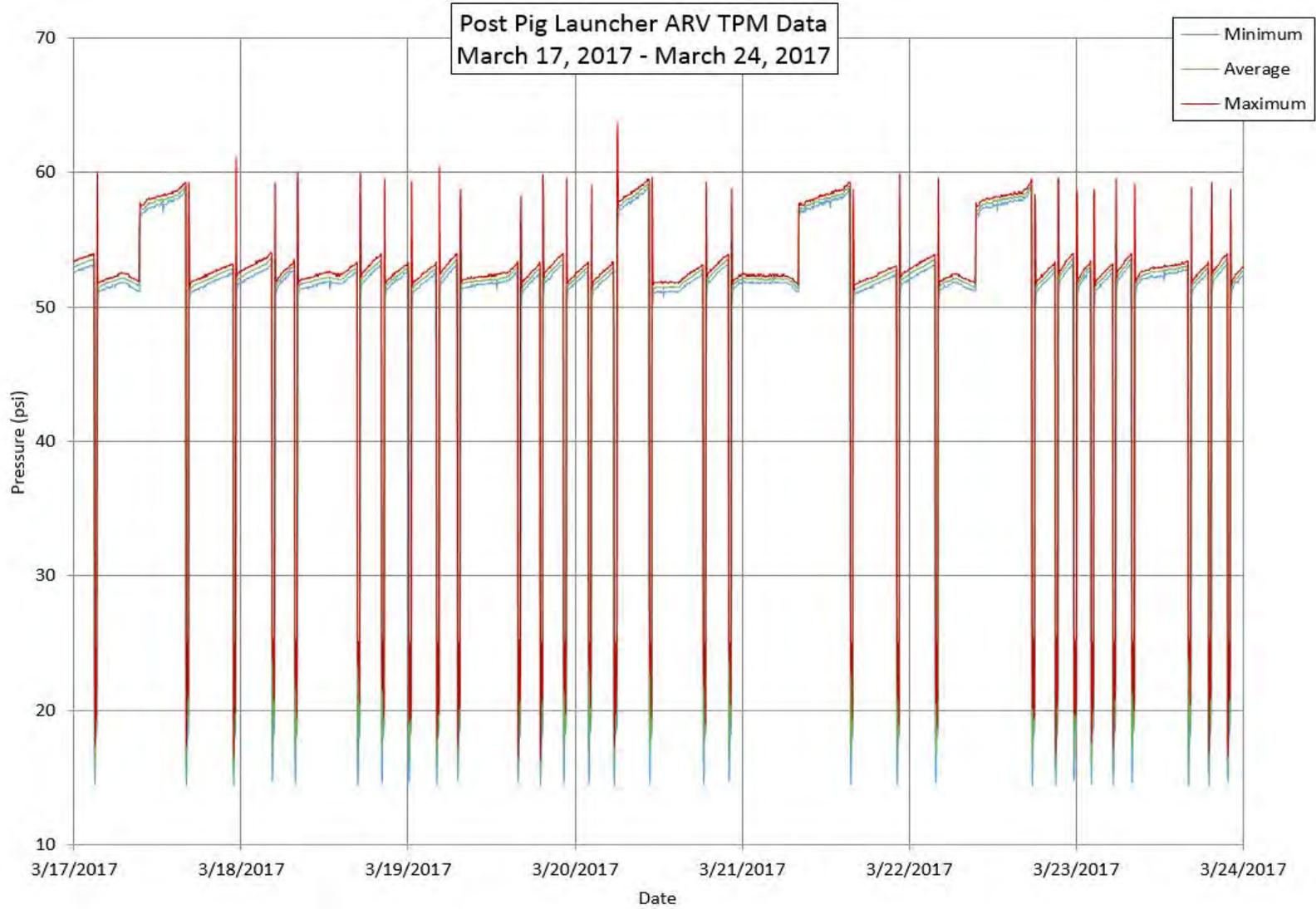


Figure 3.8: Pressure Recordings: March 17, 2017 to March 24, 2017

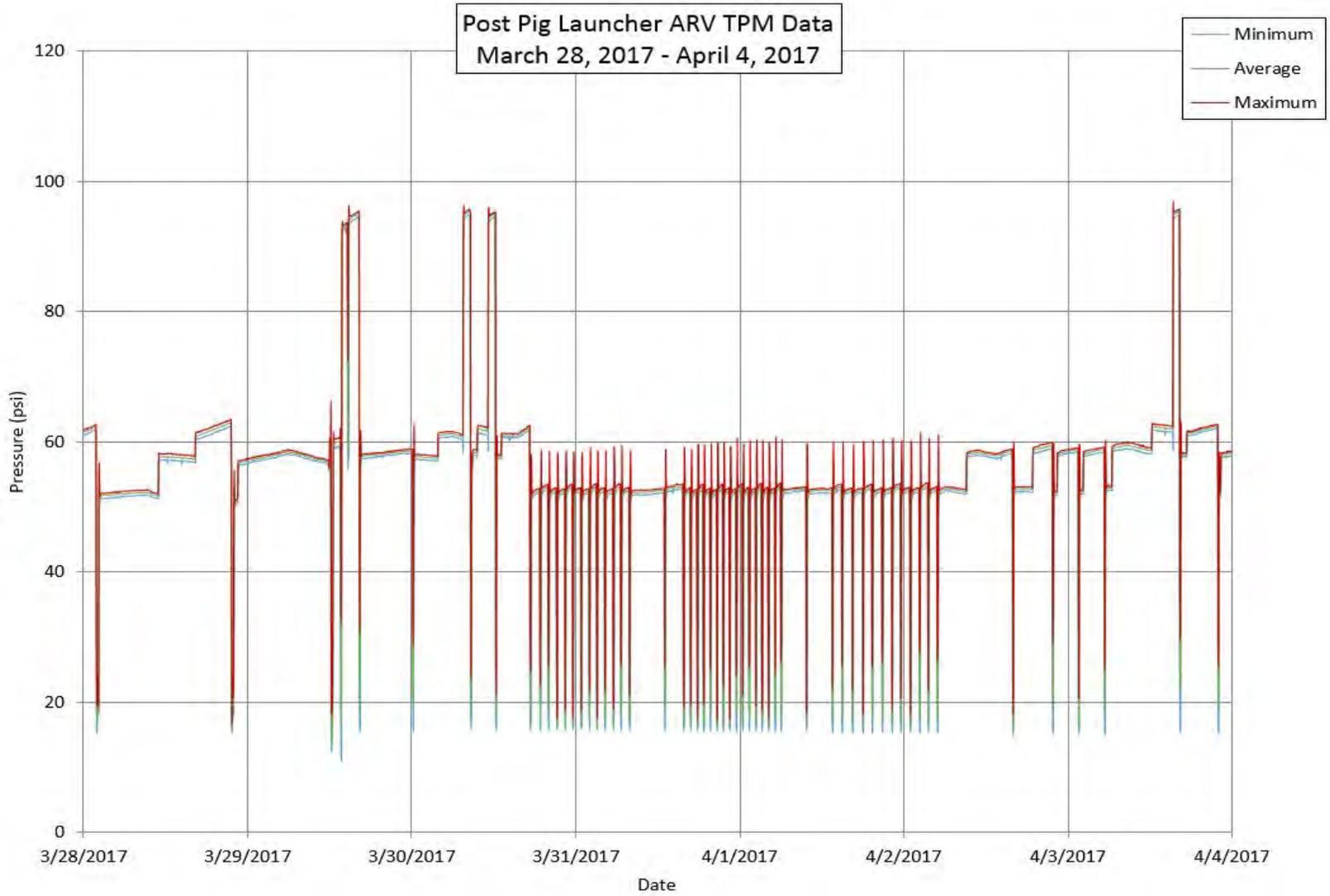


Figure 3.9: Pressure Recordings: March 28, 2017 to April 4, 2017

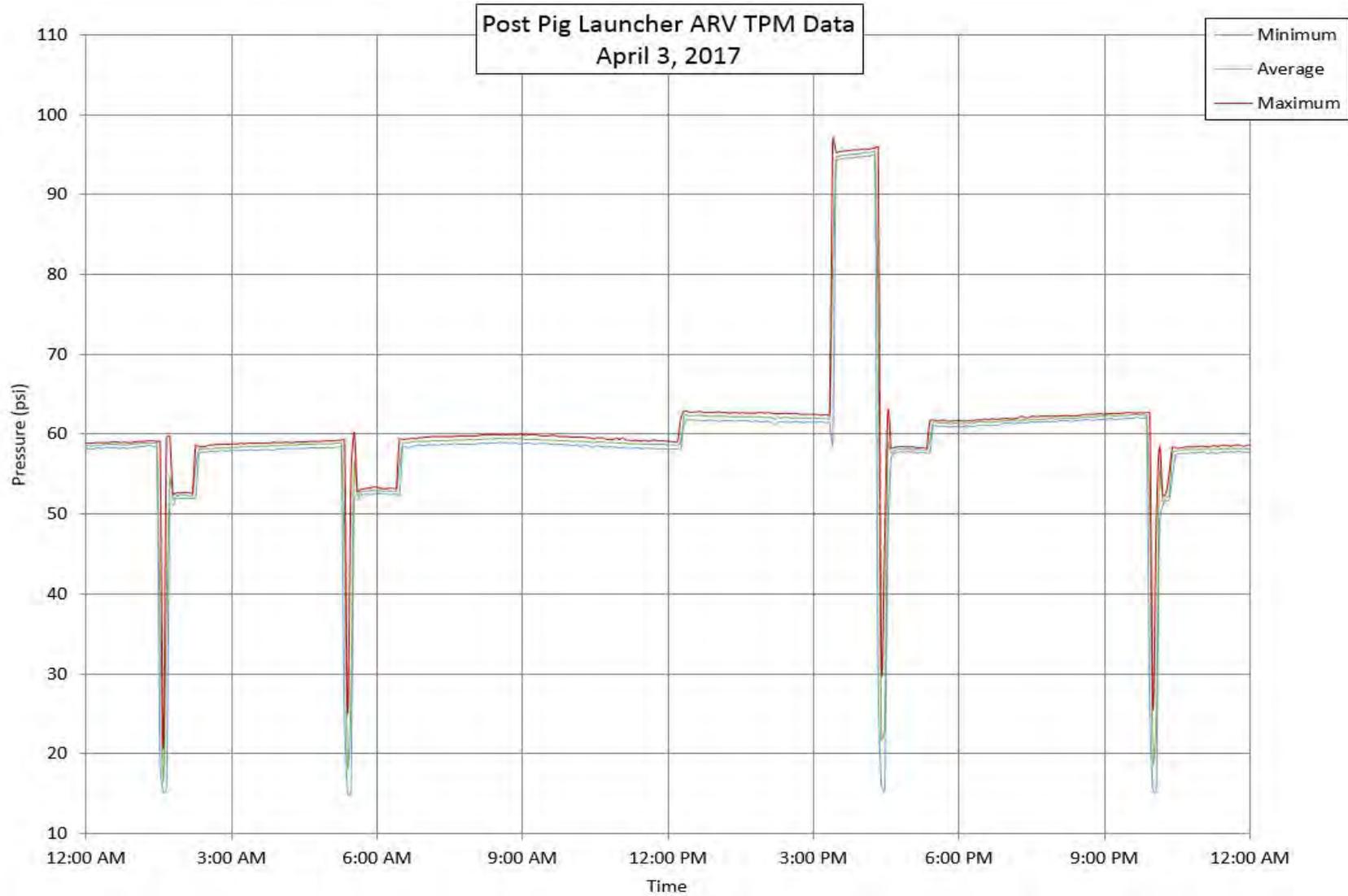


Figure 3.10: Maximum Pressure Day: April 3, 2017

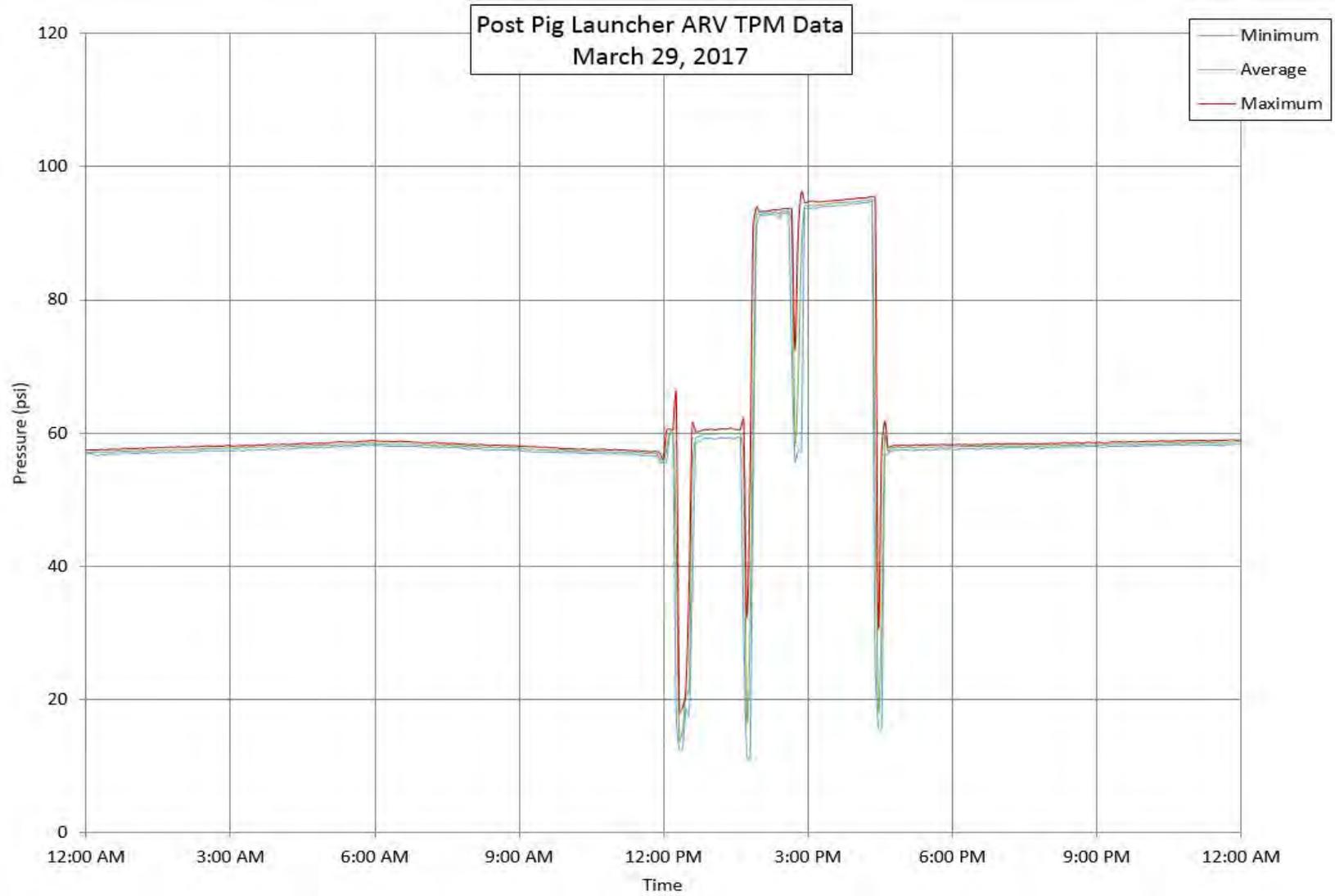


Figure 3.11: Minimum Pressure Day: March 29, 2017

## 4. SmartBall Inspection Details

### 4.1 Planning Document & Drawing Review

Prior to the execution of the project, Pure Technologies reviewed the site and all available pipeline drawings for suitability. Following this review, a planning document that described the upcoming SmartBall inspection was generated. This planning document was submitted to LCFWSA on March 20, 2017.

The drawings received and reviewed by Pure Technologies included:

- April 1978 Contract Drawings
- April 1978 Miscellaneous Details Sheet 61
- July 1979 Raw Water Transmission Main Details Sheet 63
- October 2013 LCFWSA Interim Booster Pump Station Sheet C-2

### 4.2 SmartBall Tool Insertion

An initial attempt was made to insert the tool through an 8-inch gate valve in the basement of the Kings Bluff PS using the claw/plunger tool shown in Figure 4.1 below. The insertion tool protects the SmartBall tool from being trapped or damaged by any buildup or debris that is present at the insertion valve. After insertion, the tool could not be tracked and it never reached extraction. Sensors were placed on all visible pipe sections between the pump station and the pig launcher and no signal from the SmartBall was detected.



Figure 4.1: Insertion Tool (left) and Stack Setup (right)

A second attempt at insertion was performed using the pig launcher outside of the pump station. The SmartBall was inserted into the pig launcher through the 8-inch flange and allowed to submerge to the bottom of the tank. A Godwin HL6M pump was attached to the flange to force water and the SmartBall into the pipeline by overcoming the 45-psi head pressure at this location. The station pumps were slowed and the gate valve to the pig launcher was opened. The Godwin was turned on and pushed 2,000 gallons of water from a water truck (Figure 4.2) into the pig launcher. There was no confirmation of movement of the tool so a second attempt was made and still no movement.

The third and final attempt at insertion was performed using a larger water source, a 20,000 gallon frac tank (Figure 4.3). The SmartBall tool was inserted into the hose connected to the pig launcher and the pump station pumps were shut down to give a lower head pressure of 25-psi. The gate valve was opened once again and the Godwin was turned on and pushed all 20,000 gallons of water into the pig launcher which helped force the SmartBall past the gate valve and into the water main.



Figure 4.2: Pump connected to water truck and pig launcher



Figure 4.3: 20,000 gallon frac tank

### 4.3 SmartBall Tool Tracking

Sixteen (16) surface mounted acoustic sensors (SMSs) were placed along the pipeline to track the progress of the SmartBall tool during the inspection. SmartBall Receivers (SBRs) were connected to the sensors on the pipeline at the locations indicated in Table 4.1 to track the tool during the inspection. The distance between and location of these SBRs is based on the information and drawings provided by LCFWSA. The time that the SmartBall tool passed each SBR location is also summarized in Table 4.1.

Only one tracking location, SBR #3, did not provide sufficient data to accurately track during this inspection. SBR #3 recorded only two points due to the SmartBall traveling over 4 feet per second. The two points was only enough information to determine the Smartball's speed but not enough to determine accurate distance from the tracking location. The Kings Bluff PS was then contacted and advised to slow the pumps to 27 million gallons per day (MGD), down from the current operating speed of 45 MGD.

Figure 4.4 shows a plot of the distance the SmartBall tool traveled versus time of day. The slope of the line indicates the instantaneous velocity of the SmartBall tool. This calculated velocity is shown versus time of day in Figure 4.5.

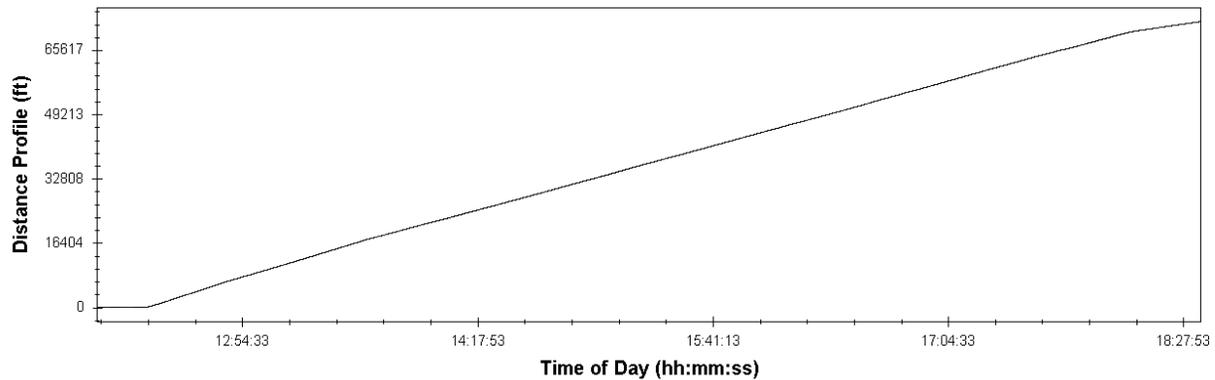


Figure 4.4: Distance the SmartBall Tool travelled versus Time of Day during the Inspection

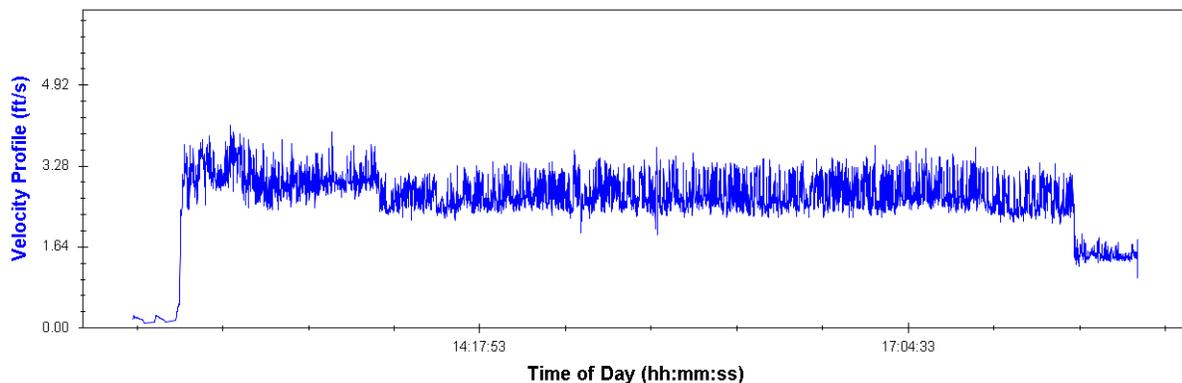


Figure 4.5: Velocity of the SmartBall tool versus Time of Day during the Inspection

Figure 4.6a shows data collected by all the SBRs, indicating the relative position of the SmartBall tool to each tracking point. Data obtained from each SBR is represented by a single color. The colors should represent a “V” shape showing how the tool is far away and coming closer to the tracking location then moving farther away from it. Figure 4.6b shows how the relative position of the SmartBall tool and how it was tracked relative to SBR #5 to give a better visual of the tracking profile.

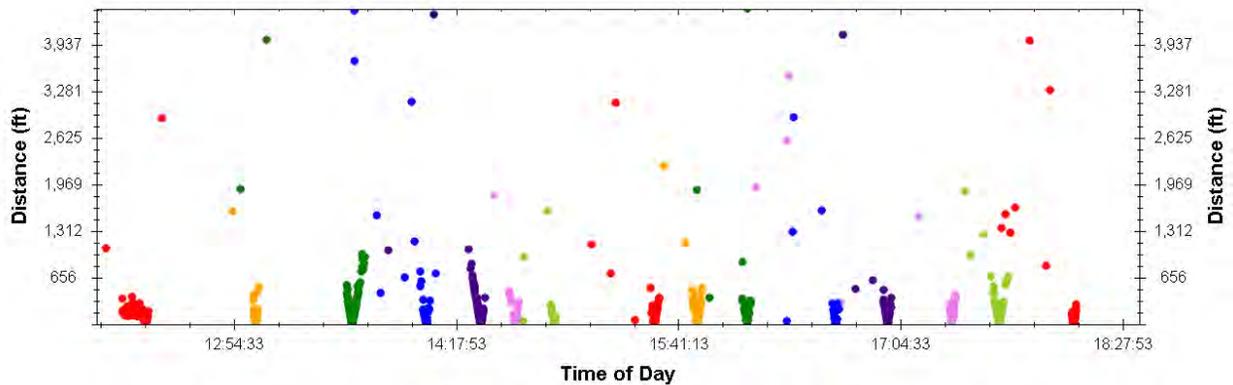


Figure 4.6a: SBR positional data for the Inspection

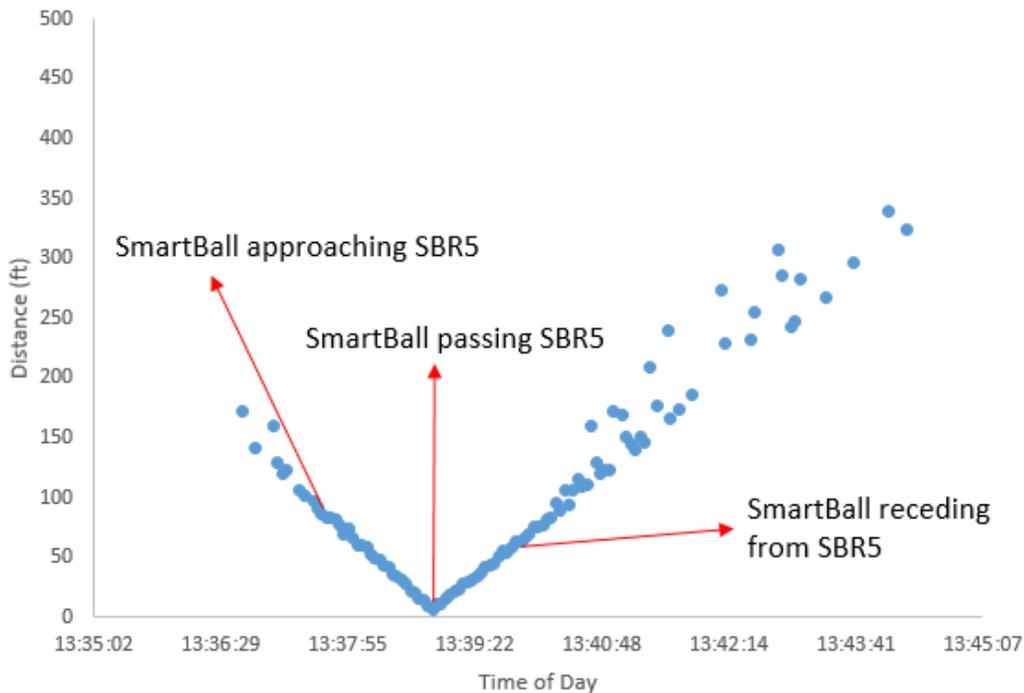


Figure 4.6b: SBR #5 positional data



**Table 4.1: SmartBall Receiver Locations**

SBR No.	Distance from Insertion	Passage Time (hh:mm:ss)	Location Description	Approximate GPS Coordinates
SBR #1	0ft	12:03:04 PM	Insertion/ Pig Launcher	34.4021, -78.2964
SBR #2	122ft	12:21:28 PM	ARV	34.4018, -78.2963
SBR #4	9,432ft	1:02:47 PM	Soft Dig	34.3822, -78.2771
SBR #5	17,338ft	1:38:53 PM	ARV	34.3685, -78.2567
SBR #6	22,627ft	2:06:41 PM	ARV	34.3595, -78.2428
SBR #7	26,545ft	2:27:05 PM	ARV	34.3530, -78.2327
SBR #8	29,069ft	2:39:56 PM	ARV	34.3477, -78.2272
SBR #9	31,978ft	2:54:39 PM	ARV	34.3422, -78.2203
SBR #10	39,368ft	3:32:06 PM	Soft Dig	34.3311, -78.2000
SBR #11	42,545ft	3:48:09 PM	ARV	34.3259, -78.1915
SBR #12	46,255ft	4:06:56 PM	ARV	34.3222, -78.1801
SBR #13	52,844ft	4:40:13 PM	ARV	34.3156, -78.1598
SBR #14	56,684ft	4:59:36 PM	ARV	34.3115, -78.1482
SBR #15	61,558ft	5:23:45 PM	Soft Dig	34.3065, -78.1332
SBR #16	65,030ft	5:41:26 PM	ARV	34.3030, -78.1225
SBR #17	70,259ft	6:09:21 PM	36-inch Tee to Interim Booster Pump Station	34.2977, -78.1064
SBR #18	72,890ft	6:34:02 PM	ARV / Extraction	34.2949, -78.0983

#### 4.4 SmartBall Tool Extraction

An extraction net was used to extract the SmartBall tool once it had traversed the entire length of the pipeline. The extraction net was inserted and verified to be correctly deployed using a pressure-proof camera before the SmartBall tool was released at the insertion site. The extraction net was inserted into the pipeline flow at the start of the inspection and was left in place until the SmartBall tool was confirmed to arrive at extraction, see Figure 4.6 below.



*Figure 4.7: Extraction Site at Brunswick Booster Station*

## 5. Summary of Acoustic Events

The acoustic data recorded by the SmartBall tool was analyzed and cross-referenced with the position data from each SBR to determine a location for each acoustic event. Table 5.1 provides a detailed summary of each leak detected by the SmartBall technology during the inspection. Please refer to Appendix B for details about leak locating and verification procedures.

Figure 5.1 shows the acoustic profile of the inspection with respect to the position of the tool within the pipeline, as detected by the SmartBall technology. The magnitude of leaks is estimated by correlating the value of the acoustic signal with historical calibration data.

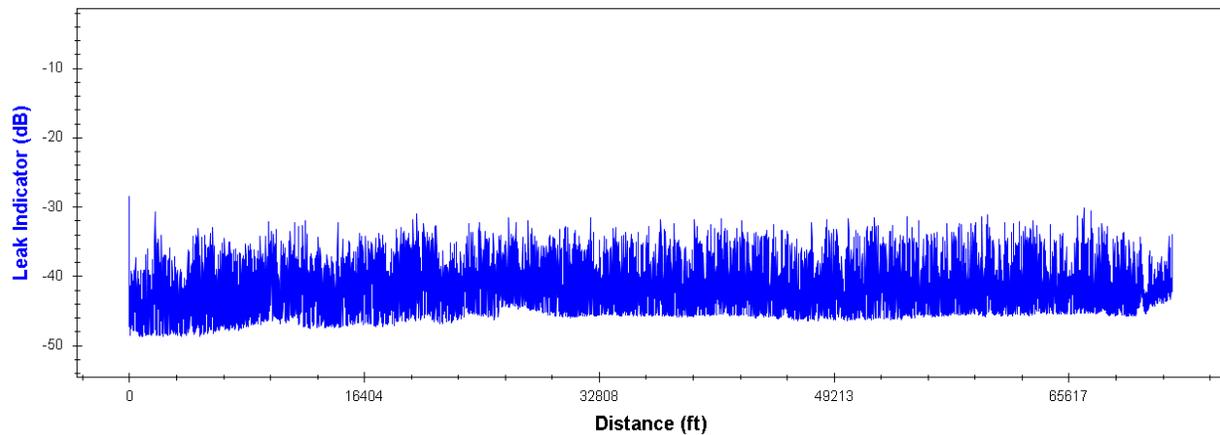


Figure 5.1: Acoustic summary of the SmartBall inspection versus Distance Traveled for the Inspection

It is important to note that this overview may contain anomalous spikes in the data. These spikes may have been caused by ambient noise around the pipeline from external sources such as pumps or nearby traffic. These sources of ambient noise are easily distinguishable from leaks or other points of interest upon further analysis by trained personnel. Ambient noise generally occurs at a much lower frequency than the frequencies generated by a leak or pockets of trapped gas.

Table 5.1: Summary of Leaks				
Description	Size of Leak	Distance from Insertion	Distance from Nearest Upstream Tracking Location	Distance from Nearest Downstream Tracking Location
Leak (Small)	Leak (Small)	72,618ft	2359.3 feet after the 36-inch Tee to the Brunswick Northwest Treatment Plant	273.4 feet before ARV manhole at Station 730+30 (SmartBall Tool Extraction Point)

\* GPS locations are approximations and in no way absolute.

In addition to location, the acoustic properties of any leaks are further evaluated to estimate the approximate magnitude of each leak. Pure Technologies reports leaks in three (3) categories: small, medium and large. Small leaks are estimated to be in the range of 0 - 2 gallons per minute (GPM). Medium leaks are estimated to be in the range of 2 - 10 GPM. Large leaks are estimated to be greater than 10 GPM.

Figure 5.2 shows the approximate pipeline map with leak location mapped.



*Figure 5.2: Overview map of the pipeline with leak location mapped*



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## 6. Conclusion

The location and small size of the detected anomaly leads to the conclusion that the suspected leak could be a valve seated incorrectly. The location lines up with the valve from the Raw Water Main to the 3-million-gallon ground storage tank at the Interim Booster Pump Station. It is advised that this valve be worked to ensure it is operating and sitting correctly. If the valve is functioning properly, the location should be further investigated to find the source of the detected leak.



# **APPENDIX A**

## **Acoustic Event Details**

Details on acoustic events of interest that were detected during the SmartBall inspection are provided below.

Site of Interest #1 - Leak	
<b>Distance to Nearest Sensor:</b>	273.4 feet before ARV manhole at Station 730+30 (SmartBall Tool Extraction Point)
<b>Distance from Insertion Point:</b>	72,618.1 ft
<b>Time Since Insertion:</b>	06:28:25
<b>Time of SmartBall Tool Pass (GMT-5:00):</b>	06:31:30 PM
<b>Acoustic Intensity:</b>	-34.3 dB <sup>1</sup>
<b>Estimated Size:</b>	Small
<b>Barrel Leak, Joint Leak, or Suspected Feature:</b>	Suspected Feature – valve to holding tank
<b>Location Accuracy Confidence Ranking:</b>	+/- 10 meters

<sup>1</sup> Used by Pure Technologies to determine approximate leak size

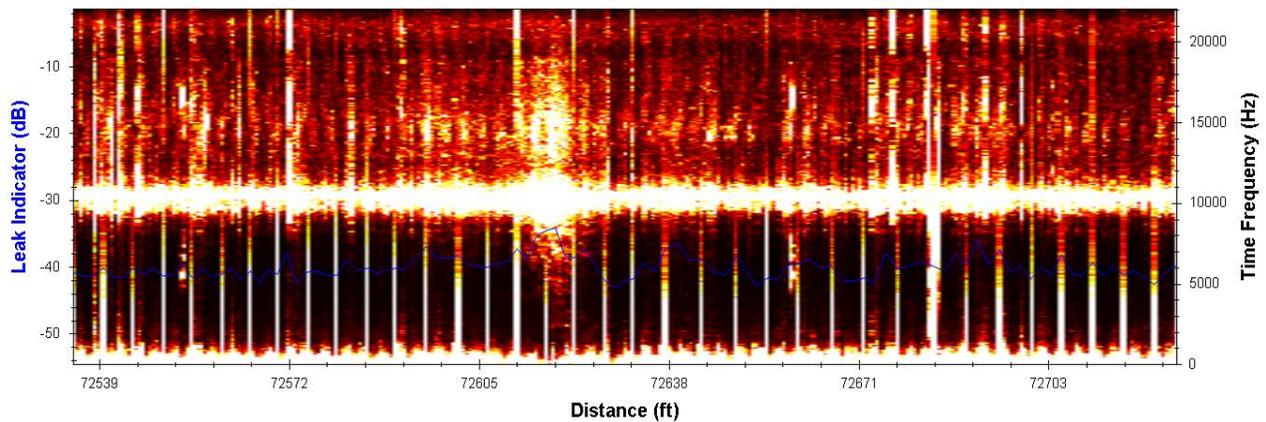


Figure A.1a: Acoustic Intensity of Event

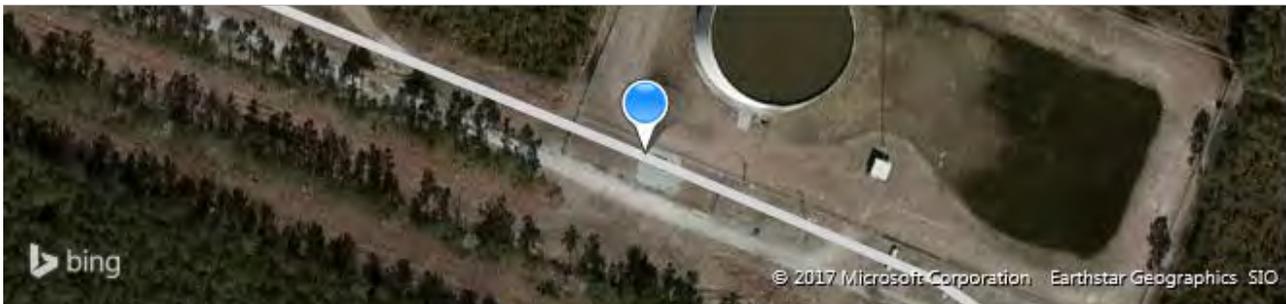


Figure A.1b: Approximate Location of Acoustic Event



## **APPENDIX B**

# **SmartBall Methodology**

## B.1 Overview

Pure Technologies' SmartBall leak and gas pocket detection system is a free-swimming, acoustic-based technology that detects acoustic activity associated with leaks or pockets of trapped gas in pressurized pipelines. The SmartBall assembly comprises a water-tight aluminum alloy core containing a power source, electronic components, and instrumentation that includes an acoustic sensor, tri-axial accelerometer, tri-axial magnetometer, GPS synchronized ultrasonic transmitter, and temperature sensor. A protective outer foam shell encapsulates the aluminum core and provides a larger surface area by which the device is pushed by the hydraulic flow of the fluid in the pipeline. The foam shell also reduces the ambient noise from the rolling action, resulting in a silent background. The SmartBall assembly is deployed into the flow of a pipeline, traverses the pipeline, and is captured and extracted at a point downstream. During the inspection, the SmartBall tool's location is tracked at known points along the alignment to correlate the inspection data with specific locations.



Figure B.1: SmartBall Core and Foam Shell a with SmartBall Receiver (SBR)

## B.2 Identifying Leaks and Gas Pockets

### B.2.1 Acoustic Events Representing Leaks

A leak inside a pressurized pipeline produces a specific acoustic signal. This acoustic signal is created when the pressurized product inside the pipeline escapes into the lower pressure atmosphere outside the pipe. While the SmartBall tool traverses the pipeline, it continuously records all acoustic data in the pipeline, which is evaluated later to identify acoustic activity that may be associated with leaks along the pipeline. As the SmartBall tool rolls along the bottom of the pipeline, it will always pass within one (1) pipe diameter of a leak or pocket of trapped gas.

As the SmartBall tool approaches a leak, the acoustic signal detected by the SmartBall technology will increase. The acoustic signal will crescendo as the tool approaches the leak, peak at the point at which the SmartBall tool passes the point of the leak, and then diminish as the SmartBall tool continues away from the leak. This phenomenon is clearly evident in Figure B.2.

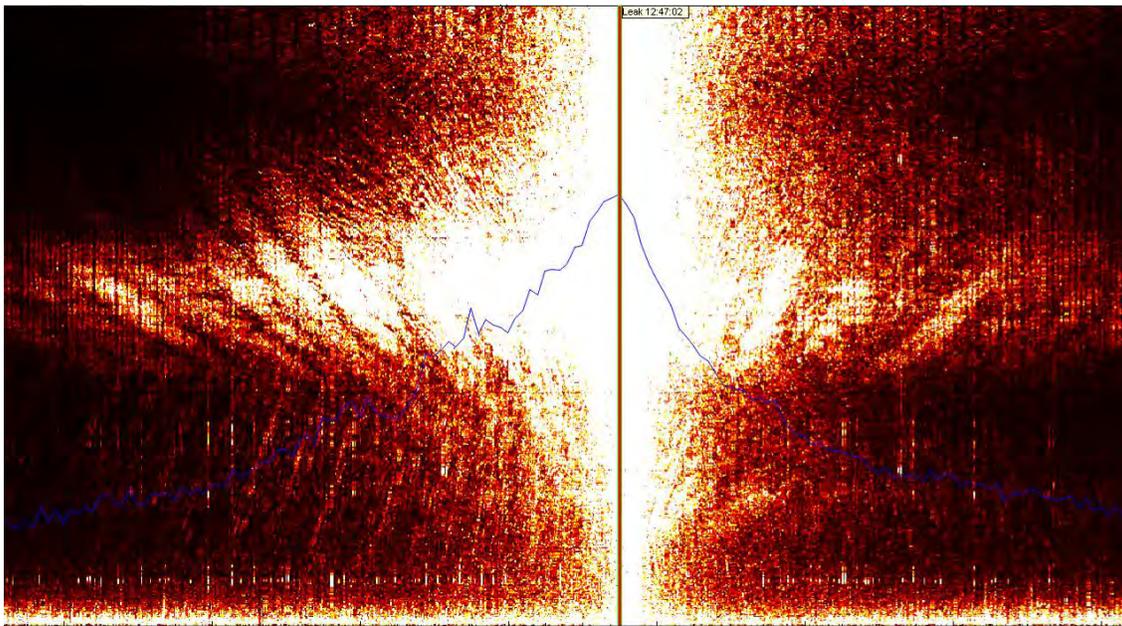


Figure B.2: Detected Leak, as shown in the SmartBall Analysis Software

In addition to detecting potential leaks and pockets of trapped gas, acoustic events are further evaluated to estimate the approximate magnitude of the leak. Pure Technologies reports leaks as being small, medium, or large. Small leaks are estimated to be in the range of 0 - 2 gallons per minute (GPM). Medium leaks are estimated to be in the range of 2 - 10 GPM and large leaks are estimated to be greater than 10 GPM.

Pure Technologies has invested heavily into identifying the characteristics of an acoustic event that is representative of a leak. The characteristics typical of a true leak as detected by the SmartBall technology include:

- The range of frequencies present increases as the tool approaches the leak

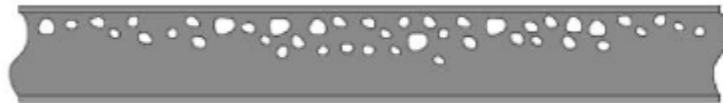
- The frequencies that appear first, grow in intensity as the SmartBall tool approaches the leak
- The frequencies that appear to indicate a leak are consistent as the SmartBall tool approaches the leak

### *B.2.2 Acoustic Events Representing Gas Pockets*

Pockets of trapped gas inside a pipeline generate a distinct acoustic signal that is detectable using the SmartBall technology. Gas pockets in pressure pipes are typically detected at high points in the pipeline and are often the result of malfunctioning air release valves (ARVs) or a lack of ARVs. The acoustic signal is created by the liquid turbulence at the air/water interface. In full, pressurized pipes, this turbulence is not present.

Pockets of trapped gas inside a pipeline have distinct acoustic signatures that are readily identified by the SmartBall analysis software and trained technicians. Pure Technologies classifies trapped air inside a pipeline into three (3) categories:

1. **Entrained Air:** This classification of trapped gas is characterized by small, moving bubbles of gas within the pipeline. Entrained air is not typically static in a pipeline and frequently migrates with the flow. These moving pockets of gas are generated in three (3) ways. They can be introduced at the pumping station as a result of air becoming entrained in the sewage as it plunges into the wet well or by inefficiencies within the pump station. They can be created at the tail of a hydraulic jump at the end of a fully developed gas pocket where small pockets of gas diffuse into the liquid phase and are carried downstream with the flow. Finally, entrained air may be created by the biochemical processes inherent to sewage mains.



*Figure B.3: Entrained Air (Pothof, 2011)*

2. **Slug or Developing Gas Pockets:** This classification can be characterized as small pockets of trapped gas that often develop as a result of an amalgamation of entrained air. Gas slugs can also be introduced via ARVs. Slugs can be either static or migratory. If they are detected at a localized high point, they are likely static; if not, they are likely migrating towards a high point.



*Figure B.4: Gas Slugs (Pothof, 2011)*

3. **Fully Developed Gas Pockets:** Fully developed gas pockets are usually located at localized high points along a pipeline. These develop as a result of slugs that have accumulated at a high point to the magnitude that they extend into the downward slope of

the pipe. A fully developed gas pocket typically has a hydraulic jump prior to the re-submergence of the pipe, creating an area of turbulent flow and gas dissolution into the liquid phase. Due to the turbulent nature of the hydraulic jump and frequent wet/dry cycles at these locations from changes in flow condition, these areas are at a higher risk of failure than other portions of the gas pocket.

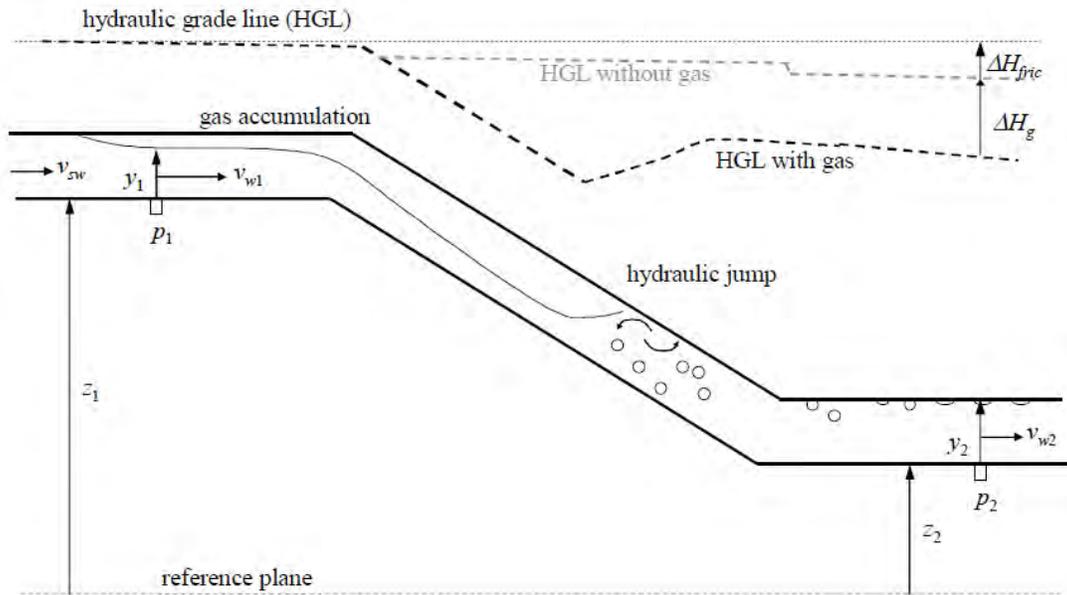


Figure B.5: Diagram of a Fully Developed Gas Pocket (Pothof, 2011)

An example of the acoustic signature generated by a pocket of trapped gas is shown in Figure B.6.

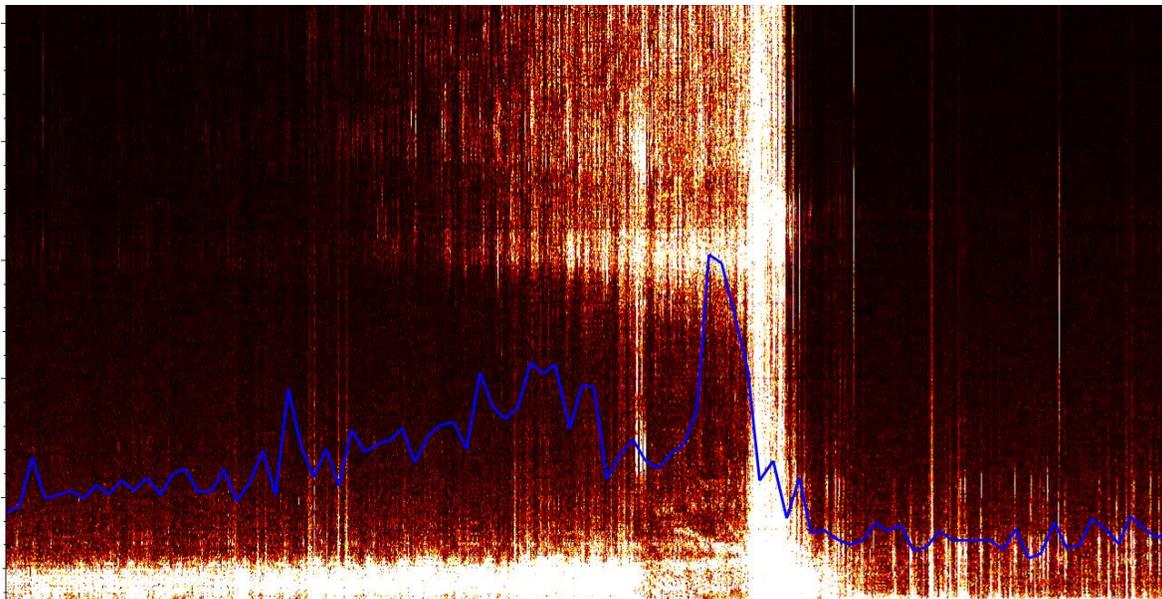


Figure B.6: Detected Gas Pocket, as shown in the SmartBall Analysis Software

### *B.3 Event Locating*

The on-board accelerometer records the rotation of the SmartBall tool, this data can be translated to a rate of rotation. From there a velocity profile for the device can be generated as it travels the entire length of the pipeline. This data is aligned with the acoustic recordings to give a precise location of any recorded event. To correlate the accelerometer data to an absolute position and time, a reference point is required. Tracking the position of the SmartBall tool via SmartBall Receivers (SBRs) provides a time and position to be stamped on the velocity profile, resulting in a position versus time relationship for the entire run of the device that is used to report the location of a leak or pocket of trapped gas.

### *B.4 SmartBall Tool Tracking*

The SBR is a device that is used to track the position of the SmartBall tool as it traverses the pipeline. The SBR comprises a GPS receiver, and a processing computer. Both the SmartBall tool and the SBR are synchronized to standard GPS time.

Surface mounted sensors (SMS) are mounted to the pipeline at planned locations and are connected to an SBR via coaxial cable. The SBR and SMS combination detects ultrasonic pulses emitted from the SmartBall tool. The SBR determines the time taken for the pulse to travel from the SmartBall tool to the SBR and calculates the location of the SmartBall tool at any given time. Figure B.7 shows an SMS, which is typically mounted to the pipeline itself or pipeline appurtenance.



*Figure B.7: SMS Adhered to a Flange*

This locational data is paralleled with the data extracted from the SmartBall tool. This combination is then used to identify the locations of leaks and pockets of trapped gas.

### *B.5 Advantages and Limitations of the SmartBall Technology*

The SmartBall technology acquires high quality acoustic data that is evaluated to identify leaks and pockets of trapped gas. While other leak detection techniques such as noise loggers and correlators may identify a single leak or gas pocket between each sensor, they cannot accurately



locate the limits of an event nor identify multiple events. The SmartBall tool travels directly past each acoustic event of interest and thus significant advantages are recognized:

- **Medium and Large Diameter Pipes:** SmartBall technology has successfully inspected and detected leaks on a wide range of medium and large diameter pipelines (12 to 96 inches in diameter). Many conventional leak detection technologies (e.g., correlators) have limitations that preclude their use on medium and large diameter pipes.
- **Pipe Material:** The SmartBall tool's leak detection ability is not affected by pipe material. Because the tool passes by the point at which the acoustic event is being created, the pipe wall is not relied on to transmit the acoustic event through the line to a sensor located far away from the actual event of interest. This greatly increases the SmartBall tool's sensitivity and ability to distinguish between separate acoustic events.
- **Sensitivity:** The sensitivity of all leak detection technologies is a function of several variables and as a result, no resolute thresholds can be established. However, the acoustic sensor inside the SmartBall tool always passes within one (1) pipe diameter of an acoustic event; therefore, it can be used to identify very small leaks due to the proximity of the SmartBall tool to the leak. It should be noted that the SmartBall technology cannot differentiate between a true leak, a simulated leak, and the potential noise of a pressure reducing valve. As such, acoustic events corresponding to features on a main should be investigated further in the field.
- **Length of Survey:** SmartBall technology has the ability to record acoustic data for over 18 hours. Depending on flow rates, the tool can inspect long pipelines during a single deployment. The longest single recording within a water pipeline with a single deployment had the SmartBall tool recorded acoustic data for a length of pipeline exceeding 30 miles.

All non-destructive testing technologies have unique capabilities and limitations that affect the accuracy and efficacy of the technology. The SmartBall tool has the following limitations:

- **Minimum Pressure:** The acoustic activity associated with a leak is derived from the pressure differential across the pipe wall. With little to no pressure differential, the SmartBall tool will not detect leakage as there will be no associated acoustic activity. Pure Technologies recommends a minimum pressure of 15 pounds per square inch (psi) for leak detection inspections; however, under ideal conditions leaks have been detected in pipelines with pressures as low as 5 psi. There is no minimum pressure recommendation for the detection of areas of trapped gas.
- **Ambient Noise:** The SmartBall technology detects and reports events that have acoustic characteristics similar to leaks on pressurized pipelines. However, other forms of ambient noise may be identified during the data analysis. For medium and large leaks, there is very little that can match these acoustic characteristics; therefore, these events are reported with a high degree of certainty. For small leaks, there may be other forms of ambient noise with similar acoustic signatures, making these signals more difficult to evaluate. Pure Technologies has invested significant resources into characterizing acoustic events and consequently asserts that leaks described in this report are leaks, unless otherwise noted. However, unknown pressure reducing valves, cracked valves in close proximity to the subject pipeline, interconnected pipelines that have not been completely isolated, and leaks in pipelines immediately adjacent to the subject pipeline can contain a similar acoustic signature and could be reported as leaks. Cars, pumps, boat traffic, and other



forms of common ambient noise should not be reported as leaks as they generate different acoustic signatures.

Reported Locations: The event locations in this report are based on project experience and the limitations of the technologies used to calculate location. There are also several other factors that could decrease the accuracy of locating leaks and gas pockets. Accuracy rankings for each event are included in each event overview.

### B.6 Overview of a SmartBall Inspection

Figure B.8 shows an overview of a typical SmartBall inspection.

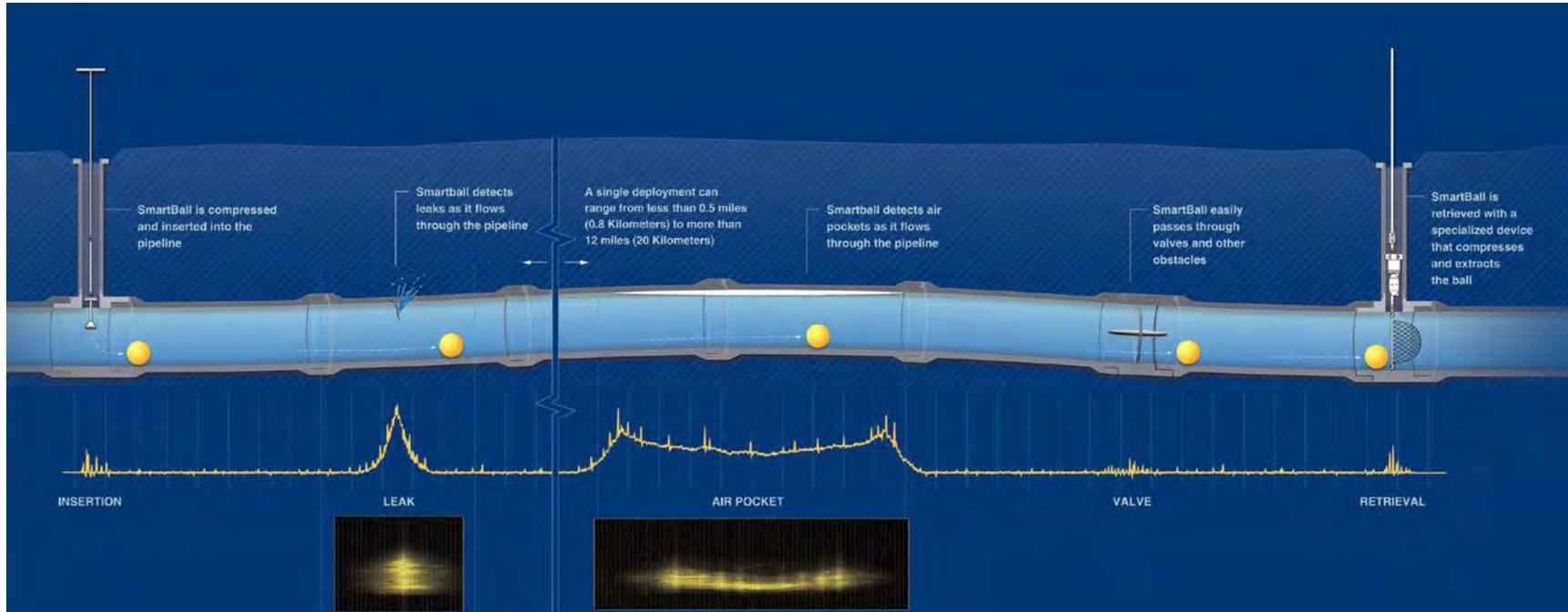


Figure B.8 – Overview of a SmartBall Inspection



# **APPENDIX C**

## **How Pipes Leak**

Understanding how pipelines leak can be a valuable skill when heading out to locate a leak point on a pipeline. By understanding the cause of leaks, one can limit the amount of excavating required to locate a given leak.

### **Cast/Ductile Iron Pipe**

Cast and Ductile iron pipes mostly consist of bell and spigot type connections. Many leaks found on this type of pipeline will be located at a joint which can be caused by improper gasket installation or soil shift. In addition to joint leaks cast and ductile iron pipes can also leak from cracks and/or through hold penetrations in the pipe barrel. The cause for these defects can be wide ranging. This types of defects will not immediately affect the pipeline itself but should be viewed as more serious than a joint leak as the structural integrity of the given pipe section has already been compromised. Barrel leaks should be addressed as soon as possible and Pure Technologies will generally be able to identify whether a leak is on the joint or barrel of a pipe section for these types of pipe.

### **Steel Pipe**

Steel pipelines are typically welded together to form a long continuous pipe with few gasket joints. Leaks on this type of pipeline can occur at joints or along the barrel both by way of cracking or through hole penetrations.

### **Plastic and other pipe materials**

Typical plastic pipe types include Polyvinyl Chloride (PVC) and High-density polyethylene (HDPE). Some other pipe types may include Glass Reinforced Pipe (GRP) that act and fail in similar ways to plastic pipes.

Generally speaking, leaks on these types of pipes will occur at the joints between two pipe sections. Usually this can be attributed to improper installation of the joint gasket or ground shifting leading to misalignment at the joint. A leak normally won't be located on the barrel of a plastic pipe as a simple crack or through hole penetration would likely cause the line to completely fail vs just leak.

Knowing that more leaks occur at joints you can focus your efforts on joints of the line vs digging linearly upstream or downstream when trying to locate a leak.

### **Concrete/Prestressed Pipe**

Concrete Pressure pipe is always constructed from bell and spigot type pipe sections. Like other bell and spigot style pipe, these pipe types will generally leak from faulty or misaligned joints. Though it should be noted that other forms of failure like cracking or through hole penetration have also been seen to be the cause of leaks, though it is less likely.

On some classes of concrete pressure pipe Pure Technologies will be able to identify if a leak is on the joint or the barrel of a pipe section. This knowledge can help when locating leaks. Knowing that more leaks occur at joints you can focus your efforts on joints of the line vs digging linearly upstream or downstream when trying to locate a leak. Additionally, if a leak is located in the barrel of a concrete pressure pipe, its verification should be escalated as it is most likely indicating some form of severe structural degradation.



<b>Permit Number:</b>	<b>EN2019-070 24</b>	<b>RC: 24-Wilmington</b>
<b>Easement TRACT:</b>	<b>003-COLU-001_000</b>	
<b>Atlas Page:</b>	<b>24 8128 – D</b>	
<b>Station(s):</b>	<b>0+00 – 46+41</b>	
<b>Approval Date:</b>		

## PERMIT TO ENCROACH UPON PIEDMONT NATURAL GAS RIGHT OF WAY AND EASEMENT

**Cape Fear Public Utility Authority (the "PROJECT OWNER")** hereby requests a **PERMIT TO ENCROACH UPON PIEDMONT NATURAL GAS RIGHT OF WAY AND EASEMENT (the "Permit")** from **PIEDMONT NATURAL GAS COMPANY, INC.** ("PIEDMONT") with **(1) 54-inch DIP raw water main encased in 72-inch steel pipe. (vacuum excavate around existing gas main to expose pipe prior to boring operations)** This installation is located at or near **1865 John Riegel Road in Riegelwood, NC and within Columbus County.** If said Permit is granted, PROJECT OWNER agrees all facilities will be installed pursuant to the following specifications unless specific written waivers are granted by PIEDMONT:

### Part I. GOVERNANCE FOR ALL LAND USES

1. If PROJECT OWNER has already retained a contractor to install or construct the facilities constituting the encroachment, then such contractor shall also be required to execute this Permit as a condition of Piedmont granting the Permit. PROJECT OWNER further acknowledges and understands that it must ensure that any current or future contractors, subcontractors, vendors, agents, and representatives comply with all terms and conditions of this Permit and that the execution of this Permit by a contractor shall not reduce, eliminate, or otherwise alter any of the terms, obligations, or requirements assigned to PROJECT OWNER herein.
2. PROJECT OWNER, or its agent, will give the following PIEDMONT Resource Center representatives a three working day notice of the day on which the encroachment(s) will be made, in order that arrangements can be made for necessary representatives of PIEDMONT to be present at PIEDMONT's election. PROJECT OWNER shall ensure construction plans reference the PIEDMONT contact requirement.

<b>RC REP:</b>	<b>Josh Reaves</b>	<b>RC:</b>	<b>24-Wilmington</b>
<b>PHONE:</b>	<b>910-251-2802</b>	<b>E-MAIL:</b>	<b>Joshua.Reaves@duke-energy.com</b>

3. To the extent allowed by law, PROJECT OWNER shall indemnify, defend, and hold harmless PIEDMONT, its affiliates, partners, successors, assigns, and the respective officers, directors, employees, agents, and representatives of each such entity from and against any and all actions, suits, claims, damages, loss, liability, attorney fees, cost and expense, including death, personal injury, and property damage occurring to PROJECT OWNER, its contractor, subcontractors, or PIEDMONT, and their respective officers, directors, employees, agents, and representatives, or to any third parties, which arise out of or in connection with, or by reason of, performance of the work herein contemplated, the existence of said installations and facilities, failure to comply with any applicable local, state or federal law or regulation and/or release of contaminants or other hazardous substances, or the acts, errors or omissions of the PROJECT OWNER or anyone for whom PROJECT OWNER is legally responsible (excluding those claims which have been solely caused by the intentional or negligent acts or omissions of PIEDMONT, its contractors, agents, and/or representatives).
4. As long as PROJECT OWNER continues to operate installations or facilities under this Permit, PROJECT OWNER shall maintain adequate comprehensive general liability insurance coverage, either through a policy or policies of insurance or an approved program of self-insurance, and any other insurance required by law. PROJECT OWNER further agrees to comply with the specific insurance requirements required by PIEDMONT in its sole discretion, if any, pursuant to Section 15 of this Permit, and PROJECT OWNER agrees to provide copies of the certificates of insurance to PIEDMONT if requested in PIEDMONT's sole discretion.
5. It is further understood and agreed between PROJECT OWNER and PIEDMONT:
  - a. That PIEDMONT does not, by consenting to the proposed encroachment upon PIEDMONT's right of way and easement, assume any responsibility for the protection, maintenance, or operation of PROJECT OWNER's facilities. Furthermore, all work performed in connection with any of the encroaching facilities and installations will be without

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any expense, risk, or liability to PIEDMONT or any of its directors, officers, agents, representatives, or employees except as otherwise expressly provided herein.

- b. That all work shall be conducted in a prudent, workmanlike manner and in conformity with any applicable statutes, orders, rules, or regulations and specifications of any governmental or regulatory authority having jurisdiction over the installations or facilities, and the work shall be in accordance with any applicable design, plans, drawings and specifications approved by Piedmont.
  - c. That PIEDMONT reserves the right to maintain and repair the existing natural gas facilities and pipelines, to construct additional pipelines, and to fully exercise its easement rights which exist now or in the future without liability for restoring the installation or for the interruption of service in the use of such installations to the extent allowed by law, at any time and from time to time in such manner as PIEDMONT determines in its reasonable discretion to be necessary for the proper operation of its pipeline system or natural gas facilities.
  - d. That except to the extent made necessary by the construction and maintenance of such permitted encroachments, and the reasonable use thereof, the exercise of any rights permitted to PROJECT OWNER shall not interfere with or supersede the rights of PIEDMONT under its easements. Furthermore, nothing herein shall be construed as expanding, creating, or granting PROJECT OWNER any authority greater than the express terms of this Permit or as required by applicable law.
  - e. That except for approved permanent surface crossings or grade changes, any disturbance to the easement area or right of way resulting from any construction activities permitted hereunder shall be restored to its pre-construction condition and to the reasonable satisfaction of PIEDMONT.
6. This Permit shall not be assigned by PROJECT OWNER except as approved by PIEDMONT in writing in its reasonable discretion.
  7. Execution below by PROJECT OWNER acknowledges agreement and acceptance of the conditions expressed herein for PROJECT OWNER's particular encroachment, and PROJECT OWNER agrees to adhere to the general requirements for permitting encroachments contained in Piedmont's GUIDELINES FOR PROPOSED LAND USES, as amended from time to time. PROJECT OWNER further agrees not to begin any work within the confines of the easement or right of way until this Permit has been executed by the Parties.
  8. That this Permit may only be terminated by mutual consent or for PROJECT OWNER's failure to cure a material breach of the terms of this Permit within 30 days (or such additional time as PIEDMONT may approve in its sole discretion after written notice by PIEDMONT to PROJECT OWNER of the default, including a description of the default).
  9. That if PIEDMONT, in its sole discretion, determines that the encroachment interferes with the exercise of its easement rights, then upon written notice to PROJECT OWNER, PROJECT OWNER shall, at its expense and within 30 days of such notice, modify or relocate its installations and facilities in such manner as to facilitate PIEDMONT's continuing exercise of its easement rights; provided that PIEDMONT shall provide reasonable alternatives to accommodate the relocation of the installations or facilities within PIEDMONT'S easement or right of way. In such an event, when feasible, PIEDMONT agrees to use good faith efforts to minimize the adverse impact on PROJECT OWNER, including providing longer notice of any necessary relocation.
  10. In the event of an emergency, in order to protect or safeguard its property, operations, equipment and/or employees from damage or injury, PIEDMONT may reasonably request immediate repair or renewal of the installations and facilities, and if the same is not performed within such period of time as Piedmont reasonably requires under the circumstances, PIEDMONT may make or contract to make such repairs or renewals, at the sole risk and actual cost and expense of PROJECT OWNER.
  11. This Permit is based on PIEDMONT's representation to PROJECT OWNER, and acceptance by PROJECT OWNER, that PIEDMONT's easement is exclusive and that the PROJECT OWNER cannot cross PIEDMONT's easement without PIEDMONT's Permit as expressed herein.
  12. Crossings are to be scheduled during PIEDMONT's normal working hours. If PROJECT OWNER, or its agent, requests crossing to be done outside of PIEDMONT's normal working hours, PROJECT OWNER shall reimburse PIEDMONT at PIEDMONT's overtime rate for all hours required for crossing and travel time.

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13. PROJECT OWNER will contact the applicable 811 OneCall in the state in which the work is performed to have all underground pipelines, installations and facilities located prior to any construction activity within PIEDMONT'S easement. All underground pipelines, installations and facilities are to be clearly marked during the construction process.
14. Proposed encroachments that are not installed within (1) year from the approval date need to be re-reviewed and reapproved by PIEDMONT Engineering before construction may begin.
15. SPECIAL PROVISIONS:
  - a. PROJECT OWNER will contact the OneCall Locating Service to have the pipeline(s) located prior to any construction activity within PIEDMONT'S easement.
  - b. Pipeline(s) are to be clearly marked during the construction process.
  - c. Installation(s) shall be in accordance with attached plans.
  - d. Installations shall maintain a minimum of 2' of separation from PEIDMONT's high pressure gas main, within the easement.
  - e. During backfilling operations, PROJECT OWNER shall provide and install color coded warning ditch tape 8"-12" above their installation.
  - f. All installations shall be excavated and no mechanical excavation permitted within five (5) feet of pipeline without express authorization of PIEDMONT representative on-site, which authorization will be given after visual inspection of the pipeline.
  - g. Before drilling begins within the easement, PROJECT OWNER shall excavate a 'window' on the drill side, extending at least 2' below PIEDMONT's pipeline for PIEDMONT's representative to monitor during drilling operations.
  - h. Neither sheeps foot rollers nor vibratory feature on roller type compaction equipment is permitted within 5 feet of PIEDMONT's marked gas line.
  - i. For Ductile Iron Pipe (DIP) installations, PROJECT OWNER shall install (2) #6 stranded wires to their DIP and excavate enough of the crossing to allow for PIEDMONT to install test wires on the gas facility.
  - j. Within one (1) week following installation, the Contractor shall submit to the engineer drawings showing actual locations of the instrument and installation and baseline monitoring records. The installation and monitoring records shall include appropriate items from the following list, but not be limited to:
    - a. Project name and number.
    - b. Instrument type and number.
    - c. Planned and as-built location in horizontal position and elevation.
    - d. Personnel responsible for installation and/or monitoring.
    - e. Date and time installation and/or monitoring.
    - f. Space for initial readings to be taken to ensure the instruments are working properly or any necessary measurements as required to ensure proper installation.
    - g. A space on the record sheet for notes, including problems encountered, delays, unusual features of the installation, and details of any events that may have a bearing on the instrument behavior.







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**Part II. EXECUTION**

This Permit shall be binding upon the parties hereto and their respective heirs, successors and assigns. The parties acknowledge that each has had an opportunity to review and understand the terms of the Permit.

(PROJECT OWNER's Name)	(Address)	(State) (Zip)
(Print Signer's Name and Title)	E-MAIL	
BY:		
(Signature of Signer)	(Date)	(Telephone)
(CONTRACTOR's Name)	(Address)	(State) (Zip)
(Print Signer's Name and Title)	E-MAIL	
BY:		
(Signature of Signer)	(Date)	(Telephone)

**Part III. APPROVAL**

To the extent of its rights or interest and without warranty, PIEDMONT hereby approves this Permit for the encroachment described in this request for Permit to Encroach Upon Piedmont Natural Gas Easement and Right of Way.

Signature	Date
ADAM C. SPRY	
Director – Land Services, Enablement	
Piedmont Natural Gas Company, Inc.	

PLEASE RETURN SIGNED DOCUMENT TO:

**PIEDMONT NATURAL GAS**  
4720 Piedmont Row Drive - Charlotte, NC 28210  
[LandTransmissionROW@duke-energy.com](mailto:LandTransmissionROW@duke-energy.com)  
Attn: Land Management

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**Part IV. COMPLETION**

Company Use Only			
Completion Log	Date	PNG Rep	Action
Approved Permit			Copy to RC & Project Owner
Archive-Land Department			Filed in Land Records Storage
Encroachment Work Complete by RC			Date & return to LandTransmissionROW@duke-energy.com
Encroachment Object Entry			Permit sent to GIS
GIS Entry Complete			Acknowledge & Return to Land Department